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4th ECVSMR Scientific Meeting

20-22 July 2023 MAISONS-ALFORT, FRANCE

PROCEEDINGS

EUROPEAN COLLEGE
OF VETERINARY SPORTS MEDICINE
AND REHABILITATION

European College of Veterinary Sports Medicine and Rehabilitation

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European College of Veterinary Sports Medicine and Rehabilitation (ECVSMR)

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- **Equine:** Nathalie Crevier-Denoix (Chair), Virginie Coudry, Jean-Marie Denoix, Lisa Katz, Annamaria Nagy, Maarten Oosterlinck

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IMPRESSUM

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PRESIDENT MESSAGE

Dear colleagues,

On behalf of the European College of Veterinary Sports Medicine and Rehabilitation, I welcome you to our 4th scientific meeting in the enchanting city of Paris, often hailed as the "City of Love" and the epitome of elegance, where iconic landmarks such as the Eiffel Tower and the Louvre Museum stand as testaments of human achievement and artistic brilliance.

The scientific and organizing committee has prepared fascinating pre-congress workshops and an extraordinary programme with top-notch presentations from world-renowned speakers. In the captivating atmosphere of the National Veterinary School of Alfort, one of the oldest veterinary schools in the world (established in 1766), our heartfelt gratitude goes to the speakers, who will share their expertise, experiences, and insights with us. Their contributions will undoubtedly broaden our horizons, stimulate thought-provoking discussions, and inspire future breakthroughs. More specifically, many animal-use activities are currently facing challenges to their social license to operate, and with several of this year's sessions devoted to welfare, doping and performance, this meeting will spark further discussion, ultimately for the benefit of the animals under our care.

T.S. Eliot once noted, "The chief danger about Paris is that it is such a strong stimulant". Let us therefore engage in meaningful exchanges, forging new connections and fostering partnerships that will continue to shape the landscape of veterinary sports medicine and rehabilitation!

Kind regards,

Maarten Oosterlinck
President ECVSMR

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RESIDENT FORUM

Moderators: Annamaria Nagy and Marion Mucha

16.00-16.20 A functionalized nanogel combining prolonged mechanical and biological effects as a novel intra-articular treatment for osteoarthritis in the horse: a double- blinded, controlled and randomized safety study. (Terlinden A, Jacquet S, Cuiller A, Cassé F, Legendre F, Manivong S, Garcia A, Roullin G, Moldovan F, Banquy X, Galéra P, Audigié F, Demoor M, Bertoni L)

16.20-16.40 Improvement of gastric ulcer and ridden horse pain ethogram scores with diet adaptation in sport horses. (Pineau V, Woort F, Julien F, Vernant M, Lambey S, van Erck-Westergren E)

16.40-17.00 An ex-vivo study evaluating potential iatrogenic damage after using the axial sesamoidean approach for synoviocentesis of the equine digital flexor tendon sheath. (Gruyaert M, Jansen F, Oosterlinck M)

17.00-17.20 Effect of speed on variations of the vertical displacement of the trunk in horses at trot on a water treadmill: preliminary results. (Fraschetto C, Jacquet S, Moiroud C, Audigié F, Chateau H, Hatrisse C, Denoix JM)

17.20-17.40 Pilot study to investigate intra- and interobserver agreement on calculation of pressure plate data in lame trotting dogs. (Bogaerts E, Brondeel C, Coppieters E, Broeckx B, Van Ryssen B, Samoy Y)

EVENING PROGRAM

19.00-21.00 Welcome reception and announcement of the winners of the VAHL Award

21/07/2023 DAY 1

08.00-8.45 Registration

08.45-9.00 Opening ceremony

KEYNOTE
Moderator: Dominique Grandjean

09.00 -09.45 Management Strategies to reduce occurrence of overheating in Working Dogs
Rob Gillette (USA)

9.45.-10.15 Coffee break

FREE COMMUNICATIONS
Moderator: Dominique Grandjean

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12.10-13.30 Lunch, Poster session

12.45-13.30 Preparatory session for the ECVSMR residents examination (Florian Buchner, Annamaria Nagy)

SESSION 1: ANIMAL WELFARE/DOPING
Moderator: Barbara Bockstahler

13.30-14.40 All you need to know about doping and its future (Xavier Bigard - France)
14.40-15.10 Concrete positive doping cases in sporting dogs (Dominique Grandjean - France)

15.10-15.40 Coffee break

15.40-16.20 The commitment of veterinary teams to animal welfare in mid-distance sled dog races (Mila Benito - Spain)
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17.30 End of the day 1

EVENING PROGRAM
19.30-23.00 Gala dinner (boat trip on the Seine)

22/07/2023 DAY 2

08.15-09.00 Registration

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Moderator: Marion Mucha

09.00-09.25 Ultrasonic screening of sporting conditions in mid-distance sled dogs (Mila Benito - Spain)
09.25-09.50 Lekkarod sled dog r2023: about the 3 main racing pathologies (Vinciane Roger - France)
09.50-10.15 About new services offered by working dogs (Dominique Grandjean - France)

10.15.-10.45 Coffee break

SESSION 3: MUSCLE INJURIES ULTRASONOGRAPHY - BLOOD LACTATE MONITORING

Moderator: Marion Mucha

10.45-11.30 Muscle injuries ultrasonography (Giuseppe Spinella - Italy)
11.30-12.00 Blood lactate monitoring for exercise conditioning in dogs (João C. Alves - Portugal)

12.00-13.45 Lunch, Poster session

KEYNOTE

13.45-14.30 Conditioning strategies to enhance performance and reduce risk of injuries in athletic and working dogs (Rob Gillette - USA)

SESSION 4: SHOULDER

14.30 -15.00 Why do shoulder injuries happen in agilities dogs? Exploring the clinical biomechanics of common injuries (Barbara Bockstahler - Austria)
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15.30-16.00 Coffee break

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17:00 Closing Ceremony

EQUINE PROGRAM

20/07/2023 PRE-CONGRESS DAY

08.30-18.00 Registration

WORKSHOPS

08.00-12.00 Equine Sports Medicine Workshop (Dr Valérie Deniau and Dr Emmanuelle Van Erck-Westergen. Grosbois training center for racing trotters - bus transportation)

13.00-15.30 Clinical Anatomy of the Equine Limbs (Pr Jean-Marie Denoix and Pr Nathalie Crevier-Denoix. Dissection room, EnvA - Maisons-Alfort)

15.30.-16.00 Coffee break

RESIDENT FORUM

Moderators: Annamaria Nagy and Marion Mucha

16.00-16.20 A functionalized nanogel combining prolonged mechanical and biological effects as a novel intra-articular treatment for osteoarthritis in the horse: a double- blinded, controlled and randomized safety study. (Terlinden A, Jacquet S, Cuiller A, Cassé F, Legendre F, Manivong S, Garcia A, Roullin G, Moldovan F, Banquy X, Galéra P, Audigié F, Demoor M, Bertoni)

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EVENING PROGRAM

19.00-21.00 Welcome reception and announcement of the winners of the VAHL Award

21/07/2023 DAY 1

08.00-08.45 Registration

08.45-09.00 Opening ceremony - Maarten Oosterlinck, Jean-Marie Denoix

KEYNOTE
Moderator: Renaud Leguillette

09.00 -09. 45 Equine performance and safety: When heart matters. (Virginia Reef - New Bolton Center, USA)

09.45.-10.15 Coffee break

FREE COMMUNICATIONS 1
Moderators: Emmanuelle Van Erck and Maarten Oosterlinck

10.15-10.30 Influence of spinal surgery on the biomechanics of the equine thoracolumbar spine (Natalie Baudisch, Henning Meyer, Christoph Lischer, Anna Ehrle)
10.30-10.45 Agreement among veterinarians and a smartphone computer vision method for equine lameness assessment during lameness examination: preliminary findings (Ilaria Grossi, Marco Pepe, Elin Hernlund, Francesca Beccati)
10.45-11.00 Magnetic resonance imaging findings in the metacarpophalangeal joint of 31 showjumping horses in full work and competing regularly (Annamaria Nagy, Sue Dyson)
11.00-11.15 Assessment of the severity of aortic valve regurgitation by spectral Doppler of aortic and carotid blood flow in horses. (Alexander Dufourni, Gunther van Loon, Annelies Decloedt)

11.15-11.40 **POSTER FLASH SESSION**

11.40-12.00 **CLINICAL CASES:**
Forelimb lameness induced by subclavian artery impairment (Jean-Marie Denoix, Maria Castellanos Alonso)

12.00-13.30 Lunch, Poster session

12.45-13.30 Preparatory session for the ECVSMR residents examination (Florian Buchner, Annamaria Nagy)

13.30-17.30 **SESSION 1: HOW TO COMBINE WELFARE AND PERFORMANCE?**
Moderators: Hélène Bourguignon (FNCH) - Arnaud Duluard (SECF), and Alberic Théry (FEI)

1 The veterinary profession in the XXI century: from technicity to prevention, an ethical issue. (Claire Scicluna and Jean-Yves Gauchot - France)
2 What are the manifestations of discomfort related to overtraining or over-exploitation in the horse at work (except signs of lameness or axial pain)? (Esther Siegers and Ellen Reolfsema - Vet Fac Utrecht, The Netherlands)
3 Management for performance - ethical and regulatory aspects in Europe (Stéphane Montavon - Switzerland)
4 How to combine welfare and performance in the Sport horse, in practice? (Rachel Murray - Rossdales, UK and Liz Brown - British Equestrian, UK)

15.10-15.40 Coffee break

5 How to combine welfare and performance in the Steeple chasers, in practice? (Hélène Pasquet - Vethippodome, France and Emmanuel Clayeux - Steeple chasers' trainer, France)
6 Management of equine athletes without injections? (Jean-Marie Denoix - CIRALE, France)
7 Injections for the management of human athletes: rules and alternatives (Jean-Marc Sène - human medicine, Santé Plus Sport, France)

Questions and Answers

EVENING PROGRAM
19.30-23.00 Gala dinner (boat trip on the Seine)

22/07/2023 DAY 2

08.00-08.30 Registration

FREE COMMUNICATIONS 2
Moderators: Virginie Coudry and Barbara Riccio

08.30-08.45 Comparative effect of water treadmill training, lunging and treadmill training during rehabilitation of horses with back pain (Tobias Geiger, Liesa Rogge, Julien Delarocque, Florian Geburek)
08.45-09.00 Computed tomographic evaluation of the sagittal ridge of the third metacarpal bone in Thoroughbred racehorses in their first year of training: a longitudinal study (Koppány Boros, Sue Dyson, Annamária Nagy)
09.00-09.15 Pilot study to evaluate potential prognostic value of Doppler signal of superficial digital flexor tendinopathies in horses at the end of their rehabilitation program (Adeline Tischmacher, Audrey Beaumont, Jean-Marie Denoix, Nathalie Crevier-Denoix)
09.15-09.30 Preliminary observations in EIPH horses receiving by inhalation a soluble form of curcumin (NDS27) (Luis Mendoza, Charlotte Sandersen, Isabelle Caudron, Jean-Philippe Lejeune, Thierry Franck, Didier Serteyn)

09.30-10.00 **SESSION 2: EXERCISE PHYSIOLOGY**
Moderator: Lisa Katz

Cardio-respiratory physiology of the swimming horse (Renaud Leguillette - Univ Calgary, Canada)

10.00-10.30 Coffee break

10.30-12.00 **SESSION 3: REHABILITATION OF TENDINOPATHIES**
Moderator: Didier Serteyn

10.30-11.10 Tendon injury rehabilitation in the human athlete (Hans Zwerver (Sports Valley, Medical Center, Univ. Groeningen, The Netherlands)
11.10-12.00 The Tendinact project: rehabilitation of SDFT tendinopathy in steeplechasers, with controlled exercise and close clinical and functional follow-up. (Nathalie Crevier-Denoix and Jean-Marie Denoix - INRAE-EnvA, CIRALE, France)

12.00-13.30 Lunch, Poster session

13.30-15.30 **SESSION 4: BONE - FATIGUE FACTURES**
Moderator: Jean-Marie Denoix

13.30-14.00 Fatigue versus rest: diagnostic imaging of associated bone alterations in the equine athlete (Fabrice Audigié - CIRALE, France)

14.00-15.30 **KEYNOTES**

Etiopathogenesis of fatigue fractures (Sue Stover - UC Davis, USA)

Management of fatigue fractures in racehorses (Chris Riggs - Hong Kong Jockey Club Equine Welfare Research Foundation Director) - Online

15.30-16.00 Coffee break

16.00-17.45 **SESSION 5: RESPIRATORY CONDITIONS LIMITING PERFORMANCE**
Moderator: Virginia Reef

Diagnosing upper respiratory tract abnormalities in your equine athlete: is it as easy as it appears? (Lisa Katz - Vet Fac Dublin, Ireland)

Mild moderate equine asthma in performance horses (Renaud Leguillette - Univ Calgary, Canada)

An update on Exercise-Induced Pulmonary Hemorrhage in the equine athlete (Lisa Katz - Vet Fac Dublin, Ireland)

17:45 Closing Ceremony

KEYNOTE AND GUEST SPEAKERS

SMALL ANIMALS

Dr. Rob GILLETTE

Dr. Rob Gillette received his Veterinary degree in 1988 from Kansas State University. His interests in animal movement and performance inspired him to pursue a post-doctoral program whose major focus was on Kinesiology with a minor in Exercise Physiology. This was through the Human Performance program at the University of Kansas and received his Masters of Science Education degree in 1998. He was Director of the Veterinary Sports Medicine program at Auburn University from 2000 to 2012. He was the Chairman of the Organizing Committee for and later first President of the American College of Veterinary Sports Medicine and Rehabilitation, becoming a Charter Diplomate in 2011. He grew up with hunting dogs as pets in Central Kansas. He was introduced to racing Greyhounds in 1985. His initial research focused on reducing racing injuries and race-related medical issues. He expanded on this to develop methodologies to better understand optimizing performance and to use these methodologies on other athletic and working dogs. When he went to Auburn University, he was exposed to many additional types of athletic dogs and to operational working dog kennels. During this time, he developed and managed his athletic and working dog laboratory researching the biomechanical and physiological nuances of the elite canine.
He has over 30 years of practice experience, over 25 years' experience with athletic and working dogs, numerous related scientific publications, and is a national and international lecturer on Athletic Dog Performance and Sports Medicine. He has consulted and worked with many various Government and Military agencies to improve or enhance the abilities and management of working dogs. He is currently the Director of Clinical Research at Nutramax Laboratories.

EQUINE PROGRAM

Pr Virginia REEF

Dr. Virginia Reef, a 1979 graduate of The Ohio State University's College of Veterinary Medicine, completed a rotating internship in large animal medicine and surgery and a residency in large animal medicine at the University of Pennsylvania, becoming a Diplomate of the American College of Veterinary Internal Medicine. Dr. Reef subsequently became the Director of the Large Animal Cardiology and Ultrasound Service and was instrumental in establishing the Section of Sports Medicine and Imaging at New Bolton Center. Dr. Reef has worked on the faculty at Penn for the past 30 years and is currently the Mark Whittier and Lila Griswold Allam Emeritus Professor of Medicine. She is a charter diplomate of the American College of Veterinary Sports Medicine and Rehabilitation, a large animal associate member of the European College of Veterinary Diagnostic Imaging and an honorary diplomate of the ACVIM College of Cardiology (2019). In addition to numerous original publications, she is the author and editor of a standard textbook on equine diagnostic imaging, "Equine Diagnostic Ultrasound." She was the chair of the ACVIM/ECEIM Consensus statement "Recommendations for Management of Equine Athletes with Cardiovascular Abnormalities".
Dr. Reef received the 2013 ACVIM Robert W. Kirk award, the 2015 American Association of Equine Practitioners (AAEP) distinguished educator award (Academic division), a doctor "honaris causa" from Ghent University in 2016 and was the AAEP Frank J. Milne State-of-the-Art lecturer in 2018.

Pr Sue STOVER

Dr. Sue Stover is a Distinguished Professor, and Director of the JD Wheat Veterinary Orthopedic Research Laboratory at the University of California at Davis. She received her veterinary degree from Washington State University, and subsequently completed an Equine Surgery Internship and Residency at University of California at Davis. She was in equine practice in Washington State before returning to the Veterinary Medical Teaching Hospital, UC Davis to teach clinical equine lameness and surgery to veterinary students and residents. She became board certified by the American College of Veterinary Surgeons while pursuing a PhD program focused on equine orthopedic research (Dorsal metacarpal disease ('bucked shins') in Thoroughbred racehorses). She now devotes her time to equine orthopedic research, with over 200 research publications; mentoring veterinary students, graduate students, and residents in research; and teaching musculoskeletal anatomy, biomechanics, and pathology to veterinary students.
Her major research focuses are the biomechanics and prevention of musculoskeletal injuries in equine athletes and treatment of orthopedic disorders in domestic and non-domestic animals. Her key contributions to the safety and welfare of horses include discovery and detection of lesions that predispose to catastrophic injuries in racehorses and elucidation of factors that contribute to injury development in sport horses. Current research efforts are focused on understanding how training and injury affect bone adaptation or propensity for bone fracture and the effects of arena surface materials and shoes on hoof and fetlock biomechanics and thus propensity for injury in athletes.
In 2016, Dr Stover received the American Veterinary Medical Association Lifetime Excellence in Research Award. She gave the John Hickman Memorial Lecture, British Equine Veterinary Association, in 2019, and was the AAEP Frank J. Milne State-of-the-Art lecturer in 2022.

Dr. Chris RIGGS

Chris studied Veterinary Science at the University of Bristol, UK, in the early nineteen eighties. He received further training in Equine Surgery at the Royal Veterinary College, UK and was awarded a PhD for research into the causes of racehorse fractures in 1991. He subsequently worked as a Senior Lecturer at the Philip Leverhulme Equine Hospital, University of Liverpool, where he developed specialist skills in equine surgery.

He gained further clinical experience at several equine referral centres in the United Kingdom and Australia before joining the Hong Kong Jockey Club as Head of Veterinary Clinical Services in 2003. He was appointed to a new role in the Club as Director, HKJC Equine Welfare Research Foundation/ Chief Advisor, Mainland Veterinary Engagement in 2019.

Chris has a particular interest, and specialist qualifications, in surgery and orthopaedics. He has published over 80 scientific papers about fatigue damage in bone and its role in racehorse fractures, among other topics. He also cares deeply about helping to provide opportunities for young colleagues to further their clinical skills, with a focus on Mainland China.

Chris is a Fellow of the Royal College of Veterinary Surgeons, UK and holds positions as Adjunct Professor at the College of Veterinary Medicine and Life Sciences, City University, Hong Kong, Special Professor at the School of Veterinary Medicine and Science, University of Nottingham, UK, and Guest Professor at Inner Mongolia Agricultural University. Chris is currently Secretary of the World Equine Veterinary Association and Chair of AO VET Asia Pacific Board.

Pr Jean-Marie DENOIX

Dr. Denoix of the CIRALE (Center of Imaging and Research on Equine Locomotor Affections) in Normandy, France has especial interest in equine musculoskeletal system anatomy, biomechanics and in the diagnosis and rehabilitation of equine lameness. He has founded ISELP in 2006. In 2013 he became Diplomate of the American College of Veterinary Sport Medicine and Rehabilitation (ACVSMR) and is a founding Diplomate of the European College of Veterinary Sport Medicine and Rehabilitation (ECVSMR).
Jean-Marie has been a speaker at many international meetings in more than 30 countries around the world. In 2021, he has been invited to present the ‘John Hickman Plenary lecture’ at the BEVA meeting and the State of the Art lecture (‘Milne Lecture’) at the AAEP convention. He has set up a rehabilitation unit at CIRALE where residents of the American and European Colleges of Veterinary Sport Medicine and Rehabilitation are trained. In his spare times, he likes training racing Standardbred trotters.

INVITED SPEAKERS

SMALL ANIMALS PROGRAM

Dr. Joao ALVES
DVM, PhD, Dipl. ECVSMR

Joao Alves graduated from the University of Lisbon, Portugal, in 2012 and has since worked at the Guarda Nacional Republicana (Portuguese Gendarmerie) with their police working dogs, focusing on sports medicine and rehabilitation, helping these animals to achieve their full potential. He completed his PhD in 2021 from the University of Evora, Portugal, in intra-articular management modalities for osteoarthritis. In 2022, he became a European Specialist in Canine Sports Medicine and Rehabilitation (Diplomate of the European College of Sports Medicine and Rehabilitation - Small Animals; DECVSMR). In addition to osteoarthritis, he does research and is interested in working dog sports medicine, photobiomodulation therapy, and canine exercise. Joao has published dozens of papers and lectures frequently on these topics.

Dr. Mila BENITO
DVM, PhD, Dipl. ECVSMR

Degree and PhD in Veterinary Medicine from the Faculty of Veterinary Medicine of Cáceres (UEX), she has been working in Spain as a lecturer at the Faculty of Veterinary Medicine of the CEU Cardenal Herrera University (Valencia) since 1999, in the Department of Animal Medicine and Surgery. Diplôme d'Ecole (DE) from the École Nationale Vétérinaire d'Alfort: Cinesiologie, physiothérapie et réadaptation fonctionelle. Specialist in dog training and Master in Animal Assisted Intervention, University of Valencia (UV).
Passionate about dogs in their sporting and human service facets, she has been collaborating for 21 years with different canine units, for whose work she was named honorary military police officer in 2015 and received the Cross of Military Merit with white badge in 2020. In her research work in this field, she has studied cardiorespiratory adaptations to effort in canine sports such as Agility, Mondio and Mushing, activities in which she has actively participated as a veterinarian in international competitions. She is a member of the veterinary team at sports competitions organised in France by the Lekkarod Foundation. She is currently a member of the Animal Welfare Committee of the Official College of Veterinarians of Valencia (ICOVV), and is a member of the Animal Welfare Committee of the International Federation of Sleddogs Sports (IFSS).

Pr Xavier BIGARD
MD, PhD, sports physician, exercise physiologist and nutritionist

Pr. Xavier Bigard is Medical Director of the International Cycling Federation (Union Cycliste Internationale, UCI). He is a former professor at the Val-de-Grâce (the French university of military medicine, Paris), where he also held the chair of Research. He also formerly advised the French Antidoping Agency, was President of the French Society of Exercise and Sport Medicine, and led researchers in sports nutrition at the French Sports Institute. His memberships include the Health-Medicine-Research Committee of the World Anti-Doping Agency, the ASOIF medical and science consultative group, and the French Academy of Medicine. Pr. Bigard's research and expertise focus on exercise physiology, muscular biology, sports nutrition, physical training tolerance, and the adaptation of active humans to extreme conditions (altitude, heat, cold).

Dr. Barbara BOCKSTAHLER
DVM, Dipl. ECVSMR, Dipl. ACVSMR, FTA, CCRP

Barbara Bockstahler studied veterinary medicine in Vienna, where she initially worked freelance in the small animal practice after completing her studies (1996 - 2002). Since 1999 she has been head of the Service for Physical Medicine and Rehabilitation at the University of Veterinary Medicine Vienna. Barbara Bockstahler

has been a specialist veterinarian for physiotherapy and rehabilitation (Austria) since 2004 and a Certified Canine Rehabilitation Practitioner of the University of Tennessee since 2007. Her research interest is dedicated to the biomechanics of dogs and she habilitated on this topic in 2009. In 2016 she became a Diplomate of the American College for Veterinary Sports Medicine and Rehabilitation. She is a founding member and current past president of the European College of Veterinary Sports Medicine and Rehabilitation.

Pr. Dominique GRANDJEAN
DVM, PhD, HDR, Dipl. ECVSMR

Dominique Grandjean is a Professor at the national veterinary school of Alfort (France), where he works as Head of the canine breeding and sport medicine unit. As a faculty in Alfort he has been focussing most of his work on dog's nutrition and working dogs' performance for the last 40 years, with a special attention to oxidative stress prevention and consequences. He was also a colonel veterinarian for the Paris Fire Brigade (military unit, 9500 firefighters) from 1993 to 2021, in charge, among other tasks, of the canine search and rescue teams, of the management of dangerous animals, and of biological hazards. Dominique is also national and regional technical advisor of the civilian security for both cynotechnics and biological hazards, and advisor for civilian security working dogs (Ministry of the Interior). He is Head of the Nosaïs medical detection dogs program since 1998. This program works on high risk prostate cancers, colon and pancreas cancers, Parkinson disease, but did also demonstrate that dogs were able to detect COVID-19 on humans.
He created in 1999 and then developed a national post-graduated diploma on disaster and environment veterinary medicine, and is also Professor at the national superior school for firefighters officers. He is the former President for the National Association of Firefighters Veterinarians.
His unit at the vet school works on a daily base with national police, gendarmerie and army canine units, and now mainly on medical detection dogs.
As a researcher his works are focussed on the consequences of stress and hostile environments (warm, cold, altitude) in the working dog, with a deep involvement in sled dog long distance races since 1980, and in search and rescue dogs since 1990. His unit (Unite de Medecine de l'Elevage et du Sport –UMES-) also includes a physiotherapy service (including a specialization diploma on the subject) and a dedicated sub-unit for canine collectivities veterinary problems. Dominique already published more than 190 scientific peer-reviewed papers on working dog physiology, nutrition and medicine, and a total of 30 books all related to this area.
He now focuses his research on human diseases detection by canine olfaction.
He has been a board member for the International Working Dog Association and is a member of the International Sled Dog Veterinary Medical Association since…the dark ages.
He is Race Director for Lekkarod international Sled dog race, has been an Iditarod veterinarian from 1983 to 1995, as well as chief vet for the late Scandream, Nenana Come Back, Alpirod and numerous European and World championships.

Dr. Marion Mucha
DVM, Dipl. ECVSMR, CVA, CCRP, CVPP

Marion Mucha studied veterinary medicine in Vienna (Austria) and finished her doctoral thesis in 2005. Since 2002 she is working at the Outpatient Clinic for Physical Therapy and Rehabilitation of the Veterinary University of Vienna (VUV) and she is also a member of the Movement Science Group Vienna. In the course of her clinical and scientific career Marion Mucha has held numerous lectures in Austria and abroad and also made research on gait analysis in dogs. She has been certified as a Veterinary Acupuncturist in 2004 (CVA, IVAS International Veterinary Acupuncture Society), as a Certified Canine Rehabilitation Practitioner in 2007 (CCRP, University of Tennessee in Cooperation with Schlossseminare) and as a certified veterinary pain practitioner (CVPP, IVAPM International Veterinary Academy of Pain Management) in 2016. In 2010 her book "Checkliste Akupunktur für Kleintiere" (Sonntag Verlag) was published. Since 2015 she is president of the Austrian Veterinary Acupuncture Society (AVAS – an affiliate organisation of the International Veterinary Acupuncture Society – IVAS). Since 2018 she is Diplomate of the European College of Veterinary Sports Medicine and Rehabilitation (Dipl. ECVSMR).

Dr. Vinciane ROGER
DVM, PCD

Vinciane ROGER graduated in 2017 from the « Ecole Nationale Vétérinaire d'Alfort », a French national veterinary school located in the Paris area. She stayed at Alfort to pursue a one year post-certification diploma (PCD) of « Kinesiology, physiotherapy and functional rehabilitation » supervised by Prof Dominique GRANDJEAN. Simultaneously, she worked at the Rehabilitation Center for small animals hosted by the School and carried out consultations and care sessions.
In 2020, she joined the Canine Sports Medicine Unit (UMES) to carry out a Standard Residency Program for the European College of Veterinary Sports Medicine and Rehabilitation. Within the UMES, she gave lectures to students, carried out follow-ups for administration working dog kennels in Paris, and also handled consultations & physiotherapy care of sporting and working dogs. She then managed the PCD and trained veterinarians to share her domain of expertise. In parallel, she participated as a vet for sled dog races since 2020, becoming in 2023 the chief veterinarian of the Lekkarod, an annual mid distance stage race that brings together more than 600 dogs during 10 days.

Pr. Giuseppe SPINELLA
DVM, PhD, Dipl. ACVSMR, Dipl. ECVSMR

Prof. Giuseppe Spinella received his DVM from the Faculty of Veterinary Medicine of Bologna University (Italy) in 1999. In 2004 he completed a PhD in Diagnostic Imaging and Veterinary Endoscopic Surgery, followed by a fellowship in Veterinary Surgery at Bologna University. In 2006 he gained a position as Researcher and Assistant Professor in Veterinary Surgery at the University of Catanzaro (Italy), and then at Bologna University (Italy), where he became Associate Professor in May 2022. He is diplomated at American College of Veterinary Sports Medicine and Rehabilitation (ACVSMR) and European College of Veterinary Sports Medicine and Rehabilitation (ECVSMR). He is currently a surgeon at the University Teaching Hospital of Bologna University and he is involved in clinical research relating to: musculoskeletal injuries in sports and working dogs, diagnostic imaging of muscular and tendon injuries in small animals and rehabilitation. He has been speaker at national and international conferences and courses on canine sports medicine and rehabilitation, and has published several papers in international journals.

EQUINE PROGRAM

Pr. Fabrice AUDIGIÉ
DVM, PhD, HDR, Large Animal ECVDI Associate Member - Head of the CIRALE (since 2014)

Graduated from the National Veterinary school of Alfort (EnvA) in 1992, he spent 6 years as a Lecturer in Anatomy at the ENVA. During this period he performed his PhD in Biomechanics on the "Kinematic analysis of lame horses".
Since the opening of the CIRALE in 1999, he is in charge of the imaging platform of the center, particularly advanced imaging techniques. In addition to a strong involvement in the clinical activity of CIRALE, his research studies are orientated towards mainly advanced and comparative imaging of the equine locomotor system. He is also finally implied in research activities orientated towards the development and validation of new therapeutic approaches for joint and tendon injuries.

Dr. Liz BROWN
MA, VetMB, CertVA, CertEP, MRCVS

Liz Brown qualified at Cambridge University in 1995 and has subsequently worked in equine practice in Leicestershire and Sussex, before moving to Lambourn in 2002. She now runs her own specialist equine practice, focussing on performance horses in eventing, jumping, racing and dressage. Liz is an FEI vet for Eventing and was stable vet at Burghley Horse Trials for nine years and officiates at many BE events.
Liz was the Assistant Vet to the British Eventing team from 2005 to 2008 and attended the 2005 European Championships, 2006 World Equestrian Games and 2008 Olympics.
Liz works and travels extensively with British competitors and was appointed as British Eventing Team Vet in 2009.
Since 2009 she has attended all European and World Championships and Olympic games in London, Rio and Tokyo with the British Team. The team were gold medal winners in Tokyo. Liz is helping to prepare the team for the European Championships in Haras du Pin in August 2023 and looking forward to the Paris Olympic Games in 2024.
Liz works daily in practice with event horses, riders and grooms with the philosophy of education, correct management and training and appropriate veterinary care to optimise the soundness, health and performance of the horses.

Emmanuel CLAYEUX

Emmanuel has been training jump horses since 2008. He has between 80 to 100 horses in training at his yard in Vaumas and has trained 840 winners. He loves cross-country races which are very popular in France. Not only does he train racehorses, he also has a passion for breeding… to name a few: Alboum photo, Dynamite Dollars, Sir de Champs and Une Artiste.

Dr. Virginie COUDRY
DVM, DESV, ISELP, Dipl. ACVSMR, Dipl. ECVSMR

Virginie Coudry graduated from the National Veterinary School of Alfort (ENVA) in 1998. After a residency under the supervision of Pr Jean-Marie Denoix, she obtained a Veterinary Specialist Diploma in Equine Biomechanics and Locomotor Pathology (DESV) in 2004. Since then, her duties consist in dealing with clinical, teaching and research activities of the CIRALE-ENVA. She has gained extensive clinical experience in the diagnosis and imaging of equine locomotor problems and causes of poor performance. She has several peer-reviewed publications.

In July 2010 she obtained certification from the International Society of Equine Locomotor Pathology (ISELP), and has been regularly instructor during European ISELP modules. She graduated from the American College of Veterinary Sports Medicine and Rehabilitation in 2017 and from the European College of Veterinary Sports Medicine and Rehabilitation in 2020. Virginie has special interest for sport horses, especially competitive driving, and took up the duties of Team Vet for the French Driving Team since 2015.

Dr. Nathalie CREVIER-DENOIX
DVM, PhD, Agrégée, Dipl. ACVSMR, Dipl. ECVSMR

Nathalie Crevier-Denoix graduated from the Veterinary School of Alfort (France, 1989). Agrégée in Veterinary Anatomy (1993), she defended a PhD thesis in Biomechanics (1996). Professor of Anatomy (1999), she is also (since 2003) the head of a research unit devoted to Biomechanics and equine locomotor pathology in Alfort. After a Veterinary Doctorate on the radiographic images of the limbs of the foal, her research activities have been covering two topics: equine tendon imaging and biomechanics, and biomechanical effects of equestrian surfaces. Her main achievements are the development of a non-invasive device for in vivo tendon force measurement (*Tensonics*, patented), the development and application of a combined dynamometric and high speed kinematic measurement protocol compatible with equine training conditions, the development of a testing device for equestrian surfaces, mimicking the interaction of an equine forelimb with the ground in the vertical plane (*Equine Track Tester*, ET2, patent deposited). In 2016 she became diplomate of the ACVSMR, and in 2019, de facto diplomate of the ECVSMR (equine). From 2019 to 2023 she has been principal investigator of a research program on rehabilitation of superficial digital flexor tendinopathy in racehorses, based on controlled exercise associated with close clinical, ultrasonographic and biomechanical follow-up.

Dr. Valérie DENIAU
DVM, Dipl. ECEIM

Valérie Deniau graduated from the National Veterinary School of Alfort in 1997 and pursued with a two-years internship in equine orthopedic and medicine at the same school. After training periods in Canada and USA she started her professional activity in France in ambulatory practices and joined the Veterinary Clinic of Grosbois in March 2001, firstly as a junior vet. She progressively dedicated herself to internal medicine and deepened her specialization through an alternative residency in Equine Internal Medicine between Grosbois and the National Veterinary School of Nantes (ONIRIS) in 2007-2012.
She is ECEIM diplomate since March 2014 and practices in internal/sports medicine referred cases as well as intensive care and neonatalogy. She regularly participates to continuing education of the practitioners through conferences, worshops and online webinars for the French Equine Veterinary Association (AVEF), private teaching groups, and the ECEIM.

Dr. Jean-Yves GAUCHOT
DVM

Jean-Yves GAUCHOT, Vet mixt practitioner Dordogne France.
President of the FSVF (Fédération des Syndicats Vétérinaires de France - Federation of Veterinary Unions of France). President of the RESPE (Réseau d'épidémio-surveillance en pathologie équine - Epidemiological Surveillance Network in Equine Pathology). Former President of AVEF (Association Vétérinaire Equine de France - Equine Veterinary Association of France).

Pr. Lisa KATZ
DVM, MS PhD, Dipl. ACVIM, Dipl. ECEIM, Dipl. ECVSMR, MRCVS

Lisa is a Professor in the UCD School of Veterinary Medicine, University College Dublin. Lisa obtained her DVM from the University of Georgia (USA, 1994) and holds an MSc degree in equine exercise physiology

(Washington State University, USA, 1998) and a PhD degree in equine vascular pharmacology (Royal Veterinary College, UK, 2003). Lisa has over 85 refereed publications in the scientific and clinical veterinary literature and has made several contributions to book chapters in her specialist areas. Her clinical and research interests focus on equine exercise physiology and genomics.

Pr Renaud LÉGUILLETTE
DVM, PhD, Dipl. ACVIM, Dipl. ACVSMR

Dr. Renaud Léguillette is the Calgary Chair in Equine Sports Medicine and is Professor at the University of Calgary, Faculty of Veterinary Medicine (UCVM). Dr. Léguillette has been a member of UCVM since its early days in 2006. Dr. Léguillette is diplomate of the ACVIM (Internal Medicine) and the ACVSMR (Sports Medicine and Rehabilitation, Equine) and is mainly practicing as a UCVM specialist at Moore Equine in Balzac, Alberta.
Renaud graduated from the ENVA (Ecole Nationale Vétérinaire d'Alfort), Paris, in 1994, and did an internship and a residency in equine medicine to then earn his M.Sc. for a study on horses affected with asthma at the FMV (Faculté de Médecine Vétérinaire), Université de Montreal. He then completed a PhD on airway smooth muscle in human patients with asthma at the Meakins-Christie Laboratories at McGill University.
Dr. Léguillette has developed a research program on inflammatory lung diseases (ie horse asthma) and EIPH (exercise-induced pulmonary hemorrhage), as well as in equine sports medicine with a focus on cardio-respiratory exercise physiology. His clinical research is often collecting data in the field on sports horses from the community in Alberta and from international collaborations.

Dr. Stéphane MONTAVON
DVM, CERP

Stéphane Montavon, doctor in veterinary medicine (DVM). During several years, he worked as a practitioner for horses at the former Swiss Army Horse reserve (DFCA/EMPFA) at the national Stud farm in Avenches, at the University of California Davis (USA) as well as in his own equine practice in Geneva. Since 2003, Stéphane Montavon is the Chief Veterinarian Officer of the Swiss Armed Forces. This former president of the Swiss association of equine medicine (ASME/SVPM) also chaired for many years the veterinary Committee of the Swiss Equestrian Federations (FSSE/SVPS). He is an expert Youth and Sport (J+S) and a professional trainer Elite of Swiss Olympic. He is a very experienced rider in the disciplines of dressage, eventing and show jumping. He is also a Certified Equine Rehabilitation Practitioner (CERP) - University of Tennessee since 2021.

Dr. Rachel MURRAY
MA, VetMB, MS, PhD, MRCVS Dipl. ACVS, Associate ECVDI

Rachel is based at Rossdales Diagnostic Centre, Newmarket. She spent more than 20 years at the Animal Health Trust where she was responsible for the Equine MRI diagnostic service, ran the orthopaedic research group and provided a clinical service focused on imaging, poor performance and rehabilitation in sport horses.
Rachel graduated from University of Cambridge before specialising in equine surgery, undertaking an internship and surgical residency in the USA, becoming a Diplomate of the American College of Veterinary Surgeons. After 5 years in the USA, she returned to England as an equine surgeon at the University of Cambridge Veterinary School. She subsequently completed a PhD, investigating exercise-associated joint adaptation and injury in horses.
She has led many studies investigating sport horse training, injury and performance, including for British Dressage, British Eventing, British Equestrian Federation and the FEI. She has also published numerous articles on orthopaedic problems, sport horse management and advanced imaging, contributed to a number of books and edited the standard text on Equine MRI.
Rachel also works for the British Equestrian Federation in various roles, from scientific advice to practical veterinary assessments with various GB squads. Rachel has worked as a veterinarian for the British Equestrian

World Class Programme since 2009 and has been integrally involved in the maintenance and preparation of numerous team horses for Championships and Olympic Games. She is an FEI treating veterinarian, has worked as a veterinary surgeon with the GB Dressage and Show jumping teams, including as a team vet, and was an official treating veterinarian at the 2012 Olympics.
Rachel has experience training and competing horses to Grand Prix and international level dressage, has competed in a variety of equestrian sports, and is a British Horse Society accredited professional coach.

Pr. Annamaria NAGY
DVM, PhD, Dipl. ACVSMR, Dipl. ECVSMR, FRCVS

Annamaria is an Associate Professor at the University of Veterinary Medicine Budapest, where she is leading the orthopaedic diagnostics and diagnostic imaging department. Formerly, Annamaria was a senior clinician at the Animal Health Trust in Newmarket, UK. Annamaria is a Diplomate of the European and American Colleges of Veterinary Sports Medicine and Rehabilitation and holds an RCVS Fellowship Diploma. Her special interests lie in diagnosing complicated lameness and poor performance cases and in advanced orthopaedic imaging, including MRI and standing CT. Annamaria is also an FEI level 4 endurance official and treating veterinarian.

Pr. Maarten OOSTERLINCK
DVM, PhD, Dipl. ECVS, Dipl. ECVSMR

Maarten Oosterlinck qualified from Ghent University and earned his PhD on the use of pressure plate analysis for the objective evaluation of equine locomotion. He is a diplomate of the European College of Veterinary Surgeons and a founding diplomate of the European College of Veterinary Sports Medicine and Rehabilitation. He currently serves as president of this college. He is a regular speaker and instructor at international courses and congresses, and has published numerous papers in peer-reviewed journals and several book chapters on a variety of equine orthopaedic and surgical topics, including visual and quantitative evaluation of lameness, hoof biomechanics, diagnostic analgesia, equine canker, etc. He is actively involved in the supervision of residents and PhD-students, he is a scientific editor for the prestigious Equine Veterinary Journal and has been a member of the examination committee of PhD-candidates in multiple countries. His daily clinical work at the equine clinic of the faculty of veterinary medicine of Ghent University is focused on equine orthopaedics and surgery, with a particular interest in podiatry and gait analysis.

Dr. Hélène PASQUET
DVM, DESV, DE, ISELP

After a residency program at CIRALE from 2004 to 2007 to obtain my specialized veterinary studies diploma in equine locomotor pathology under the supervision of Professor Jean Marie Denoix, I established my private equine practice near Clermont-Ferrand in Auvergne in 2007. I gradually developed my activity, becoming certified by Iselp in 2010 and completing over 25 training courses as an instructor in Europe. We are fortunate to have a multidisciplinary team of equine veterinarians and to work in a modern clinic equipped with a significant technical platform. My practice is mainly focused on steeple chase horses and showjumpers, for which I provide high-level sports monitoring. I am particularly focused on diagnosis, using ultrasound in particular, and I love sharing my experience with students and colleagues.

Pr. Ellen ROELFSEMA
DVM, PhD, Dipl. ECEIM

Ellen Roelfsema graduated from Faculty of Veterinary Medicine at Utrecht University in 1999 and has worked at Utrecht University, Department of Equine Sciences , ever since. In 2006 she was registered as specialist in Equine Internal Medicine by the KNMvD (Royal Netherlands Veterinary Association, RNVA). In 2012 she

became specialist of the European College of Equine Internal Medicine (ECEIM). In 2007 she finished her PhD entitled: "Endocrinological and behavioral adaptations to experimentally induced physical stress in horses". Currently, Dr. de Graaf-Roelfsema is assistant professor at the Department of Equine Internal Medicine, Utrecht University where she works as a specialist in the University Clinic for Horses and has teaching as well as research responsibilities. Her clinical interest is on equine internal medicine, donkey medicine, metabolic and endocrinological diseases, poor performance and behavior. Her research focuses mainly on endocrinological and metabolic disorders (EMS, PPID) and laminitis.

Dr. Claire SCICLUNA
DVM, DE

Equine vet practitioner graduated in 1989 (Maisons-Alfort, France). Started in Grosbois, then created its own clinic in Chamant (near Chantilly) in 1996: Clinique du Plessis, referral center, technical platform and equine rehab center. Vice President of Equ'Institut, she founded in 2011 for education, innovation and clinical research in equine health. Involved in FVE, FEEVA, EHN and AVEF for the defense of equine drugs. Although anesthesia, pain and intensive care are its favorite topics, she is diplomated in equine rehabilitation and equine welfare and ethics.

Dr. Jean-Marc SÈNE
MD, Sports traumatologist, Lecturer in Sports Traumatology, Federal Doctor of the French MMA Federation

Sports doctor with more than 20 years of experience in high level sport. In particular, I had the chance to take care of the French women's football team and the French Judo team. I participated in 2 Olympic Games, 12 World Championships and 20 European Championships. Sports traumatologist, trained in ultrasound of the musculoskeletal system, mesotherapy and manual medicine, I use this entire diagnostic and therapeutic palette on a daily basis to support the athletes in my charge. In addition to my activity in private practice, I currently hold the positions of Lecturer in Sports Traumatology at the Sorbonne University Faculty of Medicine and Federal Doctor of the French MMA Federation (FMMAF).

Dr. Esther SIEGERS
DVM, Dipl. ECEIM

Esther Siegers graduated from the faculty of veterinary medicine in Utrecht in 2012 and started a rotating equine internship in the Equine veterinary teaching hospital of Utrecht University. After her internship she worked at the anesthesia department. In 2014 Esther started a residency in equine internal medicine and became an ECEIM diplomat in 2019. She is now combining clinical work with a PhD program focused on exercise physiology in horses. In the clinic Esther is supervising the neonatal intensive care unit.

Dr. Emmanuelle VAN ERCK-WESTERGREN
DVM, PhD, Dipl. ECEIM, Dipl. ECVSMR

Emmanuelle graduated in 1996 from the French Veterinary School of Maisons-Alfort. She obtained a PhD from the University of Liège (Belgium) and worked at the Equine Sports Medicine Centre in Liège until 2009. In 2006, she contributed to developing the equine sports medicine unit in the CIRALE in Normandy (France) where she consulted as senior clinician.
Emmanuelle launched her own ambulatory referral practice, the 'Equine Sports Medicine Practice' (ESMP) in 2010. Based in Belgium, ESMP offers specialized service in equine internal and sports medicine throughout Europe and the world.
The Royal Belgian Federation of Equestrian Sports has appointed her as team veterinarian in 2015 and as veterinary expert for the FEI.She is the first woman to be elected president of the Belgian Equine Practitioners Society (BEPS).

Emmanuelle is double-boarded, from the European College of Equine Internal Medicine (ECEIM) and the European College of Veterinary Sports Medicine and Rehabilitation (ECVSMR).
She is author or co-author of over 50 peer-reviewed scientific articles and regularly lectures at international conferences. She is also co-editor for the 3rd Edition of "Equine Sports Medicine and Surgery".

Pr Johannes ZWERVER
DVM, PhD, Professor of Sport & Exercise medicine

Johannes Zwerver MD PhD, (nickname Hans) is Professor of Sport & Exercise medicine at the University of Groningen in the Netherlands. He works as a specialized sports medicine physician at Sportsvalley in the Gelderse Vallei Hospital in Ede, which is one of the Dutch Olympic high performance centers. As a former team physician for professional football, basketball and Dutch cyclo-cross teams he has ample experience in working with both elite and recreational athletes. His research focusses on etiology, prevention, diagnosis and management of (overuse) injuries, especially tendon problems.
He defended his thesis on Patellar Tendinopathy in 2010. Main study was a multicenter RCT investigating the effectiveness of ESWT in athletes with patellar tendinopathy (TOPGAME study). After this he was the project leader of several RCT's investigating exercise and treatment intervention in athletes with (patellar) tendinopathy. More recently he participated in the Jumper study, a RCT comparing effectiveness of progressive tendon loading exercises to eccentric training in athletes with patellar tendinopathy.
Prof Zwerver chaired the 5th International Scientific Tendinopathy Symposium in The Netherlands in 2018 and initiated international collaboration to achieve consensus on various tendinopathy topics. He (co) authored more than 100 peer reviewed papers and book chapters and is editor of an international book on Imaging of Sports Injuries.

RESIDENT FORUM

ABSTRACTS

A functionalized nanogel combining prolonged mechanical and biological effects as a novel intra-articular treatment for osteoarthritis in the horse: a double-blinded, controlled and randomized safety study

Antoinette Terlinden[1]*, DVM, Sandrine Jacquet[1], DVM, DESV, DECVSMR, Aurélie Cuiller[2], PhD, Frédéric Cassé[2], PhD, Florence Legendre[2], PhD, Seng Manivong[3,4], Araceli Ac Garcia[4], PhD, Gaëlle Roullin[4], PhD, Florina Moldovan[3], MD, PhD, Xavier Banquy[4], PhD, Philippe Galéra[2], PhD, Fabrice Audigié[1], DVM, PhD, Assoc LA-ECVDI, Magali Demoor[2], PhD, Lélia Bertoni[1], DVM, DESV, PhD.

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[4] Université de Laval, Québec, Canada

Background: Hydro-expansive functionalized nanogels constitute a therapeutic prospect for osteoarthritis.

Objectives: Evaluate the effect on healthy joints of repeated injections and overdose by injecting thrice the efficient nanogel dose.

Material and methods: Metacarpophalangeal joints of 8 healthy experimental horses were randomly and blindly injected with 2 mL of nanogel and 2 mL of saline on the contralateral limb. Repeat injections were performed twice at weekly intervals, followed by injection of a triple dose on week four. Clinical, ultrasonographical and synovial fluid biochemical follow-up were performed blindly up to three months following first injection.

Results: Physical examination parameters, lameness and sensitivity to passive flexion remained stable. Mild to moderate synovitis was noted the day following injection in the nanogel group, with a significant difference compared to the placebo group (linear mixed model; $p<0.05$). Spontaneous resolution was observed on day 3 following injection and no effect of repeated injections was noted. Similar effects occurred after injection of the triple dose ($p<0.05$) and resolved after a week. Synovial fluid biochemical parameters significantly increased in the nanogel group one week after injections but remained below usual thresholds for healthy joints.

Main limitations: Small number of horses and absence of washout period between repeated injections.

Conclusion: Triple injection of the efficient dose and injection of thrice the efficient dose do not cause harmful effects on healthy joints although moderate and transient dose-dependent synovitis was observed 3 to 7 days following injection. The therapeutic potential of the nanogel has yet to be measured on arthritic joints.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: The study was approved by the ComEth Anses/ENVA/UPEC (protocol code 21-037#30112 OA-ACTIVE, and date of approval 2021-04-06-10.
Sources of funding: This research is supported by the Normandy County Council and funded by the European Union in the framework of the ERDF-ESF operational program 2014-2020.

Improvement of gastric ulcer and ridden horse pain ethogram scores with diet adaptation in sport horses

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Background: Gastric ulcers are highly prevalent (64%) in sport horses and may lead to poor performance, changes in behavior and impact horse welfare.

Objectives: To assess whether sole dietary changes affect gastric health and pain ethogram scores in ridden showjumping horses.

Methods: Nine showjumpers trained at the same stable receiving a pelleted diet high in sugar and starch (>30%) were examined at T0 and after 12 weeks (T12) of changing to a cooked, muesli-type low-starch (11%) diet. At each examination, the horses underwent a filmed standardized exercise test (SET) with the same rider. A ridden pain score (RHpE) was calculated by two blinded observers watching the videos. The day after the SET, horses underwent a gastroscopy and ulcers were blindly scored a posteriori using a proprietary score (out of 11). No antiulcer medication was administrated, horses were housed on shavings and received free choice hay. Results were analyzed with Wilcoxon signed rank and Spearman tests.

Results: After 12 weeks of the low starch diet, there was a significant improvement of ulcer scores (4.6±2.5 at T0 vs 1.0±1.0 at T12, P=0.006) and of the RhpE scores (6.9±2.9 at T0 vs 2.9±2.0 at T12, P=0.009). Total ulcer scores and glandular disease scores were positively correlated with RhpE scores (respectively, r=0.436, P=0.07, and r=0.564, P=0.015). Heart rate and blood lactates measured during SET were not significantly different at T0 and T12.

Conclusion: A cooked, muesli-type, low starch diet significantly reduces the risk of gastric ulcers and pain score during riding in horses.

Conflict of interest: Study funded by Lambey SA. F. Julien, M. Vernant and S. Lambey are employed by Lambey SA.
Ethical committee: Study performed in the context of routine clinical evaluations. Owner consent was obtained.
Sources of funding: This research was funded by Lambey SA.

An ex-vivo study evaluating potential iatrogenic damage after using the axial sesamoidean approach for synoviocentesis of the equine digital flexor tendon sheath

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Background
The axial sesamoidean approach is commonly used for injecting the digital flexor tendon sheath (DFTS), but potential iatrogenic tendon damage has not been evaluated.

Objectives
To evaluate iatrogenic tendon damage after DFTS injection using the axial sesamoidean approach.

Methods
Forty-four inexperienced (final year veterinary students) and four experienced operators (>5 years' experience) performed DFTS injection with methylene blue in cadaver limbs using the axial sesamoidean approach. The number of needle redirections before injection was recorded. After dissection and visual inspection by one investigator, the success rate was determined, and iatrogenic damage was categorized as needlepoint injury(-ies) (NPI) or linear damage (in mm) to the superficial (SDFT), deep digital flexor tendon (DDFT), or proximal scutum (PS).

Results
Inexperienced operators were successful in 41/44 injections (30, 9 and 2 after one, two and three attempts, respectively). In 34/41 limbs, at least one NPI to the SDFT was identified, and in 3/41 limbs, linear lesions (2, 4 and 5 mm) were observed. In 26/41 limbs, at least one NPI to the DDFT was identified, and in 2/41 limbs, linear lesions (3 and 4 mm) were observed. In 15/41 limbs, at least one NPI to the PS was identified, and no linear lesions were observed. Experienced operators were successful at first attempt in 4/4 injections with only one SDFT showing one NPI.

Limitations
Ex-vivo study. Few experienced operators.

Conclusion
The axial sesamoidean approach may cause iatrogenic damage, especially in the hands of inexperienced operators. However, the clinical relevance of small lesions remains unclear.

Conflict of interest: None.
Ethical committee: Not applicable; cadaver limbs of horses euthanized for reasons unrelated to this study were used, with owner consent for use of specimens in research.
Sources of funding: This research received no external funding

Effect of speed on the vertical displacement of the trunk in horses at trot on a water treadmill: preliminary results

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c-Univ Lyon, Univ Gustave Eiffel, Univ Claude Bernard Lyon,1, LBMC UMR_T 9406, F-69622 Lyon

Background: Water depth (WD) modifies the vertical displacement (VD) of the trunk in horses walking and trotting on a water treadmill (WT). The effect of different trotting speeds has not been previously assessed.

Objective: To measure the trunk VD in horses trotting on a WT at different speeds and WD.

Material and Methods: Six sound Standardbred horses were trotted on a WT at two speeds (3.5 m/s and 5 m/s) and during four conditions: dry treadmill (DT), WD at the mid-cannon bone (WD-CAN), mid-radius (WD-RAD) and shoulder (WD-SHOUL). Inertial sensors were placed at the level of the withers, thoracolumbar spine (T18) and tuber sacrale (TS) to obtain the VD. Measure of the vertical acceleration was double integrated to the VD (cm). For each horse and condition, the relative difference of the upward amplitude of VD was compared between the two speeds (Wilcoxon Signed Rank test). Data are presented as medians and their quartiles in square backets.

Results: The amplitude of VD significantly decreased in T18 when trotting at 5m/s compared to 3.5m/s at all conditions, especially at WD-CAN (-2.1 [-2.4;-1.6] cm; $p<0.03$). At 5m/s, the amplitude of VD of the withers and TS significantly decreased (-1.2 [-1.7;-1.1] cm and -1.5 [-1.8;-1.1] cm, respectively; $p<0.03$) at WD-RAD compared to 3.5 m/s.

Main limitations: Small sample size.

Discussion and conclusions: Trotting on a WT at increasing speed significantly decreases the VD of the trunk in horses, suggesting that speed is an important factor to consider when designing WT training or rehabilitations protocols.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: The study was approved by the Ethics Committee ComEthAnses/ENVA/UPEC (protocol code 13/12/18-8 and date of approval: 13/12/2018)"
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Pilot study to investigate intra- and interobserver agreement on calculation of pressure plate data in lame trotting dogs

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Background: Pressure plate analysis is regularly implemented to examine lame dogs and is an outcome value in follow-up studies on surgical techniques.

Objectives: Investigate whether the results obtained after processing the same pressure plate data by different persons and repeated calculation by the same person could result in a clinically relevant change of peak vertical force (PFz) and symmetry indices (SI).

Material and Methods: Nine unilateral or bilateral lame dogs were trotted across a pressure sensitive walkway. The PFz and SI were calculated by four trained veterinary nurses with similar experience level to investigate the interobserver agreement. Intraobserver agreement was assessed by a second calculation round. A change in PFz of 1% compared to the measurements of the most experienced veterinary nurse was considered a clinically relevant difference. The cutoff for SI was set at 3,2% to distinguish between sound and lameness.

Results: The overall interobserver agreement was 78% (range 67 – 100%) for PFz and 89% (range 67 – 100%) for SI. The overall intraobserver agreement was 91% (range 50 – 100%) for PFz and 81% (range 0 – 100%) for SI.

Discussion: Possible underlying causes for the observed variation could be different trial selection with possible mistakes in recognizing the correct gait pattern, not excluding trials where dogs pulled the leash or did not look forward or errors in assigning the correct feet.

Conclusions: Values for PFz and SI obtained by trotting a lame dog on a pressure sensitive walkway could change by processing the same data twice or by different persons.

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SMALL ANIMALS PROGRAM:

KEYNOTE AND INVITED LECTURES

Management Strategies to reduce occurrence of overheating in Working Dogs

Robert L. Gillette, DVM, MSE, DACVSMR

A management or conditioning program that properly addresses the mental, metabolic, and environmental factors can help reduce the number of heat stroke events in athletic and working dog populations. It should include strategies that focus on minimizing the pre-activity and intra-activity increases in body temperature, early recognition by the handler of hyperthermic signs and early initiation of treatment efforts by the handler.

Heat stroke is a commonly recognized Veterinary Emergency and recognized medical event in military and law enforcement working dogs.[1-4] There are typically two types of heat stroke, Non-exertional and Exertional. Non-exertional heat stroke is caused by exposure to high external temperatures. A common Non-exertional case can be a dog left in a hot car for a period of time sufficient to result in a heat stroke. An Exertional case can be associated with exercise.[5] Heat related illnesses (HRI) can be classified in levels related to the length of exposure, predisposing factors and seriousness of the presenting clinical signs. "Heat Stress" has been described as the mildest form where the core temperature is within an accepted value normal related to the activating stressor and is associated with discomfort and physiological strain.[5] "Heat Cramps" have been described as another milder form of HRI, where there is extreme dehydration, muscle cramps and sodium depletion with the core temperature within an accepted value for the activating stressor.[2] Although described as not being recognized as a problem in veterinary patients, it can be confused with exertional rhabdomyolysis or hypoglycemia, which can occur in athletic and working dogs who also will have an increased body temperature while working. "Heat Exhaustion" has been described as the inability to work due to lethargy caused by extreme heat conditions.[2] Signs include weakness, anxiety, fainting and there will be a slightly increased core body temperature (<40° C) or a decreased body temperature.[5] "Heat Prostration" is more sever then Heat Exhaustion and is characterized by headache, vomiting, tacycardia and hypotension.[2] This can be seen (showing as a staggering gait, vomiting, glassy eyes, etc) in many types of activity or working events including hunting dogs or other working dogs in warm seasons, racing greyhounds, sled dogs, etc. Again, the signs may be exhibited in these athletic or working dogs as signs similar to rhabdomyolysis, hypoglycemia and sometimes bloat. Any treatment or management efforts in these scenarios should focus on these signs occurring related to preliminary effects of heat stroke until other causes have been confirmed. "Heat stroke" is the most severe form of HRI. In these cases, the core body temperature is greater than <40° C, there is central nervous dysfunction, circulatory insufficiency and breakdown of normal enzymatic and cellular function.[2,5]

Thermoregulation describes how the body regulates its temperature related to homeostasis. Athletic and working dogs perform their activities in a wide range of environments including the extremes of the Arctic pole to the desert regions of the Sahara. In addition, there are companion and wild dog populations that live in these areas that exhibit minimal metabolic stress or related medical conditions. For this reason, the statements "Too Cold" or "Too Hot" are relative terms to the regional weather conditions. Therefore, any discussion of developing a management plan to reduce overheating in athletic and working dogs should take into account environmental extremes, all the factors related to these the external influences and the dog's management capabilities or internal factors. It should be designed to fit the designated population, subgroup, organization, or personal kennel as a whole yet recognize that there will be individual variants within that population.

Thermoregulation of the dog includes behavioral components as well as metabolic components. A normal dog will alter their behavioral actions and is driven to take measures to enhance heat management. Foxhound hunters commonly recognize scenarios where their hounds will seek out rivers, ponds, shady areas and will alter their running style when they are beginning to get warm. These behavioral indicators tell the huntsman it is time to rest or cool the hounds. Working dog handlers describe scenarios where the dogs may be hesitant to perform requested tasks as they begin to get heated. These early behavioral changes indicate to the experienced handler, that their dog is beginning to warm up and it is time to stop this activity and place the dog in a cooler environment for a rest. It is important to note that these behavioral adjustments are not initiated by the environmental temperature but by the dog's internal thermostat. In many athletic or working dogs, their working mental state can predispose them to an increase in body temperature.[6,7] Activity excitement and/or anxiety has been shown to increase the dog's body temperature prior to beginning their designated activity.[8,9]

In some dogs, this psychological factor can be the reason for an extreme hyperthermic event. Related to a management plan, these individuals may need to identified, so an adaptation in the management plan can be developed to address their specific issues. Other times a change in deployment activities or work efforts can result in a psychological stressor that can affect an entire group or subgroup leading to hyperthermic issues. Many times, transitional efforts by the handler can be implemented to reduce the mental stressor that is related to the issue. It is important to recognize the psychological or mental factors of Heat Stroke so that the management plan can be developed to reduce its incidence.

In the dog there is a series of metabolic events that work together to manage the body's thermoregulation. If there is an increase in body temperature the hypothalamus will act as a thermostat. It recognizes the body temperature is reaching a limit (high or low) and initiates the metabolic and behavioral actions to address this change. For example, if the dog is exercising and their body temperature starts to increase; the thermoregulation center will recognize this increase and stimulates a response by the body. The related metabolic actions by the body will prevent the temperature from increasing and reduce the temperature if needed. Looking at the thermoregulation process in this manner helps to visualize how and where this system can fail.

Panting is the most recognized mechanism used by the dog to cool down. The surface of the respiratory tract is wet and the evaporation that occurs as the air passes over the surface acts to enhance heat loss. Other methods may play a greater role in the cooling process. Conduction is one method of removing heat from the body and or skin and is the process where one object transfers heat to another object through surface contact. Radiation is the process where heat radiates off a body without surface contact. Convection is the process of air movement across the surface removing the heat. The moving air receives the heat and moves it away into the environment. To enhance this process, the body will alter some blood flow to the surface to enhance heat loss. In heat extremes, the body will divert more blood towards the surface and away from internal components. Heat is then dissipated enhanced by radiation, convection or conduction resulting from the blood flowing at the body's skin surface.

The body generates a great deal of heat from the metabolic chemical reactions. Proper exercise and conditioning has shown to reduce the effects of work and its influence on body temperature.[10,11] The dietary program can also have an influence on the metabolic factors related to work-related hyperthermia in dogs.[12,13] These factors should be considered when developing a management plan for athletic and working dogs.

The macroenvironment, the microenvironment as well as the dermal environment will certainly play a role on the dog thermoregulatory capabilities. One way to address these issues is through acclimation. It is important to know the environment in which the dogs will be working. Kennel or housing strategies can be developed to best acclimate the dogs to environmental extremes. Many times, we cannot change the environment the dogs will be working in, so it is important to best prepare the dog to be least effected by the all the factors. The proper management strategy will take all of this into account and can result in a reduction of heat stroke events.

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All you need to know about human doping, current situation and future

Xavier Bigard, MD, PhD, Medical Director, Union Cycliste Internationale, Aigle (CH)

When humans compete against one another, including in sport, the competitors, by definition, seek to achieve an advantage over their opponent. Frequently they use drugs and other substances to gain the upper hand. In sport such conduct is usually termed cheating and has existed for as long as sport has been organised. While the violation of Olympic rules in the ancient games was dealt with harshly in the ancient games, it does not appear that the use of drugs and other substances to improve athletic performance was considered cheating.
It was not until the 1920s that there was a widespread attempt to denounce doping in sport, but without designating it as a formal breach of the rules or as cheating. By 1933 the word doping had become part of the English language, but it was not until 1967 that the International Olympic Committee (IOC) voted to adopt a drug-testing policy banning the use of specific drugs. After the World War II, doping expanded significantly with systemic team doping programs emerging, and doping controls were first introduced. Since the mid 20th century, the use of amphetamines, followed by the anabolic steroid and cortisone, human Growth Hormone (hGH) and erythropoietin (EPO), and more recently the peptides areas has become widespread.
Following a major doping scandal that shook the world of cycling in 1998, the World Anti-Doping Agency (WADA) was established in 1999 as an international independent agency to lead a collaborative worldwide movement for doping-free sport. WADA was established on 10 November 1999 to protect athletes, promote the values of clean sport, and preserve the spirit of sport internationally. WADA's primary role is to develop, harmonize and coordinate anti-doping rules and policies across all sports and countries. The WADA Code is the core document that harmonizes anti-doping policies, rules and regulations within sport organizations and among public authorities around the world. It works in conjunction with eight International Standards which aim to foster consistency among anti-doping organizations in various areas. The International Standard for Testing and Investigations (ISTI), IS for the Prohibited List (The List), IS for Education (ISE) are important for harmonising anti-doping procedures and raising their quality to the highest level.
Substances and/or methods are included in the WADA Prohibited List if they meet two of the following three criteria (i) Evidence that it has the potential to enhance sport performance; (ii) Use of the substance or method represents a health risk; (iii) Use of the substance or method violates the spirit of the sport (this definition is outlined in the WADA Code). Certain doping agents can improve specific aspects of physical performance in athletes, but serious health risks are associated with doping in healthy adults, although our knowledge on this may be just a tip of an iceberg. Thus, data from research studies likely may in fact underestimate the side-effects of doping agents. That is why educational programmes should be implemented to improve athletes' knowledge on health risks of doping agents. During this presentation, the rights and responsibilities of athletes when they are subject to doping controls anytime or anywhere will be presented.
Improving our knowledge on the prevalence of doping is an important step in developing efficient prevention and control programmes. The prevalence of doping can be indicated through surveys or by the testing of participants, but both methods have inherent problems. For example, survey data has limitations relating to differences in the definitions of doping and the taking of 'banned' substances for social rather than performance enhancing reasons, as well as a reliance upon honest self-reporting of an illicit activity. Whereas the clinical testing of a blood or urine sample may fail to identify doping cheats if the timing of sample collection does not coincide with the window of time when the substance or its metabolites are present within the individual's sample.
WADA has taken the lead in the development of the Athlete Biological Passport (ABP) December 2009. The fundamental principle of the ABP is to monitor selected biological variables over time that indirectly reveal the effects of doping, rather than attempting to detect the doping substance or method itself. The ABP provides valuable information that can be used to direct anti-doping activities such as Target Testing or investigations more effectively. The first ABP version contained a standardized approach to the profiling of individual Haematological variables for the detection of blood doping. In 2014, the initial system was complemented with the Steroidal Module, which was launched to establish longitudinal profiles of an athlete's steroid variables

measured in urine samples. WADA continues to develop the ABP in consultation with stakeholders, by refining the present modules as well as adding new ones as they are finalized.
The fight against doping must be regularly adapted and improved. Progress is regularly made in the areas of analytical precision, anticipation of new threats (such as genetic doping), and the use of new approaches such as hair testing and dried blood spots (DBS) as complementary approaches to urine and venous blood.

CONCRETE POSITIVE DOPING CASES IN SPORTING DOGS (DOMINIQUE GRANDJEAN - FRANCE)

Doping cases in sporting dogs not too often but…

Prof. Dominique Grandjean DVM, PhD, HDR, Dipl ECVSMR

Doping agents can be used in human as well as animal sports. As in human competitions, the use of performance-enhancing drugs in animal sports is prohibited in competition and even out of competition for some products. In dog racing or other types of competitions, doping agents are use to illicitly improve the animal physical/performance and/or to modify natural behavior (increase courage, aggressivity, …). But in dogs competition also appear cases of involuntary doping, or doping to loose or make loose.
Control methodology includes a chain of evidence (2 samples, anonymous, labeling, official agreed laboratory, …) and several types of samples can be performed: saliva, blood, urine, hair, urine being the most popular.
The practical approach of several positive doping cases in racing dogs demonstrate the need for a better dedicated education of both veterinarian and trainers/owners. “Anti-doping education” can take two fundamentally different forms: disciplinary version of “education” that is rooted in deterrence and punishment, and a “moral education” that takes the honesty of most people for granted and relies on the power of persuasion and respect of the animal rather than the harder discipline of inflicting penalties. Moral persuasion alone is not enough; in fact, the threat of being penalized is assumed to promote adherence to ethical norms.

The commitment of veterinary teams to animal welfare in middle distance sled dog races

Mila BENITO, DVM, DECVSMR, PhD.

Mushing is a sport popularised in North America and Europe, where dogs pull sleds. Interest in the sport is growing and it is now also being practised in countries with little snow, using wheels (dryland mushing). Although there are different types of races (sprint, middle and long distance), in all of them there is a historical concern for the welfare of the dogs. In this lecture we will look at the welfare of sled dogs participating in the increasingly popular, medium distance sled dog stage races, both on snow and on dryland. In these races there can be 10-20 stages in total and each stage can reach 20 to 80 km per day.

The major commitment of the sled dog sports federations is to the preservation of the animal health and welfare of the dogs participating (and accompanying dogs) in the sporting events. The IFSS (International Federation of Sleddog Sports) itself has an animal health and welfare committee where special emphasis is placed on the care of participating dogs. This sensitivity towards canine care and welfare is also shared by other associations such as ISDVMA (International Sled Dog Veterinary Medical Association), which has been developing in its congresses a strong collaboration with mushers to achieve a common goal: the persistence of welfare in sleddog sport. This and other associations are in line with the animal rights protection laws of the respective countries and also take up other issues specific to sled dog sport, such as the transport and health control of the sport dogs, whose breeds are not exclusively huskies, but also include short-haired, very fast dogs with different requirements.

Factors such as the type of race they are participating in, weather or terrain must be monitored to recognise possible causes of distress in sled dogs. Veterinary teams will be aware of the specific injuries associated with each. In addition, these specialised teams are aware of the influence of factors such as type of race, weather or terrain on the stress or distress that may occur in sporting dogs. This is especially important when the ambient temperature is the cause of either hypothermia or hyperthermia. The welfare of our dogs is what should guide our future research as specialists in canine sports medicine and the effects of humidity and temperature (Wet-bulb temperature or WBT) appropriate for each type of race and category should be known. Likewise, age control is equally important given the consequences of starting competition too early or keeping dogs at an advanced age in top competition.

Use of ultrasound in canine sporting competitions

Mila BENITO, DVM, DECVSMR, PhD.

Ultrasonography is a non-invasive diagnostic method that allows us to obtain rapid information on possible injuries in sporting dogs. It is useful both in the initial veterinary check-up and during the follow-up of the patient, when the duration of the competition lasts for several days. Ultrasonography can advise on when to drop-off from the race (withdrawal of the dog from competition) and becomes an objective and reliable diagnostic support tool.

In the pre-competition examination (Vet-check), ultrasonography allows us to be more confident in our diagnosis when a heart murmur has been auscultated or when an alteration in the femoral pulse is detected. In dogs over 8 years of age, its usefulness becomes more evident, as it allows us to perform a complete endocardial and functional myocardial examination when our equipment has a Doppler mode, in addition to the 2D and TM mode.

During competition, when a muscle or ligament injury occurs, ultrasound has a high diagnostic capability, which will complete the history and physical examination of the canine patient. In Wheel dogs there is intense work of their hind limbs and they may suffer overstretching of their Achilles tendon, which makes ultrasound the first test of choice in diagnostic support, providing information on the ultrastructure, echogenicity and degree of thickening of the tendon.

For veterinary specialists in canine sports medicine, who have been working in the field, it is an affordable technique that gives an accurate diagnosis of all traumatic or non-traumatic injuries that may occur in the sporting dog. The advantages of this diagnostic technique over others is especially for the assessment of tissues such as muscle, ligament and tendon, but also allows the assessment of small injuries that may go unnoticed in the routine physical examination, allows comparison with the healthy side to determine the extent and characteristics of the injury area and new technological advances allow increasingly compact equipment that allow to complete the examination, giving a high independence of the explorer.

During the conference, the results of two portable ultrasound systems in a competitive environment will be presented.

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Lekkarod sled dog race 2023: about the 3 main racing pathologies

Vinciane ROGER, DVM, Resident ECVSMR, National Veterinary School of Alfort (France)

The LEKKAROD mid-distance sled dog race is a stage race lasting 10 days in France every year. In 2023, 78 mushers entered the race, from all over Europe, with 600 dogs. The veterinary teams must be prepared to care for these dogs on a 24/24 basis and to handle any emergency that may arise. The aim of this work is to discriminate the main pathologies and manage them in accordance with IFSS doping rules, but also in respect of the well-being of the dogs and the expectations of the mushers. A very important aspect concerns the prevention of these pathologies, which the veterinary team must be able to carry out.
The first pathology represented in this 2023 edition of the race was musculoskeletal, where the veterinary team must examine dogs with stiff gait due to restricted joint amplitudes and reduced gait. The main areas of injuries in this race were the triceps muscle for the forelimb and the fascia lata muscle (and/or iliopsoas muscles) for the hindlimb.
The second cause of veterinary intervention was stress diarrhoea, occurring during or at the end of a stage, which can even be haemorrhagic, requiring, in all cases, control of the general condition so that it does not turn into inflammation of the intestine, with the appearance of pancreatitis.
Finally, the third pathology encountered the foot (cuts and abrasion), but also paronychia and inflammation of the interdigital spaces.

About new services offered by working dogs

Prof. Dominique Grandjean DVM, PhD, HDR, Dipl ECVSMR

Service dogs are widely employed by numerous administrations around the world and their efficiency is now fully recognized, especially in the domains of olfactory detection.
Since, a few years, news areas of utilization of the extraordinary dog's nose do appear, covering mainly biological detection:

- *Biosecurity (food, food contaminations, nosocomial pathogens, fecal pollutions, ...)*
- *Biomedical detection (infectious and non-infectious diseases)*
- *Conservation (reintroduced or endangered species tracking, invasive species, anti-poaching, bush meat, animal cadavers)*
- *Dangerous species (mainly snakes)*
- *Plants programs (invasive species, endangered species, plant viral diseases)*

The future is also opened to dogs helping the fight against bioterrorism.
These evolutions must bring veterinarians to provide more attention to stress related diseases and their early detection.

Muscle injuries ultrasonography

Giuseppe Spinella (Italy)

In sports and working dogs, muscular trauma is a quite common injury. In sports medicine, injury incidence seems to be relatively high in dogs performing high-impact sports, such as agility and flyball. The literature has reported that 32–41.7% of agility dogs had experienced at least one injury, which is generally located in the shoulder region and the iliopsoas muscle [1-4]. A similar rate was also described in dogs performing flyball activity (34–39%) [5,6]; while low rate injury was reported for endurance sports dogs such as Canicross (21.9%) [7]. In working dogs, a recent publication reported an injury incidence of 45.5%, generally related to mild muscular trauma [8]; besides, hunting dogs commonly report lesion to shoulder and Achilles tendon.
Literature does not reveal great consensus on muscle injuries' classification, despite their clinical importance. However, the most differentiating factor is the trauma mechanism. Muscle injuries can be broadly classified as either traumatic (acute) or overuse (chronic) injuries [9].
In human medicine, in 2013, Munich Consensus System reported a classification and grading system, that included descriptors (such as acute, overuse, direct and indirect injuries) and created a severity grade system (mild, moderate, subtotal disorders and complete lesion) [10]. Differently, the British system, designed by Pollock et al. in 2014, reported five-grade-injury classification, from 0 – 4, based on clinical and MRI features [11]. Grade 0 generally reported lesions consistent with DOMS (Delayed Onset Muscle Soreness). Grades 1 -3 refer to small, moderate or extensive muscle tears. Grade 4 refer to complete tears of either muscle or tendon.
In veterinary medicine, a 3-grade system of classification is generally applied [12,13, 14]. Grade I (mild grade) strains show intact muscle function, with focal oedema or haemorrhage and less than 5%of the muscle involved [12]. Grade II (moderate grade) strains are characterized by increased muscle involvement, mild fibre disruption, increased oedema or haemorrhage, and reduced strength of the musculotendinous unit [12]. Grade III (severe grade) strains involve significant fascial tearing, muscle fibre disruption, and significant oedema or haemorrhage [12]. Grade I injuries are rarely noted or diagnosed, asides from athletic or performance animals, and generally resolve with appropriate rest in <1 week [12,13, 14].
Ultrasonography is commonly used for diagnosis of muscular trauma in dogs. Ultrasound has probably a lesser accuracy compared to MRI, but it represents a better diagnostic tool for its non-invasiveness and, consequently, for its more versatile application also in the healing phase, allowing repeated diagnostic assessments. Acute lesions generally report a decreased echogenicity, inhomogeneous anechoic areas of edema, increase of vascularization and possible disruption of muscular fascia [14]. Muscular injuries, if not correctly treated and diagnosed, may evolve in chronic lesions with fibrosis and mineralization; moreover, chronic lesions are generally observed consequently to an overuse. Ultrasound may easily visualize scar tissue as hyperechoic area, that can appear localized within the belly or it can widely cover the muscular belly leading to fibrotic myopathy or permanent muscular contracture [14].
Moreover, role of ultrasound is not limited to diagnostic phase, but it can also be highly involved for injury recovery or for echo-guided biological therapy application.

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Blood lactate evaluation for exercice conditioning and monitoring in dogs

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Worldwide interest in canine exercise and sports has grown over the last few decades. For the occasional exercise enthusiast or the more serious sporting or working dogs, the animal may be required to sprint, jump over obstacles, turn sharply, scale walls, overcome unstable surfaces, or others. Depending on the dog, they may be required to perform these exercises in the snow, desert, woods, or rubble for short or very long periods. Conditioning of the musculoskeletal and cardiopulmonary systems is a fundamental part of the overall training program for these dogs, and canine athletes have high cardiovascular and thermoregulatory demands. Historically, most work has focused on sprinting greyhounds or sled dogs. Still, a growing interest has recently been centered around exercise and physical conditioning in other canine athletes and working dogs.

Blood lactate (BL) is often used to evaluate the level of exercise effort and fitness in both human and animal athletes, particularly in horses. The concept of a lactate threshold has been traditionally used. It is defined as the highest sustained intensity of exercise for which measurement of oxygen uptake can account for the total energy requirement or the workload at which BL starts to rise exponentially. The rationale behind using BL to measure physical fitness is that a fitter athlete would reach the lactate threshold at higher levels of intensity and/or after a longer period of activity. It also has a convenient side to its use, as easier and more practical to determine. Training at the lactate threshold level has been shown to improve performance in human sports, and different levels for the lactate threshold have been proposed. The most common one is set at 4mmol/L.

Other approaches have also been studied, such as determining the maximal lactate steady state (MLSS). The MLSS is defined as the highest constant velocity at which the concentration of BL does not increase beyond the initial transient during constant-load exercise. This principle is reflected in protocols for determining the MLSS, during which BL must not increase more than 1mmol/L for at least 20 minutes of exercise at a constant intensity. This exercise intensity is considered that at which glycolysis, leading to lactate formation, began to make a net metabolic contribution. It is currently considered the gold standard for evaluating aerobic activity and has been used in humans and horses. Similar to working at the lactate threshold level, several reports have described that training at the MLSS level improves performance in human sports.

While much of the approaches used in dogs have been based on human and equine information, a variety of methods are being reported for dogs on performance testing, from protocols for the determination of the MLSS, to setting conditioning programs, as with high-intensity interval training, or to evaluate dogs with cardiac disease and response to treatment.

Exploring these concepts will allow us to improve training plans, performance, and welfare, reducing injuries and adding active longevity of canine athletes.

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Conditioning strategies to enhance performance and reduce risk of injuries in athletic and working dog

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What is Canine Performance

To get the best performance out of your dogs, they must be properly conditioned, mentally prepared, and be free of any pain that might affect performance. Performance is influenced by internal factors and external factors. Once these factors are defined then the training and conditioning program is designed specifically to address these needs. The external factors include dog interaction, environmental climate and location, housing, type of work, and work factors. The internal factors include anatomical make-up, physiological function, and psychological influence. The areas that influence these internal factors are genetics, health, nutrition, training, and conditioning. The best performance will come from the dog with the correct anatomical build, that is in peak condition, and is psychologically ready to perform its particular duties. Any change in performance can then be attributed to an anatomical lameness, a medical illness or imbalance, or a psychological alteration.

When discussing performance there are many different descriptions and levels that need to be considered. To be able to communicate and discuss performance we must apply basic definitions to these descriptors of performance. There are three basic aspects to assess performance: (1) the type of skill or event, the canine is going to perform; (2) the performance definitions of this skill or event; and (3) the competition level and competition type that is required for this event. Athletic performance itself, is defined as either personal or relative. Each individual strives for their best personal performance. Training and conditioning are focused towards the best personal effort as the end result. Relative performance compares the individual's performance relative to the competitor's performance. In relation to the competition an individual's peak performance may not always provide a winning result. Skills can be defined as working skills and athletic competition. Working performances would, for example, include military dogs, law enforcement dogs, environmental dogs, hunting dogs, and herding dogs plus many others. These dogs must be able to perform their duties not for competition but to fulfill their roles at work. Athletic competition would, for example, include racing events, hunting related trials, herding trials, IPO, dog pull, agility, and obedience competitions plus many others. The performance expectations of these two skill areas are very different. The working canine must be able to maintain its skill level each day it is working to fulfill its function. The athletic canine must be able to give a maximum performance each time it competes. Neither of these skills is less important, but they must be defined to properly train and condition a dog to meet its skill expectation.

The type of event is the next performance area to be considered. To judge performance, you must determine what event is involved, the activities of this event, and the performance definitions of this particular event. Scheduling also plays a very important role in performance. The event schedule can be year-round or seasonal. It can require a consistent level of performance, or fluctuate, requiring a peak at a certain time. Once this is defined, we then look at the level of performance. The athlete is defined as an: (1) elite athlete, (2) amateur athlete, (3) professional athlete, and the (4) recreational athlete. Training and conditioning programs should be determined according to the athlete's capabilities and the level in which the athlete will compete. An elite, professional canine athlete will have different expectations than the once a year, amateur athlete. It should be noted that an elite athlete can compete at an amateur level and its training program might be adjusted to fit this level. In any case the training and conditioning program should be determined by each individual's personal performance expectations. Performance can be analyzed once we have set our performance expectations for the defined event.

Lameness is a most common cause of performance impairment and should be analyzed first. Gait analysis, or motion analysis, is an excellent tool in diagnosing lameness in the canine athlete. These abnormalities can be detected by the trained eye or can now be easily detected and quantified by video-computer kinematics. The dogs are video'd while performing their event or in a laboratory setting. The video itself can be digitized into a personal computer. The movements can then be reviewed and can be quantified for analysis by the diagnostician. After we rule out any musculoskeletal pathology as a cause of poor performance, we must then address health of the dog. Most medical problems can be detected by a general diagnostic work-up. If the dog is in good health, the clinician should then evaluate the training and conditioning program of the handler or trainer. This is the area where proper communication plays a role. The clinician must determine (1) the type of

skill or event the dog is going to perform; (2) the performance definitions of this skill or event; and (3) the competition level and competition type that is required for this event. From this evaluation, it can be determined if the handler's performance expectations are too great for the canine athlete in question, or if the training and conditioning program should be altered.

A feeding program can be implemented that will optimize the ability of the athletic and working dog. This program can be designed to enhance available energy, allow for efficient energy metabolism, and delay cellular fatigue. A dog's ability is defined by how it performs. If the dog is performing at a level that is satisfactory, then there is no need to change the dog's nutritional program. Most dogs are able to perform their duties while being fed a general dog food. For these dogs, any of the major dog food brands provide the proper nutrients and energy. In the elite athletic and working dogs, a more appropriate nutritional program is needed to optimize their metabolism, their ability to perform and enhance their career longevity.

There are two types of activities performed, sprint/strength activities and endurance activities. They utilize different energy sources. Sprint/strength activities utilize immediate energy sources while endurance activities mainly use oxidative energy sources. The type of energy source utilized is related to the length of time that the activity is performed. Muscles play a very important role in performance and work activities. This is true even in the dogs that do scent related work. Scent dogs must travel or move around the work area and towards the scent source. Although the dog is using its nose to detect, the muscles are working to allow locomotion of the body. It is important that the body of a working dog be conditioned to handle the physical work that it will need to perform. A conditioning program combined with the proper nutrition program can be designed to allow for optimal performance and prevent early fatigue.

The key to performance nutrition is to have energy available when needed and, in endurance athletes, to train the body's metabolic systems to utilize the oxidative energy system. The order of energy utilization by the body during a high activity event is to use carbohydrates first followed by fat and then finally protein. It is important that the body be prepared and conditioned to use fat and avoid burning protein as an energy source. This will act to delay muscle fatigue and avoid the deleterious effects associated with fatigue. The end result will be better performance and career longevity.

Developing the Conditioning Program

Preparation of the body for performance utilizes two physiological laws of Exercise Physiology, Wolff's Law and Davis' Law. Wolff's Law states that bone in a healthy person or animal will adapt to the loads under which it is placed. Davis' Law states that the related soft tissue in a healthy person or animal will adapt to the load under which it is placed. These changes occur as a result of biomechanical stressors and how they affect the body. Whole body stressors will affect the whole body while segmental stressors affect select components of the body. It also needs to be understood that fatigue will play a role and the difference between whole body fatigue and segmental fatigue. The end result is to prepare the structures of the body for the stresses of operation. The conditioning program discussed here is based on the SAID Principles (Specific Adaptations to Imposed Demands) of human training.

- *Injury Reduction- What type of injuries commonly occur in the dog's activity and what type of conditioning is required to reduce those injuries?*
- *Speed- What type of speed training does the dog need to have for its activity?*
- *Endurance- What type of endurance will the dog need for its activity (e.g. muscular and cardiovascular)?*
- *Muscle Groups- Which muscle groups need to be trained for the dog's activity?*
- *Muscle Action- What type of velocity of contraction, synergistic firing of the muscle, and more will be required for the dog's activity?*
- *Energy Source- What energy sources will be used, and in what manner will they be used for the dog's activity?*

The first step is to determine the force actions involved in the activities. Then determine the workload (effort and time demands) on the dog while performing these identified activities. The next step is to determine the environment in which the dog will be working. The last step is to identify what types of surfaces and terrains in which the dog will be working. Once these are identified, the training will be designed using three basic conditioning concepts, Sprint activities, Strength activities and Endurance activities. A balance of these three types of activities may be called "cross-training" and is focused in enhancing the body to handle the specific needs of their work or athletic effort in the environments and surfaces where they work. Each of these activities involve one or more of the normal forces of activity; movement initiation, straight-forward

locomotion, turning, movement deceleration (stopping) and the normal variants, jumping &/or aggression work. So, the design will be based on using the proper balance of these normal forces to achieve the desired outcomes. The program will include activities that prepare and strengthen the structure to handle the rigors of everyday work.

The program must also prepare the body metabolically to handle the workload and duration of the effort. The regimen will be designed to enhance the body's metabolism in a manner that the work effort does not create a negative metabolic state. Anytime the body enters a negative metabolic state, typically a recovery period is needed prior to the next effort. The proper conditioning program will prepare the body at a metabolic level above the needs of the work or athletic effort. Designing the training/conditioning program in this manner typically results in a reduction of exercise related injuries and results in enhanced performance.

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Why do shoulder injuries happen in agilities dogs? Exploring the clinical biomechanics of common injuries

Barbara Bockstahler and Julia Giovanardi

Research, albeit mostly based on surveys, has described injuries that are particularly common in various sports and that vary by sport. The most information in this regard is available for the sport of agility. For these, the shoulder, carpus and/or paws, and back are frequently cited, with overall musculoskeletal and tendon injuries frequently mentioned. In addition, the surveys have attempted to identify risk factors for the injuries (see the paper Surveys vs. Science: Reviewing the Research on Sporting and Working Dog Injuries). In addition to their use in surveys, biomechanical research has become increasingly important and provides important insights into the loads to which sporting dogs are subjected. These studies also provide possible clues to the etiology of certain diseases.

When looking at the survey of injuries that were reported, it is noticeable that the forelimb was the most common location of injury [1–3], with the shoulder being the most common location overall [1–6]. The three most common obstacles where injuries were reported are the simple hurdle, the A-wall, and the walkway. Studies investigating biomechanics in agility are found to most commonly examine the simple hurdle and the A-frame; no studies are available for devices such as the tunnel or the walkway.

When attempting to correlate injuries with biomechanics, it must be remembered that it can be difficult to determine from owner surveys whether injuries are recent or whether injury is due to chronic overuse. It must also be considered that various influencing factors, such as age, previous sports injuries, existing orthopedic conditions, performance level, and training frequency have been associated with increased risk of injury by at least some studies.

The hurdle represents the device most commonly associated with sports injuries [1,2,6], and here the forelimb was most commonly affected [1,6]. In any case, it should be noted that the hurdle also represents the device most commonly used in the course [7–9]. When completing the hurdle, the forelimb muscles exhibit very high activity during the jump [10] and high forces and impulses act primarily on the forelimbs [11–13].

In addition, jump height, distance between hurdles, and size category have a large influence a on the measured parameters, such as the angulations of the joints and length and shape of the trajectory [14–18]. Limb dynamics during hurdle completion is also a complex event [11,12]: dogs of lower skill levels show higher limb compression and lower -stiffness during landing after a hurdle than dogs of higher skill levels. This could led to the conclusion that more inexperienced dogs may not be able to activate antigravity muscles in a timely manner upon landing after a jump. This could be associated with increased eccentric muscle activation and thus increased risk of soft tissue injury, consistent with results of surveys describing an increased rate of shoulder injury, particularly strains, and a more frequent rate of injury in dogs with under four years of agility experience [1,6].

Further studies surveying muscle activity of additional muscles are desirable, especially since studies show that the back [1,2,4–6] and iliopsoas muscle [3] are also frequently injured, and the hindlimb also has a considerable amount of work to do [11,12]. The increased risk of injury in border collies [1,4] can also be partially explained by biomechanics at the hurdle. Collie-type dogs jump faster and farther than noncollie-type dogs and bend their heads ventrally during the jump, but noncollie-type dogs tend to hyperextend their heads dorsally [18]. However, the extent to which head posture influences the risk of injury has not yet been clarified.

The A-wall is cited as a common cause of shoulder, back, and toe injuries [1,6,19], and research has primarily focused on its angle of inclination [10,20,21]. Furthermore, the influence of bandages [22] and the kinematics of experienced and inexperienced dogs [23] have been studied. Bandages did not affect any extension of the carpal joint. Reducing the angle of inclination has no effect on vertical ground reaction forces; but braking and acceleration forces change with lower angle of inclination during ascent onto the A-wall [21]. It is possible that the frequency of shoulder and toe injuries can be explained by the technique at the contact zone (2on2off or runnings contacts), but further studies are needed for this. Regarding the kinematics of the front limbs, the level of experience had no influence, whereas inexperienced dogs basically moved their head and back more during the completion of the A-wall than experienced dogs [23]. This may explain why dogs under four years of agility experience are more likely to injure themselves than dogs with over four years of agility experience [24].

No biomechanical studies exist yet for the walkway. The walkway is one of the three devices most frequently associated with injuries [2,5,6,24]. Here, injuries to the thorax, head, and back are clustered [1,6], mainly in the form of abrasions [1]. The majority of these injuries can be explained by a fall from the equipment [2]. In this regard, studies regarding biomechanics, limb dynamics or step sequence on the walkway would be interesting to find out if there is a physical-mechanical cause that could explain the frequency of these falls, what role the technique at the contact zone plays in this, and how such accidents could be prevented if necessary.

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Physical therapy for shoulder disorders. What can be done and what can we expect?

Marion Mucha

Especially in the field of sports medicine, we see many dogs suffering from shoulder problems. The most common muscle and tendon-related changes in the shoulder joint that lead to performance problems and lameness include tendinopathies of the biceps and the supraspinatus muscle. Shoulder osteoarthritis, however, is also common, often secondary to tendinopathies, and results in pain and lameness.
The first thing owners want to know is when their dog will be allowed to do dog sports like agility again and what the chances are for a full recovery.
Especially in tendon problems the road back to sport and full performance is a long rocky one. Patience is particularly important with tendon disorders. Four to 12 weeks of absolute rest are necessary to achieve complete tendon regeneration after three to six months in the ideal case. Our approach to obtaining the best possible results is to increase the exercise slowly only when the dog is completely symptom-free. In dogs suffering from osteoarthritis of the shoulder, the prognosis is even more guarded and a return to sports should be avoided if possible, for the patient's well-being.
Regarding the therapy laser and extracorporeal shock wave therapy seem to be promising therapeutic methods.
In a small study with 7 dogs of different breeds suffering from tendinitis of the biceps brachii muscle we investigated the effect of laser therapy (MLS-MphiVet laser (ASA)). The treatment response was evaluated with ground reaction forces of the front limbs before and after the therapy. The overall treatment response was good and this led us to the opinion, that laser therapy in tendon problems is a promising modality even though studies with a larger number of dogs are required.
More veterinary literature is available on the use of ESWT for the treatment of tendinopathies.
In 2007 we published a case series of three dogs suffering from shoulder tendinopathies treated with radial shockwave therapy. The outcome was evaluated with ground reaction forces and diagnostic imaging and showed promising results (1).
In a retrospective study published 2015 15 client-owned dogs diagnosed with shoulder lameness (biceps tendinopathy, medial shoulder instability or supraspinatus tendinopathy) that had failed conservative management, were treated with ESWT and the results seem promising. On the other hand, the results must also be viewed critically due to retrospective nature with a high risk of bias and due to the lack of objective outcome measures and a control group (2).
Another retrospective study with 29 client-owned dogs suffering from biceps or
supraspinatus tendinopathy showed a 85% success rate as determined by owner
assessment. This study lacks a control group and objective outcome measurements as well and has a high risk of bias (3).
A metaanalysis conducted from 2010 until 2020 in human medicine LLLT showed statistically and potentially clinically significant improvement in pain and function in the short term. Extracorporeal shock wave therapy showed statistically significant improvement in pain and function at all follow-up periods; however, its clinical significance was indefinite (4).
Multibiosignal therapy (MBST) is a quite new modality for treatment of musculoskeletal problems. Studies evaluating the effect of pain and lameness in dogs suffering from osteoarthritis provide inconsistent results with a positive tendency (5, 6). In our patients, suffering from tendinopathies of the shoulder joint, especially of the biceps brachii muscle we have seen some promising outcomes so far. In any case, further studies should be conducted to scientifically investigate these observations.
Therapeutic ultrasound is also a treatment modality that is often used in the treatment of tendon disorders, but so far, existing studies cannot scientifically recommend its use due to the high bias of the studies.

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45 YEARS WITH RACING SLED DOGS…WHAT DID THEY BRING TO CANINE SCIENCE AND MEDICINE? (DOMINIQUE GRANDJEAN - FRANCE)

Being a snow veterinarian, how do you find science in the mountains?

Prof. Dominique Grandjean DVM, PhD, HDR, Dipl ECVSMR

The passion for sled dogs can bring a veterinarian to try to understand and know more, and more from field studies to more sophisticated researches.
The extraordinary "biological machine" that is the sled dog brought a lot to veterinary medicine and dog nutrition and physiology:

- *Energy sources*
- *Quality of the energy provided*
- *Oxidative stress approach and anti-oxidants quality and levels*
- *Interests of omega 3 fatty acids*
- *Dietary soluble fibers*
- *Small sport medicine traumatology*
- *Overheating prevention*

And there is probably still lots of new knowledge a sled dog can provide us, may be also in terms of comparative biology and interest for human medicine!

SMALL ANIMALS PROGRAM:

FREE COMMUNICATIONS

ABSTRACTS

The effect of different substance combinations administered through mesotherapy for dogs with hips osteoarthritis

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Background/Objectives
To evaluate the effect of different substance combinations administered through mesotherapy in dogs with osteoarthritis.

Material and Methods
Dogs exclusively with bilateral hip osteoarthritis were included, and both hips were treated. Four substance combinations were identified: lidocaine, piroxicam, and thiocolchicoside (MG, n=38); lidocaine, piroxicam, and Traumeel (TG, n=22); lidocaine, piroxicam, and glucosamine (GG, n=22), and the same combination as in MG combined with photobiomodulation (MPG, n=22). Treatment frequency was one treatment/week for four weeks, followed by one treatment every two weeks for three treatments. Copies of the Canine Brief Pain Inventory (CBPI), Liverpool Osteoarthritis in Dogs (LOAD), and Canine Orthopedic Index were obtained at T0, +15d, +30d, +60d, +90d, and +120d. The groups' results were compared with the Kruskal-Wallis test, $p<0.05$. Kaplan-Meier estimators were determined, and Cox proportional hazard regression analysis was used to investigate the influence of treatment, age, sex, body weight, breed, and OFA score.

Results
The sample had a mean age of 7.6±3.1 years and a body weight of 28.6±5.5kg. Hip osteoarthritis was classified as mild (4), moderate (70), or severe (30). No differences were found at T0. Significant differences were observed from the +15d to the +120d evaluations, with MG and MPG showing greater improvements, particularly with CBPI and LOAD. Kaplan-Meier estimators showed MG and MPG had longer periods with clinically significant results. Treatment contributed more frequently to the outcomes observed.

Conclusions
Different combinations improved clinical signs in patients with hip osteoarthritis. The one in MG, particularly combined with photobiomodulation, produced better, longer-lasting results.

Conflict of interest: The authors declare they have no conflict of interest.
Ethical committee: This study's protocol was reviewed by the Ethical Review Committee of the University of Évora (Órgão Responsável pelo Bem-Estar dos Animais da Universidade de Évora, process nº GD/21660/2022). Written, informed consent was obtained from the Institution responsible for the animals.
Sources of funding: This research received no external funding.

Rehabilitation applied to vestibulo-cerebellar syndrome in presumed cerebellar hypoplasia: Can we avoid euthanasia?

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Background
Cerebellar hypoplasia (CH) is a congenital neurologic condition caused by the inadequate development of the cerebellum which is responsible for fine-tuning of motor movements. This pain free condition remains stable, so the patient can live an acceptable quality of life if able to ensure basic functions such as eating, drinking, moving, and resting comfortably.

Case description
A 4-month-old Australian shepherd was presented for rehabilitation management with presumed CH. Clinical presentation included: head tilt towards the left side, intermittent positional nystagmus, non-ambulatory severe ataxia and increased reflexes and extensor tone in all limbs with a lack of tonus inhibition on the left side. Goals were to improve gait function and body orientation to ensure optimal quality of life.

Treatment protocol
The rehabilitation protocol included mobilizations, balance exercises, assisted walking and underwater treadmill sessions. Emphasis was placed on the ability to turn left for this patient since this was his larger deficit. A four-wheeled cart was prescribed to promote independent mobility and trunk stabilization. Furthermore, a Bailey chair and a soft diet prescription were provided to promote a safe vertical eating setup in a context of megaesophagus.

Outcome
Outcome assessments gathered for 1.5 years of rehabilitation included decreased head tilt, improved motor function, and independent ambulation was achieved with a four-wheels cart.

Conclusion
Dogs with CH can learn to compensate for their condition. Therefore, rehabilitation represents an option for those patients to improve motor function and quality of life.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: Not applicable due to the case report nature of this scientific paper.
Sources of funding: This research received no external funding.

Therapeutic effect of the treatment with radiofrequency at 448kHz in 10 dogs with coxarthrosis – pilot study

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Background
Positive effects of Radiofrequency (RF) at 448kHz have been shown in various human medical studies, but the effects of RF on pain in dogs is little studied. The study aimed to assess the pain-relieving effect of RF at 448kHz using only resistive mode (RES) in dogs with coxarthrosis.

Material and Methods
Ten dogs (18.01 ± 4.84 kg, 9.53 ± 4.80 years) with radiologically confirmed coxarthrosis were included, and nine were considered for assessment. In bilateral disease, joint to be treated was determined by orthopaedic examination and/or ground reaction forces (GRF). Patients received 6 treatments (INDIBA® Animal Health AH-100) using RES at an intensity of 15% for 15 minutes. Before treatment, GRF, graded lameness examination score (GLES), range of motion (ROM) and Canine Brief Pain Inventory (CBPI) were assessed and repeated on the day of the 5th (day 16) and one week after the last treatment (day 27). A linear model with measurement day and limb as fixed effects and post hoc comparisons using Sidak's alpha correction procedure were used to evaluate the treatment success.

Results
Treatment was well tolerated, with no stress signs in 9/10 dogs. GLES showed a significant improvement at day 16 ($p = 0.03$) and 27 ($p = 0.008$). GRF, ROM and CBPI did not show a significant improvement.

Discussion - Conclusions
Since positive effects were shown in GLES, further research should focus on the effects of RF for pain management in dogs, including a first phase of capacitive mode and a larger number of patients.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: The study was approved by the by the Ethics and Animal Welfare Committee of the University of Veterinary Medicine, Vienna, in accordance with the university's guidelines for "Good Scientific Practice".
Sources of funding: This research was funded by Indiba S.A.

Development of a new guide dog harness using a three-dimensional musculoskeletal model and inverse kinematics

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Objectives
Simulate the motion of the canine scapula with a musculoskeletal model using inverse kinematics (IK) to assess the limitations of the current harnesses and develop new guide dog harnesses.

Material and Methods
A musculoskeletal model including bodies, joints, coordinates, and muscles was developed in NMSBuilder and imported into OpenSim software. IK was performed on the model using existing motion data and results were compared with the direct kinematics (DK) to validate the model. The topography of the areas that should not be in contact with the harness during gait was identified in the sagittal plane using virtual landmarks and point kinematics. To assess the craniocaudal and dorsoventral translations of the scapula, the cranial border, caudal angle, and dorsal border of the scapula were investigated.

Results
The range of motion (ROM) of the shoulder joint consisted of 32.2° and 39° with DK and IK respectively. Maximum flexion and extension of the shoulder with IK were 10.4° and 28.6° respectively. To have a free craniocaudal movement of the scapula, the optimal harness should not exceed the sixth rib on the thorax and its cranial parts should be aligned approximately along the fifth cervical vertebrae. The dorsal border of the scapula should be free of harness, as it exceeds the topography of the spinous process of the first thoracic vertebrae in the middle of the stance phase.

Conclusions
These results help scientists to better understand the normal gait of dogs and design new harnesses to improve the limited ROM of forelimbs.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: Not applicable due to the retrospective design of the study.
Sources of funding: This research was funded by Verein, Freunde der Assistenzhunde Europas“, Kittsee, Austria.

First steps in discipline-specific canine exercise physiology: a field study on canicross dogs

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Background and objective
Canicross and its derivatives are burgeoning sports activities for the dog-master duo; nonetheless, scientific knowledge in this field is lacking. Our objective consisted in a first approach to this gap.

Material and Methods
On December 2021 (5°C, 80% humidity) and May 2022 (20°C, 54% humidity), we recruited 9 and 11 dogs covering a distance of 5.7 and 4 km, respectively. We collected physical and blood parameters as heart rate (HR), respiratory rate (RR), rectal temperature (RT), hematology, biochemistry, blood lactate and glucose, at rest (T0), immediately (T1) and 1 hour after exercise (T2). We performed an ANOVA on repeated measures.

Results
On December as on May, we observed a significant increase in RT and HR. Mean RT at T1 was more than 1°C higher on May (40.49±0.88) than on December (39.29±1.06). Hematocrit increased with exercise in both conditions, the rise being significant only in December. Concerning electrolytes, only Mg decreased with exercise on December, whereas also other electrolytes (Cl, K, Ca, P, Mg) changed on May. Biochemistry was unchanged, except for creatinine on May. Lactate was not affected by exercise on December but increased significantly on May from T0 to T1.

Discussion
Few parameters were modified in cold conditions, while electrolytes and lactate significantly changed in warmer conditions. The difference in the increase of RT between December and May is a crucial parameter for animal welfare. Hypomagnesemia with exercise was common to both situations.

Conclusions
Research on canine exercise physiology deserves development to support owners and veterinarians.

Conflict of interest: The authors declare no conflict of interest
Ethical committee: The study was approved by the Animal Ethical Committee of the University of Liège (N° of approval 21-2396)
Sources of funding: This research received no external funding

Intra-articular blood cell secretome, triamcinolone, or both in dogs with hip osteoarthritis – a cross-over study

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Background/Objectives
To evaluate the intra-articular of Blood Cell Secretome (BCS), triamcinolone, or both in dogs with osteoarthritis.

Material and Methods
Fifteen dogs with different degrees of hip dysplasia were selected and equally divided into a BCS (BCSG), triamcinolone (TG), or combination group (BCS+TG). BCSG received an intra-articular administration of 3ml of BCS, TG received 0,5ml (20mg) of triamcinolone acetonide, and BCS+TG received both. Cross-over was performed for BCSG and BCS+TG after 180 days. The Canine Brief Pain Inventory, Liverpool Osteoarthritis in Dogs (LOAD), and Canine Orthopedic Index were completed on days 0, +8d, +15d, +30d, +60d, +90d, +120d, +150d, and +180d. Groups were compared with the Kruskal-Wallis test. Kaplan-Meier time-to-event estimators were calculated, $p<0.05$.

Results
Dogs had mean age of 9.6±2.9 years and a bodyweight of 29.2±3.9kg. Hips were graded with severe (7) and moderate (8) osteoarthritis. No differences were found at T0. Significant differences were observed with Pain Interference Severity scores from +8d ($p=0.04$ and $p=0.03$, respectively) to +150d ($p=0.03$ and $p=0.04$, respectively), with BCS+TG showing lower scores. With the LOAD, improvements lasted to +120d ($p=0.04$). Improvements in Stiffness, Function, and Gait were observed between +15d ($p=0.03$, $p=0.02$, and $p=0.02$, respectively) and +90d ($p=0.04$ for all). BCS+TG exhibited clinically-important differences for longer periods, followed by BCSG and TG.

Discussion - Conclusions
BCS in combination with triamcinolone significantly improved the scores of several clinical metrology instruments, particularly considering the pain scores. BCS and Triamcinolone used as a separate treatment also showed a similar effect, but to a lesser extent.

Conflict of interest: The blood cell secretome used in this study was prepared with the Orthogen® Device, provided by Orthogen AG.
Ethical committee: The study protocol was approved by the ethical review committee of the University of Évora (approval nº GD/37188/2021/P1). Written, informed consent was obtained from the Institution responsible for the animals.
Sources of funding: This research received no external funding.

SMALL ANIMALS PROGRAM:

POSTERS ABSTRACTS

Biomarkers of physical activity and Betahydroxybutyrate variation in sled dogs competing in three different lenght of trials.

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Background - Objectives
Increasing the lenght of a trial results in a progressive switch to aerobic consumption and utilization of keton bodies. Beta hydroxybutyrate (BHB) represents an essential energy carrier when the supply of glucose is too low, such as in the case of prolonged exercise.

Material and Methods
48 dogs were enrolled: 14 nordic breed dogs in a short 4 km trial, 18 alaskan husky breed in a medium 40 km trial, and 15 nordic breed dogs in the 80 km long distance sleddog trial. Blood samples were taken: 3 to 8 hours before the race (T0) and within 5 minutes after the dogs stopped their activity (T1).

Results
In the short run there were minor changes in Glucose (Glu) and Calcium (Ca) values from T0 to T1. In the medium and long distance we observed rising of BHB, Aspartate Aminotransferase, Creatinine kinase. The medium trial was the one where we observed an elevation of creatinine, Sodium, Potassium (K) and Chloride as well. Decreasing values were registered for Glu and Magnesium in the medium trial and for Ca and K in the the long trial.

Discussion - Conclusions
Exercise in dogs induces physiological changes associated with intensity and duration of the effort. BHB varies as the trail becomes more challenging for the dogs. We observed minor changes in the short run and moderate changes in the long run whereas in the medium run changes appeared to be over-expressed. This could be attributed to sample or study limitations or to adaptation to endurance exercise.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: The study was approved by the University of Udine - Dipartimento di Scienze Agroalimentari, Ambientali e Animali (Organismo Preposto al Benessere animale) (protocol code 9/18 and 17.12.2018 date of approval)"
Sources of funding: This research received no external funding

Comparison of physiological parameters in IGP (International Gerbrauchshunde Prüfung) dogs before and after a training routine.

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Background and objectives
IGP is a popular sport for all working breeds, consisting of three phases: obedience, tracking and protection. Aim of this study was to determine physiological changes in sporting dogs before and after a IGP training.

Material and Methods
10 IGP experienced dogs underwent a competition like training in an environmental temperature between -4 and 8°C. Before and after training an electrocardiographic analysis, an echocardiographic study, rectal temperature and blood pressure measurement was performed and a blood sample (3 µl venous blood) to obtain lactate concentration was collected.
Student's t-tests for related samples and test for magnitude of effects were performed.

Results
All dogs had respiratory sinus arrhythmia at rest. Rectal temperatures increased significantly after exercise (from 38.2 ± 0.3 to 40.0 ± 0.5°C; $p<.01$), as did lactate (1.3 ± 0.3 to 5.8 ± 1.5 mmol/L $p<.01$), R-wave amplitude (2.3 ± 0.3 to 3.0 ± 0.7 mV; $p<.01$), heart rate (82.6 ± 22.5 to 142.0 ± 21.5 lpm; $p<.01$) and left ventricular internal dimension at end diastole (LVIDd) (3.56 ± 0.5 to 4.10 ± 0.5 cm; $p<.05$). The magnitude of the effects of IGP training was considered large, ranging from r=.66 for LVIDd to r=.97 for lactate and heart rate.

Discussion - Conclusions
Despite the small sample size and although different training protocols were used, the results indicate that significant changes in physiological parameters occurred. Further studies under standardized conditions with a larger number of animals should be conducted.

Conflict of interest: authors declare no conflict of interest.
Ethical committee: The study was approved by the Ethics Committee Animal of the CEU-Cardenal Herrera University (protocol code CEEA 22/03, 02.03.2022).
Sources of funding: This research received no external funding.

Treatment of a common calcaneal rupture with tenorrhaphy, platelet-rich fibrin and a temporary transarticular external skeletal fixation of the tibiotarsal joint in a cat: A case report with postoperative gait analysis assessment

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Objectives
Surgical treatment of a complete common calcaneal tendon rupture, of the right hindlimb in a 10-years-old domestic outdoor shorthair cat, male castrated, with 5 kg of weight, by tenorrhaphy and platelet-rich fibrin (PRF) technique, associated to temporary transarticular external skeletal fixation of the tibiotarsal joint.

Material and Methods
The diagnosis was based in a previous failed attempt of surgical treatment, the orthopaedic examination, ultrasound and radiographic findings. A locking-loop suture with nonabsorbable monofilament suture was performed and involved by a PRF membrane. PRF was obtained by centrifugation of an autologous whole blood sample (3000 rpm, 10 min) in sterilized conical base polypropylene tubes, without clot activator. PRF is rich in leukocytes, platelets and growth factors, which are important mediators of healing process. A temporary modified type II external fixation, with the tibiotarsal joint in slight extension (145º), was applied.

Results
The external fixation was maintained until tendon healing, ultrasonographically confirmed 35 days postoperatively. Clinical and ultrasonographic evaluation 60 and 120 days postoperatively showed normal limb function and good tendon healing. Gait analysis at that time points showed slightly lower measured ground reaction force (GRF) in the operated limb, compared to the contralateral, and the published GRFs for healthy cats. Long-term follow-up examination 1 year postoperatively revealed that the cat presented normal gait evaluate during orthopedic examination, normal GRF and activity level.

Conclusions
To the author's knowledge this is a successfully first report of PRF use for the treatment of a tendon rupture in a cat, associated to gait analysis.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: Not applicable due to no ethical concerns with the collection of data or with the management of the case. The owner has consented to the use of clinical case data for this report.
Sources of funding: This research received no external funding.

Effect of sedation with acepromazine and dexmedetomidine on kinetic parameters in healthy dogs

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Background
The kinetic gait analysis using force plates is the Gold Standard method that allows to objectively evaluate the evolution in orthopedic patients rehabilitation and the performance in sports/work dogs. However, the difficulty of performing this procedure lies in the behavior of the patient and, mainly, in the environment in which this action is carried out. Therefore, knowing the influence that the use of low-dose anxiolytic drugs with no analgesic effect has on the kinetic parameters would be very useful, since sedation would greatly facilitate its development.

Material and Methods
The kinetic analysis was carried out in twenty healthy greyhound dogs divided into 2 groups based on whether they have been sedated with acepromazine (0.015mg/kg IM) or dexmedetomidine (2-3µg/kg IM). Effect of each sedation on gait was evaluated by the peak vertical force (PVF), vertical impulse (VI) and symmetry index (SI).

Results
There was no statistically significant differences between the PVF pre and post-sedation in either of two groups. However, there are significant variations in the IV (Wilcoxon; $p<0.05$) in both groups. For SI, no differences were observed, eventhough, in case of acepromazine it is close to significance in hind limbs (Wilcoxon; $p=0.06$).

Discussion/Conclusion
There are no studies to our knowledge that analyze the effect of sedation on gait in the canine species. Comparing our results with those obtained in horses, we not observed differences, considered as the most objective parameter of the analysis. For this reason, we consider that sedation can help to perform kinetic analysis in dogs.

Conflict of interest: "The authors declare no conflict of interest."
Ethical committee: "The study was approved by the Institutional Review Board (or Ethics Committee) of University of Extremadura (protocol code 29/2020 and 13/04/2020)"
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Analysis of the canine athletes participating in the Lekkarod™ mid-distance sled dog race

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Objectives
The aim of this study was to characterize the dogs participating in the Lekkarod™ mid-distance sled dog race, to have an overview concerning the origin, age, breed, sex and reproductive status of each participant. In addition, the collection of clinical cases during the race will make it possible (in further study) to establish a profile of pathologies also associated with the age and sex of the patient.

Material and Methods
This study was carried out during the Lekkarod™ 2023 mid-distance race, obtaining, in situ, information from the 599 dogs participating in the race.

Results
Out of the 599 dogs in the study, 45,1% followed the complete 7-day race (227 km), while 54,9% were the dogs that only participated in the last three days (105 km). 45,7% are female, among 38,3% had been sterilized, while in male dogs, 20% had been neutered. More than 57% of the dogs were born in France, while 19% of the dogs have a microchip number that does not allow to identify the country of birth. The most represented breed is the Siberian Husky (52,1%), followed by the Alaskan Husky (27,7%) and the European Sled Dogs (16,7%). The mean age was 4,82 years old (sd:2,3).

Conclusions
The present data provide the veterinary team substantial information, that can accelerate the diagnostic-therapeutic procedure, such as the reproductive status with the risk of pyometra for example.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: Not applicable due to being a clinical veterinary study
Sources of funding: This research received no external funding

Effects of physical exercise on the urinary metabolome in military working dogs

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Background and Objectives
The urinary metabolome has been investigated in humans to obtain information on changes of the metabolic profile after physical exercise and to identify possible novel biomarkers of adaptation to exercise training. Similar studies are currently lacking in dogs. This research aims to explore the effects of physical exercise on the urinary metabolome in military working dogs.

Material and Methods
Twenty-four trained military working dogs (explosive and mine detection dogs) were enrolled in this study. Dogs were randomly divided in two groups: ten dogs performed 20-minute training of search activity and 14 dogs additionally exercised 10-minute treadmill. Urine was sampled before and after a training session of search activity. The metabolome was analyzed using an untargeted 1H-NMR. A Partial Least Squares Discriminant Analysis (PSL-DA) followed by t-test was used to identify significant differences between the two time-points investigated ($p<0.05$).

Results
Ninety-six molecules were unambiguously quantified by the metabolomic analysis and the PLS-DA model indicated fourteen metabolites presenting significant differences before and after exercise. In particular, 3-methyl-2-oxovalerate, acetate, methionine and 3-hydroxyisobutyrate presented highly significant differences ($p<0.01$). Among several metabolic pathways, the metabolites pertaining to energy production and amino acid and steroid hormone metabolism appeared to be influenced in response to exercise.

Conclusions
Metabolomics analysis reveals a significant modification in the urinary metabolic profile due to physical exercise. The clinical relevance of this study is related to the utility of urine as non-invasive sample to monitor the health status after training activity and exercise in dogs.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: The study was approved by the Ethics Committee of Bologna University (ID 914/2018)
Sources of funding: This research received no external funding


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EQUINE PROGRAM:

KEYNOTE AND INVITED LECTURES

Equine Performance and Safety: When Heart Matters

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Equestrians and their athletic partners perform high-intensity exercise in a variety of different disciplines competing at or near their maximal physiological limits. Exercise-associated sudden death in any one of these sports is a tragedy. In the absence of other pathology, horses that collapse and die are assumed to have exercise-associated sudden cardiac death (SCD). The majority of these occur during training (60%), rather than in competition. Injury to the rider/driver occurs in approximately 25% of these occurrences.

Further investigations of abnormalities capable of causing SCD is essential to reduce injury and death in equestrian sports. Most young racehorses that collapse and die in the absence of other pathology are thought to have experienced ventricular tachycardia, ventricular fibrillation, and cardiac arrest. In some, histopathologic changes are found consistent with this pathogenesis. In others, severe exercise-induced pulmonary hemorrhage (EIPH) or pulmonary edema is detected. While great vessel rupture is also a cause of SCD, this is less common in the young racehorse. Moderate to severe aortic regurgitation, aortocardiac fistula, and aortopulmonary fistula (Friesian) can all result in ventricular tachycardia and SCD. Horses with myocardial infarction, myocardial toxicity, cardiomyopathy, and acute mitral chordae tendineae rupture can all experience SCD. While horses with congestive heart failure are usually not competing in high-intensity exercise, they may be competing at lower levels of athletic endeavor with subtle or no clinical signs.

Cardiac abnormalities may also limit performance, although many horses show no clinical signs. Atrial fibrillation (AF) affects performance in racehorses and horses performing high intensity exercise such as upper level eventers, and some polo ponies, show jumpers, fox hunters and even Western competition horses. Ventricular septal defects (VSDs) can affect performance, although many Standardbred racehorses can perform successfully, except at the elite level. Few Thoroughbred racehorses can race successfully with a VSD, except at very short distances. This is also the case for horses in other disciplines that require sustained high intensity athletic work. Moderate or severe aortic and mitral regurgitation may also affect performance in high performing athletes but may go unnoticed in horses performing less intense work. Pulmonary hypertension may also affect performance with both lower airway and cardiac disease. Risk assessment should be performed in all horses with these and other cardiac abnormalities to determine the safety of horse and rider in each discipline.

The veterinary profession in the 21st century: from technicality to prevention, an ethical issue

Jean-Yves Gauchot, DVM - Claire Scicluna, DVM

Wikipedia defines the vet medicine as “the branch of medicine that deals with the prevention, management, diagnosis, and treatment of disease, disorder, and injury in animals. It deals with animal rearing, husbandry, breeding, research, and product development.”
This definition shows by itself how wide is the scope of veterinary medicine, in order to cover all matters on all animals.
With time, knowledge, technicality and society evolutions, the task is changing and the veterinarian has now to deal with other challenges in order to keep the public’s trust in its respectful work.
Equine veterinary profession is a good example of this evolution through ages.

About History
The horse is integral part of the veterinary history.
Its domestication, the oldest trace of which dates back to around 3000 BC, is the first step to the human-animal relationship : the first transportation mode
Ancient indian sage and veterinarian Shalihotra (mythological estimate c. 2350 BCE), the son of a sage, Hayagosha, is considered the founder of veterinary sciences.
By turn, the Egyptian, Greco-Roman, Byzantine, Arab, Asian and Western civilizations were concerned with better managing equine diseases in order to continue being able to use them on a daily basis for transportion, go to war, helping them with agricultural work, even at least being a food product.
Claude Bourgelat founded the first veterinary school in Lyon in 1762, in order to transmit the essential notions of observations and measures to be taken to combat animal epidemics such as rinderpest. On the human model, veterinary medicine is beginning to be taught and in the field of anatomy, it is the horse that is often used as a reference.
The concept of animal medicine profession to serve public health was born and spread throughout the world.
The veterinarian is able to understand what the animal is suffering from while it does not speak to him, he treats the animal on which man sometimes depends for work or travel: the veterinarian is important and so respected.

About Society evolutions
The birth of the industrial area made animal energy disappear. With the development of much more efficient carbon energies, the horse as traction energy is declining, and it is now less and less used as a working tool, except in poor countries.
The disappearance of the horse as a pillar of motor energy was the triggering factor for a societal change: the citizen no longer rubs shoulders with the horse on a daily basis, he gradually loses his equestrian knowledge, he no longer meets him, he no longer knows more about it.
The horse is now widely used in leisure, sport, races, walks, pony clubs and human care and therapy : the relationship with the animal has evolved.
Horse people now represent only a tiny part of society. The number of horsemen is dwindling, except among professionals who make a living from equestrian activity.
The horse is no longer simply a work tool: it becomes an investment, and sometimes goes so far as to become a companion animal, like a pet.
The Horse Well-Being concept is emerging: it is a question of paying attention to a companion with whom you share a period of your life. Its use for professional purposes, and above all for profit, is closely scrutinized.
This is a turning point that has been exacerbated since the 2000s.
The veterinarian must then treat the horse correctly and do everything possible for its comfort and well-being, but not become complicit in abusing treatments to force or even boost the horse's natural abilities. animal for the sole profit and/or pleasure of its owner. The sports follow-up of an equine athlete should not be a matter of hyper-care.
Conversely, the veterinarian remains the sentinel of animal health and well-being and always must be vigilant for any lack of care, whether it is negligence or abuse.

Since rationality is no longer the only driving force behind health care and monitoring, there is a massive development, as for humans, of additional medical or paramedical care professions for horses: osteopathy, massages, animal communication, podiatry, etc.
The veterinarian is not anymore the only one able to take care of horses : the type of respect has changed. Listening to and communicating with the client as well as the know-how of the veterinarian are guarantees of the respect shown to him.

About equine veterinary medicine evolution
Establishing a diagnosis and choosing a treatment are the very essence of the profession of veterinarian. In accordance with the code of ethics, these steps must be carried out according to the rules of the art.
In a society where everything goes fast and seems accessible to all, advances in medicine, surgery, imaging and pharmacy are such,, that the client tends to think that caring for and above all curing the animal depends only on the implementation of technical means and new tools by the veterinarian.
Gone are the days when the veterinarian heals the animal, which nevertheless does not speak and does not explain its problem or where it hurts, after a simple clinical examination.
Gone is the end of the client's admiration for a practitioner whose job is often similar to that of a pediatrician but even harder, since the animal doctor must know how to treat all species and all diseases.
So certainly the animal still does not speak, but blood tests, X-rays, ultrasounds and other MRIs or scintigraphy will reveal the root of the problem to find the solution...
The reality is quite different: finding the root of the problem, finally maybe, but finding the solution to the problem... that's another story!
Not to mention that ‘technique at all costs’ also has a cost and that a certain balance between the service and the invoice undoubtedly induces respect and confidence from the customer, especially for a long lasting relationship over time.
Practices evolve with techniques, tools available and knowledge evolution at the same time. However, if clinical data arrive in real time, their analysis is only possible a posteriori: this is the basis of scientific studies, even though Evidence Based Medicine.
Thus, the latest treatment placed on the market or the latest surgical technique announced are not necessarily the best and/or the strongest one.
However, it is not necessary to wait years before proposing and using this or that innovative treatment with the excuse of insufficient evidence of effectiveness or that it is necessary to change one's habits. It is up to the veterinarian to train and keep abreast of medical advances in order to best advise the client.
Through the evolution of knowledge and technique, veterinary medicine is tending towards specialization, and equine is no exception to the rule.
However, a horse remains above all an animal in its entirety, and not considering the whole horse (and its environment) during an examination or the implementation of a treatment risks to fail in the expected results, regardless of the specific medical or surgical technique used.
Finally, veterinary medicine can’t escape from the fashion effect.
The attraction for the treatment or the method of care that has transcended this or that champion remains an object of desire for any horse owner: if it is good for him, it is surely good for my horse.
The veterinarian will have to answer the ever more pressing questions and requests of customers eager to treat the best (sometimes even the most) to improve the performance and or well-being of their animal. He will try to earn his respect through his advice and good care, not always at the end of his needles!

About equine veterinary ethics
Ethics, also called moral philosophy, concerns questions of value, involving the notion of true or false, good or bad concepts.
Beyond the medical and scientific aspect supposed to dictate his work on the basis of his knowledge, skills and experience, the veterinarian must respect the animal and its owner by providing advice but above all the best care. more appropriate to the animal.
The right to practice the veterinary profession requires membership to a statutory body (order) which establishes its rules in a code of ethics, that members must respect.
If the code of ethics lays the corner stones of an ethical practice, it is up to each veterinarian to set the limits of his practice, taking into account the ever more pressing demands and technical developments that make his work environment.

In practice, it is perhaps time to lay the basics of a chart for veterinary ethics in equine care, in order to:

- Put the horse back at the center of the veterinary care system
- Restore a little morality in an economic spiral of a sector that is suffering financially at all levels
- Put the veterinarian back in his art of equine medicine and bring it back to light
- Remind the basics of a profession which, by specializing, gains in technicality but must not lose in humanity or in respect for the horse
- Make each equine veterinarian think about the medical, philosophical, legal and economic reality of his practice,

And highlight the essential points of the equine veterinary profession:

- Approach the horse in a professional and caring manner
- Practice respectful restraint of the horse
- Follow a logical diagnostic approach
- Prescribe accurately and wisely
- Provide quality care
- Respond to the customer's request with respect for the horse
- Ensure pain management
- Exercise its capacity as sentinel veterinarian

Even if the exercise of the veterinary art is personal and that "each veterinarian is responsible for his decisions and these acts", morals and philosophy of the practice have their legitimate place.
Because since 2015 there is now "a new code of ethics for a more competent, freer but more responsible veterinarian", there is a place for a charter for quality horse medicine and surgery, always adapted, reasonable and animal friendly.

On Equine Veterinary Practice Today: Questions to be asked

1. Do you think that the criteria defining ethics in professional organizations are applicable in equine veterinary medicine:
    - Honesty
    - Integrity
    - Transparency
    - Responsibility
    - Confidentiality
    - Objectivity
    - Respectfulness
    - Compliance with laws and regulations

2. What do you think of the following practices:
    - Treat a racehorse without knowing the racing code
    - Choose a treatment exclusively according to the value of the horse
    - Perfuse ad libitum
    - Hot iron cauterization of the soft palate for DDSP
    - Prevent heats in mares by continuous medical treatment all the year
    - Perform systematic ‘aesthetic’ arthroscopies before foal sales
    - Carry out complete X-ray assessments before each sale
    - Cartilage defects ‘gluing’ in foals
    - Carry out convenience infiltrations at the simple request of the holder
    - Perform more than 4 infiltrations same day, same horse

- Carry out systematic and repeated joint injections for 'maintenance' or 'prevention' on a non-lame horse
- Perform castrations without suturing surgical wounds
- Perform standing castration
- Do not consider sedation as a mean of restraint
- Carry out systematic antibiotic therapy with joint injections
- Carry out preventive antibiotic therapy
- Maintain antibiotic treatment for more than 10 days
- Do not consider any treatment other than corticosteroids for joint injections
- Treat stomach ulcers without prior gastroscopy
- Deliver medication over the counter
- Treat curve and sore-shins with cryotherapy
- Not caring for an old horse
- Not propose euthanasia at the right time
- …

About the future equine vet

The equine veterinarian must now focus his practice on prevention and no longer on highlighting his technicality. This prevention will have an impact on the reduction of the horse's major problems, such as fractures or the reduction of colic (which is already well demonstrated by good feed management).

Clinics must seek their profitability more in advice and preventive care and less in technical interventions such as "all the way" infiltrations and reconsider the merits of certain surgeries proposed.

The past 20 years have brought tremendous scientific and technical advances to the equine veterinarian (the disciplines of anesthesia, internal medicine, intensive care, screening for infectious diseases, musculoskeletal disorders, imaging), which has made it possible to be technically better, without a doubt, and to make a real leap forward in equine medicine and surgery. The time to analyze this period has now arrived to position horse care in the right place on the animal welfare scale, without going into "hyper care" which could be equated with a form of abuse.

Collectively, the profession must constantly question itself and denounce bad practices and deviations, but also question the justification of its actions: this is the very essence of our profession and the future of the equine industry. .

"Being ethical today for a veterinarian means first and foremost offering a service loaded with competence and ethics…. The only veterinary profession quality label ! "
Michel Baussier

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What are the manifestations of discomfort related to overtraining or over-exploitation in the horse at work?

Esther Siegers and Ellen Roelfsema

The welfare of equine athletes is under increasing scrutiny and criticism from both the general public as from within the equine industry [1]. In an international survey performed by the FEI, respondents were, among others, concerned about 'physical stress and injuries', 'overworking', 'pushed past limits' in equine athletes [1]. Optimizing welfare of (sport) horses involves many factors such as feeding, social contact and free exercise. A well designed training program contributes to the welfare of equine athletes [2]. An inappropriate high training load can lead to overreaching within weeks and may result in increased injury risk or poor performance [3-5]. A chronic imbalance between training load and recovery time can put a horse at risk for overtraining. The overtraining syndrome (OTS) is associated with behavioral, emotional and physical symptoms [3, 6].

Studies in racehorses and standardbreds induced overreaching or overtraining with intense treadmill training for 4 or 5 days a week. Overtrained horses were less cooperative, had a reduced run time to fatigue or reduced V4 and V10 (speed with plasma lactate concentrations of 4 and 10 mmol/L respectively) [7-9]. In the study of the Graaf-Roelfsema *et al.*, performance and behavioral changes of the intensively standardbreds did not restore after 4 weeks of detraining [9], indicating overtraining. In young Friesian horses, a state of overreaching or overtraining could be induced by training under saddle 4.7 times a week for 10 weeks. These horses performed less in ridden standardized exercise tests after the training period, shown by increased plasma lactate concentrations and heart rates [10.]
In the study of de Graaf-Roelfsema *et al.*, exercise was used as the acute stressor to induce overtraining. Muscle adaptations, measured by EMG and muscle biopsies, were not found in the overtrained group compared to the normal trained group. However, changes in endocrine responses (stress hormone, growth hormone and glucose/insulin metabolism) and behavior were significant [11,12]. This implies that stress-related disorders like overtraining, originate in the brain and precede alterations in peripheral organs like muscles. In general, stress occurs when the homeostatic balance of the body is disturbed. The body responds with secreting a whole array of hormones to reestablish homeostatic balance such that, if the same stressor were imposed again, the homeostatic mechanisms would not be disrupted to the same extent, resulting in overcompensation [11]. The hormonal events during reestablishment of homeostasis due to (exercise) stress can be divided into two phases. Initially, a catabolic phase in which sympathetic-adrenal medullary axis and the hypothalamic-pituitary-adrenocortical (HPA) axis are activated. Followed by an anabolic phase in which both the growth hormone-insulin-like growth factor-1 (GH-IGF-1) axis as well as the gonadal axis are activated. When homeostatic balance is not restored, the body experiences chronic stress which induces chronic activation of the endocrine system, ending in a neuro-endocrine disorder [11].

Although neuro-endocrine disturbances were obvious in overtrained Standardbreds, the hormonal tests to distinguish the intensified trained horses from the controls are not easy to perform in common practice [11,12,13]. Mood changes are considered as an useful indicator of overreaching/overtraining in men. The same applies to equine athletes, where overtraining is associated with a neuro-endocrine imbalance and altered behavior [11,12]. In humans, questionnaires and scales are often used to assess mental health. In the above mentioned overtraining study of de Graaf-Roelfsema *et al.*, behavior of the horses was systematically analyzed by three different assessments based on a translation of a questionnaire (POMS, profile of mood state) used in human athletes suspected of overreaching/overtraining [14]. The first assessment was observation before, during and after a training session. The second assessment was a 6-hour observation in their stable (time-budget). The third assessment was the Novel Horse Test (NHT), which aimed to assess the mental attitude towards a presented stimulus, in this case a horse. It appeared that the standardized NHT was the most useful to compare all horses. The observations of normal behavior in the stable and during the training showed clear individual changes in the intensively trained horses, but no group effects. For experimental behavioral studies it seems that response-to-test situations arouse more equal responses than observations of behavior under normal circumstances. The most common findings were: less interaction with other horses, less exploration in a novel environment and reluctance to work [14].

Both training load and mental factors are important to prevent overtraining and improve wellbeing of the equine athlete. In an appropriate training protocol, intense training sessions should be followed by time for

recovery [3, 15, 16]. Studies in racehorses, standardbreds and Friesian stallions showed that overreaching or overtraining did not occur when relatively intense training sessions were followed by 1 or 2 days (active) rest [6,7,8,15, 16]. For studying individual horses, observation of behavior under normal circumstances provides more than enough information to decide whether mood disturbances play a role. However keeping records of the horse's behavior is essential since the changes in mood state occur gradually and are therefore easily missed in a day-to-day meeting situation.

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Managing horses for performance - Ethical and regulatory aspects in Europe

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Summary: The evolving status of both the leisure and sport horse in the Western world, coupled with societal expectations to ensure animal dignity and welfare, presents equine veterinarians with new challenges. In their daily practice, veterinarians must consider whether the equine's intrinsic needs are being satisfied, assess relevant constraints and weigh stakeholder interests while also seeking to transmit this knowledge to their clients.

Current situation: Although ethically aware, veterinary practitioners are mainly motivated by the need to maintain the usefulness and effectiveness of equines. Therefore, this is an anthropocentric approach to disease control primarily aimed at preserving human interests.

A paradigm shift: Equines, once primarily utilitarian and symbols of physical prowess, in Western society currently fulfil functions that are mostly recreational or sporting in nature and have captured new, often young, female and urban, demographics. At the same time, societal demands for animal welfare are growing and are questioning many current practices. Critics denounce the suffering of animals during their use. There are two opposing approaches: on the one hand, there is the **ethic of responsibility**, which is supported by the majority of people and aims to protect animals but is not opposed to their use. This pragmatic and reasoned line of thought accepts the asymmetry of the relationship between humans and equines, which stems from the irreversible status of domesticated animals acquired over the millennia. On the other hand, the **ethic of conviction** rejects the idea of a species gap and advocates anti-speciesism and the general abolition of animal use. Based on the development of the level of sensitivity in society and the social and life sciences, e.g., bioethics, the Swiss Horse Industry Council and Observatory (COFICHEV) defends the right to use equines if certain conditions are met. In doing so, it supports **the ethical principle of personal responsibility** towards them and reciprocity: if we ask a lot from equids, we must give them a lot in return. This is based on the results of research in various disciplines and promotes equitable relationships between humans and equines. This reasoned approach examines, from a moral perspective, the interests of both parties, the intensity and extent of their needs, and the nature, causes and justification of constraints. It is therefore a systematic deliberation about what is right and just from a current perspective. Through this understanding, it develops questioning and a search for appropriate responses in a given context.

Veterinarians also face challenges: The veterinary profession plays a decisive role in ensuring and improving equine welfare. The study and training programmes in Europe are undoubtedly well designed to transmit the cardinal values of the profession supported by numerous social competencies (client communication, responsiveness, reliability, taking responsibility, transparency, etc.). However, even if animal ethics are taught, a large proportion of equine veterinarians subsequently encounter difficulties in carrying out **a detailed and honest weighing of interests** in practice. The main obstacle is how to objectively assess the natural needs of the equid as well as identify infringement of their dignity and well-being. In addition, a veterinarian's relationship with horses can often be characterised, like that of the owners, by notions of use, control and submission, especially when their value is primarily measured in monetary terms. By emphasising a human view of welfare, some veterinarians fail to recognise equines as subjects of their own existence seeking to satisfy intrinsic needs. By placing too much emphasis on self-defined goals, such as pain relief, these same veterinarians fail to recognise the animal's perspective, i.e., how it perceives its environment. During treatment, they are not always able to correctly identify the behavioural signs of discomfort or pain. This can lead, for example, to the treating veterinarian not being able to give appropriate advice or to postpone the time of euthanasia. Clearly, some equine veterinarians have not yet grasped the practical significance of the gradual extension of anthropocentrism to an approach based on biocentrism that gives equines an intrinsic value to be respected.

A challenge for equine medicine: Recently, there have been several signs that the sustainability of the equine industry depends on how the public perceives equine welfare, especially when activities or disciplines come under fire. Today, only ethologists and the few veterinarians who have developed strong skills in equine ethology are in a position to offer their expertise in the field of advice and ethics, especially when weighing the different interests. However, in the future, therapists (veterinarians, osteopaths, physiotherapists...) and other actors in the equine industry will have a personal responsibility in their daily practice to master the determining concepts such as dignity, well-being, use of constraints (justified or not) and whether or not a particular action is justified based on the circumstances at hand. This knowledge will help them to take ethical principles into account and to focus their attention on a harmonious interspecies relationship that includes the needs of both equines and humans.

The major themes: In summary, the knowledge to be developed serves to master the processes that lead to the reduction or avoidance of unjustified constraints affecting the dignity of equids and harming their well-being (pain, damage, anxiety, degradation, profound modification of abilities or phenotype, excessive instrumentalisation). This requires an objective understanding of the biological, physiological, biomechanical, behavioural and adaptive functions and capacities specific to the equine species.
There are various European laws on animal protection that characterise welfare. It is defined as a state in which an individual does not experience negative sensations and lasting dissatisfaction of its natural needs. More specifically, the *conditions under which it is kept and fed do not disturb its bodily functions and behaviour. Nor do they place excessive demands on its adaptive capacity. Thus, within the limits of the latter, the equine animal retains the possibility to behave in accordance with the ethogram of its species.*

Social Licence to Operate: The Chair of the FEI Welfare Commission, Prof. Natalie Waran, presented in a preliminary report the role and rationale for the creation of the Commission, its objectives and its role in relation to equestrian sports (April 2023). She explained the importance of the Social Licence to Operate (SLO) to the existence and longevity of equestrian sport. Equestrian sport is unique because it involves the use of an animal that the public perceives as particularly vulnerable. This commission conducted two large-scale surveys: one among the equestrian community (FEI and non-FEI stakeholders) and one among members of the public in 14 countries. The public survey showed that 67% of respondents were concerned about the involvement of horses in equestrian sports. Respondents called into question whether horses enjoy being involved in sport and wanted to see improvements in welfare standards. Public concern for the horse and its welfare appears to be more important than other social licence to operate issues such as personal safety and sustainability. The equine veterinary practitioner is intimately connected with this public concern and plays a prominent role as a therapist, educator and reference person with their clientele.

Conclusions: What COFICHEV is questioning today is how some socially or professionally credible individuals can defend erroneous ethical opinions through seemingly well-meaning and logical reasoning (guaranteeing animal welfare, e.g., through overuse of anti-inflammatories or restricting free movement on the pretext of the risk of injury). These misconceptions may arise from the intrinsic complexity of the situations observed, the weight of tradition or an imperfect command of scientific knowledge that leads to overestimating, underestimating or misinterpreting certain behavioural traits.

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How to combine welfare and performance in the sport horse, in practice

Rachel Murray, Liz Brown. British Equestrian

Balancing welfare and performance is about holistic management of the horse, with veterinary management forming part of the overall planning and management. The veterinary surgeon needs to work as an integral part of the team supporting the horse, with the horse's best welfare and health as the basis, maintaining communication with all members of the support team and athlete to optimise planning and trust.

The goal is PREVENTION of problems, lameness and injury, not fighting fires. For best welfare and performance, planning is the key to making sure that the horse is able to perform easily, comfortably and happily, minimising risk of injury , without need for last minute unplanned veterinary interventions.

The sport horse veterinarian is involved in horses from their initial development and training, through early competition and development towards elite competition, then potentially down-grading or retirement. At each stage, horses need to be managed holistically as far as possible, taking into account the maturity and experience of the horse.

A developing athlete will be building core stability, muscle strength and endurance, developing neural pathways, learning skills and improving flexibility, which needs support during this process, ensuring that areas are not overtrained and that small issues are managed early before compensatory movement patterns are developed which become a long term problem for the horse. It is the responsibility of the sport horse veterinarian to be a part of this process, aiming to detect and manage issues early. The mature, experienced athlete is focussing on maintaining strength, endurance, fitness, skills. In the older horse, tendon and ligament quality is reducing and so risk of injury is potentially increasing, flexibility may be more difficult maintain, particularly if the horse has time out of work, and the horse may require more physiotherapy input to maintain both performance and welfare. It is therefore important that the veterinarian focusses on maintaining the horse rapidly or prior to development of problems in order to avoid time out of exercise, even if that exercise type has to be altered. It is also important to remember that not every equine athlete will have the innate ability to perform at high level or athletes may reach a stage of their career that they cannot perform at an expected level. The support team should be a part of responsible decision-making in the best welfare of these athletes, avoiding interventions that are not in the best longer term support of the horse.

The veterinary management of the horse involves observation and knowledge of the horse's daily management and intervention where necessary in key areas:

- Correct stable management and care, consistent and sympathetic management when handled or ridden
- Feeding – feeding to optimise intestinal health and performance, including mental wellbeing, and understanding of the balance of nutritional elements. Understanding that compromised gut health can impact on movement and performance.
- Farriery – optimal foot trimming and shoeing appropriately for the work and conformation of the horse. Understanding the biomechanics and anatomy of the limb to fully assess the impact of changes in shoeing or alterations to the balance and loading of the limb. The appropriate use of studs to aid performance while avoiding unnecessary wear and loading on joints and soft tissue structures.
- Tack and saddle fitting – understanding the impacts of tack on biomechanics and correct muscle development. The assessment of saddle fitting to ensure that the horse can use its back correctly and encourage appropriate muscular development, understanding the association between incorrect saddle fit and orthopaedic pain and injury.
- Training & riding - The assessment of the way the horse is trained and ridden and the impact this has on correct muscle development, mental wellbeing, and injury prevention. Consistent training methods so the horse can learn and develop confidence in the rider or handler and understand the task being asked of it. The ability of the rider to optimise or compromise horse welfare both in daily training and during competition.
- Surfaces – the assessment of surfaces and training facilities with consideration for injury prevention.
- Travel - The planning of travel arrangements and management of the horse during travel to prevent compromise to health and welfare.
- Regular clinical assessments to identify areas which require early veterinary intervention or appropriate management.

- Paraprofessionals - Communicating and working with other professionals to ensure optimal management.
- Competitions - The careful management of the horse at competitions, understanding where the change in management may impact health and performance. The thorough clinical assessment of the horse during competitions. Appropriate warm up and work while at competitions.

In well-managed equine athletes, the same things will optimise both performance and welfare, without a contradiction between them. For example, a horse that has good nutrition, is strong and fit, with well-fitted tack, carefully and frequently shod, ridden on good surfaces with a tailored training programme, and travelled optimally with adequate recovery before competition will be in a position to both perform optimally and have good welfare. Whereas a horse that is ridden in badly fitting tack, is not strong or fit enough, is travelled badly with inadequate recovery time, or is badly shod or badly prepared is likely to have both bad welfare and perform suboptimally. Some horses may still perform in the face of poor welfare, likely suboptimally for the horse's potential, but still potentially to a level that a rider continues to compete with poor welfare. It is a veterinarian's responsibility to educate the rider and support team to improve overall management and not only to depend on veterinary interventions as a short term fix for problems secondary to bad overall management.
A rapid detection and reporting system for any problems will optimise both welfare and performance. This requires involvement of the rider, trainer, groom, owner and other members of the support team to detect subtle alterations in performance or behaviour in order to make management and/or veterinary interventions before they have a significant impact on performance or welfare. This requires communication and a relationship of trust and not threat at all levels, with constant education and ideally with commitment to a long term goal.

Management during training
In order to reduce risk of injury, equine athletes should have a balanced training programme: physiological fitness, muscle strength and endurance, coordination - skills training, with core stability and including cross-training, and not just single sport training. A training programme should plan basic training foundation, with scheduling to peak at a specific competition or multiple competitions. For best welfare and performance there should be a plan to include routine veterinary assessments throughout the non-competing times and competition season, so that the horse is reviewed on a frequent basis to pick up any changes, so management changes and any interventions can be made safely in time for the horse to be in the best possible condition for training and around competing. Planning ahead for interventions and early detection of any subtle signs of reduced performance are essential for performance and welfare, although the veterinarian needs to have the capacity to react and adapt to changes throughout the process, depending what the horse needs for best support. Competition planning and avoiding overtraining and overcompeting is key for preventing injury,

optimising performance and welfare. This requires coordination with not only the support team around the athlete but also any selectors or performance managers.

Management in competition

It is just as important to manage the equine athlete as a team in competition as out of competition. Attention to detail, clinical assessment, communication and planning are key. Interventions should be on the basis of good performance and welfare for the horse, avoiding using these purely as a placebo for the rider.

HOW TO COMBINE WELFARE AND PERFORMANCE IN STEEPLE CHASE?

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The well-being of horses is essential from an ethical standpoint and must be considered as a prerequisite for sports performance. Steeple chase is a highly demanding discipline combining speed, endurance and technique. The pursuit of performance is inseparable from the well-being of horses, particularly in order to enable them to have the mental capacity required for high levels of competition. Animal welfare is a complex, multifactorial state defined by various criteria such as nutritional and social needs, signs of good physical and mental health. Improving animal welfare relies on three main pillars: enhancing living conditions, optimizing training methods then ensuring health and sports monitoring. In this presentation, we will illustrate the measures implemented to improve the quality of life for horses at Emmanuel Clayeux's stable.

ENHANCING LIVING CONDITIONS

it is first necessary to reproduce a natural environment that meets the basic physiological needs of the animal. The horses have individual grass paddock with indirect contact with their peers in order to minimize the risk of kicking accidents. This allows the horses to move freely every day and take advantage of paddock time to warm up or recover. The horses can graze on grass which not only provides better digestive comfort but also allows for muscle stretching. Turnout in the paddock significantly reduces the occurrence of myositis and the incidence of gastric ulcers.
The horses live in a rubber-floored stalls that greatly reduces the risk of slipping and falling and improves the comfort. All racehorses in training have wood shavings as bedding which helps to reduce dust and minimize the risk of respiratory disease. Dust is also minimized by the presence of appropriate ventilation in the stable, as well by systematically watering the aisles before sweeping. The horses always have a clean water source available and multiple water source and salt addition during hot periods.

The horses have access to unlimited hay, distributed in various hay racks or similar. Hay is regularly analyzed to assess its nutritional properties, including protein content. Grain feeds are distributed three to five times a day with addition of oil depending on their individual needs. Special attention is given to feed for horses that have difficulty finishing their ration. Measures are taken to prevent or treat gastric ulcers in these horses. Vices have been proactively identified and various measure put in place to assist the quality of the horses stable life, such as paddock routines, toys…

It is important to minimize external sources of stress such as noise and music, and to allow the horse to rest daily after training sessions in the calmest possible stable environment.

When veterinary intervention is required, consideration is made for the animal's stress level and minimize it as much as possible throughout any procedure. Medical training is used to help horses better accept exams, biological sampling such as blood draws, and vaccinations.

OPTIMIZE TRAINING METHOD

The horses are warmed up at walk for about 20 minutes and then trotted to check the symmetry of their gaits. Horses with back and muscle stiffness are placed under a solarium during their preparation.
Sessions consist of hurdle in a lane to familiarize the horses, gallops on the track to work on hunting gallops and canters, work on turf, trotting and training on steeple and cross-country fences.
The track is harrowed every morning and between sets to maintain an appropriate depth and suppleness. The sand track is intentionally kept deep to limit speed and promote proper muscle development. During winter frosts, a synthetic track is used.

On race day, the rectal temperature of horses is systematically taken before their departure.
The horses travel without hay to limit exposure to dust.

ENSURING HEALTH AND SPORTS MONITORING

The presence of a contagious disease can have disastrous consequences for training. Implementing a stable protection strategy is essential. Special attention is given to new arrivals: the horses are isolated and integrated if no symptoms of contagious disease are present. In case of an epidemic, samples (guttural pouch lavage) are taken during quarantine. A footbath is placed at the entrance of the stable for external visitors. Flu and rhino pneumonitis vaccinations are mandatory from breeding stage and they are essential for racing.
A deworming program is followed by conducting batch fecal egg counts beforehand. The weight of the horses is evaluated every month to maintain their optimal weight.
A focus on respiratory disorder prevention is ensured daily by limiting the horse exposure to dust.
Every morning and evening, the horses are checked by the first groom to detect areas of heat, injuries, sensitivities, nasal discharge, any signs of decreased appetite, ophthalmic issues…Any abnormalities are reported to the trainer for reassesses and a decision on presenting the horse for the weekly veterinary examination.

The vets visit weekly to assess any horse with abnormalities such as lameness, respiratory issues, muscular problems or wounds... Investigations are carried out at the stable to establish an early and accurate diagnosis and find the best course of action. For locomotor issues, we try to keep it relatively simple by diagnosing and giving the necessary rest time. For bone injuries, for example-we try to give the horses a minimum of four months of rest before resuming activity. The use of intra-articular steroids has been greatly reduced since I started working at this stable. Due to cases of fractures after fetlock injections, it is my preference to no longer perform fetlock injections with steroids even if the radiographs appear normal on a painful joint. Rest is recommended instead. When treating, it is important to be as conservative as possible so as to avoid risks associated with such medical treatments.
As for back pain, we apply a treatment program based on ultrasonographic guided injections of steroids, physiotherapy, alongside the use of a solarium, ample paddock time, and adapted training strategies.
Tendonitis of the superficial lesion tendon is a common injury that requires a long period of rest, typically ranging from 6 months to 1 year, along with a gradual return to pasture.
Muscle injuries are monitored through samples and ultrasound examinations, especially in the case of isolated lesions. It is important to regularly analyze risk factors and vary them according to the seasons. Myositis, for example, is more often observed in mares during the first cold days of autumn. During these periods, close monitoring of the mares is carried out, and an appropriate diet is given by limiting carbohydrates and adding oil to the ration. The mares are also given more time in the paddock to increase their daily walking time. A reduction in the incidence of myositis has been observed for several years.
Respiratory problems are indeed one of the main causes of underperformance and proper diagnosis is essential for effective management. Endoscopy, tracheal, bronchoalveolar lavage are regularly used to identify the underlying cause of the respiratory problem such as equine asthma, exercise-induced pulmonary hemorrhage, diseases of the upper respiratory tract…In equine asthma, for example- in addition to improvements of the air quality, medication such as broncho dilatators and steroids is often used to reduce inflammation and improve respiratory health.
Digestive comfort is closely monitored by the first groom and appropriate treatment is implemented when there is suspicion of gastric ulcers. This may include measures such as providing oil in the diet, feeding smaller and more frequent meals, administering medications like omeprazole and sucralfate.
Any symptoms related to anxiety are identified and a supplementation of magnesium and tryptophan is carried out for those who are most stressed.
Longitudinal monitoring and a cross sectional approach are essential elements of a successful sports career tracking.
By adhering to the anti-doping guidelines set by France Galop, medical treatments is used with caution and only when absolutely necessary for the well-being of the animal.

Management of equine athletes without injections

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Summary
The purpose of this presentation is to emphasize the need for a complete and precise clinical examination coupled with an athletic evaluation at work of horses presented for locomotor affections. The objective is to gain the keys -to improve the management of these patients with a limited recourse to medication or surgery. Based on the clinical manifestations and imaging findings, a selective trimming and shoeing combined with an individual and specific exercise program on an adequate exercise surface contributes to improve many horses a different level of athletic use. The objective of this presentation is to demonstrate that the management of equine athletes should not be primarily based on injections or surgical treatments, but that the a non-medical/invasive approach should be place in the foreground of the management of the horse problems and career.

A good diagnosis is better than injections!
It is well admitted that an adequate management of the equine locomotor affections (injuries and manifestations) requires a precise clinical diagnosis. This should be supported by an adequate documentation and evaluation of the horses at work. Besides, a precise evaluation of all the individual features of each horse is essential to get data for the horse management and an objective assessment of the evolution. In a reduced lapse of time, there is a tendency to conclude prematurely on the first positive block or the first imaging finding(s). We should always consider that this is a limited part of the horse locomotor alterations or restrictions and could be concomitant or secondary to other problems. The same for treatment (Fig. 1). In many situations an incomplete attention/concentration during an examination will conduct to treat a secondary problem and this is true even with the use of advanced imaging techniques such as magnetic resonance imaging, CT scan and nuclear scintigraphy as well as with the use new devices designed for an objective assessment of the equine locomotor patterns.

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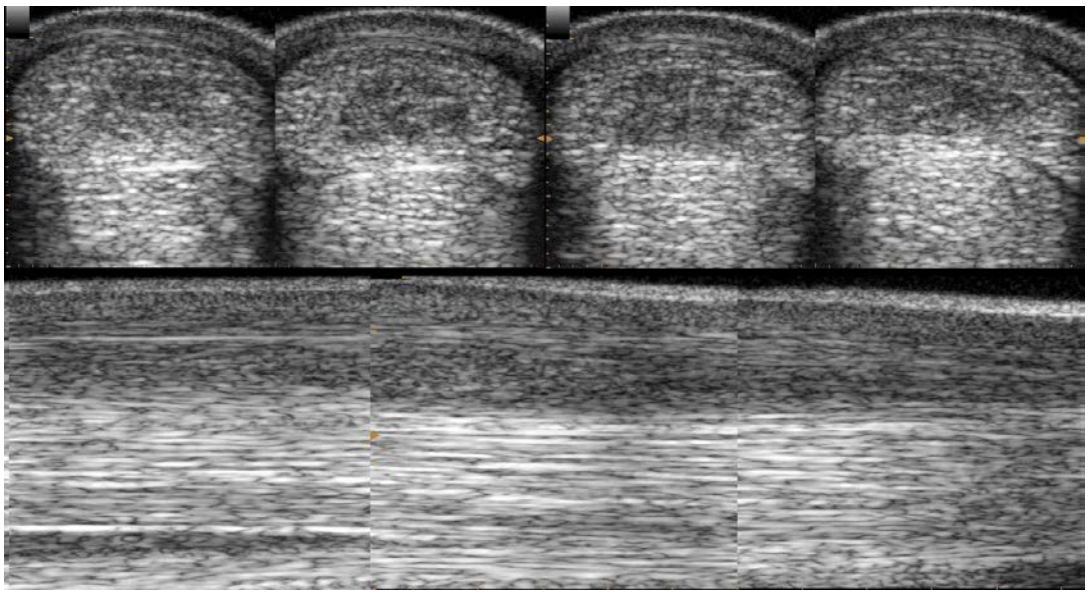

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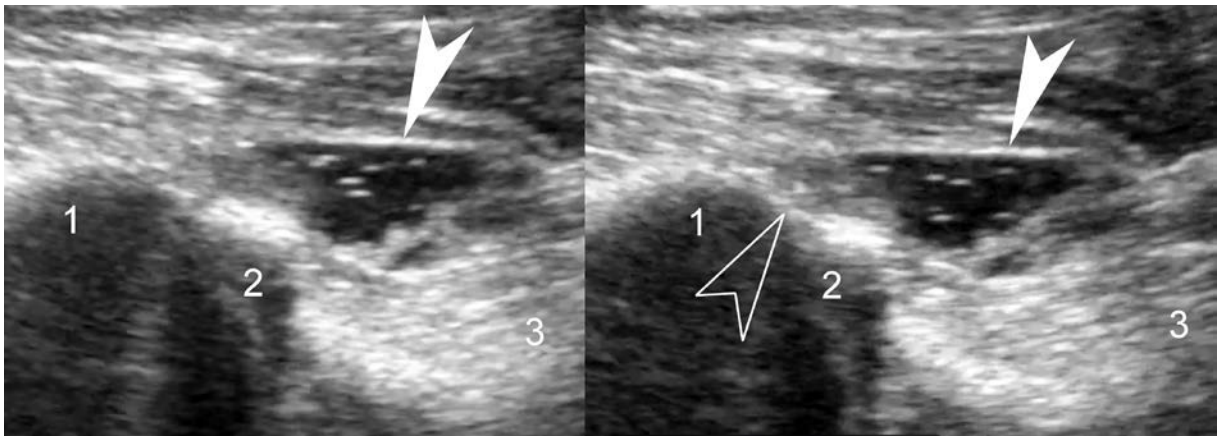

Fig. 1: Four years old Standardbred trotter female presented for ultrasound control of a superficial digital flexor tendinopathy of the left forelimb (Fig. 1a). At follow up clinical examination the horse was not lame but demonstrated a reduction of the cranial phase of the stride of the right forelimb (Fig. 1b). Radiographs of the right shoulder were taken and were unremarkable (Fig. 1c). Ultrasonographic exam of the right shoulder using a caudolateral approach (Fig. 1d) demonstrated a significant synovitis of the scapulohumeral joint. This is a key information for the management of the left SDF tendonitis. 1- Scapula (caudal profile of the glenoid cavity); 2- Humeral head; 3- Brachialis muscle; Open arrow: scapulohumeral joint space; White arrowhead: Distended synovial fluid cavity with echogenic spots.

Corrective shoeing is better than injections!

Many distal limb problems can be improved by adequate trimming and shoeing. Recommendations for trimming and shoeing are only partly based on imaging findings, but are more related on the horse manifestations to reduce the level of pain. Fortunately, in most of the cases, clinical manifestations match with imaging findings. A lot of conditions such as podotrochlear syndrome (navicular disease), proximal interphalangeal arthropathy in forelimbs and hindlimbs, chronic digital sheath tenosynovitis can be used to illustrate that corrective trimming and shoeing based on clinical manifestations and supported by biomechanical considerations has the highest long term efficacy compared to medication or surgery. In a horse presenting overload subchondral bone disease of the medial metacarpal condyle, pain is usually higher on the cercle opposite to the affected limb because of increased pressure at the medial aspect of the fetlock (Fig. 2a to 2d). Management of this subchondral bone disease (to prevent worsening) and reduction of the level of pain in this specific situation needs a combination of corrective shoeing and exercise program. The foot will be trimmed short enough and especially at the medial quarter if needed. A corrective shoe providing more support of the lateral part of the foot (with wider lateral branch) and a reduction of support medially with a narrower medial branch and a bevel on the external rim of it will be recommended to decrease medial load of the fetlock and redistribute the load on the sounded lateral part of this joint (Fig. 2e). Moreover, rehabilitation of the horse will be done on a soft but reactive ground surface avoiding turns on the opposite side of the affected limb.

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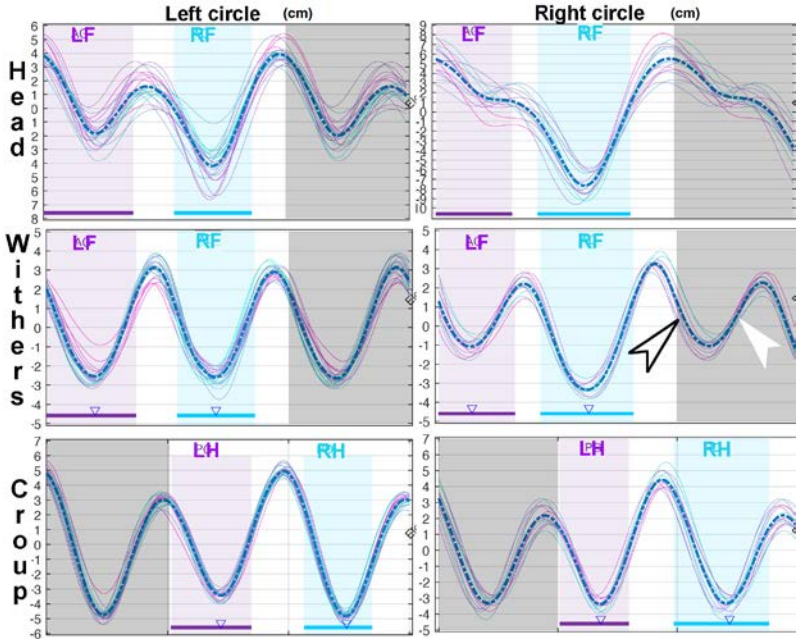

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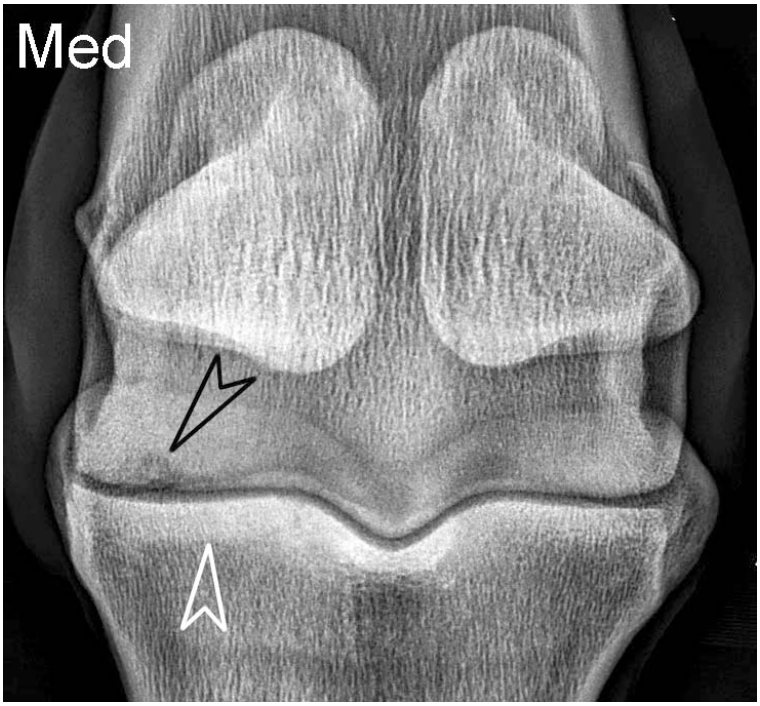

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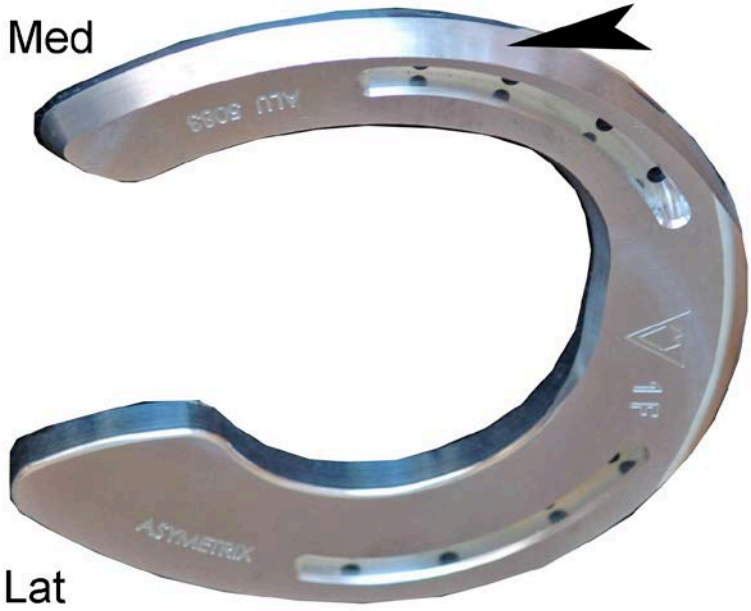

Fig. 2: Medial subchondral bone overload disease of the metacarpal condyle. Fig. 2a: The horse presents a left front lameness on the right circle, putting higher load on the right forelimb. Fig. 2b: Equisym trajectories of the head, withers and tuber sacrale demonstrating a left front lameness on the right circle (open arrowhead: defect of load absorption of the LF, white arrowhead: defect of LF propulsion); Fig. 2c: Dorsopalmar radiograph of the left front fetlock showing a medial subchondral lucent area of the metacarpal condyle (black open arrowhead) and a medial subchondral bone sclerosis of the glenoid cavity of the proximal phalanx (white open arrowhead); Fig. 2d: Frontal MRI scan demonstrating the subchondral bone changes concentrated on the medial part of the metacarpophalangeal joint with a focal subchondral bone necrosis (open arrowhead) and spongious bone sclerosis (white arrowheads). Fig. 2e: Suggested corrective shoe for the left forelimb presenting a wider lateral branch to increase the ground reaction force on the side of the sounder part of the fetlock and a narrow medial branch with an abaxial bevel (arrowhead) to decrease the load medially.

Individually designed exercise management is more adequate than injections (or surgery)

The objective of a complete clinical examination and athletic evaluation at work is not only to reach the diagnosis of the osteoarticular, musculoskeletal and neurological manifestations of the horse, it also to identify the worst situations for the horse that should be temporally avoided and the most tolerated ones which will be used for keeping the horse at exercise. Management of horses demonstrating axial discomfort or pain induced by thoracolumbar or cervicothoracic conditions is highly dependent on the riding technique and training aids may help (Fig.3 and 4).

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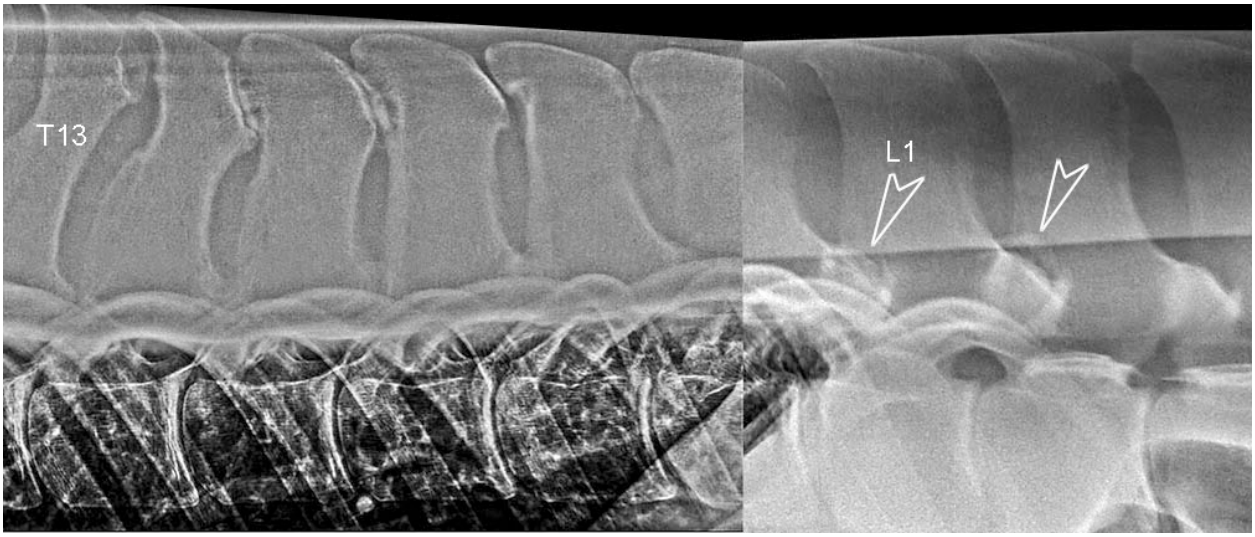

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Fig. 3: Four years old Thoroughbred filly showing clinical and athletic manifestations of back discomfort. Fig 3a- Radiographic image of the thoracolumbar spine showing grade 3 to 4 kissing spines lesions and arthropathy of the articular process joints between T18 and L2 (open arrowheads); Fig. 3b- The filly was intolerant at work and dangerous on the track with different riders; Fig. 3c- The attitude and comfort of the filly was significantly improved with the use of rubber reins placed without tension between the bit and girth. This simple training aid allowed to continue a rehabilitation protocol for a superficial digital flexor tendinopathy on the track.

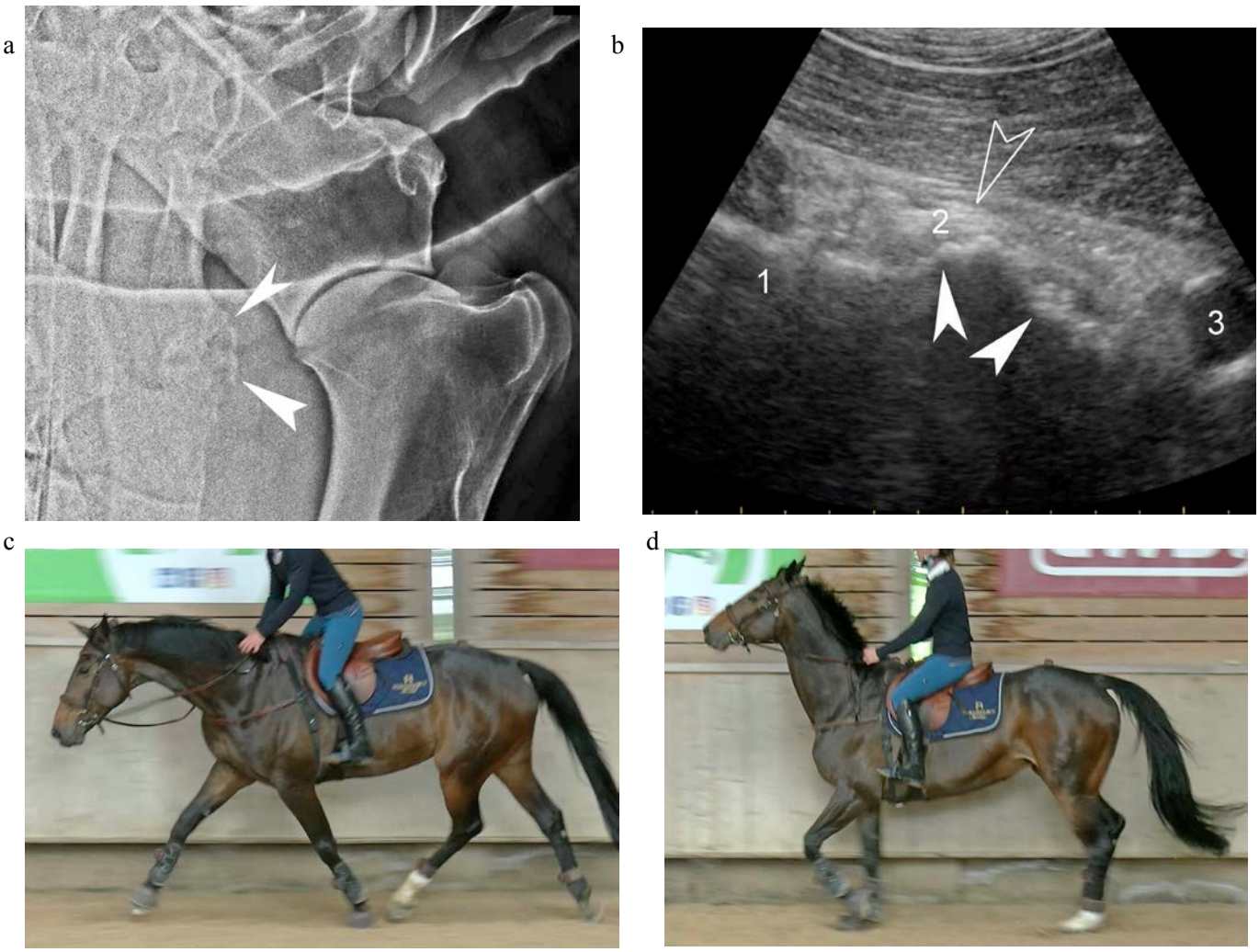

Fig. 4: Twelve years old warmblood mare showing clinical and athletic manifestations of axial discomfort. Fig. 4a: Radiographic image of the entrance of the thorax; there is a congenital synostosis of the left two first ribs with an exuberant callus cranially (arrowheads). Fig. 4b: Ultrasonographic image of the first rib and related anatomical structures. The brachial plexus is passing over the exuberant callus (arrowheads). 1- Left first rib; 2- Brachial plexus; 3- Subclaviar artery. Fig. 4c: Intolerance of the mare at trot, the rider doing sitting trot. Fig. 4d: Rider in suspension, the mare demonstrates a completely different attitude at work.

Keeping proprioception is best than killing the pain

Self-control of pain level decreases biomechanical stresses on injured anatomical structures and prevent worsening of the lesion. Biomechanical stresses in tendons and joints are permanently controlled and adjusted through proprioceptive neurological pathways. Neurectomy of the deep ramus of the lateral plantar nerve for the management of suspensory disease on the hindlimbs is supported by several retrospective studies. It is well recognized that the level of evidence of this type of study (without or with match or control groups) is quite low. Potential adverse effects include development of neuromas (Fig. 5). Moreover, anesthesia of the lateral plantar nerve can induce analgesia of different conditions of the tarsus, metatarsus and distal limb. Besides, severe injuries of the suspensory ligament have been managed successfully using a conservative approach with adequate shoeing sometimes combined to physiotherapy techniques.

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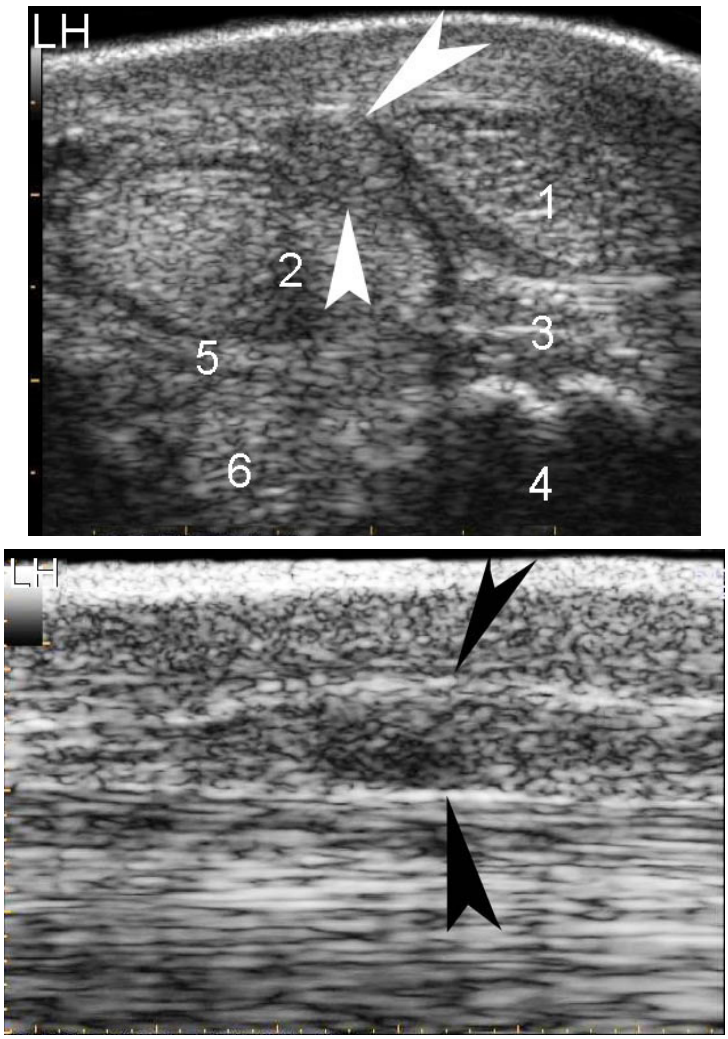

Fig. 5: Transverse (Fig. 5a) and longitudinal (Fig. 5b) ultrasound scans of the tarsometatarsal junction showing a neuroma of the lateral plantar nerve (arrowheads). 1- Superficial digital flexor tendon; 2- Lateral digital flexor tendon; 3- Long plantar ligament; 4- Head of the fourth metatarsal bone; 5- Accessory ligament of the deep digital flexor tendon; 6- Third interosseus muscle.

Conclusions

New colleges of Veterinary Sport Medicine and Rehabilitation should not reiterate mistakes of the past. Injections are not new! They have been used, sometimes excessively, in the past to compensate the lack of knowledge in biomechanics, rehabilitation techniques and exercises.

Sport Medicine is not (only) injections and injections (with no or limited diagnostic data) are not sport medicine. Injections (or surgery) should be considered only after a strong diagnosis supported by adequate documentation. Injections often provide short/medium term improvement; the heart of sport medicine is to preserve the horse career!

Colleges of veterinary sport medicine and rehabilitation must contribute to change the paradigm of the management of equine locomotor affections. This requires different complementary approaches; 1- education of the clients (owners, trainers, riders…); 2- education of the equine vets and 3- another way of remuneration for the equine vets who should be paid more on their time, competence and advise than on the number of radiographs and injections performed.

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Injections for the management of humans athletes: rules and alternatives

Jean-Marc Sène, MD

The use of infiltrations in human athletes is more or less important according to sports disciplines. The products traditionally used are most often from the corticosteroid family. The desired effect is to fight pain, inflammation and improve joint mobility. There are known side effects of corticosteroids when they are used frequently, hence the importance of specifying the therapeutic indication through a precise diagnosis confirmed in particular by medical imaging. For the sake of efficiency, the infiltrations are carried out most of the time under radiological control. There are often effective alternatives to the use of corticosteroids. Among these alternatives hyaluronic acid or Platelet Rich Plasma (PRP) are increasingly used. Mesotherapy can also be effective in some therapeutic indications. Finally, rehabilitation and manual medicine are non-drug methods that have an important place in the fight against pain and the improvement of joint mobility. Beyond an infiltrative joint treatment, rehabilitation must be continued in secondary prevention by a specific strengthening and warm-up routine before each intensive sports session. The technical adaptation of the activity associated with specific recovery is also essential in the management and must be done in cooperation with the trainer. Retaining that an isolated infiltration with the sole purpose of masking pain hinders longevity and promotes long-term sequelae in the athlete, especially if it is repeated.

Cardio-respiratory physiology of the swimming horse

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Swimming has been used as a rehabilitation and conditioning tool in horses for many years. Because of the technical challenges associated with measuring physiological parameters during underwater exercise in horses, only few studies have reported some cardiac and respiratory physiological parameters during various swimming protocols. It is only very recently that the workload of the swimming exercise has been quantified in horses.

Cardiac assessments during swimming have included mean heart rate (HR), stroke volume, and cardiac output. Recording ECGs in swimming horses has also been recently reported. In untethered swimming horses that were acclimatized to the protocol, the heart rate (HR) varied between 165-179bpm, which is far inferior to HRmax. These exercising HR were relatively low in spite of observing a mild "stress" reaction at the onset of the swimming training, followed by a more relaxed behavior after a few swimming lengths. Importantly, swimming exercise was not associated with complex arrhythmia and their prevalence (0.5%) was lower than during active-recovery (post-swimming). The type of arrhythmias recorded during swimming were single events SVPCs and VPCs. A greater prevalence of arrhythmias has previously been described during immersion of horses (standing) in hot water (38- 40°C).

Although swimming is defined as an aerobic exercise, a specific breathing strategy has been documented in swimming horses; It involves bradypnea with rapid and explosive expiration and inspiration, followed by a period of apnea where the nostrils are closed. In untethered swimming over a 75m pool length, a similar breathing pattern has been reported (and breathing rate 10-16/min) but with a prolonged apneic period when horses were first entering in the pool (over 20-30 sec.). During tethered swimming, endoscopic examination also revealed a high prevalence of upper airways collapse during the apneic periods. It is well documented that apnea is associated with the bradycardia described as the mammalian diving response (MDR), but bradycardia during apneic phases of swimming have not been observed, suggesting that horses have a low MDR during swimming.

The workload (indicated by oxygen consumption: $\dot{V}O_2$) during swimming has been shown to be compatible with a low-intensity, aerobic, exercise; $\dot{V}O_2$ was reported at a mean 37.1ml/(kg.min) in endurance horses, when the $\dot{V}O_2$ max in similar athletes is known to be >200ml/(kg.min). Spirometry measurements during horses swimming with an ergospirometry mask showed a unique high-flow inspiration with an inspiratory time less than half that of expiration. Furthermore, expiratory flow tracings showed some marked oscillations that coincided with a vibration of the nostrils and an expiratory sound.

Another study also documented the absence of EIPH in endurance horses swimming over 5x 75m pool lengths. Although the sample size was only 15 horses with repeated measures, this indicates that at least in untethered swimming in a straight pool, EIPH is probably uncommon.

In conclusion, swimming represents a submaximal, primarily aerobic (low $\dot{V}O_2$) exercise in horses, with a submaximal HR, low cardiac arrhythmias prevalence, a unique short inspiration/high-flow breathing pattern, and with periods of apnea possibly associated with stress when initiating the swimming exercise.

(List of references available in the presentation.)

Tendon injury rehabilitation in the human athlete

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Abstract

Tendinopathy describes a complex multifaceted pathology of the tendon, characterized by pain, decline in function and reduced exercise tolerance. The most common overuse lower extremity tendinopathies in human athletes involve the patellar tendon (Jumper's knee) and the Achilles tendon. Athletes often suffer from chronic or recurrent pain and continue to play despite their symptoms. So, they often can't play to their full potential and sometimes even have to end their career because of this injury. The underlying pathophysiology is complex and not fully elucidated. The etiology is multifactorial and in athletes (over)load is considered to play a crucial role. Although diagnosis is mostly achieved based on clinical symptoms, in some cases additional pain-provoking tests and imaging might be necessary. One should realize however that there is a mismatch between pain and imaging findings.

Treatment can be frustrating both for the athlete and the clinician. Management in human athletes consists of patient education, management of expectations, next to pain and load management and exercise and loading programs to strengthen the muscle-tendon complex. Etiologic factors should also be addressed and abnormalities in the kinetic chain have to be corrected.

Several therapeutic modalities, injection therapies and surgical interventions have been described and are used in sports medicine practice. However, their effectiveness remains ambiguous and these treatment options are definitely not the 'quick fix' athletes are often looking for. Furthermore, return to play decisions can be challenging since many medical, sports risk and decision modifying factors have to be considered. Thus management of tendinopathy in human athletes should be individualized and is for sure not 'one size fits all'. Future research should therefore focus on elucidating the underlying pathophysiology of tendinopathy, and on developing more personalized effective rehabilitation protocols, depending on the stage of the disease and the performance level the athlete is striving for.

Tendinact: Medical and athletic aspects: What we have learnt and still need to deepen

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Technical aspects

At inclusion, every horse had a complete clinical and imaging evaluation using radiography of the four limbs and vertebral column, ultrasonography of the key areas of the axis and four limbs, full body scintigraphy and MRI of the fore fetlocks (Fig. 1). In such a prospective study, documentation of the horse gaits at each step of the rehabilitation program is essential. This was performed using regular videorecordings of the clinical examination and horses at exercise on the track. Analysis of every horse gaits, joint and axial movements and comparison between horses was subsequently and still possible.

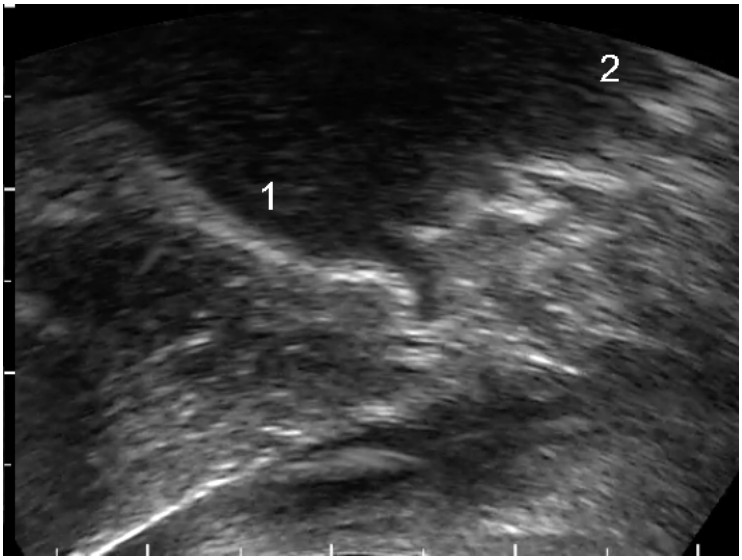

Fig. 1: Remodeling of the joint margins of the right sacroiliac joint in horse 6 presenting a SDFT injury of the left thoracic limb. 1- Sacrum; 2- Ilium margin.

Monthly dynamic recordings of the ultrasound examination have been also particularly useful to analyse evolution of the findings with time. A complete dynamic overview of the metacarpal area in 20 seconds allowed to get more than 1000 images, thus, based on the architecture of the peritendon, evolution of precise locations of the tendon was possible several months apart (Fig. 2, 3 and 4).

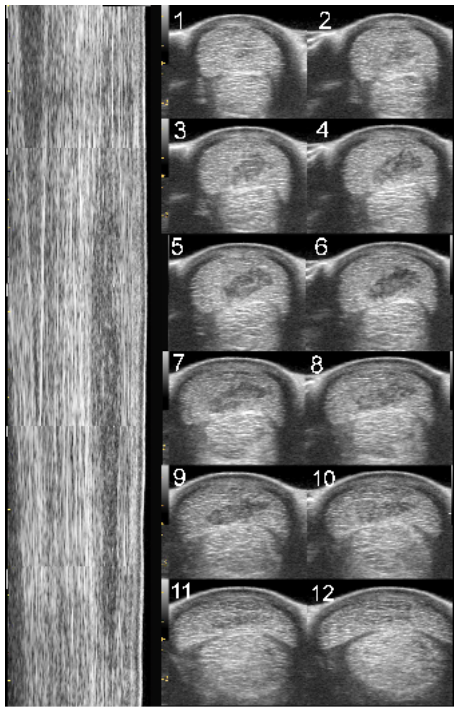

Fig. 2: Longitudinal and transverse ultrasound scans of the left SDFT of Horse 7. Additionally, proximodistal transverse dynamic recordings were performed to provide a complete imaging of the tendon lesion filling the gaps between the 12 transverse sections.

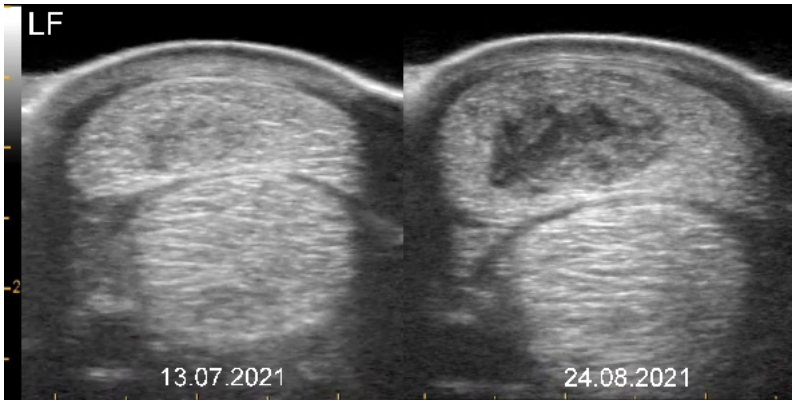

Fig. 3: Worsening of the clinical and ultrasound findings on horse 11 between inclusion and week 6 despite the lower level of exercise limited to 15 mn of walk per day.

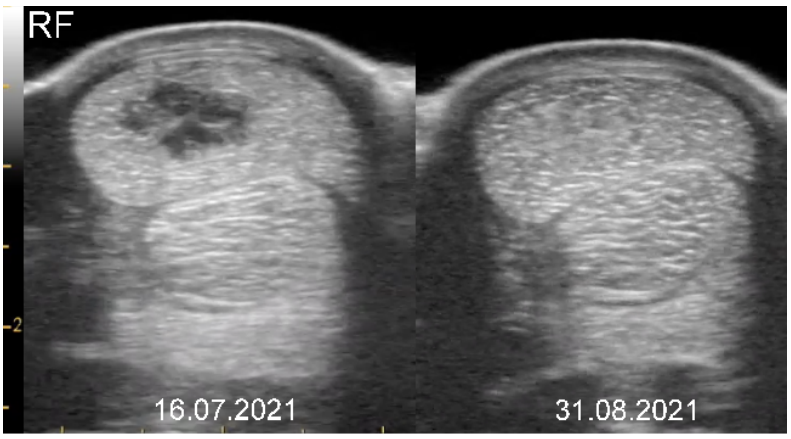

Fig. 4: Improvement of the clinical and ultrasound findings on horse 12 between inclusion and week 6. This horse was able to be back at the trot 8 weeks after inclusion and at the canter 12 weeks after inclusion.

Doppler was used to document blood supply of the lesion and tendon tissue around it and was well correlated to CT angiography done 2 or 3 times along the follow up of the horses. Quite intense doppler signal was found in clinically sound horses undergoing a progressive increased level of exercise even at the end of the exercise program, before full training and racing. Despite individual variations, at the end of the rehabilitation program a reduced blood perfusion was correlated to successful return to racing (Tischmacher et al, 2023).

Interindividual variations of tendons injuries

On the 11 horses included in the study 5 of them were injured on the left forelimb, 4 on the right forelimb and 2 of them were bilaterally injured. At inclusion, the severity evaluated on cross sections of the injured SDFT ranged from mild to severe. Ultrasonographic and clinical evolution during the first 2 months of follow up varied between horses and was not correlated to the initial severity at inclusion. Most of the horses showed a good clinical and ultrasonographic evolution during the first 2 months of follow up with quite stable findings after the third month. Two horses showed slower evolution/recovery. One horse deteriorated during the first 2 months despite achieving the lowest exercise level at the walk (Fig. 3). On the opposite, one horse had a complete ultrasound and physical recovery in 6 weeks and was able work at slow canter 2 months after inclusion (Fig. 4).

Interindividual physical and dynamic variations

A range of variety of fetlock angles and pastern orientation was observed ranging from 1 horse with low pastern axis on the 4 limbs (H7, who suffered from a left forelimb SDFT lesion) to 3 horses with straight pastern axis, 5 of them having normal pastern axis (Table 1). One horse with a lower fetlock suspension on the left forelimb had a left SDFT lesion (H9, Fig. 5) and another horse with left SDFT lesion developed progressively a defect of fetlock extension (H6, Fig. 6).

Fig. 5: Asymmetry of fetlock suspension at the walk on horse 9 suffering from a left SDFT lesion. There was less fetlock suspension on the left thoracic limb since inclusion. This asymmetry was present also at trot and canter during the rehabilitation program.

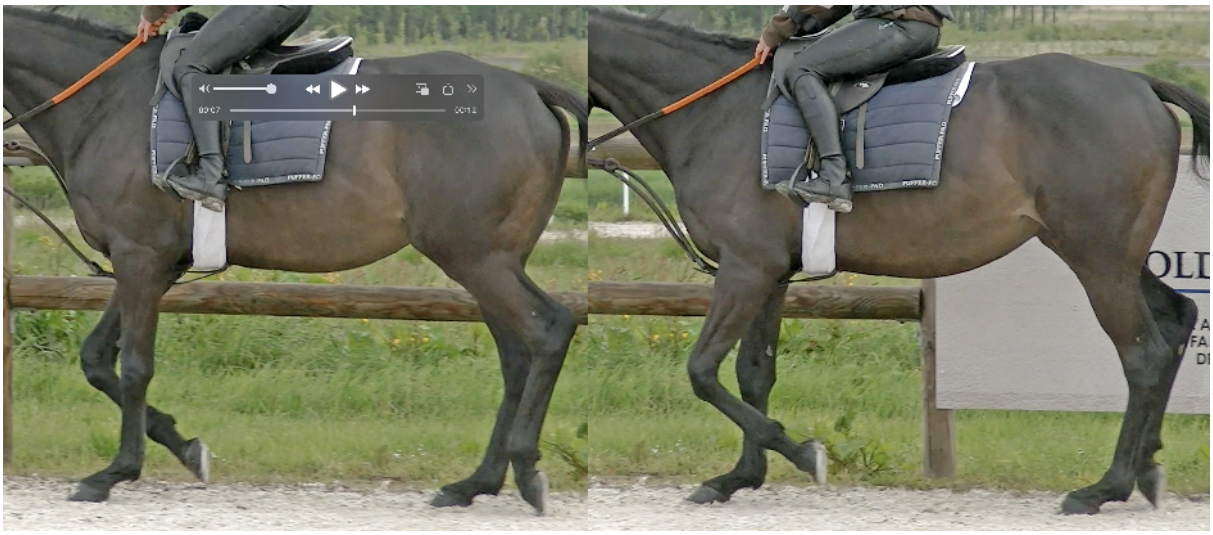

Fig. 6: Asymmetry of fetlock extension at the trot on horse 6 suffering from a left SDFT lesion. A progressive reduction of fetlock extension on the left limb was simultaneous to healing of the injured SDFT.

Regular dynamic examination (at least once a week for 8 to 14 months) allowed to determine the type of laterality at canter for each horse (Table 1). Four horses were right-handed and 3 of them had a lesion of right SDFT, the other one was injured on the left SDFT (H6). Five horses were left-handed and 3 had a lesion of the left SDFT, one horse had an injury of the right SDFT, the last one had a recent injury of the right SDFT and an old injury of the left SDFT (H4). Two horses were ambidextrous; one was injured on the left SDFT (H7) and the other one had a bilateral lesion more severe on the left SDFT (H11). Therefore, injuries were more frequently observed on the preferred leading limb.

HORSES	Injured SDFT	Laterality (R vs L handed)
2-	RF (>LF)	Right
4-	RF>LF	Left
5-	LF	Left
6-	LF	Right++
7-	LF	Ambidextrous
8-	RF>LF	Right
9-	LF	Left
10-	RF	Right
11-	LF>RF	Ambidextrous
12-	RF	Left
13-	LF	Left
Total	5LF+ 4RF +2bilat	5 Left ; 4 Right 2 Ambidextr.

Preferred leading limb affected: 6
Trailing limb affected: 3

Table 1: Distribution of tendon lesion with reference to physical (fetlock angle) and dynamic (laterality) characteristics of the horses

Conclusion

Reviewing cases of this study, the value of averages or statistics and even experience seems questionable as so many individual factors may interfere with etiopathogenesis and outcome. It was clear that any extrapolation from one case to another case apparently similar was useless or even dangerous. We had to concentrate on every specific case and according to individual physical, functional and pathological status, adapt the follow up and exercise level accordingly.

We learned that the methodology is superior to experience. At the end, may be because of the relatively low number of horses, no rules were established but methodology, including diagnostic and documentation techniques as well as physical, functional and pathological criteria to be considered appeared the most important lesson to manage individual cases.

A careful monitoring (clinical and US) and documentation is the key, taking into account the horse everyday physical, dynamic and mental variations and changes as well as the rider subjective feeling and feed-back (to be considered with caution).

Finally, in the absence of detection of subtle changes using this methodological supervision, **this study demonstrated the tolerance to an early return to controlled exercise.**

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Fatigue versus rest: imaging of associated bone injuries in the equine athlete

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Introduction

Bone exercise-related injuries represent one the most frequent cause of lameness and poor performance in race and sport horses. In a retrospective study on clinical cases referred at CIRALE for magnetic resonance imaging (MRI) of the fetlock (Audigié et al. 2011), bone contusion was the main diagnosis in about 80% of racing horses and in 30% of sport horses where bone densification, degenerative joint disease and tendon and ligament injuries were more frequently observed compared to racing horses. These bone injuries may appear after an acute traumatic event but are in the vast of majority of cases induced by repetitive and intense biomechanical stresses generating fatigue injuries of the bone material (Crevier-Denoix et al. 2017). Bone overuse lesions were first documented using routine imaging techniques (radiography and ultrasonography) and bone scintigraphy (Denoix et Audigié 2004, Ross 1998, Trope et al. 2011). The increase use of computed tomography (CT) and MRI has allowed to go further in the diagnosis, documentation and pathophysiology of bone fatigue injuries. Moreover, the development of a standing MRI machine has made it possible to carry out this examination routinely and to perform follow-up evaluations of bone overuse lesions (Powell 2012). These follow-up exams are particularly useful to document the healing stage of these lesions but they have also identified alterations in bone tissue associated with rest or a marked reduction in the level of activity of the athletic horse due to its locomotor injury. Thus, the purpose of the presentation is to describe and discuss diagnostic imaging of fatigue bone injuries in sport and racing athletic horses and to document bone alterations induced by a rest period in these horses. Bone lesions of the foot and fetlocks will be taken as an example in this presentation.

1. Diagnostic and follow-up imaging of fatigue bone injuries:

MRI of bone overuse changes has allowed to identify three main types of alterations (Powell 2012, Tranquille et al. 2012, Olive et al. 2017, Peloso et al. 2017) that can affect either the cancellous bone or the compact bone:

- ✓ **Bone densification – bone sclerosis of the cancellous bone**: this alteration is characterized on MR images by a marked decreased of signal on T1 weighted (T1w) and T2w images and an isosignal and STIR images. In lesions associating different types of bone alterations, the T2w FSE (Fast Spin Echo) sequence is particularly useful to "isolate" the sclerotic part of the lesion which appears as a low signal intensity area within the injured bony part. Bone densification/sclerosis represents a physiological adaptive process of the bone to the biomechanical stresses. It can be associated with certain types of limb conformation and be induced by an increase in the level of exercise of the horse (Crevier-Denoix et al. 2017). Consequently, bone densification/sclerosis is frequently observed in sound horses but it can also represent a pathological process in lame horses particularly if associated with other bone alterations (see below) or when presenting an intense aspect and/or a wide extent in the bone;
- ✓ **Bone marrow edema like (BMEL) lesion of the cancellous bone:** this increase fluid content of the bone is characterized on MR images by a moderate decreased of signal on T1w, an iso or mildly hyperintense signal on T2w FSE images and an hypersignal on STIR images. On T2*w GRE (Gradient Echo) out-of-phase images, BMEL lesion can have variable signal ranging from hypo to iso and hypersignal depending of the level fat-water phase cancellation artefact within the altered bone. In lesions associating different types of bone alterations, the STIR sequence or another fat suppression sequence (DIXON, fat saturation sequence on high field MR machine) is particularly useful to "isolate" the BMEL lesion which appears as a hypersignal intensity area within the injured bony part. This pathological alteration may represent different types of histological changes such as: cancellous bone edema, hyperhemia, osteofibrosis or osteonecrosis and/or proteinaceous fluid accumulation (Busoni et al. 2005, Murray et al. 2006, Trope et al. 2011). BMEL injuries are most likely found in lame horses but they can also be observed in performing horses depending of the individual clinical tolerance and evolution stage of the lesion.

✓ **Bone resorptive lesion:** this alteration is characterized on MR images by an increased signal on the different sequences: T1w, T2w and STIR images. This lesion may affect either the subchondral compact bone or the adjacent cancellous bone such as in subchondral cyst like lesion. This pathological alteration may represent in adult horses an osteolysis/osteonecrosis or demineralization of the compact bone or an osteonecrotic bony area with proteinaceous fluid accumulation within the cancellous bone.

These 3 types of bone tissue alterations can lead to different types of bone lesions. The term **bone contusion or bone bruise** is usually used when BMEL lesion are found within the injured bone to differentiate these lesions from pathological bone sclerosis. Bone contusion and bone resorptive lesions may lead to **bone impaction with collapse of the articular surface**, these changes being frequently observed in palmaro/plantaro-distal osteochondral lesions of the metacarpal/tarsal condyle (POD disease) (Bani Hassan et al. 2016, Barr et al. 2009, Pinchbeck et al, 2013). In more severe and advanced cases, these fatigue alterations may lead to either **subchondral cyst like lesion or fissure and fatigue fractures** (Ramzan et al. 2015, Trope et al. 2015, Whitton et al. 2010). Finally these different types of fatigue bone injuries will predispose to the development of a ***degenerative arthropathy*** of the corresponding joint.

Follow-up imaging of fatigue bone injuries is essential to evaluate the stage of healing of the injured bone. In combination with the clinical signs of the horse, these informations allow to more accurately adapt the level of exercise of the horse. In our experience, follow-up imaging has permitted to identify that BMEL lesion can improve significantly and even heal completely in 1 or 2 months when their origin is mainly an overstress process without significant associated bone injuries such as bone resorptive lesion, marked bone sclerosis, subchondral or articular cartilage surface injuries, subchondral cyst like lesion or stress fracture. In these last cases, changes in BMEL lesion will generally take more time to occur (several months) and may persist in some cases at a lower level due to chronic alteration of the bone tissue. MR follow-up exams have also shown for instance after a fracture of the distal phalanx that BMEL lesion can worsen in terms of extent and intensity during the first days and weeks after the acute onset. In the same way, focal intense subchondral BMEL lesion have been found in horses in the days following an acute onset of marked lameness without evidence of stress fracture. Follow-up MR examination performed 1 month later have demonstrated in some cases the presence of an unicortical fatigue fracture within the BMEL lesion. Consequently, the presence of a focal intense subchondral BMEL lesion in anatomical sites predisposed to the development of fatigue fractures (ie: palmaro/plantaro distal metacarpal/tarsal condyle, sagittal groove of the proximal phalanx) must be considered as a potential precursor sign of stress fracture and should lead to a second MR evaluation about 1 month later. In such cases, the development of CT exams of the distal limb in standing horses may help to diagnose these fatigue fractures at an earlier stage compared to MRI.

2. Follow-up imaging of bone rest alterations:

Bone alterations associated with an 8-week period of stall rest with cast immobilization have been first documented with dual energy X-ray absorptiometry (Delguste et al. 2007). More recently, Stewart et al. (2020) have documented bone changes induced by the same protocol with MRI and CT. Bone CT density was significantly decreased in the cast forelimb and increased trabecular bone fluid was found in the cast fore fetlock on MRI. These changes were not reversed after 12 weeks of remobilization.

If these studies provide useful data, they differ from reduced exercise programs used to manage joint and tendon injuries in performing sport and race horses. To go further, we have recently investigated using CT and MRI, bone alterations induced by a rest period in a group of 9 steeplechasers presenting an acute superficial digital flexor tendonitis. Standing MR images of both fore fetlocks were acquired in the month following injury (M1) and about 2.5 months [range: 66-94 days] after the first examination (M3). CT images of the injured forelimb were also acquired at the same periods and the mean fetlock bone density (HU) calculated. Results have shown that the fetlock bone density of the lame limb was significantly decreased with a mean demineralization of 7.4% [range: 1.7-16.0 %] between M1 and M3 (Figure 1). A third CT exam was performed at the end of the recovery period just before beginning the last pre-racing training: about 6.5 months after M3 (mean: 190 days, range: 77 – 305 days). Even after this long recovery phase, the fetlock bone density of the lame limb was still significantly decreased compared to M1 with a mean demineralization of 3.6%. Individual results in this small group of horses seem to show that the percentage of demineralization was correlated with the intensity and duration of the rest period. Standing MRI has revealed a significant increase of signal on STIR sequence at M3 compared to M1 on both fore fetlocks (Figure 1). The pattern of this BMEL

alteration was generally diffuse and frequently more pronounced in the dense bony parts of the fetlock (ie: palmaro-distal aspect of the condyle, dorsal part of the sagittal ridge of the condyle, proximal sesamoid bones).

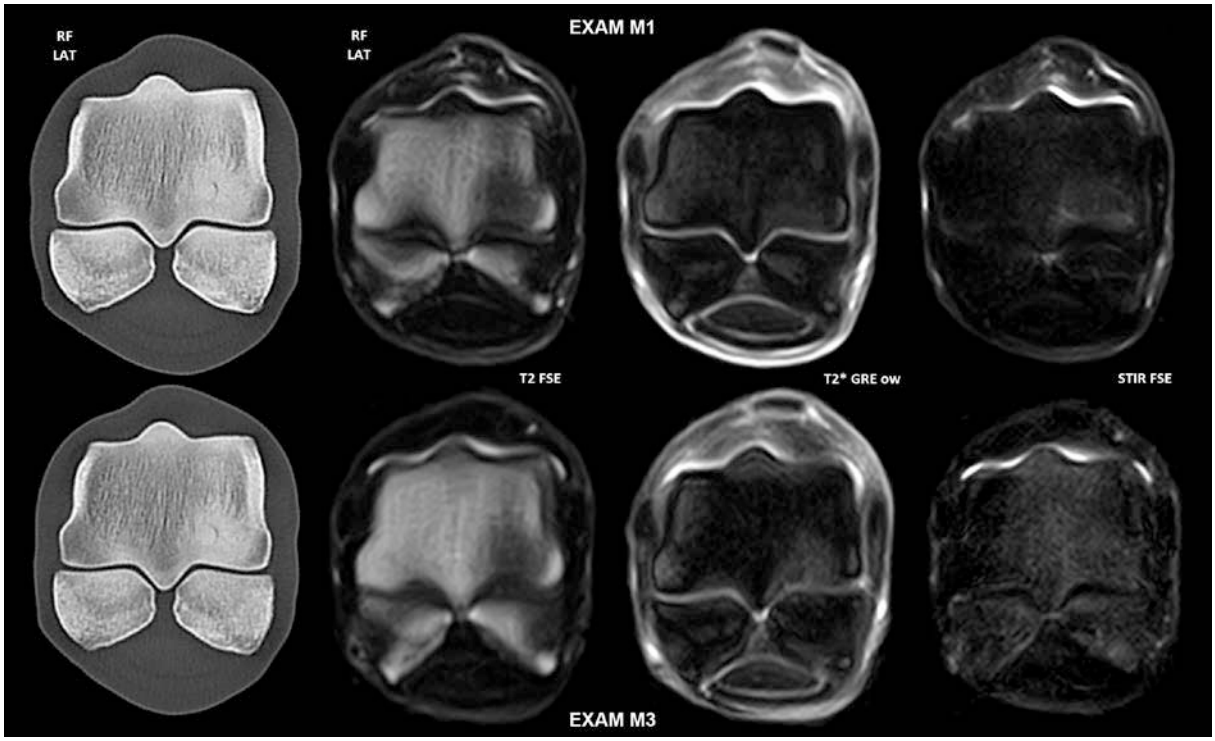

Figure 1: CT and standing MR examinations of the fore fetlock of the SDFT injured limb in a steeplechaser. Upper images: exams performed at M1 (29 days post-acute SDFT injury). Lower images: exams performed at M3 (65 days after M1). Note the diffuse decrease of CT bone density at M3 compared to M1 (the windowing of both CT images is the same). In this horse, the mean fetlock bone density was decreased by 6.6% at M3 compared to M1. Standing MR images demonstrate at M1 a chronic palmar bone contusion of the medial metacarpal condyle with sclerosis and BMEL. At M3, a mild decrease of the bone sclerosis is visible on the T2w FSE image and the STIR image shows a diffuse BMEL lesion in both the metacarpal condyle and proximal sesamoid bones. These marked signal changes are also found on the T2* GRE ow sequence with fat-water phase cancellation artefacts within the altered bone.

This **"bone rest edema" associated with a decreased bone density** should be considered when interpreting MR follow-up examinations in athletic horses undergoing a rest period due to articular or tendon lesions. If rest periods are justified by the clinical signs of the horse and to allow subchondral bone repair (Holmes et al. 2014) in the injured joint, it seems essential: 1) to optimize the duration and intensity of this rest period to limit the associated bone rest changes and 2) to consider these changes when designing the rehabilitation program of the horse. For instance, Bani Hassan et al. (2016) have demonstrated that a resting period of about 6 weeks (range: 1 – 16 weeks) generates a greater bone porosity of the superficial subchondral bone increasing the risk of collapse of the articular surface in the distal metacarpal condyle.

Conclusion

Diagnostic imaging techniques, particularly advanced ones, allow today to identify and document bone fatigue injuries with a high sensitivity and specificity. Standing MRI and in the near future standing CT will represent essential imaging techniques for follow-up examinations: 1) to evaluate the healing stage of the lesions and 2) to document bone changes associated with a decreased exercise regimen such as bone rest edema alterations.

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The authors declare that there were no conflicts of interest.

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Etiopathogenesis of Fatigue Fractures

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Although bones can be fractured in a single large traumatic accident, fractures in athletes are the result of smaller repetitive loads. Bone, like other materials, will fatigue with repeated loading. Fatigue is the initiation and propagation of cracks in a material due to cyclic loading. With repeated loading in the laboratory bones will lose stiffness and strength, and ultimately fracture. The relationship between number of repeated loads required for bone failure is exponential. Higher loads create markedly more damage in far fewer cycles than low loads. Each loading cycle (stride of the horse) induces some level of damage in the bone material. Bone can sustain low level loads for a long time; non-destructive damage is continually self-repaired. Conversely, fewer large loads may induce destructive damage that requires remodeling for repair, increasing susceptibility to more damage with continued loading. At an extreme, the bone will ultimately fail (i.e., fracture) due to accumulation and propagation of cracks through the process of fatigue.

Bone damage occurs when higher than expected, loads (stresses) cause bones to deform (strain) excessively. The most easily observable forms of damage histologically are diffuse damage and microcracking. One mechanism for preventing excessive deformation and consequent bone damage formation is to enlarge the bone structure. The stress associated with high loads is reduced when bones get larger and the strains within bone material become smaller. This process occurs during growth. Bones not only get longer, but larger in diameter to support increasing body mass. Sport horse training involves increases in bone loads, whether by inducing faster speed, higher jumps, or unique gymnastics. Ideally, the increase in exercise intensity is graduated, allowing for skeletal adaptation to small increments in skeletal loads.

Bones incur a spectrum of bone damage. Mild, non-destructive bone damage promotes skeletal adaptation. Large increases in bone loads, excessive loads, numerous repeated loads, or repeated loads on compromised bone tissue can produce more severe bone damage. For example, continued high intensity exercise on metacarpi with dorsal metacarpal disease before adaptation is completed can lead to incomplete cortical fracture (stress fracture) or catastrophic complete bone fracture. More severe forms of damage compromise osteocyte viability and induce bone remodeling. Removal of damaged bone tissue occurs quickly, but replacement with new, undamaged tissue requires longer time.

During repair, transient osteopenia compromises the strength and stiffness of the bone material. Consequently, repeating the most recent intense loads is more damaging because bone stresses, and thus deformations, are higher because of the reduced amount of bone material at the affected site. Further, this weakened site acts as a stress riser that can promote complete bone fracture under otherwise normal loading circumstances. However, on completion of modeling (periosteal callus and trabecular thickening) and intracortical remodeling (secondary osteons) the bone structure is stronger, and the bone material is tougher, further resisting microcrack initiation and propagation and increasing fatigue life.

Management of Fatigue Fractures in Racehorses

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Prevention

The phrase "Prevention is better than cure" is particularly appropriate for fatigue fractures in racehorses: caught before early damage extends to fracture, they have an excellent prognosis; overlooked and they often result in a fatal outcome.

These injuries are manifestations of Repetitive Stress Injury (RSI) and, as such, reflect progressive deterioration of the material properties of affected bone caused by accumulating fatigue damage. Developing training programmes that do not cause this damage must be our end goal although in the interim, detecting evidence of fatigue early enough to implement interventions that allow physiological processes to repair it and the horse's skeleton to be returned to health is important.

Definitive diagnosis of early fatigue damage is usually made by some form of imaging. This may be undertaken in response to specific clinical signs although even quite severe pathology considered prodromal to fatigue fracture may be asymptomatic. This has prompted work to develop screening tools, which include epidemiological profiling, presence of specific molecular biomarkers, changes in stride characteristics and findings from an array of diagnostic imaging modalities, all of which are designed to detect the presence of fatigue damage that may precede severe fracture.

Treatment

Complete fractures that arise as a consequence of fatigue may require surgical intervention to reconstruct the bone, reduce the bone fragments, and to stabilise them by internal fixation. Pathology of surrounding tissues secondary to complete fracture of bones of the limb that occur during high speed locomotion is often so severe that repair is not viable and euthanasia of the horse is the only option. Incomplete or mono-cortical fractures may be managed by conservative means alone or in combination with surgery, which usually involves precise placement of one or more screws to encourage healing and reduce the risk of the fracture extending. Localised fatigue damage, in the absence of evidence of fracture, is usually managed by conservative means alone.

Fracture healing and repair of fatigue-damaged bone both rely on physiological resorption of dead or diseased bone and its replacement with fresh, healthy tissue. Osteoclastic resorption of bone, deposition of fresh osteoid by osteoblasts and subsequent mineralisation of the new matrix is a slow process that is affected by the local strain environment. There is good experimental evidence that high strains inhibit bone resorption and strains below a threshold limit, bone deposition. Experimental and clinical evidence indicate that an incomplete fracture will usually heal within three months. Repair at that stage is still dependent on woven bone, which is formed relatively quickly and mineralises rapidly, although has inferior mechanical properties to lamellar bone. Therefore, repair that is associated with callus requires further time for complete healing as the woven bone is progressively resorbed and replaced with lamellar tissue.

Certain drugs partially inhibit remodelling and repair of connective tissue, including bone. Important among these are non-steroidal anti-inflammatory drugs, especially those which affect the cyclooxygenase-1 pathway. Therefore, these drugs should be administered judiciously when managing a horse with a fatigue fracture and it is prudent to restrict their use to only the first few days after fracture, when pain associated with the injury is significant. Bisphosphonates are used specifically to inhibit bone resorption. Low-level experimental evidence in humans suggests that they are not effective in preventing fatigue fractures from occurring. Studies in human medicine indicate that their use does not delay fracture healing although the quality of repair is impacted as replacement of woven bone with lamellar tissue is hindered.

A good diet, which is supplemented with minerals at the right concentration and correct ratios is a fundamental requirement to bone health. There is little knowledge about the importance of Vitamin D in the horse although it is sensible to ensure that any fracture case is receiving a diet that is suitably supplemented. Horses do not generate Vit D in the skin and all horses that are not fed suitable quantity of appropriate forage should receive a feed that is supplemented with Vit D (usually D3).

Strict stable rest is only indicated when the horse is significantly lame from pain associated with the acute injury or when there is a risk of extension of an unstable fracture. Certain injuries, most notably pelvic fractures, may be best managed by cross-tying the horse in a stable to prevent severe extension of the fracture

as the horse lies down or stands up. However, in most cases of fatigue fracture, horses are best mobilised as soon as they are comfortable. Regular, cyclical, low-level strain on bones of the limbs associated with gentle exercise at the walk in hand is unlikely to inhibit bone resorption and may encourage formation of new tissue. Cyclical strains may also influence deposition of collagen fibres to be orientated with prevailing strain patterns, although there is no direct experimental evidence to support this. Typical rehabilitation programmes for stress fractures of the humerus and tibia include three to four months of restricted exercise, with the first four weeks involving stall rest with gentle exercise at the walk in hand. Turn out into a small paddock when available is recommended by some or, alternatively, a form of exercise that is different from the normal (previous) pattern may be beneficial. The volume of enforced exercise is gradually increased after approximately eight to ten weeks, although this may be varied according to clinical signs.
Various therapeutic aids, such as extracorporeal shock wave therapy, low-intensity pulsed ultrasound and capacitively coupled electric fields are sometimes used in rehabilitation of horses with stress fractures although there is no evidence for their beneficial effect in the horse and low evidence in human studies. An experimental study in rats indicated that low mood states may have a significant, negative impact on fracture healing and it may be worth bearing this in mind when managing horses rehabilitating from stress fracture1.

Prognosis

Follow-up studies in Hong Kong and Australia of horses that have recovered from common racing-related fatigue fractures indicate that the long-term prognosis for return to successful racing is favourable. In one study conducted in Hong Kong, of 39 horse that sustained a humeral stress fracture and 26 a tibial stress fracture, the median duration of missed training days was 632. Horses that sustained these injuries started in races a median of four less times than matched controls over the following 12 months although their overall career length was not significantly impacted. In a separate study of stress fractures of the proximal limb and pelvis, 81 of 99 horses that suffered a fracture, which did not result in mortality, returned to racing and 45 of these won a race subsequently3.

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Diagnosing upper respiratory tract abnormalities in your equine athlete: is it as easy as it appears?

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Diagnosis of upper airway obstructive (UAO) disorders

It is important to diagnose any disease as accurately and early in the disease process as possible. When using a diagnostic test to aid in the overall diagnosis, it is important to validate the test, especially when ordinal grading systems are used. Sources of measurement disparity (e.g., variation) need to be identified as part of the test validation. For the diagnosis of UAO disorders, sources of variation include variations in observer grading, variations in equipment settings and exercise workload and intra-horse disease variation.

Observer grading variability

Good-to-excellent intra-observer and moderate-to-excellent inter-observer agreement for grading of arytenoid asymmetry at rest has been identified (Hackett et al., 1991, Hawe et al., 200, Perkins et al., 2009). Good-to-excellent intra- and inter-observer agreement for palatal instability (PI) and epiglottic structure (Allen & Franklin, 2013) and good intra- and moderate inter-observer agreement for medial deviation of the aryepiglottic folds (MDAF) (Allen & Franklin, 2013) have also been reported.

Our research group determined intra- and inter-observer reliability for UAO disorders identified at rest and during overground endoscopic (OGE) examination (McGivney et al 2016). Observers of similar clinical experience were found to be generally consistent in grading disorders. Substantial-to-excellent intra-observer reliability was found for most UAO disorders, although only moderate agreement was found for vocal fold collapse (VFC), ventro-medial luxation of the apex of the corniculate process of the arytenoid (VLAC) and nasopharyngeal collapse (NPC). Conversely, inter-observer agreement was much lower except for grading the absence of recurrent laryngeal neuropathy (RLN) and the presence of intermittent dorsal displacement of the soft palate (iDDSP), both during exercise. When the disorder was graded as present or absent, the agreement estimates were higher between observers, but remained only fair for MDAF and VLAC and poor for VFC and NPC. Despite similar observer experience and standardised grading schemes individual subjectivity appears to affect grading of most UAO disorders leading to errors. These grading disparities are important to consider when treatment options are based on a disorder grade. ***A single observer is more consistent in grading OGE videos than multiple raters.***

Variations in equipment settings and exercise workload

Our research group determined the associations of endoscopic tip placements (EP) and flushing interval (FI) settings with exercise workload and OGE exam results (McGivney et al. 2018). EP was found to affect palatal dysfunction (PD) grading during an OGE examination, with horses more likely to be diagnosed with PD with the EP in a more rostral position. Exercise velocity was also found to affect MDAF grade through interactions with EP. Horses were more likely to have more severe MDAF grade as speed increased with a rostrally placed EP. Consistency of EP is thus an important consideration when palatal function outcomes are to be compared, such as before and after upper respiratory tract (URT) surgery. Consistency of the exercise velocity during an OGE exam is also important when interpreting an OGE exam.

Intra-horse disease variation

Moderate intra-horse variability has been reported for resting laryngeal grade. A single study found variability in laryngeal and palatal function between OGE exams with no treatment intervention, although there were different workloads and distances between the exams. In addition, surgical correction of UAO disorders (e.g., RLN) have been implicated in the development of other UAO disorders (e.g., iDDSP, MDAF, VLAC), although intra-horse disease variability was not considered.

Our research group evaluated serial resting and OGE exams of Thoroughbred racehorses under the same exercise conditions with no treatment intervention. Numerous UAO disorders showed weak-to-negligible agreement in disorder grade/appearance between putatively identical OGE exams. PI, MDAF, epiglottic grade and iDDSP were all highly variable in the direction of change between the exams. The duration between the OGE exams did not affect the variability for most of the UAO disorders. The time between exams did increase the magnitude of the change for arytenoid asymmetry at rest (AArest) and PI, with no distinct pattern (e.g.,

grades improved or became worse with no pattern). Arytenoid asymmetry during exercise (AAex) was the most consistent UAO disorder between exams, with either no change or a worsening of the grade. If the grade for AArest was ≥3.2, this disorder was moderately consistent between the exams, with either no change or a worsening of the grade. AArest grades ≤3.1, however, were quite variable between exams, although the highest variability in grades between exams were for PD. ***It appears that for some UAO disorders, intra-horse variability exists.***

UAO disorders in horses with no history of poor performance

Our research group performed OGE exams in a large number of Tb Flat racehorses in active race training. Although 53% of the horses investigated had no history of poor performance and/or abnormal noise, 96.4% were diagnosed with ≥1 UAO, with 84% diagnosed with complex disorders. PD, MDAF and VFC were the most identified UAOs. ***It appears that UAO disorders can be found in horses w/no history of poor performance.***

Conclusion

Defined agreement estimate cut-offs for UAO disorder diagnosis need to be established, with variations in grading affecting accurate diagnosis. Grading disparity is an especially important consideration when treatment options are based on a disorder grade. It would be beneficial to train a clinical team on UAO disorder grading to reduce variation. Conversely, using a single observer allows more consistent grading of OGE videos versus multiple raters. Consistency of EP and exercise velocity during an OGE exam are also quite important, especially when outcomes are to be compared when assessing treatment response. For some UAO disorders intra-horse variability appears to exist which may make it difficult to consistently diagnose an UAO disorder and assess for treatment success. UAO disorders can be found in horses with no history of poor performance. This requires further research in the area to help to assess the actual impact of each UAO on performance and the requirement for certain treatment modalities.

Mild moderate equine asthma in performance horses

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Introduction:

Equine asthma is the most recent nomenclature to define a non-infectious lung inflammation associated with respiratory clinical signs of variable severity. Equine asthma encompasses 1) mild/moderate equine asthma (previously "inflammatory airway disease"), and 2) severe equine asthma (previously "heaves"/recurrent airway obstruction). By contrast with severe asthma, horses with mild/ moderate equine asthma will not show increased respiratory effort at rest after a moldy hay challenge[1]. It is important to note that a diagnosis of lung inflammation is meaningless without first documenting the clinical signs in horses with asthma.

Prevalence of mild/moderate asthma in horses:

The prevalence of mild/ moderate asthma is high even in populations of horse athletes. Field studies found a prevalence of lung inflammation (which is not exactly synonym of equine asthma) 0f 65-80%, including in racehorses [2,3].

Clinical signs:

Clinical signs of mild/moderate asthma are generally subtle in performance horses (since they are still used in performance activities!). Survey studies found that the most important questions to ask to the riders are about the presence, timing, and frequency of cough[2,4]. Nasal discharge and other clinical signs are usually reported and can be scored.

Diagnosis:

The diagnosis of equine asthma is based on ancillary tests.

The tracheal endoscopy is not specific of equine asthma. However, studies showed a decrease in performance in racehorses and sports horses that presented with increased tracheal mucus [5,6].

The bronchoalveolar lavage (BAL) is the reference method to confirm a diagnosis of equine asthma. It not only documents the presence of inflammation in the lower airways, but it also allows quantifying it, identifying the type of inflammation (allergic vs neutrophilic) and finally it helps quantifying the organic particulates in the small airways. A BAL technique will be briefly presented. The cytological analysis requires some staining and cell counting specific to the BAL.

Management/ Treatment:

It is important to convey the message to horse owners that although equine asthma can be effectively managed, there is no cure for this disease. Management involves a combination of medical treatments and measures to control exposure to environmental organic dust.

The literature disproportionately assesses the effects of treatments in horses with severe asthma as compared to mild/moderate asthma; There are only a few controlled studies assessing the clinical efficacy of medications in mild/moderate equine asthma.

-Corticosteroids:

Dexamethasone is the systemic corticosteroids of reference in equine asthma and has been used as a benchmark in many studies assessing the efficacy of therapies [5-22]. All the studies except for three [5,6,10] used horses with severe asthma and documented a positive clinical improvement. One study found that dexamethasone IM and inhaled fluticasone propionate both decreased airway hypersensitivity and hyperresponsiveness after 1 week of treatment, but without effect on BALF cytology [10]. This confirmed that corticosteroids therapy has some value in the treatment of mild/moderate equine asthma. In another study, horses with moderate equine asthma that were kept in a dusty environment dexamethasone showed some anti-inflammatory effect on the cytokine expression of lung cells without any change in the cytology of the BALF [6].

Because systemic corticosteroids are associated with hypothalamic-pituitary-adrenal (HPA) adrenal suppression, inhaled corticosteroids present the advantage to have a local airway anti-inflammatory activity,

while potentially decreasing the systemic absorption. An inhaled delivery system using ciclesonide has recently been approved for commercialization to treat severe equine asthma, making it the only approved corticosteroid for this condition. Ciclesonide is a pro-drug that is metabolized by esterases in the lung epithelium into des-ciclesonide, which increases its potency by many100 fold. The clinical efficacy of inhaled ciclesonide in severe asthma horses was demonstrated in a study (keeping horses in a dusty environment) at the label dosage of Aservo™ [8]. Importantly, the results showed no adrenal suppression, even when the highest dose of ciclesonide was used.

-Bronchodilators:

The benefit of bronchodilators over corticosteroids as treatment for horses with mild/moderate equine asthma was not reported when measuring the horses' aerobic capacity assessed by measuring peak oxygen consumption during exercise to fatigue(VO_2peak) [5]. It therefore appears that once horses have improved the lung inflammation by environmental and corticosteroids therapy, bronchodilators would not add to their aerobic capacity.

- Environmental measures

Improvement in air quality has an overriding effect over treatments with corticosteroids in horses with mild/ moderate equine asthma [5], as well as in horses with severe equine asthma [7]. There is a clear agreement between studies that improving hay and bedding conditions will have a dramatic effect to reduce airborne dust. However, between the hay and the bedding, the forage has a greater impact on the respirable dust and endotoxin concentrations in the breathing zone of horses than the bedding [76,85-87].

(List of references available in the presentation.)

An update on Exercise-Induced Pulmonary Haemorrhage in the equine athlete

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Overview
EIPH is common in racehorses but can be seen in most breeds under strenuous exercise. Poor performance is a common complaint, ±epistaxis, with a prevalence of up to 80% (*Birks et al. 2002, Hinchcliff et al. 2005, Morely et al. 2015*). The prevalence of epistaxis is much lower, ranging between 0.1-9% (*Knight & Evans 2000, Newton et al. 2005, Langford et al. 2013*). The incidence of EIPH is higher for horses exercising on an incline *vs.* horses exercising on the flat, with EIPH prevalence higher in steeplechasers than in Flat racehorses.

Pathogenesis of EIPH
Most research supports EIPH to be due to pulmonary capillary stress failure due to pulmonary hypertension and increased pulmonary capillary transmural pressure. During high-intensity exercise extremely high negative alveolar pressures and extremely high positive capillary pressures are routinely created. The latter is due to increases in blood volume, heart rate and cardiac output. In most species pulmonary arterial pressure (Ppa) increases to around 35 mmHg during strenuous exercise; in the horse, however, Ppa routinely increases to >90 mmHg. Any scar tissue around the capillaries can further increase capillary pressure (*Williams et al. 2013*). Blood flow is preferentially distributed to the caudodorsal lung lobes, with EIPH predominantly occurring in this area.

Other possible causative/co-factors
Locomotion-induced shock on the caudodorsal thorax has been proposed as a primary cause of EIPH (*Schroter et al. 1998*). This is supported by the high incidence of EIPH in horses racing over obstacles and/or on hard ground. However, this does not fully explain the underlying cause of EIPH since EIPH also occurs in swimming horses (*Nicholl et al. 1978*). Although a more recent report did not identify epistaxis in post-swimming horses (*Watkins et al. 2006*), the mean pulmonary arterial and right atrial pressures during swimming are reported to be like those of horses with EIPH during maximal intensity on the treadmill (*Jones & Hiraga 2006*).

Risk factors for EIPH/epistaxis
Older reports identified associations of EIPH with age (*Pascoe et al. 1981, Raphel & Soma 1982, Lapointe et al. 1994*) but not gender, although one study found female Thoroughbreds to be 1.4 times more likely to have exercise-induced epistaxis than stallions (*Takahashi et al. 2001*). After one episode of epistaxis, recurrence was found in 13.5% of horses after 1 month of rest (*Takahashi et al. 2001*). The prevalence of EIPH has been reported to increase with speed/work intensity (*Raphel & Soma 1982, Oikawa 1999*). However, it has been found that age, gender, the type and distance of the race, speed, hardness of the ground, weight carried, and air quality were not risk factors for EIPH (*Hinchcliff et al. 2010*). However, air temperature was a significant risk (*Hinchcliff et al. 2010*), with horses racing at temperatures < 20°C at almost two times the risk for the development of EIPH.

Heritability
Although it is difficult to evaluate heritability for EIPH (no distinct cohorts), there is some evidence for heritability of epistaxis (*Weideman et al. 2004, Velie et al. 2014*)**.**

Physiological effects of EIPH
EIPH is associated with a worsening of arterial hypoxaemia and hypercapnia during exercise (*Couetil & Denicola 1999, Sanchez et al. 2005*) and a decrease in VO_{2max} at supramaximal exertion (*McKane et al. 1995, McKane et al. 2008*).

Evaluation and diagnosis
Tracheobronchoscopic (TBE) examination and/or bronchoalveolar lavage fluid (BALF) cytology are the most used, evaluating for the presence of RBCs and/or haemosiderophages in BALF. There currently is no agreement on the number of RBCs in BALF that is diagnostic for EIPH. Total hemosiderin score is another

option for evaluating the presence and severity of EIPH from BALF. It is currently recommended that the BAL be performed 30-60 min after exercise, maybe longer? TBE is best performed within 1-2 h post-exercise. If TBE is performed immediately after exercise with no blood found repeat 1-2 h later.
An EIPH grade 0 from a TBE does not mean that there is no evidence of EIPH. If a grade 0 is identified, a BAL would need to be performed to fully rule-out any evidence of acute and/or chronic haemorrhage. No correlations between TBE EIPH grades and BALF RBC numbers have been found. A cut-off BALF RBC of 992/µl has recently been suggested to be the recommended diagnostic threshold (*Sanchez et al. 2019*).

Clinical relevance to performance
EIPH may impair performance or be associated w/ superior performance. Negative effects of EIPH on performance have been found in racehorses (*MacNamar et al. 1990, Couroucé-Malblanc et al. 2002, Newton et al. 2005, Hinchcliff et al. 2005*). Horses finishing 1st/2nd have been reported to be 1.4X more likely to have EIPH than horses finishing 7th/8th (*Rohrback 1990*). Furthermore, EIPH positive horses have been reported to be more likely to finish unplaced (*Costa & Thomassian 2006*). Horses w/grade ≥2 EIPH TBE scores have significantly lower odds for finishing in the 1st 3 positions; horses with a grade ≥1 finished further behind the winner *vs.* EIPH negative horses (*Hinchcliff et al. 2005*). Horses with a grade 4 EIPH TBE score have been associated with shorter racing careers, while horses with a grade ≥2 scores have a lower likelihood to be in in the 90th higher percentile for race earnings (*Hinchcliff et al. 2005*). Conversely, no association with EIPH and finishing position has been reported (*MacNamara et al. 1999, Birks et al. 2002*). *Morley et al.* (2015) found that horses with EIPH grade 0 as compared to horses with grades ≥1 were twice as likely to win races, finish on average one length ahead and be 2.5 times more likely to be in the highest decile in earnings.

Association between MEA & EIPH?
Proposed association (*Newton & Wood 2002*), causal not proven. Clinically associations not found (*Chapman et al. 2000, Allen et al. 2006*). Experimentally associations found, not sure the cause or effect. Experimentally blood in LRT may elicit mild, prolonged inflammation (*McKane et al. 1999, Kingston et al. 2002, Art et al. 2002*). Lower airway inflammation may promote EIPH (*McKane & Slocombe 2010*)

Association between UAO & EIPH
Increased transmural pulmonary capillary pressure gradient resulting from UAO may lead to pulmonary capillary rupture (*Cook et al. 1988, Ducharme et al. 2010*). Some researchers have reported an association between EIPH and UAO (*Cook et al. 1988, Couroucé-Malblanc et al. 2010*) while other groups found no associations (*Davidson et al. 2011*). However, combinations of UAOs and EIPH have been reported to have more significant negative effects on indirect measures of aerobic parameters (*Sanchez et al. 2005*).

Long-term effects
The presence of blood over time contributes to ultrastructural sequelae (neovascularisation, fibrosis), resulting in increased resistance and decreased compliance (*Art et al. 2002*). Downstream pulmonary veno-occlusive remodelling has also been shown to occur in chronic EIPH horses (*Williams et al. 2008, Derksen et al. 2009*). This is attributable to chronic hypertension, with possibly increased recurrence and worsening of episodes of EIPH with age.

Furosemide
Furosemide has proven effects (*Hinchcliff et al. 2009*). It reduces right atrial, pulmonary arterial, pulmonary wedge and pulmonary capillary pressures as well as venous return to the atria with reduced cardiac filling and pulmonary venous pressure. It has been suggested that diuretic weight loss is the primary beneficial effect (*Zawadzkas et al. 2006*). It is proposed to enhance performance with faster racing times, increased VO_{2max} and time to fatigue observed (*Bayly et al. 1999, Zawadzkas et al. 2006*).

Nasal flair strips
This may reduce the incidence of EIPH by reducing the severity of pleural pressure changes during exertion. Some researchers found no effect on EIPH (*Goetz et al. 2001*). Conversely, other groups found a decrease in EIPH severity (*Poole et al. 2000, Geor et al. 2001*).

Systematic review of EIPH

There is moderate-high quality evidence to support EIPH to be progressive, associated with pulmonary lesions and adversely affect racing performance. Based on the presence of pulmonary lesions, it can be considered a disease. Severe EIPH has been associated with a shorter career duration and inferior finishing positions (*Hinchcliff et al 2005*). Furosemide is an effect prophylactic treatment.

Is EIPH a disorder or physiological response?

Some researchers consider EIPH a physiological response to high intensity exercise in horses. The extremely high prevalence in various breeds undergoing strenuous exercise and the presence of lesions in very young horses in early training (*Oikawa 1999*) support this theory.

Conclusions

EIPH is a common condition of horses undergoing strenuous exercise, with pulmonary capillary stress failure the most likely cause. Moderate-severe EIPH may negatively affect racing performance. EIPH is often variable in severity and appears to be progressive. Furosemide can reduce the incidence/severity of EIPH. It may be prudent to avoid training/racing horses with a history of repeated moderate-severe EIPH during colder months, increasing the intervals between races.

EQUINE PROGRAM:

FREE COMMUNICATIONS

DAY 01

ABSTRACTS

Influence of spinal surgery on the biomechanics of the equine thoracolumbar spine

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Background
Surgical options for treatment of overriding spinous processes (SP) include partial SP ostectomy and interspinous ligament desmotomy.

Objectives
To investigate the influence of cranial wedge ostectomy and desmotomy on the biomechanics of the equine thoracolumbar spine and the paraspinal Musculi multifidi.

Material and Methods
Twelve thoracolumbar spine specimens were mounted in a custom-made mechanical test rig. The spinal range of motion (flexion, extension, lateral bending, axial rotation) was compared using computed tomographic imaging under mechanical load before and after ostectomy (six specimens) and desmotomy (six specimens). Surgery was initially performed at the thoracic vertebrae Th15-17 and subsequently between Th14 and the first lumbar vertebra L1. Data were analysed using Wilcoxon/t-test and linear mixed model. To assess surgical trauma to the Musculi multifidi, anatomical dissection was performed following desmotomy (Th14-L1) (descriptive analysis).

Results
In neutral position, the Median (Md.) distance between SP increased from 8.8 to 13.0 mm after partial ostectomy ($p < 0.01$) and from 7.2 to 7.4 mm after desmotomy ($p = 0.09$). Both surgeries increased the rotational range of motion at the surgical site significantly ($p < 0.01$), particularly at the level of Th14/15 (preoperative Md. 6.4°, postoperative Md. 8.2°). Dissection identified damage to the Musculi multifidi following desmotomy in all cases.

Conclusions
Limitations include the limited number of specimens and the ex-vivo characteristics. As the Musculi multifidi provide intersegmental stabilisation, local soft tissue damage in combination with increased postoperative mobility suggests a reduced functional stability in the equine thoracolumbar spine following spinal surgery.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: The study was approved by Landesamt für Gesundheit und Soziales, (LaGeSo), Berlin, Germany (IVC1Schr-StN010/20) in April/2020.
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Agreement among veterinarians and a smartphone computer vision method for equine lameness assessment during lameness examination: preliminary findings

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Introduction
Objective measurements of a horse's motion at the trot has become an important tool during clinical lameness investigation. The aim of the study was to estimate the agreement between a smartphone computer vision method and two veterinarians for equine lameness assessment.

Matherials and methods
Forty-one horses were evaluated during clinical examination by the first author (VET 1) and simultaneously recorded by a single smartphone camera markerless system (SC). The gait was evaluated in straight line and on the circles and classified as sound, irregular and lame; limb/s affected were recorded. Videos of examinations were also evaluated retrospectively by an experienced veterinarian (VET 2) blindly. The interobserver agreement between veterinarians and SC were calculated using Cohen's weighted K coefficient, overall and for each limb.

Results
Overall, maximum agreement recorded was moderate (κ_w=0.58), with higher value between VET 1 and SC (0.05<κ_w<0.58) compared with VET 1 and VET 2 (0<κ_w<0.58) or VET 2 and SC (0.<κ_w<0.447). Agreement was higher for the straight line condition (0.15<κ_w=<0.52) and for forelimbs (0.36<κ_w=<0.58) evaluations compared with circles condition (0.24<κ_w<0.33) and for hindlimbs (0.10<κ_w<0.44) evaluations.

Conclusions
Agreement between SC and operators was similar to that reported in previous studies with other objective gait analysis systems. The easy use and the results of this study encourage the use of the SC as a supporting tool for lameness diagnosing. Some results were influenced by the κ statistics paradox for unbalanced case distribution.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: Not applicable due to retrospective analysis of clinical data.
Sources of funding: This research received no external funding

Magnetic resonance imaging findings in the metacarpophalangeal joint of 31 showjumping horses in full work and competing regularly

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Objectives
To document magnetic resonance imaging (MRI) findings in the metacarpophalangeal joint of competing showjumpers.

Materials and Methods
Thirty-one showjumpers, in full work and with no history of metacarpophalangeal joint disease, underwent lameness examination and low-field MRI of both metacarpophalangeal joints.

Results
Horses (age range 5-15 years [median 7]; competition level 110-145 cm [median 125]) showed no consistent forelimb lameness in a straight line or on the lunge. Thickening of the subchondral bone and/or hypointense signal in T1- and T2-weighted sequences (mineralisation) in the trabecular bone of the sagittal ridge of the third metacarpal bone (McIII) was detected dorsally in 51/62 limbs, and palmarly in 26/62 limbs. In the medial metacarpal condyle mineralisation was seen in the dorsal and palmar aspects in 48/62 limbs. In the lateral condyle palmar mineralisation predominated (53/62 limbs). The pattern of mineralisation was usually bilaterally symmetrical. Extensive mineralisation was seen only in horses competing at ≥130 cm. Thickening of the subchondral bone of the proximal phalanx was seen in all but one limb, but hypointense signal in the trabecular bone was not observed. Hyperintense signal (in all sequences) was detected in the subchondral bone in the medial condyle (dorsal aspect: one limb, weight-bearing surface: one limb) and in the sagittal ridge of McIII (four limbs of two horses). No significant soft-tissue abnormalities were identified.

Conclusions
Trabecular mineralisation in the distal aspect of McIII was common and may reflect adaptive change in showjumpers; its clinical significance should be interpreted with caution in lame horses.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: Approved by the Ethical and Animal Welfare Committee of the University of Veterinary Medicine Budapest and by the Government Office of Pest County (PE/EA/1051-7/2021) on the 23rd September 2021.
Sources of funding: Project no. FK 138825 was supported by the Ministry of Innovation and Technology of Hungary from the National Research, Development and Innovation Fund, financed under the FK_21 „OTKA" Fiatal kutatói kiválósági program funding scheme. Project no. TKP2020-NKA-01 has been implemented with the support provided from the National Research, Development and Innovation Fund of Hungary, financed under the Tématerületi Kiválósági Program 2020 (2020-4.1.1-TKP2020) funding scheme. Hallmarq Veterinary Imaging Ltd. generously waived the scan fees.

Assessment of the severity of aortic valve regurgitation by spectral Doppler of aortic and carotid blood flow in horses

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Background
Echocardiography is essential for evaluating the impact of a cardiovascular disorder on athletic performance or life expectancy in sport horses. However, the diagnostic value of pulsed wave Doppler (PWD) and continuous wave Doppler (CWD) in horses with aortic regurgitation (AR) is relatively unexplored.

Objectives
To compare 2D, M-mode, colour, PWD, CWD echocardiography and carotid artery PWD in horses with variable severity AR.

Materials and Methods
Cardiac dimensions and blood flow were measured in healthy horses (n=20) and horses with mild, moderate and severe AR (n=60). Clinical data including non-invasive blood pressure and occurrence of dysrhythmias were recorded. Groups were compared using analysis of variance, chi-square and Kruskal-Wallis tests.

Results
Aortic PWD blood flow velocity was significantly higher in moderate (median0.94 m/s[range 0.80-1.33],p=0.07) and severe AR (median1.02 m/s[range:0.81-2.02],p<0.001) compared to normal horses (median0.79 m/s[range:0.64-1.05]). CWD pressure half time (PHT) was shorter in severe compared to mild AR (median 571ms [range:281-909] vs. 850ms [253-2832], p=0.005). Positive proximal carotid artery PWD flow velocity increased significantly in severe compared to mild AR or normal horses (p<0.001). Negative end-diastolic carotid artery flow was noticed in moderate or severe AR. Horses with ventricular dysrhythmia had a lower CWD PHT, higher carotid artery PWD velocity and more severe AR grade (p=0.035, p=0.028, p<0.001; respectively). Left ventricular dilation was associated with increased pulse pressure (p<0.001).

Conclusions
Echocardiographic PWD and CWD techniques support AR classification based on 2D, M-mode and colour Doppler. Although PHT was associated with pulse pressure and AR grade, significant overlap between groups was present.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: Not applicable due to retrospective analysis of data.
Sources of funding: This research was supported by the Special Research Fund Ghent University (01B05818).

EQUINE PROGRAM:
FLASH PODIUM POSTERS ABSTRACTS

Short lateral collateral ligament injuries of the equine tarsus: description and outcome in 24 cases treated conservatively

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Background
Short lateral collateral ligament (SLCL) lesions of the equine tarsus and their prognosis after conservative management are poorly documented.

Objectives
To describe the ultrasonographic appearance of SLCL injuries in horses examined in a referral center (2001-2021) and to assess the impact on their career.

Materials and Methods
Twenty-four horses (median age 7 [IQR: 4.8-9]; sport horses=15; Standardbreds=7; pleasure horses=2) with SLCL injury diagnosed on ultrasound, conservatively treated and with at least 1 year of follow-up were included and allocated in two groups, depending on lesions identified alone or in combination to other tarsal collateral ligaments (CLs). Follow-up information (resting time, ability to return to work, performance level after the injury) were compared between the two groups (Fischer's exact and Mann-Whitney U tests).

Results
SLCL injuries were more frequently identified alone (14/24) than with other CLs (10/24). Predominant lesions were enthesopathies (17/24), with (*n=2*) or without (*n=15*) avulsed fragments and involving the proximal (*n=10*) or the talean insertion (*n=7*), followed by desmopathies (7/24) and rarely rupture (*n=3*). Lesions were associated to tarsocrural joint synovitis (*n*=22). Horses were managed with stall rest, progressive rehabilitation, additional systemic (NSAIDs, biphosphonates) or intraarticular (steroids) medication, local cryotherapy. The median resting time (120 [60-180] days) and outcome did not differ between the 2 groups ($p>0.05$); all, except one horse, returned to previous work and 20 horses performed at same or higher level than before the injury.

Main limitations
Retrospective nature, small sample size.

Conclusions
SLCL injuries have a favorable outcome after conservative management.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: Not applicable; retrospective study on clinical cases. All owners consented to the use of all case information and images for scientific publication
Sources of funding: This research received no external funding.

Limb stiffness in fore and hind limbs and after superficial digital flexor tendon and suspensory ligament injury – a clue to limb function and injury response?

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Background
I*n vivo* measurement of limb stiffness (LS) provides a non-invasive proxy assessment of superficial digital flexor tendon (SDFT) and suspensory ligament (SL) function. Here we compared fore and hindlimbs and evaluate the long-term effects of injury.

Materials and Methods
LS was calculated using floor scales and an electrogoniometer on the dorsal fetlock. The fetlock angle and weight were simultaneously recorded with the limb weight-bearing and when the opposite limb was picked up (increased load) and this repeated five times. The goniometer was then placed on the contralateral limb and the process repeated. LS was calculated from the regression line of angle versus load. Fetlock angle when the weight was zero (as a measure of conformation) was interpolated from the graph. Previous publications and our data show excellent repeatability (CV<6%). In 45 horses, 54 measurements were made in uninjured limbs, 26 in limbs with SDFT injury and 9 with SL injury (acute to 3 years post injury), and analyed using a paired t-test.

Results
LS correlated with weight in forelimbs (p=0.000002) and hindlimbs (p=0.006). When normalised to the horse's weight (534+/-115kg), forelimb LS was significantly higher ($22.3(+/-4.5)x10^{-3}degree^{-1}$) than for the hindlimb ($16.4(+/-4.0)x10^{-3}degree^{-1}$; $p<0.000001$). While there were no significant differences between forelimb and hindlimb conformation in unaffected or SDFT injury, both LS and conformation was significantly greater in limbs with SL injury (p=0.009 and p=0.002 respectively).

Conclusions
Lower hindlimb LS may have relevance to the predisposition and recovery of soft tissue injuries. Forelimb SDFT injuries do not affect limb conformation or long-term LS.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: Ethical approval not required as non-invasive measurement as part of clinical management.
Sources of funding: This research received no external funding.

Beyond VLa4 and V200: useful fitness parameters for performance evaluation and prediction in Standardbred racehorses

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Background
Parameters obtained by exercise tests, such as speed at aerobic threshold (VLa4) and at heart rate of 200 bpm (V200), are considered good fitness indicators; however, their association with racing results has been questioned. We aimed to investigate the role of these and other fitness parameters in performance evaluation.

Materials and Methods
The clinical records of 245 Standardbreds, median age 3(3-4) y.o, referred for poor performance, were retrospectively reviewed. Besides diagnostic procedures to identify poor performance causes, horses underwent an incremental treadmill test. The following fitness parameters were obtained: V200, VLa4, heart rate at aerobic threshold (HRLa4), lactate peak (Lacmax), maximum speed (Vmax), maximum haematocrit (Htmax) and minimum pH (pHmin). Racing data were extracted from a horseracing database (number of starts, wins and placings) in the 3 months pre-examination and in lifetime, and with total earnings. The associations between fitness parameters and racing results were evaluated by Spearman's correlation.

Results
In the previous 3 months, starts were correlated with Vmax, wins with VLa4, placings with V200, VLa4, HRLa4, Vmax, and inversely with Lacmax. Lifetime starts were correlated with VLa4, HRLa4, Vmax and Htmax; wins, placings and earnings with V200, VLa4, HRLa4, Vmax and Htmax. In 2-year-old horses, pHmin was associated with lower lifetime earnings, and Htmax with more starts, wins, placings and earnings.

Conclusions
Parameters obtained by treadmill tests both reflect the poor performance condition and the career potential. Besides V200 and VLa4, useful parameters include HRLa4, Vmax and Lacmax; pHmin and Htmax are of interest in 2-year-old Standardbreds.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: Ethical approval was waived, as it is a retrospective study including only patients undergoing standard diagnostic procedures for clinical purposes; informed consent for the use of clinical data was obtained from all owners or holders.
Sources of funding: This research received no external funding.

Pilot study for validation in-vivo of a supporting device limiting extension of the metacarpophalangeal joint in sound horses

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Background
During the rehabilitation, it is essential to reduce the load and strains on the metacarpophalangeal joint (MCPJ) and flexor tendons/ suspensory ligaments.

Objectives
To evaluate the efficacy of a carbon fiber composite support system (SS) in reducing the extension of the MCPJ in walk and trot in 5 sound horses.

Materials and methods
Sagittal plane MCPJ patterns of forelimbs were recorded using 2 inertial sensor measurement units (IMUs) *per* limb without the SS (S) and with 2 different grades of attenuation of MCPJ extension (1 'minimal' and 4 'maximal') with the SS on the right forelimb (R). The left forelimb (L) was used as control. A paired T-Test was used to compare L and R range of motion (ROM) and maximal extension (ME) of the MCPJ under the 3 conditions.

Results
No statistically difference between L and R ROM and ME at trot and walk without the SS was found. A significant difference was observed in walk for setting 1 for ROM (L 58.7°±8.8°-R 35.5°± 10.1° $p< 0.001$) and ME reduction (L -12.8°±4.5°; R -5.3°± 3.1° $p< 0.05$) and setting 4 (L 62.3°±6.8° R 30.7°± 9.9° $p<0.00$; L -13.7°± 3.6° R -8.2°± 4.5° $p<0.01$). Reduction was significant in trot for setting 1 (ROM mean L 78.9.°±12.5° R 51.3°± 14.4° $p<0.05$; ME L -28.9.°±7.2° R -16.8°± 7.3° $p<0.05$) and setting 4 (ROM L 80°± 9.1° R 40.2°± 5.3° $p<0.001$; ME L -26.2°± 5.9° R -17°± 4.4° $p<0.05$).

Conclusion
SS is effective in limiting MCPJ ROM and ME in sound horses.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: The study was approved by the Ethics Committee of Turin (protocol n. 0000285/2023; approval date 01 February 2023).
Sources of funding: This research received no external funding.

A preliminary investigation on prevalence, severity and clinical significance for occipital bone exostoses in Dressage and Standardbred horses

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Background and Objectives
Head and neck hyperflexion during working has gained attention as a potential risk factor for nuchal ligament elongation, increased pressure in the atlanto-axial region, development of exostoses on the occipital bone (EOB) and nuchal bursa inflammation. Dressage (DH) and Standardbred horses (STBR) have different genetic, tack, working conditions and age during their athletic careers, all of which could affect prevalence and severity of EOB in these breeds. To test this hypothesis, we retrospectively assessed evidence of radiographic EOB and associated clinical signs in 64 DH (4; range, 1-18 years) and 32 STBR (4; range, 1-11 years) evaluated for reasons unrelated to the study.

Material and Methods
All horses had their poll examined and occipital bone imaged (radiographic view centred on the external occipital protuberance). Clinical response to digital pressure of the poll was classified as painful or not. Radiographic images were blindly assessed, and lesion severity expressed using a 5-point score whose interobserver agreement was assessed using a 2-way random effects model (ICC>0.8). Associations between score and clinical data were investigated with logistic regression.

Results
EOB were identified in 79% STBR and 75% DH (p=0.8). Radiographic score significantly increased with age (OR 1.3; 95% CI 1.1-1.5; p<0.0001). Horses showing palpation soreness were ~3-fold more likely to have higher scores compared to horses with a non-painful response (OR 3.6; 95% CI 1.5-9.0; p=0.005).

Conclusions
EOB prevalence is similar in DH and STB. Increasing age and palpation soreness are associated to severity of radiographic findings in the occipital region.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: Not applied as only horses examined for clinical problems were retrospectively enrolled, and for which informed consent of the owners for research use of clinical data was available.
Sources of funding: This research received no external funding.

Water treadmill training causes a significant increase in back dimensions at the level of Th10 in warmblood riding horses without a history of back pain

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Background
Back pain is common in ridden horses. Data on the effect of water treadmill training (WT) as a potential preventive strategy in horses is sparse.

Objectives
The aim of this study was to identify the effects of 9 weeks WT on back dimensions in warmblood riding horses without back pain.

Materials and Methods
Fifteen horses (median age 9 years) were trained three times per week up to 30 minutes on a water treadmill. The remaining days the horses were in ridden training. Back dimensions were objectively assessed at week 0, 3, 6 and 9. A flexible curved ruler was shaped three times along the transverse contour of the back at the level of Th10, Th14, Th18 and L3. The contours were digitalized and areas under the curve (AUC) to a level 10 cm below the dorsal midline contour were calculated.

Results
The AUC increased over time at the level of Th10 (marginal means and 95% CI at week 0: 1649 [1488–1810] cm², week 3: 1688 [1532–1844] cm², week 6: 1727 [1571–1883] cm², week 9: 1766 [1605–1927] cm², adj. P = 0.034) but not at the caudal levels.

Discussion
The results indicate that WT may lead to an increase in muscle cross section caudal to the withers but not in the caudal thoracic and lumbar region.

Main limitations
Small sample size and lack of control group.

Conclusions
WT potentially contributes to muscle hypertrophy at the level of Th10 in warmblood riding horses without back pain.

Conflict of interest: The authors declare no conflict of interest
Ethical committee: The study was approved by the ethics committee of the responsible German federal state authority (State Agency of Nature, Environment and Consumer Protection North Rhine-Westphalia, AZ: 81-04.13)
Sources of funding: Liesa Rogge was temporarily funded by “Konrad-Adenauer-Foundation”

A preliminary study to evaluate the effects of a single dry-needling acupuncture treatment on racehorses with clinical signs of back stiffness

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Background
Acupuncture may provide an alternative to manage back stiffness. No study currently demonstrates its effectiveness in athletic horses.

Objectives
Evaluate short-term effects of one dry needling treatment on back stiffness in steeplechase horses.

Methods
Study included twelve sound racehorses with back stiffness, shortened strides, or poor hindlimb propulsion reported during training by the trainer and confirmed on clinical examination. Horses were randomly assigned to acupuncture treatment (n = 6) or no treatment (n = 6). Horses' locomotion during their training session before treatment and 7 (D7) and 14 (D14) days after was scored blindly by their trainer and rider, through a questionnaire. Before and two days after treatment, the thoraco-lumbar mobility was measured using inertial measurement units (IMU) and change in the flexion-extension of the back and limb propulsion at the trot and free jumping was scored by blinded expert veterinarians from severe degradation to marked improvement.

Results
Significantly more horses were improved on D7 and D14 in the acupuncture group (6/6) compared to control (1/5) (Fisher's exact test; p = 0.01) according to the trainer and rider scores. Acupuncture group had a significantly higher improvement score set by experts (0.50 [0.5-0.9]) compared to control (-0.25 [-0.5- 0]) (Mann-Whitney's; p = 0,04). IMU measures were not significantly different between groups.

Main limitations
Limited number of horses and subjective primary outcome. Inclusion based on clinical signs without imaging.

Conclusions
This preliminary study indicates a potential positive effect of acupuncture that needs to be confirmed on a larger number of horses.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: The protocol was approved by the ethics committee on animal investigation (ComERC/ENVA 2019-07-19).
Sources of funding: This work was supported by Boehringer Ingelheim Animal Health (France, Europe) through the "Bourses aux idées" organized by the Ecole Nationale Vétérinaire d'Alfort (ENVA) on 04/04/2019.

EQUINE PROGRAM:

CLINICAL CASES

ABSTRACT

Clinical and ultrasonographic findings of a subclavian-axillary artery thrombosis in a 15 years old show jumping stallion

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Background
The objective of this article is to describe one clinical case. Clinical manifestations of worsening while warming up and getting better when cooling down, coupled with the lack of response to anesthetic blocks lead to an ultrasonographic examination, which showed an echogenic mass into the subclavian-axillary artery compatible with a thrombus.

Material and Methods
Local ultrasound guided injection of the thrombus with fibrinolytic, anti-inflammatories and antimicrobial drugs did not modify substantially the size and location of the thrombus, and clinical manifestations persisted, so surgical thrombectomy was performed under general anesthesia.

Results
One month after the surgery, the thrombus was detected again, and lameness did not improve. The horse was sent to a field for two years. After that time, on a new examination, no clinical manifestations of lameness were detected. On ultrasonographic examination, the thrombus was not detected. The subclavian-axillary arteries were not identified as before, and the presence of smaller vessels in this anatomical location suggested the presence of neovascularization.

Discussion - Conclusions
Arterial thrombus is a rare cause of front limb lameness. This case highlights the importance of the detailed clinical examination to detect and interpret the source of the lameness and the value of the ultrasonography for diagnosis. As there are no previous treatments described for this kind of thrombus location, empirical approach was used, ultrasound guided intervention with medication first and surgical intervention finally.
The new blood flow arrangement could be the reason for the lack of clinical manifestations after the long period of turn out in the field.

Conflict of interest: the authors declare no conflict of interest.
Ethical committee: the owner agreed on all phases of the case
Sources of founding: this research received no external funding

EQUINE PROGRAM:

FREE COMMUNICATIONS

DAY 02

ABSTRACTS

Comparative effect of water treadmill training, lunging and treadmill training during rehabilitation of horses with back pain

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Background
Data about efficacy of water treadmill training (WT) during rehabilitation of horses with back pain is scarce. Aim of this study was to analyze the efficacy of WT in comparison with lunge (LT) and treadmill training (TT).

Materials and Methods
Eighteen warmblood riding horses referred with confirmed clinical signs of back pain including abnormal responses to passive mobilisation were randomized into three groups to participate in a 6-week WT, LT or TT program at otherwise same conditions. Two clinicians, one blinded to the programme performed a structured clinical examination of the back at three time-points (baseline, week 3, 6). Mechanical nociceptive thresholds (MNT) were determined with pressure algometry by the latter clinician blinded to the values.

Results
Visual scores for the lumbar region ($p=0.001$) and palpation sensitivity scores along the thoracic and lumbar region significantly improved at week 6, compared to baseline ($p<0.001$). No differences in MNT were detected between WT, LT and TT at any time-point ($p>0.05$). At week 3 and 6 of all programmes MNT significantly increased at the level of the 10th to 18th thoracic (T18) and 3rd lumbar vertebra compared to baseline. The biggest difference was detected for the parasagittal region around T18 ($8.62 Ncm^{-2}$ vs. $10.29 Ncm^{-2}$, $p=0.01$).

Main limitations
Small group size, lack of control group with ridden rehabilitation exercise

Conclusions
Different training programmes without a rider could be benefical for horses with back pain. WT seems to be equivalent to TT and LT to increase MNTs in the region with main saddle contact.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: The study was approved by the ethics committee of the responsible German federal state authority (State Office for Nature-, Environment- and Consumer Protection North Rhine Westphalia, AZ: 81-04.13).
Sources of funding: Liesa Rogge was temporarily funded by “Konrad-Adenauer-Foundation”

Computed tomographic evaluation of the sagittal ridge of the third metacarpal bone in Thoroughbred racehorses in their first year of training: a longitudinal study

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Objectives
To document progression of computed tomographic (CT) findings in the sagittal ridge (SR) of the third metacarpal bone in Thoroughbred racehorses in their first year of training.

Materials and Methods
Standing CT examination of both metacarpophalangeal joints of 40 non-lame Thoroughbred yearlings, just entering racehorse training, and two follow-up examinations approximately six months apart were performed. The presence and location of hypoattenuating lesions were recorded. The mean Hounsfield Unit (HU) was measured in sagittal reconstructions in eight radial segments of the SR and these values were compared between examinations using a paired t-test.

Results
The second and third examinations included 31 and 23 horses, respectively. A hypoattenuating lesion was identified in 35/80 limbs at the first examination, all in the dorsodistal aspect of the SR. In horses with ≥2 examinations, 6/30 lesions were no longer present at the second examination; at the third examination lesions were not identifiable in further 6 limbs. There was greater mean HU in the dorsal than in the palmar half of the SR ($p<0.001$). The distal half of the proximal dorsal quarter of the SR had the greatest mean HU ($p<0.001$). There was significant increase in mean HU in all segments between the first two examinations ($p<0.02$) but not between the second and third examinations.

Conclusions
A significant increase in attenuation of the SR, reflecting increase in density, occurred in the first six months of training. Hypoattenuating lesions in the dorsal SR can resolve during the first year of training.

Conflict of interest: None declared.
Ethical committee: Approved by the Ethical and Animal Welfare Committee of the University of Veterinary Medicine Budapest and by the Government Office of Pest County (PE/EA/1051-7/2021) on the 23rd September 2021.
Sources of funding: Project no. FK 138825 was supported by the Ministry of Innovation and Technology of Hungary from the National Research, Development and Innovation Fund, financed under the FK_21 „OTKA" Fiatal kutatói kiválósági program funding scheme. Project no. TKP2020-NKA-01 has been implemented with the support provided from the National Research, Development and Innovation Fund of Hungary, financed under the Tématerületi Kiválósági Program 2020 (2020-4.1.1-TKP2020) funding scheme.

Pilot study to evaluate potential prognostic value of Doppler signal of superficial digital flexor tendinopathies in horses at the end of their rehabilitation program

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Background
Superficial digital flexor (SDF) tendinopathies are common in racehorses. Reducing the risk of recurrence is a major final goal of rehabilitation. Doppler ultrasound is increasingly used to assess evolution of intratendinous blood perfusion (BP), allegedly correlated to the stage of healing and prognosis.

Objectives
To assess if increased BP of a healing SDFT at the end of a rehabilitation program was associated with impaired outcome.

Material and Methods
Ten steeple-chasers with unilateral SDF tendinopathies completed an individualised rehabilitation program (40 to 65 weeks) with monthly ultrasound examinations, then went back to training. Video recordings of the last Doppler examination of the injured tendon of each horse were blindly reviewed and maximal tendon BP (maxBP) was scored using a 4-grade scale. As the median value of maxBP in the 10 tendons was 2.15. maxBP was considered low if ≤2.15, high if >2.15. Racing outcome was recorded for as long as available. Success was defined as completion of 3 or more races without re-injury. Association between outcome (success/failure) and maxBP (low/high) was evaluated using Fisher's exact test.

Results
Five horses had low maxBP and a successful outcome. Five horses had high maxBP: four went back to training but re-injured their SDFT before completing 3 races; one retired because of pulmonary issue.
Outcome was significantly correlated to maxBP of the injured tendon at the end of rehabilitation (p=0.008).

Conclusion
This pilot study finally included only 9 horses but renders promising results on a potential prognostic value of Doppler imaging of injured tendons.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: The study was approved by the Institutional Ethics Committee of the National Veterinary School of Alfort (ComERC EnvA; protocol code 2019-02-08; date of approval 2019-03-27).
Sources of funding: This study was funded by the Région Normandie, the FEDER (Fonds européen de développement régional), the Fonds Eperon and the IFCE (Institut Français du Cheval et de l'Equitation).

Preliminary observations in EIPH horses receiving a soluble form of curcumin (NDS27) by inhalation

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Background and Objectives
Exercise-induced pulmonary hemorrhage (EIPH) is caused by the rupture of the alveoli-capillary barrier, due to the high gradient between the intravascular pressure and the negative alveolar pressure, inflammation plays a role as well. An inhaled soluble form of curcumin (NDS27) reduced neutrophil activation in equine asthma. The aim of this study was to evaluate the effect of NDS27 on bleeding intensity.

Materials and Methods
From a population of bleeder Thoroughbred horses, 9 stallions and 11 mares (mean age: 4.1±1.1 years) were recruited with a bleeding score > 2 after a flat race (1200m or 1400m). They were randomly assigned in two groups of 10 horses receiving either 100mg of inhaled NDS27 2x/day for five days and 1x/day for 5 days or inhalation with saline (placebo group), while having their training intensity reduced. Three weeks later, the horses participated in a race. Bleeding scores, BAL fluid colour scores and percentages of haemosiderophages were evaluated with Kruskal-Wallis and one-way ANOVA, respectively.

Results
The NDS27 group showed significantly lower values for the three parameters compared to the placebo group: median bleeding score: 1 versus 3 (P=0.005); median BAL color score 2 versus 5 (P=0.001); haemosiderophage: mean values±SD: 1.5±1.7%. versus 7.7±4.8% (P=0.001)

Discussion - Conclusions
NDS27 known as an inhibitor of the neutrophil myeloperoxidase activity and elastase release is also able to reduce the bleeding intensity in EIPH. Despite the limitations related to a field study, these preliminary results justify more investigations to assess the mechanism of NDS27 in EIPH.

Conflict of interest: Didier Serteyn is co-inventor of the NDS27 patent owned by the University of Liege
Ethical committee: "The clinical trial was approved by the Emirates Ministry of Agriculture (Dubai), 22th of October 2022.
Sources of funding: This research was funded by a "Proof of Concept" grant from the University of Liege.

EQUINE PROGRAM:
POSTERS ABSTRACTS

Genome-wide association analysis of muscle fiber traits in the Purebred Spanish Horse

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b – *Background*

Genome-wide association studies (GWAS) have been performed for different phenotypes in equinebreeds although the Purebred Spanish Horse (PRE) has been little characterized in this regard.

c – *Objective*

To perform a GWAS considering 16 muscle parameters in PRE horses.

d – *Materials and methods*

Samples of blood frozen and muscle biopsy data from 160 horses, were analyzed with GeneSeek®Equine SNP70 Beadchip (NEOGEN). After filtering with PLINK®v1.9, 65,090 Single Nucleotide Polymorphism (SNP) were selected, considering specific criteria as mapping to autosomes, minor allele frequency ≥0,05, Hardy-Weinberg expectation $P<0.001$ and genotype call rate >90%. The GWAS was performed with GEMMA®v0.98.1, correcting for population structure by considering the relatedness matrix and applying False Discovery Rate correction.

e – *Results*

17 genome-wide significant SNP were associated with muscle fiber types and IIX myosin heavy chain isoform. These SNP are located near of the *MYPN*, *RBPJ* and *LCORL* genes.

Main limitations: Limited number of horses.

f – *Discussions and Conclusions*

The significant SNP were associated are related to muscle fiber types and that they are close to genes mentioned which are involved in sarcomere organization, cardiac muscle cell proliferation and measures of skeletal frame size and adult height.

Conflict of interest: The authors declare no conflict of interest.

Ethical committee: Not applicable as decided by the Ethics Committee for Animal Experimentation of the University of Cordoba, because this research is based on the analysis of results obtained over the years.

Sources of funding: This research was partiality funded by Animal Breeding Consulting S.L.

Variation of the cross-sectional area of the forelimb superficial digital flexor tendon during the first months of training in 3-year-old French Trotters

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Background
While tendon adaptation to exercise, including increase in tendon cross-sectional area (CSA), is well established in the human athlete, evidence in racehorses is poorly documented. Superficial Digital Flexor Tendon (SDFT) is the most frequently injured tendon in racehorses.

Objectives
In order to evaluate the adaptative response of young racehorses tendons to exercise, the CSA of the SDFT was monitored during the initial months of training in French Trotters (FT). We hypothesized that tendon CSA would increase in response to exercise.

Materials and Methods
After a 3-month rest period, 12 three-year-old FT were trained 3 times a week during 4 months by a trainer, either on a soft track (n=6) or on a hard and unprepared track (n=6) with gradual increase of the workload. Ultrasonographic examinations of both forelimb SDFT were performed at the beginning, middle (M2) and end (M4) of the protocol. For each horse, CSA was calculated (using ImageJ) by a single operator from 5 ultrasonographic transverse images acquired at 19 cm distal to the accessory carpal bone.

Results
Three horses trained on the hard track developed SDFT tendinopathy and were excluded of the analysis. Tendons without tendinopathy (n=18) had a significant CSA increase over the 4 months of training: percentage change from the value measured at initial examination was 5.8% ($p<0.0001$) at M2 and 4.0% ($p=0.006$) at M4.

Conclusions
Forelimb SDFT CSA increase was greater during the first 2 months of training in three-year-old FT, compared to the next 2 months, although exercise intensity continued to increase.

Conflict of interest: the authors declare no conflict of interest.
Ethical committee: the study was approved by the Institutional Ethics Committee of the National Veterinary School of Alfort (ComEth EnvA; file number 12-026; approval ref. 10/07/12-2).
Sources of funding: this work was financially supported by the FEDER (Fonds Européen de Développement Régional), the Conseil Régional de Basse-Normandie, the Institut Français du Cheval et de l'Equitation, the Fonds Eperon, the Institut National de la Recherche Agronomique and the French Ministère de l'Agriculture.

Characterisation of high-intensity exercise during training using an untargeted metabolomics approach in thoroughbred flat racehorses

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Background and Objectives: High-intensity exercise (HI) sessions are essential in thoroughbred (TB) flat racehorses training programs. This untargeted metabolomics study aimed at characterizing the metabolic response induced by HI in field conditions.
Materials and Methods: Six TB racehorses performed a non-standardized HI according to their training program. Heart rate (HR), speed and distance were recorded. Blood samples were collected at rest, 5 minutes, 30 minutes and 120 minutes after exercise to monitor targeted biochemical parameters such as lactatemia, serum creatine kinase activity (CK) and acylcarnitines profile. Rest and 30 minutes after exercise plasma samples were analyzed using an untargeted metabolomic approach based on liquid chromatography coupled with mass spectrometry.
Results: Horses aged 2.5±0.6 years with varying racing histories (0 to 14 races) ran at 48.2±1.1 km/h for 1.4±0.5 km resulting in 203±8 bpm heart rate and a lactatemia of 8.1±1.5 mmol/L five minutes after exercise. Cortisol, insulin, creatinine, urea, CK, triglycerides and several acylcarnitines increased significantly, whereas beta-hydroxybutyrate decreased significantly after exercise ($p < 0.05$, Wilcoxon signed-rank test). Supervised analyses revealed HI-induced changes of 53 metabolites associated mainly with protein (58.5%), lipid (17.0%), nucleotide (11.3%) and vitamin (7.6%) metabolism. Metabolites of glutamate, tyrosine and tryptophan pathways were enriched.
Discussion and Conclusions: Metabolome changes were associated with routine biochemical modifications and provided an extended characterization of the physiological response to HI. Untargeted metabolomics has the potential to identify metabolites of interest to monitor horses' response to training and could help to better understand the underlying mechanisms of overtraining and injury development.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: The study was approved by the Ethics Committee of the University of Liège (n°21-2403, 22/12/2021).
Sources of funding: This research was funded by the FNRS (Fonds de la Recherche Scientifique) and the IFCE (Institut Français du Cheval et de l'Équitation).

Generalized sarcoidosis and hypertrophic osteopathy in a Standardbred with poor-performance.

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Background and objective: Equine sarcoidosis (ES) is a rare but emergent disease of unknown etiology. Body of literature on ES remains limited, especially on the generalized forms associated with hypertrophic osteopathy (HO). This case report describes clinical and imaging findings in a racehorse with exercise intolerance affected by generalized ES and subsequent HO.
Material and methods: A 6-year-old Standardbred gelding was presented for sudden exercise intolerance, weight loss, pyrexia, skin lesions, facial and peripheral multifocal swelling.
Results: The horse underwent diagnostic imaging of head and limbs. Radiography and ultrasonography of the head revealed periostitis and regional soft tissue swelling of the maxillary bone. Bilateral marked periostitis with palisade-like appearance involving diaphyseal or metaphyseal region was also identified on distal radius and metatarsal bones, suggestive of HO. Computed tomography excluded dental or sinus abnormalities. Due to the appearance (scaling, crusting and exfoliating) of skin lesions on the croup and lower hindlimbs during hospitalization, biopsies were performed revealing granulomatous dermatitis. This finding was consistent with ES, thus explaining HO. Rapidly declining conditions of the horse led to the decision of euthanasia. Post-mortem examination revealed splenomegaly and several pulmonary nodules. Histopathology on different organs confirmed severe granulomatous lesions; PCR on a pool of tissues identified EHV-5.
Discussion and conclusions: ES, even in its generalized form, is an emergent disease that should be considered in case of unspecific clinical signs combining exercise intolerance, weight loss, facial/distal limb bone deformities and skin lesions; EHV-5 could play a role in the development of the disease.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: Not applicable due to the fact that all the examinations were performed for medical reasons. The owner signed a consensus for the utilization of his horse's data.
Sources of funding: This research received no external funding.

Cannabidiol in horses – influence on stress parameters and implications for medication control

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Background: The study aims to determine cannabidiol (CBD) pharmacokinetics and behavioural effects with the hypothesis that CBD reduces anxiety in horses.

Material and Methods: Case/control study: oral administration of CBD(3mg/kg BID)/placebo paste (n=6+6 Haflinger-crosses, 7 mares, 5 stallions, aged 3-26y) for 15d with daily collection of blood samples(1.5+11h post administration) and spot urine samples (11h post administration) throughout and every 48h during the elimination-phase. Baseline samples were obtained 1d before trial start. Analysis included CBD/metabolites, cortisol (LC/MS/MS), heartrate variability (Polar H10 Heart-Rate-Sensor, HR+SDRR+RMSSD analysis) and blinded behavioural assessment (sedation score). Horses were loaded onto a trailer and novel object tests (pool-raft in closed environment) were performed 1d before and on day 13 during the trial. Cortisol-levels were tested immediately before and after novel object testing. Pharmacokinetic evaluation was based on population pharmacokinetic analysis using nonlinear mixed-effects modelling. Elimination-half-life was determined via linear regression. The CBD steady-state urine to serum concentration ratio (Rss) was calculated for the elimination-phase.

Results: Oral CBD medication was well-tolerated in horses. Stress parameters were blindly evaluated and compared between groups using an ANOVA. Results did not differ significantly between the CBD and placebo group. Horses did not show reduced anxiety in response to a novel object or reduction of loading-time onto a trailer. Pharmacokinetic analysis identified three compartments with high volumes of distribution (Rss=4.45±1.04).

Conclusions: CBD shows high tissue-retention with extended elimination-phase compared to previous reports. Main limitation is a small sample size. Further investigations of CBD's calming effects are required to determine cut-off-values for medication-control.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: The study was approved by the competent authority for licensing and notification procedures for animal experiments (LAVG) in Brandenburg, Germany (AZ: 2347-12-2021) in May 2021.
Sources of funding: The study was funded by the Freie Universität Berlin, the German Equestrian Federation (FN) and the Herosan healthcare GmbH.

Comparison between magnetic resonance imaging and computed tomography for following up healing of equine superficial digital flexor tendinopathy

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Background
While MRI has been used to follow-up superficial digital flexor tendon (SDFT) injury, data from CT are scarce. Mean grey-level (MGL) of tendon section is an indicator of healing, especially in spontaneous injuries, where lesion delimitation may be difficult (diffusion).

Objectives
To compare MGL variation in healing SDFT, using MRI T1w-GE and T2w-FSE sequences, and CT.

Materials and Methods
Nine steeplechasers affected by a recent unilateral SDF tendinopathy were followed-up during rehabilitation. MRI and fan-beam_CT examinations were performed the same day, at 3 stages: 27(8), 96(11) and 286(71) days post-injury (mean(sd)). MGL of successive transverse images corresponding to the "maximal severity zone" (2cm tendon length) was obtained after tendon delineation (homemade software). Correlation coefficients were calculated for each tendon between series of MGL (3-stage values) comparing modalities two-by-two. For each comparison, the 9 coefficients were averaged.

Results
Grey-level range (max-min) observed in the 9 SDFT images was larger with MRI (full range observed, reported to 256) than with CT (83 HU). However, correlations between modalities (on MGL variation) were high. :
T1w-GE_vs_CT: r=-0.94
T1w-GE_vs_T2w-FSE: r=+0.64
T2w-FSE_vs_CT: r=-0.63
In 2 tendons though, T2w-FSE was not correlated with T1w-GE nor CT. Signal intensity at the last stage was low on T2w-FSE in these enlarged 2 tendons, while their diffuse lesion was still obvious on T1w-GE and CT.

Conclusion
Although tendon healing is observed through a larger range of grey-levels with T1w-GE MRI, the latter is well correlated with CT. T2w-FSE brings complementary information, in relation with faster return towards signal normalization.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: The study was approved by the Institutional Ethics Committee of the National Veterinary School of Alfort (ComERC EnvA; protocol code 2019-02-08; date of approval 2019-03-27).
Sources of funding: This study was funded by the Région Normandie, the FEDER (Fonds Européen de Développement Régional), the Fonds Eperon and the IFCE (Institut Français du Cheval et de l'Equitation).

Gastroscopy findings and faecal blood test in active dressage horses with clinical signs suggestive of equine gastric ulcers

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Objectives: Equine gastric ulcer syndrome (EGUS) is insufficiently documented in dressage horses. This study aimed at assessing the potential of clinical signs and faecal blood test (FBT) to diagnose EGUS in active dressage horses.

Methods: Retrospective study conducted on 24 client-owned dressage horses with clinical signs suggesting EGUS. Gastroscopy, FBT (Succeed, Freedom Health, USA) and questionnaire completed by horses' owners were recorded during clinical investigation. When present, equine squamous (ESGD) and glandular (EGGD) gastric diseases were characterized according to guidelines. One-way ANOVA or Chi-carré test with $p < 0.05$ was used to compare horses without gastric disease, with ESGD and/or EGGD.

Results: Eight (33.3%) horses had no gastric disease, 11 (45.8%) had ESGD with a grade ≥ 2/4, and 12 (50.0%) had EGGD. Pain at girthing was the most common complaint in horses with ESGD (81.8%) and EGGD (91.7%) but also in all horses (100.0%) without gastric disease. Poor performance was reported more commonly in horses without gastric disease (50.0%) than horses with ESGD (27.3%) or EGGD (8.3%). No significant difference with stabling time was observed among horses with or without EGUS (mean ± SD: 17.5 ± 3.7 hours per day). Presence of faecal haemoglobin and albumin did not allow to distinct horses with ESGD (36.4% and 63.6%, respectively) or EGGD (33.3% and 66.7%, respectively) than horses without gastric disease (25.0% and 50.0%, respectively).

Conclusion: Clinical signs or results of FBT did not allow screening of dressage horses with or without EGUS for which gastroscopy remains mandatory for diagnosis.

Conflict of interest: The authors declare no conflict of interest.

Ethical committee: No need as this is a retrospective study. Owners provided informed consent for their horses' inclusion in the study that was part of routine veterinary practice to establish a diagnosis of gastric ulcers. All procedures are in accordance with the national and international guidelines for animal welfare.

Sources of funding: This research received no external funding.

Can venous blood platelet count predict Platelet Rich Plasma platelet concentration in horses?

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Background
Platelet concentration is used to describe Platelet Rich Plasma (PRP) composition and is integrated in most human regenerative medicine classification system that may apply to equine PRP characterization.

Objectives
The study aimed to assess if measuring venous blood platelet count can predict PRP platelet concentration.

Material and Methods
The study designed as a prospective trial included 2-20 year-old horses without systemic disease. Blood samples were collected simultaneously for venous count and PRP preparation with two kits (PRP-A: Arthrex ACP Double Syringe®, PRP-F: Fidia Hy-tissue®). Platelet count was evaluated with a validated method for equine blood and PRP (Thrombo-TIC®). Data were tested for normality (Shapiro−Wilk test) and analysed with a Student's t test and linear regression for paired samples. Results are expressed as mean ± SD with $P<0.05$.

Results
Samples were collected in 22 horses for PRP-A and 19 horses for PRP-F. Mean venous platelet count was 178±35 $x10^3/\mu L$. PRP platelet concentration was 257±54 and 276±47 $x10^3/\mu L$ corresponding to 1.51±0.38 and 6.46 ±1.07 $x10^9$ platelets/sample for PRP-A and PRP-F respectively. A linear relationship between venous platelet count and PRP platelet concentration was found statistically significant for PRP-A (p=0,005) and PRP-F (p=0.02).

Discussion/Main limitations/Conclusions
Although the test kit used is limited to platelet count when other cell counting like leukocytes are thought to be PRP relevant, venous blood platelet count was found to be a predictive variable for PRP platelet concentration. This information and measurement method may be used as part of the tools available to describe PRP content and efficacy.

Conflict of interest: The authors declare no conflict of interest.
Ethical committee: The study was approved by the Ethical Committee for Veterinary Epidemiological and Clinical Research of Oniris (Cervo 2021-4-V). Horses were included in the study upon obtaining a signed owner consent.
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