Final report **summary**

The use of advanced diagnostic imaging modalities to reduce fetlock injury and breakdown in racing Thoroughbreds: A retrospective study of racehorse fatalities in southeast Queensland

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Abstract

Early detection of racehorses at risk of stress fracture is key to reducing the number of horses that suffer catastrophic fracture while racing. Bone changes are often present in the limbs of Thoroughbred racehorses in work, particularly in the fetlock region. However, it is currently unknown whether some of these changes indicate an increased risk of fracture or healthy changes in response to high-speed exercise.

This study assessed imaging and post-mortem appearances of fetlock changes and the comparative use of x-ray, computed tomography (CT) and magnetic resonance imaging (MRI) for detection. All fetlock joints were assessed from 20 horses that died during racing or training, including horses with and without fetlock fracture. Some findings were common and possibly represent normal bone change. Other findings were more prevalent in horses with fracture, possibly indicating increased fracture risk.

The results of this research will help to inform vets assessing fetlock images as to the clinical relevance of changes in this area, minimising the number of horses removed from training unnecessarily and increasing detection of horses at risk before catastrophic injury occurs.

Background

Breakdown injuries in Thoroughbred racehorses have serious welfare and economic relevance. Early detection of horses at risk of fracture is challenging as most racehorses do not show clinical signs or lameness prior to breakdown. Many catastrophic fractures in racehorses are due to microdamage accumulation in the bone, which can potentially be detected early with certain advanced imaging modalities (CT and MRI). The fetlock region is the most common site of injury in Thoroughbred racehorses and so is the focus of this research.

The increasing use of CT and MRI worldwide has improved the ability to detect bone changes in the fetlock region. However, interpretation of these imaging findings is complicated by the fact that certain changes likely represent a normal adaptive response of bone to the increased loads of high-speed exercise, and so can be considered within normal limits for a racehorse in work. There is still a lack of strong evidence-based research on the clinical relevance of some bone changes seen on advanced imaging in racehorse fetlocks and how they should be interpreted with regard to fracture risk. Improved knowledge of the occurrence and appearance of fetlock changes in horses that suffer catastrophic fractures will lead to earlier identification of at-risk horses.

Objectives

The objectives of this project were:

1. Determine the imaging and post-mortem appearance of subclinical and clinical fetlock pathology in a population of racing Thoroughbred fatalities in southeast Queensland.
2. Compare the utility of radiography, low-field standing MRI (sMRI) and contrast arthrography computed tomography (CTA) to diagnose and characterise changes in the fetlock.
3. Identify any trends or common imaging findings in the study population that could potentially serve as markers of increased fracture risk in the training and racing population.

Research

Cadaver limbs were collected from 20 Thoroughbred racehorses that were euthanised or died while in work (racing or training) in southeast Queensland. All fetlocks of each horse underwent a complete radiographic, sMRI and CTA examination, followed by post-mortem assessment. Data were collected on age, sex and race history of each horse. Descriptive and statistical analyses were performed, with horses grouped by reason for death (fetlock fracture; fracture elsewhere; non-musculoskeletal cause of death), age and limb affected. Investigation was focused on the imaging and post-mortem findings in the parasagittal grooves of the fetlock and on the distribution and appearance of a particular MRI finding (short tau inversion recovery, or 'STIR', hyperintensity).

Key findings

Proximal sesamoid bone fracture predominated as the cause of fetlock fracture, and tibial or humeral stress fractures were most common in horses with fracture elsewhere. Certain findings, such as palmar osteochondral disease (POD), were found in nearly all horses at post-mortem, regardless of fracture status.

Certain imaging and port-mortem findings were more prevalent in the horses with catastrophic fracture. It is possible that many of these changes indicate bone overload and microdamage, suggesting an increased risk of fracture overall, rather than indicating a specific risk of fracture at the location of the fetlock.

Asymmetry in bone changes within each fetlock is the most clinically relevant finding of this study and may indicate increased risk of fracture if seen in racehorses. Asymmetry in sclerosis (hardening of the bone) in the parasagittal grooves and/or palmar condyles, and asymmetry in POD lesion severity were significantly associated with fracture in the fetlock or elsewhere. Lysis (loss of bone density) in the lateral parasagittal groove was also associated with fetlock fracture.

STIR hyperintensity (a change seen on MRI, possibly indicating fluid, e.g. oedema or haemorrhage) in the bones of the fetlock region was common on MRI and, depending on location and severity, may be related to healthy adaptive bone changes or to microdamage accumulation and fracture.

Many other gross pathological and imaging findings, such as subchondral bone and cartilage defects in the parasagittal grooves, were not related to fracture risk and were common across the study population, indicating these may be normal adaptive changes in horses in high-speed work. Some of these changes may have previously been considered a concerning finding on advanced imaging examination of horses presented for fetlock-related lameness. Their frequent identification in this population suggests these findings should not be over-interpreted as this may lead to unnecessary time away from work.

Use of a 'condylar' sequence on MRI, to acquire images perpendicular to the articular surface of the distal metacarpal/metatarsal condyles, may improve detection of changes in this region. Most changes were not detected on x-ray.

“Due to the high incidence of bone changes in the opposite fetlock to the fractured limb, bilateral advanced imaging is recommended in racehorses with suspected fetlock pathology.”

Implications for industry

This research provides an improved understanding of catastrophic fracture in the racing Thoroughbred population in southeast Queensland and the prevalence and appearance of overall musculoskeletal injury in the fetlock region in this population, adding to overall Australian data on this topic.

This research has identified optimal advanced imaging techniques to aid vets in the detection of different bone and cartilage changes in certain areas of the fetlock. This research also adds to the information available on the clinical relevance of advanced imaging findings in the fetlock. These findings can be used in fracture screening protocols and when assessing horses with poor performance or lameness, to better understand the clinical relevance of imaging changes that are seen in the fetlock area. This will minimise the number of horses removed from racing and training unnecessarily while also aiding early detection of horses at risk of fracture so management changes can be made before catastrophic injury occurs.

The findings of this study provide a strong basis for further research into fracture prevention in the Australian racing thoroughbred population and worldwide, particularly in the area of STIR hyperintensity in the equine fetlock.

Recommendations

Veterinary interpretation of fracture risk and the clinical relevance of bone changes detected in the fetlock region on advanced imaging can be improved by assessing the severity, location and distribution of the findings, and by taking into account the horse’s age, sex and exercise history. In particular, asymmetry of certain bone changes may indicate increased risk of fracture. In contrast, some changes were found commonly in many racehorses and, depending on the individual case, may not warrant removal of the horse from training. Due to the high incidence of bone changes in the opposite fetlock to the fractured limb, bilateral advanced imaging is recommended in racehorses with suspected fetlock pathology. Certain imaging techniques may also improve detection of bone changes in the fetlock.

Despite being the most detailed description of fetlock pathology in racing fatalities in southeast Queensland to date, the post-mortem findings in this study are limited by sample size and are not a complete overview of musculoskeletal injury in racing fatalities in southeast Queensland. Complete data collection and post-mortem of all Thoroughbred fatalities in racing or training in Queensland is recommended, so that fracture and fatality risk factors can be established and prevention strategies employed. It is important that further epidemiological and post-mortem studies in Queensland are carried out to better inform policy and industry directions.

Publications

Johnston, G. C. A., Ahern, B. J., Woldeyohannes, S. M., Young, A. C. (2021). Does the Low-Field MRI Appearance of Intraosseous STIR Hyperintensity in Equine Cadaver Limbs Change when Subjected to a Freeze-Thaw Process? *Animals* 11(2), 475. https://doi.org/10.3390/ani11020475

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