CATASTROPHIC MUSCULOSKELETAL INJURIES OF THE DISTAL LIMB IN THOROUGHBRED RACEHORSES

by

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Submitted to the Faculty of Veterinary Science, University of Pretoria, in partial fulfilment of the requirements for the degree MSc Veterinary Science

Pretoria, February 2016

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To my loving parents who have been my biggest supporters through all studies and my greatest role models

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Acknowledgements

Without the help of the following people this dissertation would not have been possible. Thank you to:

Prof Ann Carstens, for your expert guidance and understanding throughout this long project. Thank you for taking a chance and believing in me when others did not. I would not be where I am today without you.

Prof Luis Rubio-Martinez, for your expert advice and comments in reviewing this work.

Dr Lizelle Fletcher and Mrs Joyce Jordaan for helping me with all the statistics.

Sr Melanie Mclean for all your guidance and expert advice on helping me with my radiographs as well as your eagle eye at judging their quality.

Dr Dale Wheeler (National Horseracing Authority of Southern Africa) for granting me access to your vast amount of information on catastrophic injuries.

To my mother, Glynis, for all your support and encouragement during this long process.

To my father, Richard, for always being willing to lend an eye and review my writings as well as for all your faith in my ability.

List of Abbreviation

AWT	all-weather track
CI	confidence interval
CMI	catastrophic musculoskeletal injury
CT	computed tomography
DDFT	deep digital flexor tendon
DJD	degenerative joint disease
DSL	distal sesamoidean ligament
e.g.	for example
ERC	Equine Research Centre
FL	forelimb
i.e.	that is
IOM	interosseous medius muscle (also referred to as the suspensory ligament)
L	lateral
LF	left forelimb
LM	lateromedial
M	medial
m	meters
MC3	metacarpus 3
MCP	metacarpophalangeal
MRI	magnetic resonance imaging
MS	musculoskeletal
MSI	musculoskeletal injury
MT3	metatarsus 3
n/a	not applicable
NH	National Hunt
NHA	National Horseracing Authority of Southern Africa

no.	number
ODSL	oblique distal sesamoidean ligament
OVAH	Onderstepoort Veterinary Academic Hospital
P1	phalanx 1
PACS	Picture Archiving and Communication System
PSB	proximal sesamoid bone
RF	right forelimb
RSA	Republic of South Africa
SA	suspensory apparatus
SDFT	superficial digital flexor tendon
SDSL	straight distal sesamoidean ligament
SRBI	stress related bone injury
TB	Thoroughbred
UK	United Kingdom
USA	United States of America
vs	versus

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Summary

Catastrophic musculoskeletal injuries of the distal limb in Thoroughbred racehorses

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Catastrophic musculoskeletal limb injuries on the track are disconcerting and unsettling, resulting in the immediate ending of a racehorse's career. Numerous studies on the incidence rates and factors influencing injuries and fatalities have been reported in most of the major racing countries around the world. Limited published data on the incidence rates and factors influencing this on South African racetracks is available. The factors which show potential for increasing the risk of injury are age, gender, track surface type and condition, distance of race, number of previous starts and time interval between races.

The objective of this study was to report and describe the incidence of the types of catastrophic musculoskeletal injuries (CMIs) of the distal limb leading to immediate euthanasia in racing Thoroughbreds on four Gauteng racetracks and also to identify their associated risk factors.

The case material data for this study was divided into two groups. Group one consisted of data from all the horses that sustained a CMI on a Gauteng racetrack within the study time period of 1998-2012 and totalled 114 in number. This data was used for determining the incidence rate of CMIs per year as well as to obtain a more accurate overview of the type of CMIs seen on tracks under study. Group two consisted of 53 racing Thoroughbred cadaver distal forelimbs, from 52 horses that were euthanized due to sustaining a forelimb fracture or rupture of the suspensory apparatus on a Gauteng racetrack. Each limb had five different radiographic views taken from mid metacarpus 3 (MC3) to distal phalanx 3, centred on the fetlock joint. Full dissections were then conducted on each limb noting the extent of the injuries. These limbs had complete histories and were used for determining all the summary statistics and those relating to the interaction of risk factors. (Approved: Animal Ethics Committee, University of Pretoria. Protocol no. V020/13)

The results obtained were as follows: using the data from group 1, the most common location for the 114 CMIs in the study period were the proximal sesamoid bones (PSBs), including the suspensory apparatus, and was represented by 55.26% of the cases. Condylar metacarpal/metatarsal fractures were excluded from this category as they were classed as a separate CMI. The second

most common location for CMI was the MC3 bone at 13.16% followed closely by the carpal region at 12.28%. Fractures involving phalanx 1, MC3 condyles and tibia were represented respectively by 6.14%, 4.39% and 2.63% of the cases. Pelvic and scapular fractures were equally represented at 1.75%. The least common region for a CMI was the femur at only 1 reported case out of the 114 horses (0.88%). There was only one reported case that failed to classify the affected area of the horse in the report. Because some of the horses in the study population obtained more than one type of CMI, the total percentage is greater than 100.

Using the data from group two, which consisted of the 53 cadaver forelimbs, 74% of all the affected limbs were of the left forelimb and 79% were of male gender, and of those 68% were geldings. Risk factors which were identified as having the strongest potential for being significant in affecting a horse's risk for a CMI were the horse's age, gender, distance raced and the jockey's weight. A total of 203 965 starts was recorded over the fourteen year racing period from 1998-2012 for all four racetracks. The racetrack with the greatest amount of starts over the study period was Vaal with 80 861 starts and the racetrack with the least amount of starts for the study period was Gosforth Park totalling 11 768 starts; this lower number of starts was due to the closing of this racecourse at the end of the 2001 racing year.

Comparing the results to international studies the following conclusions were made. Worldwide there is a trend for the left forelimb being injured most commonly regardless of the direction in which the racing and training takes place. It is interesting to note that while many studies have identified this phenomenon very little explanation has been provided as to why it occurs. A suggestion is that perhaps horses, like humans, have a preference for one side and therefore take more weight onto it, regardless of racing direction, and thus have more strain placed onto it. Another possibility is that when racing, more weight is placed on the medial aspect of the outside limb i.e. the left limb when racing clockwise. This would provide an explanation as to the finding here in South Africa, where racing takes place in a clockwise direction, but would not explain why, even when racing anti-clockwise, we still see the left forelimb being the most commonly injured limb. The high number of male horses, in particular geldings, maybe due to them generally having longer racing careers than fillies, mares and colts which may be used for breeding purposes, thus having a shorter racing career. The types of CMI in relation to the factors, especially surface type, are generally on par with what has been reported in other countries. A limitation of this study is the relatively low numbers of limbs in group two of the study population. This study lays the foundation for further research into determining the risk factors for CMI in South Africa.

Chapter 1: Introduction

Catastrophic musculoskeletal injuries (CMIs) are the most common type of injury ending a racehorse's career and have been intensively studied over the last few years in many countries. However, limited published data is available on them in South Africa. With the horse racing industry being a multi-million Rand business, injuries to horses is costly. It is therefore important, not only from an economic perspective that these highly prized animals obtain as few injuries as possible, but also to ensure that the horse's welfare is at all times a priority, this in turn helping to prevent a negative public view of racing.

Factors influencing injuries and fatalities as well as descriptions of the types of injuries seen, have been reported in most of the major racing countries of the world, namely the United Kingdom (UK), United States of America (USA), Japan, Hong Kong, Australia and Canada, but only one paper has been published in South Africa (RSA) that looked solely at the incidence rates of breakdowns on racetracks in Gauteng [1-7]. More research is needed in this area in South Africa describing the types of injuries seen on our tracks as well as the factors influencing these injuries.

Studies have reported numerous factors that are associated with an increase of risk of musculoskeletal injuries or fatalities, often with marked differences between the different race tracks in each country. This is possibly due to each country's unique environments and challenges faced in their respective racing industries.

1.1 Objectives

- To describe and report the types of CMIs leading to immediate euthanasia in racing Thoroughbreds (TBs) in RSA
- To determine the incidence rate of CMIs in racing Thoroughbreds in RSA and determine if they are similar to those reported in other countries.
- To determine if risk factors associated with CMIs of the distal forelimb in racing TBs in RSA are similar to those reported in other countries.
- To determine if the left forelimb (LF) is most frequently involved in catastrophic musculoskeletal injuries in RSA racehorses as it has been reported in other countries.

1.2 Justification and benefits

As trends in the type of catastrophic injuries diagnosed around the world are established, protocols can be put in place that can help with the prevention of the occurrence of these injuries. It is also preferable that an extended time period is used when conducting studies of this kind, so that any long term patterns or trends in type of injury can be identified. Knowledge on the factors influencing injuries can help in minimizing future risks.

Chapter 2: Literature review

2.1 Introduction

Catastrophic musculoskeletal limb injuries are the most common type of injury ending a racehorse's career abruptly [8]. Numerous studies on the incidence rates as well as factors influencing injuries and fatalities have been reported in some of the major racing countries of the world, namely the UK, USA, Japan, Hong Kong, Australia and Canada [1-6]. However, the studies have often resulted is conflicting results among the countries in which they were performed [9-17]. An example of this is an Australian study conducted on racetracks in Sydney which documented an incidence rate of 0.04% per racing start which is markedly lower than that of a UK study that had a 0.08% incidence rate [3, 15]. This is possibly due to each country's unique environments and challenges faced in their respective racing industries. So far only one dissertation and one article, published in the proceedings of a conference, have investigated the incidence rate of CMIs in South Africa and the factors influencing them in this country [7, 18]

Factors identified with potential for increasing the risk of injury are age of horse, age of the horse at its first race, gender, track surface condition, distance over which the race is run, number of starts, racecourses, starting position, time interval between races, jockey weight, and training regime; certain blood lines have also been shown to have a genetic predisposition to certain types of injuries [3, 11, 19-23].

It is imperative that these factors and new ones are continually identified and researched along with new techniques that will enable the identification of horses at risk. Only once at risk individuals and inciting factors have been identified with a large degree of accuracy and certainty, will we hopefully see a significant lowering of the number of racehorses that are injured [21].

2.2 Definition of catastrophic musculoskeletal injuries

It is important that a clear definition of what catastrophic musculoskeletal injuries are, is established. Often the term "breakdown" is used, which is a non-specific term used in many studies for when a horse suffers an injury while racing, and either doesn't complete the race or is lame thereafter. The term can be ambiguous and includes both catastrophic and non-catastrophic injuries and as such the definition of "breakdown" varies considerably between studies with no one universal definition

existing [1, 7]. This is likely a reason why the incidence rates of catastrophic injuries differ between studies as different definitions of CMI are applied.
"Breakdowns" usually include both soft tissue and bony injuries and not all the injuries resulting in a horse "breaking down" are considered catastrophic. It is for this reason and the term's ambiguity that it was not considered for use for this study. For this study only serious musculoskeletal injuries are evaluated, thus only inoperable fractures and full rupture of the superficial and/or deep digital flexor tendons (SDFT/DDFT) or the whole suspensory apparatus (SA) were considered as catastrophic. Some fractures are amenable to surgical reparation and some horses may recover from certain soft tissue injuries. Some treated animals may re-enter racing.

For this retrospective study an injury is defined as a catastrophic musculoskeletal injury when the injury results in the horse's racing career being ended because the possibility of full recovery allowing the horse to return to racing, is highly unlikely and necessitates immediate euthanasia on the track or where the horse is transported from the track (to be euthanized out of public view) [1, 3, 7, 13, 19].

2.3 Types of Catastrophic Musculoskeletal injuries

Catastrophic musculoskeletal injuries can be divided into two general types, namely fractures and soft tissue injuries (i.e. tendon and ligament damage) [22, 23]. Fractures are often deemed the more common form of injury due to the higher number of reported cases from racecourse reports and because they usually result in immediate euthanasia on the racetrack. Catastrophic fractures can occur in the metacarpus 3/metatarsus 3 (MC3/MT3), proximal sesamoid bones (PSBs), the radius, ulna and pelvis. The most commonly reported catastrophic fractures are ones occurring distal to the carpi [22].

Soft tissue injuries often do not result in the immediate termination of the horse on the track and are also often undiagnosed until the horse has left the racetrack. This results in an underestimation of their true level of significance [21]. Most catastrophic soft tissue injuries are present when the suspensory apparatus, consisting of the superficial and deep digital flexor tendons, interosseous medius muscle (IOM) and its distal slips, ruptures completely, ending a racehorse's career. Soft tissue injuries are often associated with, or secondary to a fracture. They are also not commonly documented [1, 3, 4].

Not all fractures and soft tissue injuries result in catastrophic injury. Fractures that are operable such as condylar and simple phalanx 1 fractures cannot be considered catastrophic due to the horse being able to return to its racing career if treatment is timeous and successful. The same can be said for certain soft tissue injuries [1, 3]. If the tendon and/or ligamentous lesions can heal with time so as to allow the horse to restart racing within six months, that type of injury will not for, the purposes of this study, be considered catastrophic [1, 3, 4].

2.4 Identification of risk factors

Numerous epidemiological studies have been performed identifying the risk factors for injuries to racehorses during racing and training. From these studies the most commonly identified risk factors are: age, gender, track surface condition, distance of race, number of starts, racecourses, starting position and interval between races, jockey, trainer and the horse's breeding [11, 19-23]. A recent study has also found previous tendon injury to be a risk factor for tendon injury diagnosis on the racecourse and for catastrophic tendon rupture [24].

As has been previously stated, many injuries that are sustained while racing are only diagnosed once the horse is back in the stable. These injuries are therefore not recorded on the racing authorities' central databases and thus many studies conducted by researchers to determine risk factors in racing, may work from incomplete data sets resulting in potentially skewed findings [25]. In the future it would be ideal to combine data on injuries obtained on the racecourse with data on injuries obtained during training in an integrated approach, to obtain a more complete view of how both sectors of the racing industry relate to one another. Numerous studies have already shown that racing poses a greater singular risk of obtaining an injury since the horse is pushed to its limits in that moment, compared to a day's training on the gallops; however, statistically most of the injuries a racehorse sustains occur during training because it spends more days training than it does racing and so has more opportunities to injury itself [26, 27]. Unfortunately, datum is not always made readily available by the trainers, and that which is obtained from them may not always be fully reliable as a definitive diagnosis was not made.

2.5 Age

The relationship between the horse's age and possible risk for catastrophic injury can aid in the identification of a high risk horse [28]. In general, horses four years of age or older are at greater risk for moderate to catastrophic injuries than are younger horses [28]. However, it has also been documented that the risk for injuries that result in death decreases with increasing age [20]. These conflicting results can most probably be attributed to the fact that age can be seen as a compounding factor. As a horse gets older its bones and soft tissue structures are conditioned and strengthened by the work, thus lowering the risk for catastrophic injuries as they adapt to the pressures of race work with each racing season that passes. However, with increasing age the horse races more frequently, thus from a statistical stand point the longer a racehorse's career, the higher its risk for catastrophic musculoskeletal racing injuries due to more opportunities to sustain a catastrophic injury [20].

Horses appear more susceptible or prone to certain types of injuries at different ages. Two year old racehorses are particularly susceptible to dorsal metacarpal disease when these horses begin work at fast speeds [20]. Tibial stress fractures are more likely to occur in two year old horses, whereas humeral stress fractures are more likely to occur in three year olds [20]. Fatal suspensory apparatus injuries are more likely to occur in horses four years of age and older [20].

Overall, the literature shows that two year olds in their first year of training and racing do not seem to have a higher risk than an older horse for sustaining an injury, be it fatal or not [19, 20, 29 – 32]. Even though two year old race horses are not yet skeletally mature and their bones therefore not strengthened and hardened by race training, they have a risk factor for injury that is comparable to older horses, since they do not race as frequently and do not endure as intensive a training regime as older horses [20, 31, 32].

Another consideration in determining a horse's risk for CMI is the age at which it starts training especially for high intensity fast work. A study has shown that three year olds that began their training at three (13.2% relative risk of sustain a CMI) were actually at a marginal disadvantage starting their training later than those three years old that started training at two who had a relative risk of 8.2% of sustaining a CMI [20,31]. Another study has shown that the relative risk of obtaining a CMI decreases as the horse gets older and has more racing seasons; 50% – risk in the second, 30% – in the third, 10% – in the fourth and 1% – in the fifth seasons [11].

2.6 Training regime

The training regime, to which a horse is exposed from a young age, can have a great impact on its future risk of injury. Numerous studies provide data showing a link between high level of high-speed training and the risk of catastrophic musculoskeletal injuries. [17, 21, 31, 33-37]. This would be in keeping with the general thought that horses exercising at high speeds incur subclinical levels of bone stress and damage that could place the bone in a compromised state prior to racing [38]. However, we know that bone is able to remodel itself in response to the forces it faces so as to allow it to undergo structural alteration so that it can best cope with the particular stress it undergoes [21, 39-41]. Bones which have been shown to undergo structural alterations induced by high speed training are the distal condyles of MC3 and MT3, the neck of the scapula, proximal and distal diaphyseals of the humerus and tibia, sagittal ridge of phalanx one, ilial wing of the pelvis and particularly the subchondral bone in these areas [21, 39-41]. In a 2011 study, the effects of previous conditioning exercise on the diaphysis of the proximal phalangeal bone and the MC3 and the MT3 proximal metaphysis were reported [42]. It was shown that horses that were exposed to conditioning exercise from a young age had stronger distal limb bones than those that had not been exposed. In the diaphysis and metaphysis of MC3 and MT3, the response to fast speed exercise work was an increase in the thickness of the circumference, thus leading to an increased resistance to deformities in these areas [42].

Further support for this adaptation is provided by studies that show that bones which have never under gone cumulative high-speed training are at a greater risk to fracture [21, 43, 44]. Therefore, a good training program should contain enough high speed work so as to allow for bone changes to increase their resistance to stress but not so much as to start to cause fatigue and subclinical damage.

Studies have also been conducted in the UK and USA looking at the total distances horses ran in training and the effect they had on the risk of obtaining a fracture [21, 31, 45]. The UK study showed that horses which ran more than 30 furlongs (6 km) at speeds greater than 14 m/s (i.e. galloping) in a 30 day period were at greater risk for fracture occurrence than those that ran less. This study is comparable to the American study which showed that horses which galloped more than 25 furlongs (5 km) in a 30 day period were at greater risk. However, it should be noted that the case definitions for the studies of what constitutes a CMI in the different countries did differ significantly [21, 31, 45].

2.7 Gender

Several studies conducted have shown that male horses are at an increased risk for catastrophic musculoskeletal injuries compared to females [7, 19, 29, 46, 47]. The one South African article showed that breakdowns occurred more frequently in males than in females with 75.5% of the study population being male and 24.5% being female [7]. The South African dissertation showed results similar to this where 14.5% of CMIs that occurred were in females and 85.5% in males. It also showed that "colt/stallions were 14.8 times more at risk of developing a CMI when compared to the fillies/mares and 5.3 times more at risk when compared to the geldings" [18]. Two studies conducted in California both showed that male horses were at double the risk of obtaining a catastrophic musculoskeletal injury while racing, compared to female horses [19, 29]. A Florida study associated geldings with a higher risk of catastrophic injury [47]. Another study reported males at 4.6 times the risk for suspensory apparatus injury than females and at 4.4 times the risk for SDFT injury as compared to females. However, another study conducted at the same racetracks failed to achieve a similar conclusion [20, 46, 48]. A possible explanation for these findings is that geldings generally have a longer career than fillies, mares or colts, which are later used for breeding purposes or sold on further, and thus fillies, mares and colts potentially run fewer races or less often and are retired earlier than geldings [19, 29].

2.8 Track surface type and racing direction

The type of track surface on which racing occurs has been shown to have an effect on both the risk of obtaining a catastrophic injury and the type of catastrophic injury [4, 8, 13, 15, 16, 19]. Racing takes places on turf, sand, dirt and all-weather tracks in both clockwise and anticlockwise directions.

The different countries throughout the world have different preferences for direction of racing as well as the track surface type used and three of the major racing countries preferences are discussed below.

In Australia, all racing is conducted on turf tracks throughout the country and all races are run in a clockwise direction except for those in Melbourne [3].

In the US, racing is primarily conducted in an anti-clockwise direction and 90% of all their racetracks are dirt tracks with remainder being turf tracks [49]. The dirt track is composed of a roadbed covered with crushed stones and sand, with an overlying cushion of fine sand and organic matter. Turf tracks in the US are made of grass grown on a sandy soil base covering a crushed stone layer and the road bed [50].

In the UK, racing occurs predominantly on turf tracks, which are made from specially sown grass mixes. All the turf tracks differ from one another in terms of the grass species used, composition, and ground firmness etc. There are also three all weather (synthetic) tracks in operation in the UK. Racing occurs in both clockwise and anti-clockwise directions [51]. The new all-weather surfaces are made of a sand, fibre and polymer binder combination that is designed not to freeze in the sub-zero temperatures experienced in the UK in the winter [52].

In South Africa, racing is predominately done on turf racecourses. Due to our country's unique climate and rainfall patterns in each province the turf conditions will all be track specific and thus not easily comparable to other countries in terms of their firmness, grass cover, footing and condition at different times of the year. The track surface type and direction of racing per race track in South Africa is given in Table 2.1.

Table 2.1: Track surface type and direction of racing per race track

Province	**Venue**	**Track surface**	**Direction of racing**
Gauteng	Turffontein	Standside and inside track, both turf	Clockwise
	Vaal	Turf and sand	Clockwise
	Newmarket	Turf	Clockwise
	Gosforth Park	Turf	Clockwise
Eastern Cape	Arlington	Turf	Clockwise
	Fairview	Turf	Clockwise
Northern Cape	Flamingo Park	Sand	Clockwise
Western Cape	Durbanville	Turf	Anti-clockwise
	Kenilworth	Turf	Anti-clockwise
Kwa-Zulu Natal	Greyville	Turf	Clockwise
	Clairwood	Turf	Anti-clockwise
	Scottsville	Turf	Clockwise

A study [4] in the United Kingdom investigated the risk factors for catastrophic distal limb fractures during racing on racecourses in the UK. It determined that the horse's risk of fracture is dependent on the type of racing in which it is involved, with flat turf racing having the lowest risk (0.4 fractures/1000 starts) whilst national hunt flat racing (racing for young race horses which are destined to go into hurdling and are gaining experience racing before their first hurdles race) had the highest risk (2.2 fatal fractures/1000 starts). Not only did the level of risk differ between the types of races but so did the type of fractures that occurred. The most common fracture seen in national hunt races (hurdle and hunt flat) was lateral condylar fractures of the third metacarpus/metatarsus. In normal flat turf racing proximal P1 fractures were the most commonly diagnosed fatal fractures, whereas biaxial proximal sesamoid fractures predominated in races on the new all-weather surface [4].

In the USA a retrospective study conducted on New York race tracks (dirt and turf tracks) found that the most commonly seen fracture involved the proximal sesamoids and MC3 simultaneously. The next most common catastrophic fracture type was of the distal metacarpal/metatarsal condyles [2]. A study in Canada [6] showed results that agreed with the findings of the UK study [4], where distal condylar MC3/MT3 fractures were also the most commonly found catastrophic injury.

The South African study reported no significant difference in the incidence of catastrophic injuries on turf compared to sand tracks overall, however the Vaal racecourse did have a slightly increased incidence (although not significant) between the incidence rate on its turf track (0.13) compared to its sand track (0.1) [7]. An unpublished study in South Africa looking at catastrophic injuries between 1998 -2004 on Gauteng racetrack also showed that there was no significant difference in the incidence rate between the different tracks [18].

When comparing injury rates of turf versus all weather and dirt tracks in the US and UK, turf generally holds the lowest risk of injury overall (UK: 0.38/1000 starts, USA: 2.3/1000 starts), followed by all-weather tracks (UK: 0.72/1000 starts, USA: not applicable (n/a)) and lastly dirt tracks (UK: n/a, USA: 0.9-1.2/1000 starts) which statistically hold the highest risk of injury [4, 8, 13, 15, 16, 19]. Caution should, however, be taken when comparing the risk factors as it must be remembered that interrelating factors are present affecting the risk analyses of tracks, e.g. climate, training regimes, frequency of racing and the definition of CMI used etc. [2, 4, 47]. Saying that turf is the safest surface would be simplistic, as all the different factors come into play.

2.9 Track surface condition

The condition of the track surface is a commonly associated risk factor for CMI as poor surface conditions, either too firm or to soft, can place excessive strain on the racing horse's limbs. The categories to indicate the condition of the track are a measure of its moisture content [49]. For turf tracks the condition is ranked as: hard, firm, firm to good, good, good to soft, soft and heavy (very moist) [8]. Dirt track condition is ranked as: fast (driest), good, dead, slow and heavy (most moisture) [2]. All-weather track surface conditions are ranked as: standard and slow [8].

Numerous studies have been conducted investigating the role that the condition of the track surface has on the risk of CMI [8, 11, 30]. A study in Britain showed that horses racing on good or fast turf tracks had a larger risk of sustaining a CMI than when racing on heavier tracks [8]. The study concluded that turf tracks that had been affected by rain and thus were classified as heavy were associated with less risk than harder (drier) tracks. A possible explanation for this is that the softer tracks provided more of a cushioning effect absorbing more of the force exerted on it by the racing horse as compared to harder turf track which would not absorb as much of the force impact and thus redirect it back on the horse's limbs. Tendon strain was more often seen on tracks classified as fast (harder) [8]. The final deductions from this study were that; the frequency of MSI was lowest on racing on turf that was soft and the rate of problems increased as surfaces became harder. The overall fatalities of horses while racing, also tended to decrease as racing surfaces became softer.

A study conducted in New York found a similar trend in the association of risk of MSI and track condition for dirt tracks [11]. Horses running on muddy dirt tracks (high moisture content) were at a significantly lower risk of sustaining a MSI than those running on normal dry dirt. Interestingly no difference in risk was found between horses running on sloppy dirt (very high moisture) and those running on muddy dirt tracks (high moisture content). This maybe be due to the fact that very few horses will run under these kind of conditions as they will be withdraw prior to the race to save them for another race and to not race them under the poor conditions.

2.10 Race distance

Flat race distances are divided into different categories namely: sprints, mile, intermediate and long distance. The distances which make up each category can differ between countries. 1 furlong = 201.16 metres (m) = 0.125 miles; 1 mile = 1609.3 m

In the UK, race distances vary between 1000 m (5 furlongs) for short races to 4400 m [53]. Race distances in the USA differ between tracks in the different states. In California races are between 1000-1700 m (5 to 8.5 furlongs) [20], in Kentucky races are between 900-3200 m (4.5 to 16 furlongs) [46] and in New York the turf tracks measured 1400-1600 m and the dirt tracks 1600 – 1800 m [54]. In Melbourne, Australia, races are between 900-3200 m [3]. In South Africa, the categories are comprised as follows: sprints are any race run over 1200 m or less, mile races are run over 1300m to 1800 m, intermediate races are from 1801 m to 2200 m and long distance races are those over a distance of 2400 m.

The distance of a race can have a significant effect on the risk of injury for a horse. Studies conducted in Kentucky, USA have shown that when the distance of the race was shorter and the number of turns less, there were more catastrophic injuries [13, 45]. However in the UK more emphasis is placed on long distance races i.e. greater than 1.5 miles (2414 m) than in the USA for causing CMIs [8].
The one USA study also noted that there was an increased risk of suspensory apparatus injuries in horses racing over shorter distances (less than 7 furlongs/1408 m) [13]. However no other studies seem to have found a link between distance and a specific type of injury.

Chapter 3: Materials and Methods

3.1 Study design

This study is a retrospective investigation that focused solely on horses that obtained a catastrophic musculoskeletal injury resulting in immediate euthanasia that occurred on a racetrack in the Gauteng province of South Africa over a 14 year period (1998-2012). These horses were humanely euthanized at the track immediately after the race in which they sustained their CMI, and provided the case material for this study. The racing season in South Africa starts on the 1st August and ends on the 31st July of the following year. Due to the Vaal Turf racetrack (located in the Free State province) being in close proximity to the Gauteng boundaries it was included in this study. Limbs 1-22 (acquired from 1998-2004) were evaluated in a previous non-published study [18]. The pathologic changes of more recently acquired limbs 23-54 (2005-2012) were identified in this study.

3.2 Experimental design

3.2.1 Case selection

The case material used in this study, are the cadaver distal forelimbs and racing data of any horse which sustained a catastrophic musculoskeletal injury and required immediate euthanasia due to the severity of the injury as determined by an appointed official racetrack veterinarian. The injury must also have occurred on a Gauteng (Turffontein, Gosforth Park or Newmarket) or Free State (Vaal) racetrack during the racing period 1998-2012.

The affected limb from each horse was then severed through the antebrachiocarpal or middle carpal joints, tagged so as to allow identification and transported to the Equine Research Centre (ERC), Faculty of Veterinary Science, University of Pretoria, Onderstepoort, 0110, Republic of South Africa. On arrival at the ERC they were placed into storage in freezers so as to prevent degradation.

Using the National Horseracing Authority of Southern Africa's (NHA) database it was determined that over the 14 year period of 1998-2012 a total of 114 CMIs occurred that fitted the definition of a CMI as stated above (NHA, P.O. Box 74439, Turffontein, 2140, RSA). Only those limbs which had obtained injury to the MCP joint area had been collected for further investigation and stored at the ERC, Onderstepoort.

Therefore, CMIs of the proximal limb that resulted in euthanasia were omitted from this study. A total of 53 limbs were thus available for evaluation. The data of 22 of these racehorse limbs, which were all positively identified, were obtained from the earlier non-published study [18].

3.2.2 Inclusion criteria

In order to be included in this study and fit this study's CMI definition, the horse must have:

- sustained a CMI whilst racing
- been euthanized at the track shortly after sustaining a CMI
- raced on one of the four racetracks in or near the Gauteng province; Turffontein, Vaal, Newmarket and Gosforth Park.
- sustained the CMI during the period of 1998-2012

3.3 Experimental procedures

3.3.1 Racing data

Four forms of data were used in this project:

1) Data obtained from the National Horseracing Authority of Southern Africa. Appendix A outlines the specific categories of data obtained, which were used to evaluate each racehorse's injury. Appendix B identifies all the horses (n = 114) that suffered a CMI on the four Gauteng racetracks during the study period.
2) Data from RSA study for a dissertation [18] – diagnosis of injuries of limbs 1-22, radiology and dissection reports along with supporting documentation on history and influencing factors – see appendix C.
3) Radiographic evaluation of limbs 23-54 (same format as previous RSA study [18]). All data was captured on data collection sheets – see Appendix D.
4) Data obtained from detailed post mortem dissections performed on limbs 23-54. Data was captured on data collection sheets – see Appendix E (similar format as previous RSA dissertation [18]).

All of the data was saved in Excel spreadsheets on KE Spargo's computer in Room 4-46 of the OVAH and a copy on a flash drive that was kept at KE Spargo's room at the Onderstepoort residence.

3.3.2 Storage of the limbs

All the limbs were stored in normal household freezers set at a temperature of -20°C and were wrapped in plastic bags prior to freezing to minimize dehydration. After the post-mortem examination the limbs were re-wrapped in plastic cling wrap, so as to again minimize dehydration, and frozen again should the limbs need to be reused for further studies.

3.3.3 Pre-radiographic procedure

Each limb was thawed prior to making radiographs, so as to allow for repositioning of the hoof and MCP joint if needed. All the limbs' soles were cleaned so as to ensure no dirt was present. See Appendix D for radiological reports on each limb.

3.3.4 Radiographic procedure

Five radiographic views were made per limb from mid metacarpus/metatarsus 3 to distal phalanx 3:

- Dorsopalmar (DPa)
- Lateromedial (LM)
- Lateromedial flexed (LM)
- Dorsolateral-palmaromedial oblique (DLPaMO)
- Dorsomedial-palmarolateral oblique (DMPaLO)

The radiographs were centred on the MCP joint and made with the limbs lying horizontally on the table with the cassette directly under the limb. Sand bags were used for support and positioning. The radiographs were made at 53kV and 3.2mAs using a Siemens Polydorus LX50 computer radiography machine.

Where an injury extended beyond the view of the radiographic field, further radiographs were made as required to make a diagnosis.

Reports on each limb were made detailing the precise diagnosis (Appendix D). All radiographs were stored on the Onderstepoort Veterinary Academic Hospital's (OVAH) picture archiving and communication system (PACS).

After the radiographs had been performed the primary investigator, Keith Spargo, stored the images on CDs, which were written within 48 hours of taking the radiographs.

3.3.5` Dissection procedure

After radiography, the limbs were transferred to the pathology department of the faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa, for dissection. Dissection of each limb occurred as follows:

- The skin was removed
- The following soft tissues were evaluated:
  - Deep digital flexor tendon
  - Superficial digital flexor tendon
  - Interosseous medius body and lateral and medial branches
  - Common digital extensor tendon
  - Annular ligament
  - Distal sesamoidean ligaments - Straight
    Oblique
    Cruciate
  - Collateral ligaments of the distal interphalangeal joint
  - Collateral sesamoidean ligaments
  - Any other trauma, soft and bony tissue
  - Articular surfaces on the MCP joint for signs of wearing of the cartilage layer

Appendix E was completed for each limb during the dissection and each soft tissue structure was marked as either being intact, partly ruptured or fully ruptured. Diagnoses were made.

3.4 Statistical Analysis

For the purpose of statistical analysis the case material data was divided into two groups, namely:

- Group 1 which consisted of all the horses that sustained a CMI within the study time period (from the NHA records) and totalled 114 in number. They were used for determining the incidence rate of CMIs per year as well as to obtain a more accurate overview of the type of CMIs seen on tracks under study.
- Group 2, a subset of Group 1, consisted of 53 identifiable cadaver limbs from 52 horses that had sustained a CMI and had their limbs sent to the ERC. Of the 22 limbs used in the previous study [18] only 20 met all the inclusion criteria. Two of the limbs (A & B) did not strictly meet the criteria as they had occurred in the earlier part of 1998 i.e. prior to 1 August but were considered to be of relevance by the investigator as they had occurred within 6 months of the

1998 racing period. A case history was available for all horses from which cadaver specimens were obtained. The cadaver limbs were used for evaluating the types and characteristics of the CMIs that occurred on Gauteng racetracks and the case histories for determining all the summary statistics and those relating to the association of risk factors.

Potential risk factors for catastrophic musculoskeletal injuries during racing that were studied were the following:

Horse factors

- Gender was divided into Male and Female and then subdivided into Filly, Colt, Mare, Stallion and Gelding.
- Age was categorised into three groups i.e. 1-3 years of age, 4-6 years of age and 7 or more years of age.
- Total number of previous starts: Low (0-15), Intermediate (16-30) and High (>30).
- Age at 1st race, in months: Three categories: <24months, 24-36 months and >36months.
- Days since previous race was divided into four categories: 0-30 days, 31-60 days, 61-90 days and >90days.
- Limb affected: Left or Right.

Race and track factors

- Racetrack (Turffontein, Vaal, Newmarket and Gosforth Park).
- Track type: Turf or Sand.
- Track condition: The going was divided into Firm, Good and Soft for the turf tracks and into Standard and Rain Affected for sand tracks.
- Race distance was divided into four categories: Sprint (<1200m), Mile (1300-1800m), Intermediate (1801 -2200m) and Long (>2400m).
- Jockey weight: Less than or equal to 55kg, 56-60kg and 61kg or more.
- Racing year (1998-2012).

The collective incidence pertaining to all four tracks represented in Gauteng was calculated for each racing year. Incidence = (number of CMIs x 1000) / number of starts. The number of CMIs is multiplied by 1000 to normalize the data so as to allow for more direct comparison between racetracks. Fisher's Exact tests and Pearson Chi-square tests were used to assess the interactions. The level of significance was set at $\alpha = 0.05$.

Dr L Fletcher from the Department Statistics, University of Pretoria advised on the statistical analysis performed on the data by Mrs Joyce Jordaan (Department of Statistics, University of Pretoria). The data was placed on spreadsheets by KE Spargo and given to Mrs Jordaan.

Chapter 4: Results

4.1 Anatomical study of catastrophic musculoskeletal injuries

Data was acquired after performing detailed radiographic (Appendix D) and dissection (Appendix E) evaluation of the injured limbs.

4.1.1 Anatomical location of catastrophic musculoskeletal injuries during the 1998-2012 racing period for the 114 CMI cases.

The NHRA of Southern Africa's records show the most common location for the 114 CMIs in the study period being the PSBs, including the suspensory apparatus, and was represented by 55.26% of the cases. Condylar metacarpal/tarsal fractures were excluded from this category as they were classed as a separate CMI. The second most common location for CMI was the MC3 bone at 13.16% followed closely by the carpal region at 12.28%. Fractures involving P1, MC3 condyles and tibia were represented respectively by 6.14%, 4.39% and 2.63% of the cases. Pelvic and scapula fractures were equally represented at 1.75%. The least common region for a CMI was the femur at only 1 reported case out of the 114 horses (0.88%). There was only one reported case that failed to classify the affected area of the horse in the report. Figure 4.1 graphically depicts the anatomical location of the 114 CMIs during the racing period 1998-2012.

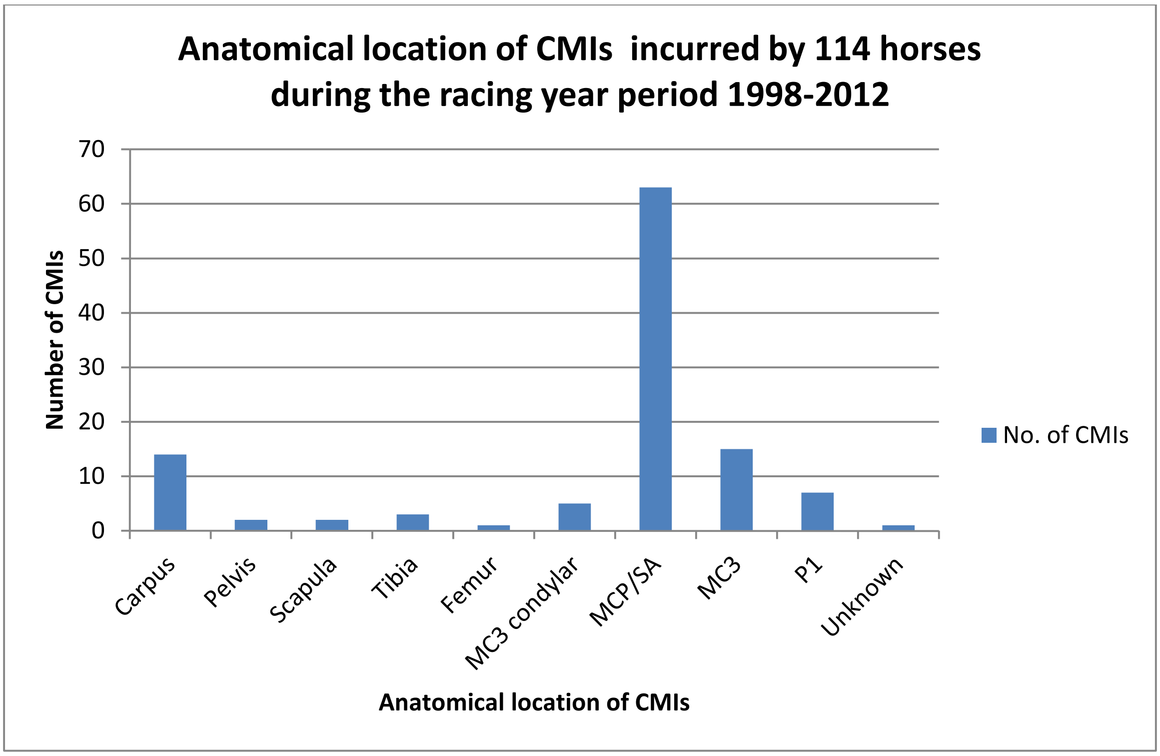

Fig 4.1: Bar chart depicting the anatomical location of the CMIs incurred by 114 horses during the racing period 1998-2012.

CMIs = catastrophic musculoskeletal injuries, MC3 = metacarpus 3, MCP/SA = metacarpophalangeal joint/suspensory apparatus, P1 = phalanx 1

4.1.2 Distribution of left versus right limb pathology

From study group 1 only those CMIs that involved a forelimb or hindlimb (i.e. excluding the pelvic fractures) were used for analysis. Only one case included both forelimbs and thus was removed from this analysis. Thus the total study population for this analysis equals 107 limbs. Table 4.2 depicts the numbers and percentages of left vs. right limbs involved in CMIs for Group 1.

Table 4.2: Distribution of left vs. right fore or hindlimb predilection for CMIs for Group 1

Limb Predilection	No.	% of Group 1 study population
Left forelimb	60	56.07
Right forelimb	33	30.84
Left hindlimb	9	8.41
Right hindlimb	5	4.67
Total	107	100

Table 4.3 Distribution of left vs. right forelimb predilection for CMIs for Group 1

Limb predilection	**No.**	**% of Group 1 study population**
Left forelimb	60	64.52
Right forelimb	33	35.48
Total	93	100

In group 2 all the CMIs occurred unilaterally. Table 4.4 depicts the percentage of left forelimbs involved in CMIs versus right forelimbs.

Table 4.4: Distribution of left vs. right forelimb predilection for CMIs for Group 2

Limb Predilection	**No.**	**% of Group 2 study population**
Left forelimb	39	73.58
Right forelimb	14	26.42
Total	53	100

For group 2 the majority of CMIs also occurred on the left.

4.1.3 Classification and distribution of fractures

For the analysis of the classification and distribution of fractures only data from Group 2 was used, as confirmed diagnoses were obtained.

4.1.3.1 Open versus closed fractures

In the CMI group 2, the majority of the fractures were closed (64.15%) and these predominately involved the left forelimb. A total of 19 forelimbs out of the 53 studied sustained open fractures. The left forelimb was predominately affected in both open and closed fractures. See table 4.5.

Table 4.5: Percentage of study population sustaining an open vs. closed fracture

Fracture type	No.	No. divide based on LF of RF affected	% of study population
Open	19	13 = LF; 6 = RF	35.85
Closed	34	25 = LF; 9= RF	64.15
Total	53		100

4.1.3.2 Proximal sesamoid bone fracture

The following results pertaining to the proximal sesamoid bones were derived from CMI Group 2:

- Proximal sesamoid bone fractures represent the most common CMI injury and fracture type, with 88.7% of the study population, 47 out the 53 cases. Only six cases did not include a PSB fracture.
- The majority of PSB fractures occurred biaxially, with 35 out of 47 cases (74.47%).
- The majority of PSB fractures occurred in the LF, with 35 out of the 47 cases (74.47%).
- The majority of biaxial PSB fractures occurred in the LF, with 28 out of the 35 cases (80.00%).

Table 4.6: Biaxial vs. uniaxial proximal sesamoid bone fractures

PSB fracture details	% of PSB fractures
Uniaxial	25.53
Biaxial	74.47

- The most common type of PSB fracture was a midbody fracture with 39 cases. The medial PSB most commonly had the midbody fracture.
- The occurrence of the other fracture types and most commonly affected PSBs is depicted in Table 4.7.

Table 4.7: Breakdown of proximal sesamoid bone fractures into type and occurrence in the study population.

PSB fracture details	Number of fractures per type	% of study population
Midbody	39	L: 15.1 M: 30.2 L + M: 28.3
Comminuted	26	L: 15.1 M: 24.5 L + M: 9.4
Basal	13	L: 5.7 M: 17.0 L + M: 1.9
Apical	11	L :17 M: 3.8
Abaxial	2	M: 1.9 L + M: 1.9
Axial	1	L: 1.9

PSB = proximal sesamoid bone, L = lateral, M = medial, L + M = lateral and medial

4.1.3.3 Condylar fractures

Out of the 53 cases examined, only 6 had MC3 condylar fractures, all of which involved the lateral condyle. Of the 6 MC3 condylar fractures, three of them occurred in left forelimb and three occurred in right forelimb. All of them were open fractures. Three of the cases were accompanied by a uniaxial medial PSB fracture, one by a uniaxial lateral PSB fracture, with another involving a biaxial PSB, MC3 and P1 fractures. The last had no other associated fractures.

4.1.3.4 Luxation and subluxation of the metacarpophalangeal joint

Cases involving luxations and subluxations of the MCP joint were equally represented at 6 each: 4 left forelimbs and 2 right forelimbs were involved. All of the luxations and the subluxations were accompanied by additional PSB fractures expect for one luxation which only had a lateral condylar fracture and one subluxation which had no other associated fractures.

4.2 Influential factors on catastrophic musculoskeletal injuries

The data of group 2 (n = 53) was used for all the following analyses.

4.2.1 Age

Table 4.8: Number of CMIs sustained per age groups

Age	No.	% of study population
1 - 3yrs	29	54.72
4 – 6yrs	23	43.40
>7yrs	1	1.89
Total	53	100

4.2.2 Gender

Table 4.9: Number of CMIs sustained per gender

Gender	No.	% of study population
Male	42	79.25
Female	11	20.75
Total	53	100

4.2.3 Total number of previous starts

Table 4.10: Number of CMIs sustained per total number of previous starts groups

Total no. of previous starts	No.	% of study population
Low (0-15)	34	64.15
Intermediate (16-30)	13	24.53
High (>30)	6	11.32
Total	53	100

4.2.4 Age at first race

Table 4.11: Number of CMIs sustained per age at first race groups

Age at 1st race	No.	% of study population
<24 months	2	3.77
25-36 months	37	69.81
>37 months	14	26.42
Total	53	100

4.2.5 Days since previous race

Table 4.12: Number of CMIs sustained per days since previous race groups

Days since previous race	No.	% of study population
0-30	35	66.04
31-60	13	24.53
61-90	5	9.43
Total	53	100

4.2.6 Track type

These results solely reflect the CMIs that occurred at the Vaal racetrack as it is the only racetrack in RSA that has both a sand and turf track. All other racing in RSA is done on turf tracks.

Table 4.13: Number of CMIs sustained per track type at the Vaal racetrack

Track type	No.	% of study population
Turf	9	45.00
Sand	11	55.00
Total	20	100

4.2.7 Track conditions

These results reflect the CMIs that occurred at all the racetracks that have a turf track but the results for the sand track conditions are based purely on the CMIs that occurred at the Vaal racetrack.

Table 4.14: Number of CMIs sustained per turf track conditions categories

Track condition (turf)	**No.**	**% of study population**
Firm	3	7.14
Good	35	83.33
Soft	4	9.52
Total	42	100

Table 4.15: Number of CMIs sustained per sand track condition categories at the Vaal racetrack

Track condition (sand)	**No.**	**% of study population**
Standard	10	90.9
Rain affected	1	9.1
Total	11	100

4.2.8 Distance

Table 4.16: Number of CMIs sustained per race distance categories

Distance	**No.**	**% of study population**
Sprint (<1200m)	15	28.30
Mile (1300 – 1800m)	27	50.94
Intermediate (1801 – 2200m)	3	5.66
Long (>2400m)	8	15.09
Total	53	100

4.2.9 Jockey weight

Table 4.17: Number of CMIs sustained per jockey weight categories

Jockey weight	No.	% of study population
<55kg	20	37.74
56-60kg	32	60.38
>61kg	1	1.89
Total	53	100

4.3 Incidence of catastrophic musculoskeletal injuries

4.3.1 Number of starts

Data pertaining to the total number of starts per race season for all four Gauteng racetracks during the racing period 1998-2012 was obtained from the NHA database (Table 4.18).

The following results were obtained from the NHA data:

- A total of 203965 starts were recorded over the fourteen year racing period from 1998-2012 for all four racetracks.
- The greatest annual total starts for all four racetracks was during the 2000 racing year with 16174 starts.
- The lowest annual total starts for all four racetracks was during the 2007 racing year with 12773 starts
- The greatest amount of individual annual starts at a single racetrack was during the 2010 racing year at Vaal with 8573 starts.
- The least amount of individual annual starts at a single racetrack was during the 2001 racing period at Gosforth Park with 1968 starts.
- The greatest amount of starts for the period 1998-2012 was Vaal with 80861 starts
- The least amount of starts for the period 1998-2012 was Gosforth Park totalling 11768 starts. The lower number of starts was due to the closing of the racecourse at the end of the 2001 racing year.

Note: Gosforth Park and Newmarket racetracks were closed down at the end of the 2001 and 2006 racing seasons respectively. Therefore, no starts were recorded during the racing period 2002-2012 for Gosforth Park and 2007-2012 for Newmarket.

Table 4.18: Number of starts per racing season for all four Gauteng racetracks during the racing period 1998-2012.

Year	**Gosforth Park**	**Newmarket**	**Turffontein**	**Vaal**	**Total**
1998	3220	4219	3653	3516	14608
1999	2878	3707	4010	4567	15162
2000	3706	4194	3459	4819	16178
2001	1968	4637	4182	4528	15315
2002	0	3951	5513	5173	14637
2003	0	3816	5275	4534	13625
2004	0	3556	5960	4601	14117
2005	0	3487	5583	5292	14362
2006	0	2548	5018	6121	13687
2007	0	0	6446	6327	12773
2008	0	0	7218	6785	14003
2009	0	0	7047	7636	14683
2010	0	0	6909	8573	15482
2011	0	0	6934	8399	15333
Total	11772	34115	77207	80871	203965

0 = racetrack closed down

Fig 4.2 depicts the number of starts per racing season for all four Gauteng racetracks during this fourteen year period.

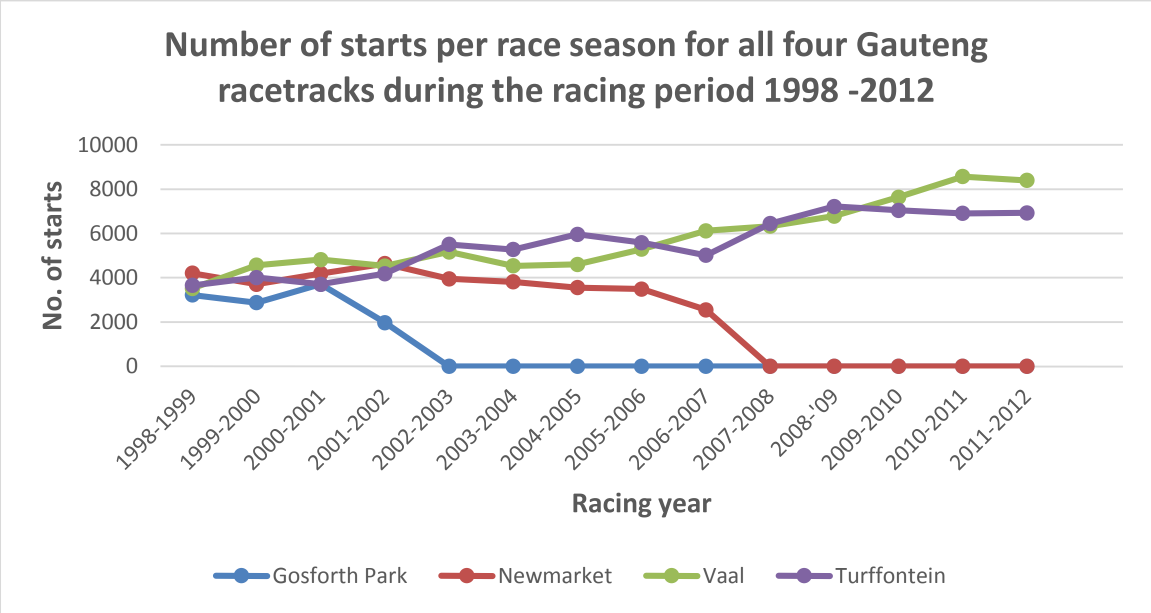

Fig. 4.2: Line graph depicting the number of starts per race season for all four Gauteng racetracks during the racing period 1 August 1998 – 31 July 2012.

4.3.2 Number of catastrophic musculoskeletal injuries per racetrack per racing season

The number of CMIs per racetrack per racing season was determined from records made available by the NHA and data of Group 1. A line graph depicts the number of CMI per racing season per racetrack during the 14 year study period (Fig 4.3). Turffontein race course had the highest recorded number of CMIs (51) during the fourteen year period, followed by Vaal (43), Newmarket (19) and finally Gosforth Park (4). The low number of CMIs at Newmarket and Gosforth Park are not true reflections of the fourteen year period due to the closure of Newmarket and Gosforth Park in 2007 and 2002 respectively. Also no conclusions should be drawn up when viewing this data (of all the racetracks) as it does not take into account the number of horses racing on each course in a specific year.

- The total annual number of CMI for all racecourses combined was the highest in 2011 (15), followed by 2004 (14) and 2008 (12) and the lowest amount of CMIs sustained in 2006 (4) and 2010 (5).
- 2006 represented the third lowest total amount of starts for all four racetracks within the 14 year period (13687).

Table 4.19: Number of catastrophic musculoskeletal injures per racetrack per racing season during the racing period 1 August 1998 – 31 July 2012.

Year	**Racetrack**				
	Gosforth Park	**Newmarket**	**Turffontein**	**Vaal**	**Total**
1998	1	3	2	0	6
1999	0	3	1	2	6
2000	2	1	5	0	8
2001	1	3	4	2	10
2002	0	2	3	3	8
2003	0	2	3	2	7
2004	0	1	8	5	14
2005	0	3	2	1	6
2006	0	0	0	4	4
2007	0	0	2	4	6
2008	0	0	6	6	12
2009	0	0	3	4	7
2010	0	0	2	3	5
2011	0	0	10	5	15
Total	4	18	51	41	114

0 = racetrack closed down

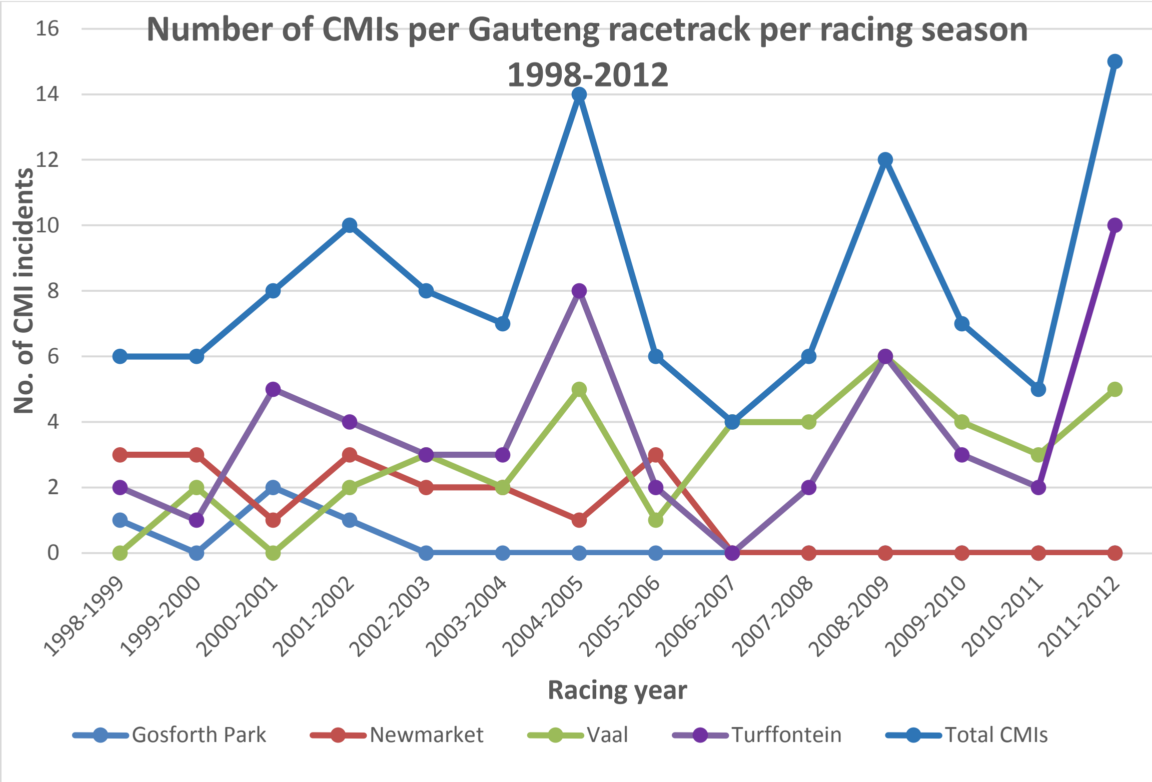

Fig 4.3: Line graph depicting the number of catastrophic musculoskeletal injuries per racetrack per racing season during the racing period 1 August 1998 – 31 July 2012.
CMI = catastrophic musculoskeletal injuries (Gosforth Park closed 2002, Newmarket closed 2006)

4.3.3 Incidence of catastrophic musculoskeletal injuries per 1000 starts per racing season

The collective incidence pertaining to all four racetracks represented in Gauteng was calculated for each racing year. A line graph depicts the incidence of CMI per 1000 starts per racing year per racetrack during the fourteen years of the study period in Fig 4.4.

The following information was deduced from this study:

- The highest individual incidence occurred at Turffontein racetrack in the 2000 racing year with an incidence of 1.45 / 1000 starts (number of starts = 3459)
- The lowest individual incidence occurred at Vaal racetrack in the 2005 racing year with an incidence of 0.19/ 1000 starts (number of starts = 5292)
- No incidence (0 / 1000 starts) occurred at Gosforth Park in 1999 (number of starts = 2878), Newmarket and Turffontein in 2006 (number of starts = 2548 & 5018 respectively) and at Vaal racetrack in 1998 and 2000 (number of starts = 3516 & 4819, respectively)

- The highest collective annual incidence (0.99 / 1000 starts) occurred in 2004 (number of starts = 14117)
- The lowest collective annual incidence (0.29 / 1000 starts) occurred in 2006 (number of starts = 13687)

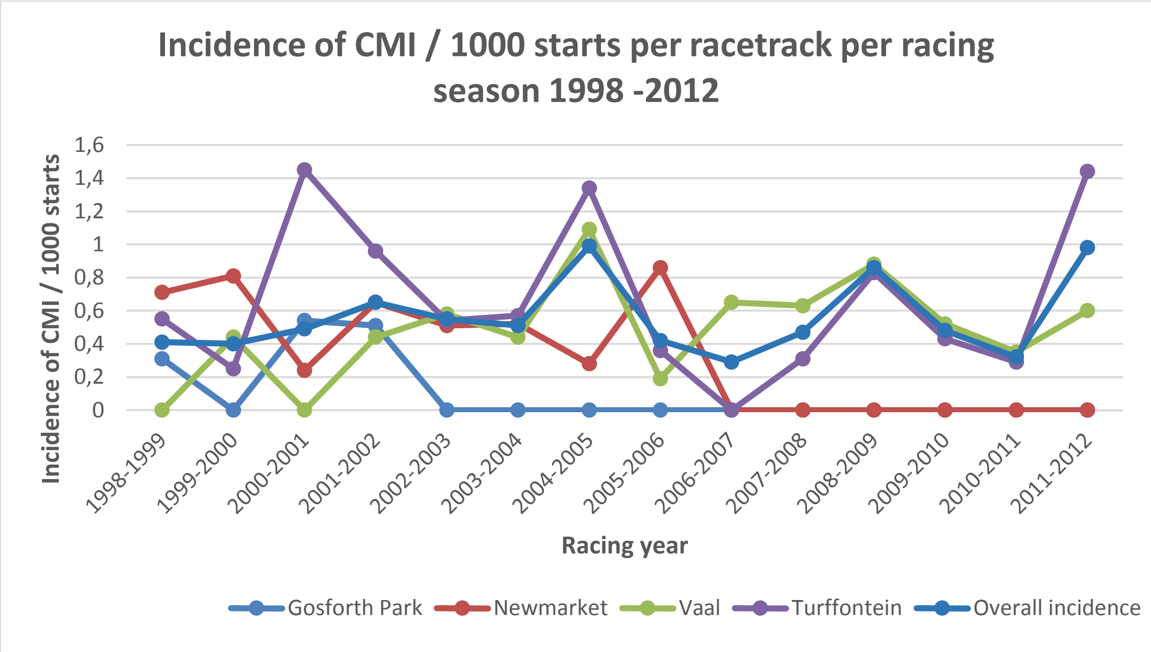

Fig 4.4: Line graph depicting the incidence of catastrophic musculoskeletal injuries per 1000 starts per racetrack per racing season during the racing period 1 August 1998 – 31 July 2012.
CMI = catastrophic musculoskeletal injuries (Gosforth Park closed 2002, Newmarket closed 2006)

4.4 Statistical analysis of potential risk factors for catastrophic musculoskeletal injuries

4.4.1 Racetrack

The number of CMIs and starts as well as the incidence rate of CMI for the four racetracks investigated in this study are shown in Table 4.20.

Table 4.20 Incidence of catastrophic musculoskeletal injuries at each racetrack.

Racetrack	No. of CMI	No. of starts	Incidence per 1000 starts
Gosforth Park	4	11772	0.34
Newmarket	18	34115	0.53
Turffontein	51	77207	0.66
Vaal	41	80871	0.51
Total	114	203965	0.56

4.4.2 Racing year

The number of CMIs and starts as well as the incidence rate of CMI for the different racing years investigated in this study are shown in Table 4.21.

Table 4.21 Incidence of catastrophic musculoskeletal injuries per racing year.

Race year	No. of CMIs	No. of starts	Incidence per 1000 starts
1998	6	14608	0.41
1999	6	15162	0.40
2000	8	16178	0.49
2001	10	15315	0.65
2002	8	14637	0.55
2003	7	13625	0.51
2004	14	14117	0.99
2005	6	14362	0.42
2006	4	13687	0.29
2007	6	12773	0.47
2008	12	14003	0.86
2009	7	14683	0.48
2010	5	15482	0.32
2011	15	15333	0.98
Total	114	203965	0.56
Average	$\mu \approx 8$	$\mu \approx 14569$	$\mu \approx 0.6$,

4.4.3 Age

The data of Group 2 with 53 horses was used for this analysis, however we had to exclude one horse from this group's analysis. Horse no. 13 was 9 years old at the time it obtained its CMI and so falls outside of the age group categories.

Table 4.22 Cross-tabulation of limb affected with the catastrophic musculoskeletal injury versus the age groups of the study population.

Limb affected	**Age Groups**		**Total**
	2-3 years	**4-6 years**	
LF	22	16	38
RF	7	7	14
Total	29	22	52

The total number of left and right front limbs that obtained a CMI is divided up into the age groups of the horses. Using Pearson Chi-Square and Fisher's Exact tests a P-value of 1.000 is obtained for both and so there is no significant association between the limb affect with the CMI and the age of the horse ($P > 0.05$).

Table 4.23 Cross-tabulation of proximal sesamoid bone fracture details versus the age groups of the study population.

PSB fracture details	**Age Groups**		**Total**
	2-3 years	**4-6 years**	
Uniaxial	7	4	11
Biaxial	21	14	35
Total	28	18	46

Horse no. 65 was excluded from this analysis as the incorrect limb was submitted and so no conclusive diagnosis of the CMI could be established

The horses in the study population that obtained a PSB fracture are divided up based on the fracture being uniaxial or biaxial and on the different age groups. Since 5 horses did not suffer a CMI involving their PSBs they were excluded from this analysis along with horse no. 13 which fell outside of the age group categories. Using Pearson Chi-Square and Fisher's Exact tests a P-value of 1.000 is obtained for both and so there is no significant association between if the fracture was uniaxial or biaxial and the age of the horse (P > 0.05).

Table 4.24 Cross-tabulation of comminuted or non-comminuted proximal sesamoid bone fracture versus the age groups of the study population.

Comminuted or non-comminuted	**Age Groups**		**Total**
	2-3 years	**4-6 years**	
Comminuted	15	10	25
Non-comminuted	14	12	26
Total	29	25	51

Horse no. 65 was excluded from this analysis as the incorrect limb was submitted and so no conclusive diagnosis of the CMI could be established

The horses in the study population that obtained a fracture are divided up based on the PSB fracture being comminuted or not and on the different age groups. Horse no. 13 was excluded from this analysis as it fell outside of the age group categories.

Using Pearson Chi-Square and Fisher's Exact tests a P-value of 0.588 was obtained for both and so there is no significant association between the fracture being comminuted or not and the age of the horse (P > 0.05).

4.4.4 Distance

Table 4.25 Cross-tabulation of limb affected with the catastrophic musculoskeletal injury versus the distance of race in which the CMI occurred.

Limb affected	**Distances**			**Total**
	Sprints	**Intermediate**	**Long**	
LF	12	20	5	37
RF	3	10	3	16
Total	15	30	8	53

The total number of left and right front limbs that obtained a CMI is divided up into the different race distance categories. Using Pearson Chi-Square and Fisher's Exact tests a P-value of 0.559 is obtained for both and so there is no significant association between the limb affected with the CMI and the different race distance categories ($P > 0.05$).

Table 4.26 Cross-tabulation of proximal sesamoid bone fracture details versus the distance of race in which the CMI occurred.

PSB fractures	Distances			Total
	Sprints	Intermediate	Long	
Uniaxial	0	10	2	12
Biaxial	14	17	4	35
Total	14	27	6	47

Horse no. 65 was excluded from this analysis as the incorrect limb was submitted and so no conclusive diagnosis of the CMI could be established.

The horses in the study population that obtained a PSB fracture are divided up based on the fracture being uniaxial or biaxial and on the different race distance categories. Since 5 horses did not suffer a CMI involving their PSBs they were excluded from this analysis.

Using Pearson Chi-Square and Fisher's Exact tests a P-value of 0.038 and 0.014 is obtained respectively. There is a significant association between if the fracture was uniaxial or biaxial and the different race distance categories ($P < 0.05$). The reason for the difference in P-values between the tests is due to there being less horses obtaining a uniaxial PSB fracture in a sprint length race than was expected statistically. Therefore, there is a larger chance of sustaining a biaxial fracture in a sprint than in another race distance.

Table 4.27 Cross-tabulation of comminuted or non-comminuted proximal sesamoid bone fracture versus the distance of race in the CMI occurred.

Comminuted or non-Comminuted	Distances			Total
	Sprints	Intermediate	Long	
Comminuted	8	13	4	25
Non-comminuted	7	16	4	27
Total	15	29	8	52

Horse no. 65 was excluded from this analysis as the incorrect limb was submitted and so no conclusive diagnosis of the CMI could be established

The horses in the study population that obtained a fracture are divided up based on the fracture being comminuted or not and on the different race distance categories. Using Pearson Chi-Square and Fisher's Exact tests a P-value of 0.927 is obtained for both and so there is no significant association between if the fracture was comminuted or not and the different race distance categories ($P > 0.05$).

4.4.5 Gender

Table 4.28 Cross-tabulation of limb affected with the catastrophic musculoskeletal injury versus the gender of the horse.

Limb affected	Gender		Total
	Male	Female	
LF	31	7	38
RF	11	4	15
Total	42	11	53

The total number of left and right front limbs that obtained a CMI is divided up into the separate genders. Using Pearson Chi-Square and Fisher's Exact tests a P-value of 0.435 is obtained for both and so there is no significant association between the limb affect with the CMI and the gender of the horse ($P > 0.05$).

Table 4.29 Cross-tabulation of proximal sesamoid bone fracture details versus the gender of the horse.

PSB fractures	Gender		Total
	Male	Female	
Uniaxial	8	4	11
Biaxial	28	7	35
Total	35	11	47

Horse no. 65 was excluded from this analysis as the incorrect limb was submitted and so no conclusive diagnosis of the CMI could be established

The horses in the study population that obtained a PSB fracture are divided up based on the fracture being uniaxial or biaxial and on the separate genders. Since 5 horses did not suffer a CMI involving their PSBs they were excluded from this analysis. Using Pearson Chi-Square and Fisher's Exact tests a P-value of 0.418 is obtained for both and so there is no significant association between if the fracture was uniaxial or biaxial and the gender of the horse ($P > 0.05$).

Table 4.30 Cross-tabulation of comminuted or non-comminuted proximal sesamoid bone fracture versus the gender of the horse.

Comminuted or non-comminuted	Gender		Total
	Male	Female	
Comminuted	20	5	25
Non-comminuted	21	6	27
Total	41	11	52

Horse no. 65 was excluded from this analysis as the incorrect limb was submitted and so no conclusive diagnosis of the CMI could be established

The horses in the study population that obtained a fracture are divided up based on the fracture being comminuted or not and on the different race distance categories. Using Pearson Chi-Square and Fisher's Exact tests a P-value of 1.000 is obtained for both and so there is no significant association between if the fracture was comminuted or not and the gender of the horse ($P > 0.05$).

4.4.6 Number of previous starts

Table 4.31 Cross-tabulation of limb affected with the catastrophic musculoskeletal injury versus the total number of previous starts.

Limb affected	**Total number of previous starts**				**Total**
	0-5 starts	**6-9 starts**	**10-20 starts**	**>20 starts**	
LF	11	6	11	10	38
RF	2	4	5	4	15
Total	13	10	16	14	53

The total number of left and right front limbs that obtained a CMI is divided up into based on the total number of previous starts the horse had before it obtained its CMI. Using Pearson Chi-Square and Fisher's Exact tests a P-value of 0.245 and 0.255 is obtained respectively and so there is no significant association between the limb affect with the CMI and the total number of previous starts ($P > 0.05$).

Table 4.32 Cross-tabulation of proximal sesamoid bone fracture details versus the total number of previous starts.

PSB fractures	**Total number of previous starts**				**Total**
	0-5 starts	**6-9 starts**	**10-20 starts**	**>20 starts**	
Uniaxial	3	3	2	4	12
Biaxial	9	7	11	8	35
Total	12	10	13	12	47

Horse no. 65 was excluded from this analysis as the incorrect limb was submitted and so no conclusive diagnosis of the CMI could be established

The horses in the study population that obtained a PSB fracture are divided up based on the fracture being uniaxial or biaxial and on the total number previous starts they had before obtaining the CMI. Since 5 horses did not suffer a CMI involving their PSBs they were excluded from this analysis. Using Pearson Chi-Square and Fisher's Exact tests a P-value of 0.794 and 0.754 is obtained for respectively and so there is no significant association between if the fracture was uniaxial or biaxial and the total number previous starts ($P > 0.05$).

Table 4.33 Cross-tabulation of comminuted or non-comminuted proximal sesamoid bone fracture versus the total number of previous starts.

Comminuted or non-comminuted	Total number of previous starts				Total
	0-5 starts	6-9 starts	10-20 starts	>20 starts	
Comminuted	7	3	6	9	25
Non-comminuted	6	8	9	4	27
Total	13	11	15	13	52

Horse no. 65 was excluded from this analysis as the incorrect limb was submitted and so no conclusive diagnosis of the CMI could be established.

The horses in the study population that obtained a fracture are divided up based on the fracture being comminuted or not and the total number previous starts the horse had before it obtained its CMI. Using Pearson Chi-Square and Fisher's Exact tests a P-value of 0.186 and 0.190 is obtained respectively and so there is no significant association between if the fracture was comminuted or not and the total number of previous starts ($P > 0.05$).

4.4.7 Age at first race

Table 4.34 Cross-tabulation of limb affected with the catastrophic musculoskeletal injury versus the age of the horse at its first race.

Limb affected	Age at 1st race			Total
	< 2 years	2-3 years	> 3 years	
LF	2	26	10	38
RF	0	11	4	15
Total	2	37	14	53

The total number of left and right front limbs that obtained a CMI is divided up into based on the age of the horse at its first race. Using Pearson Chi-Square and Fisher's Exact tests a P-value of 1.000 is obtained for both and so there is no significant association between the limb affect with the CMI and the age of the horse at its first race ($P > 0.05$).

Table 4.35 Cross-tabulation of proximal sesamoid bone fracture details versus the age of the horse at its first race.

PSB fracture details	Age at 1st race			Total
	< 2 years	2-3 years	> 3 years	
Uniaxial	0	10	2	12
Biaxial	2	24	9	35
Total	2	34	11	47

Horse no. 65 was excluded from this analysis as the incorrect limb was submitted and so no conclusive diagnosis of the CMI could be established

The horses in the study population that obtained a PSB fracture are divided up based on the fracture being uniaxial or biaxial and on the age of the horse at its first race. Since 5 horses did not suffer a CMI involving their PSBs they were excluded from this analysis Using Pearson Chi-Square and Fisher's Exact tests a P-value of 0.608 and 0.828 is obtained for respectively and so there is no significant association between if the fracture was uniaxial or biaxial and the age of the horse at its first race (P > 0.05).

Table 4.36 Cross-tabulation of comminuted or non-comminuted proximal sesamoid bone fracture versus the age of the horse at its first race.

Comminuted or non-comminuted	Age at 1st race			Total
	< 2 years	2-3 years	> 3years	
Comminuted	1	18	6	25
Non-comminuted	1	18	8	27
Total	2	36	14	52

Horse no. 65 was excluded from this analysis as the incorrect limb was submitted and so no conclusive diagnosis of the CMI could be established

The horses in the study population that obtained a fracture are divided up based on the fracture being comminuted or not and age of the horse at its first race. Using Pearson Chi-Square and Fisher's Exact tests a P-value of 0.876 is obtained for both and so there is no significant association between if the fracture was comminuted or not and the age of the horse at its first race (P > 0.05).

Chapter 5: Discussion

This was a long term study resulting in an understanding of the types of CMI injuries sustained on the four Gauteng track as well as many of the risk factors associated with the injuries. An attempt has been made to analyse these results, comparing them to the results of the other racing countries highlighted in the literature review and providing possible explanations for the occurrence of some of the results or trends seen as well as differences seen in South Africa's results compared to the rest of the world.

5.1 Anatomical areas affected

The CMIs primarily involved the forelimbs, which correlates well with previous studies that have shown that the forelimb was involved in more than 80% of the cases [7, 8, 13, 19, 48, 55, 56]. Forelimbs are prone to injury due to greater relative forces imposed on them at higher speeds. Forelimb lameness is more common than that of hindlimbs due to the horse's centre of gravity being positioned closer to the forelimbs. The weight distribution between the forelimbs and hindlimbs is approximately 60:40 [57]. Also if we consider the pattern of limb placement during the different paces, in the canter and especially the gallop there is a moment in time in which the whole weight of the horse is placed on only one of the forelimbs thus being the sole weight-bearing point, possibly predisposing this limb to injury. The rider's influence also needs to be considered. The addition of the jockey and his/her position in the saddle during the race may further shift the distribution of weight more onto the forelimbs due to the jockey sitting very close to the forelimbs and leaning forward over the withers and forelimbs when in the light seat position during the actual race, potentially increasing the ratio to 70:30 [57]. Simultaneous front and hindlimb injuries are uncommon [8].

All of the CMIs in this study (group 1, n= 114) occurred unilaterally except for one, CMI no. 60, which was bilateral (i.e. in both the LF and RF) and predominantly involved the left forelimb. Previous studies have also shown the left forelimb to be the most predominantly affected limb [7, 29, 48, 55,]. A horse will naturally lead with the inside forelimb when going around a bend or corner because this places the horse in a more balanced way of going. The inside leading limb is loaded more than the outside limb when in a bend or turn especially at the gallop as the inside leading limb will be the one taking all weight at one point due to the gallop being a four beat pace [13]. When racing counter-clockwise horses are usually on the left in the turns and on the right lead during the straight [13]. Racing and training in Gauteng takes place in a clockwise direction. Thus the horses are most likely to lead with the right forelimb in the turn and then change over to the left on the straight as the right leg starts to become fatigued due to the excessive strain being imposed on it. One would thus assume that the limb most commonly affected would be the right forelimb when racing clockwise and the left forelimb when racing counter-clockwise. However, this is not the case with all the previous studies including this study showing that the left forelimb remains the predominantly affected limb [7, 29, 48, 55]. The reason or explanation for this phenomenon is not currently known but perhaps for clockwise racing more strain is placed on the left leg directly after the flying change of leads, where the whole of the horse's weight will land on the left forelimb alone, and once the horse is on the straight and in the final push to the finish. Another possibility is that when racing more weight is placed on the medial aspect of the outside limb i.e. the left limb when racing clockwise. In counter clockwise racing this is a very puzzling scenario where all logic would say that the right limb should then be the more affected limb if we take the assumption that the same mechanism of injury occurs in both directions of racing. However, if we follow the assumption that horses, like humans, have a limb preference, and that the majority of horses are right "handed" and therefore the left side is inherently weaker or are left handed and therefore the left side bears on more weight, then the occurrence of majority left forelimb injuries could be explained. If this theory was to be tested, we would need to review where on the racetrack the horses obtained their injury. If this theory is true, then the majority of horses racing clockwise will obtain their left forelimb injury on the straight or at the end of the turn when they change leads and counter clockwise racing horses will suffer the majority of their left forelimb injuries while still at the early stages of the races up until the final part of the last bend before the horses change leads.

It is probable that most CMIs are not as a result of a single inciting event but arise as a result of cumulative smaller injuries and micro-fractures within the bone that have been occurring over some time probably during training sessions, and the fatigue that has set in on the horse's limbs towards the end of the race is the final catalyst needed for the limb to fail. This shows that stress related bone injury is a very important aspect that needs to be considered [22, 38, 39]. Racehorses' limbs adapt in response to repetitive mechanical stresses placed on the limbs during training by a process of remodelling [38, 39]. The remodelling phase comprises a phase whereby new bone is deposited in specific areas to enable the limb to better withstand the stresses and strains of racing. The delay between the reabsorption and remodelling phases places these racehorses at risk as the bone is weaker and is less likely to withstand the cumulative stressed of racing and may lead to a CMI [39].

The most common location for a CMI in this study was the metacarpophalangeal region including the suspensory apparatus (55.75% of the 114 cases). This is similar to findings in other studies conducted in Britain which found the flexor tendons or the IOM (25.37%), followed by the MCP and PSBs (11.46%) to be the most common injury sites for CMIs [8]. In a study conducted in California, it was found that the PSBs and MC3s (42% of cases) were the most common racing and training injury sites [19]. Injuries and damage to the SA was virtually solely seen occurring in the forelimbs of Thoroughbred racehorses that were performing at high speeds [58]. The speed at which the horse works and fatigue of the flexor muscles supporting the metacarpophalangeal joint will place undue stress on each of the other components of the suspensory apparatus which then need to compensate. The MCP is a highly mobile joint which can become intensely loaded and is at its highest risk for injury when the horse is at full gallop. The suspensory apparatus acts by counteracting the high load experienced by the joint and maintains the range of extension [58]. The PSBs are a vital component of the SA and the MCP joint articulation, and are also particularly susceptible to injury in horses performing at high speeds [58]. It has been shown that when the hoof impacts with the ground it actually slides forward from its initial placement before stopping, this action is even greater when performed on the sand or all-weather surface [13]. This causes an increase in the degree of fetlock extension as that leg becomes the predominant weight-bearing limb, thus placing greater strain on the SA.

The effect of training on the strength of the SA has been investigated and it appears that training strengthens the ligaments of the SA so that the weakest component of the apparatus becomes the PSBs [59]. One excessive hyperextension may be sufficient to produce an acute failure of the PSB. Alternatively, the repeated higher strain may cause cumulative damage to the SA thus making the PSBs more prone to failure [4].

The most common CMI fracture in the study were PSB fractures. Proximal sesamoid bone fractures were also found to be one of the most common sites of primary injury in a study conducted in California (42%) [55] and represented the second most common injury in study conducted in Britain (11.46%) evaluating flat racing injuries [8]. In this study the majority of the PSBs fractured in the LF. This correlates well with the California study which also showed that the injuries of the LF more likely involved the PSBs [55]. Due to the resulting over extension and collapse of the MCP these fractures were also commonly linked with extensive damage to the flexor tendons and ligaments in close proximity to the MCP.

Fractures of the MC3 or MT3 condyles occur almost solely in racehorses while performing at high speed and are rarely associated with a specific incident. These fractures are more common in Thoroughbreds than other racing breeds and predominately involve the lateral condyle of the LF. It has been shown that in Thoroughbreds that are racing there are linear defects present in the mineralized articular cartilage and subchondral bone of the palmar/plantar surfaces of the condylar grooves adjacent to the sagittal ridge. They are linked to intense focal remodelling of adjacent bone [39], in response to cyclic loading associated with training and racing which is detectable at as little as four months of training [39, 58]. The results of the one study suggest that condylar fractures are rather pathological or stress fractures than ones occurring from a single incident and these fractures arise from a pre-existing, branching array of fissures in the condylar groove of the distal end of MC3 or MT3 [58]. It is theorized that the high incidence of this fracture results from unbalanced lateral loading on the left forelimb that peaks during counter-clockwise turns [18]. In this study all six of the condylar fractures involved the lateral condyle and were represented by three LF and three RF respectively. Previous studies have showed that condylar fractures predominately involve the lateral condyle of the left forelimb, 76% lateral vs. 8% medial [55] and 0.97 lateral/ 1000 starts vs. 0.24 medial / 1000 starts in all race types [4]. With racing and training in Gauteng occurring in a clockwise direction thereby placing more strain on the RF, one would have expected the majority of the condylar fractures to involve the lateral condyle of the RF. The occurrence of an even bilateral distribution of the lateral condylar fractures seen in this study and not a left forelimb majority like that reported, should not be analysed too intensely as we had a very small study population.

5.2 Incidence of catastrophic musculoskeletal injuries

The incidence of CMIs in this study (Group 1, n= 114) falls well within the ranges reported worldwide. The overall incidence of CMIs per 1000 starts for the racing period 1998 – 2012 was 0.56 (203965 starters). The three studies that have reported a lower incidence than this was a study in the UK reporting on the 1999-2001 racing period (0.38), a study in Sydney reporting on the 1985-1995 racing period (0.3) and a study in Victoria reporting on the 1989-2004 racing period (0.44). [1, 4, 17]. There were also ten studies which reported a higher incidence than this study, however. This incidence of CMI is also lower than that reported previously during the racing period 1987-2008 (1.1) but is slightly higher than the incidence reported in the study done from 1998-2004 (0.53) for the four Gauteng racetracks involved in the study [7, 18]. The annual collective incidences calculated in SA from 1998-2012 (0.99 and 0.29, highest and lowest respectively) are lower than that calculated anywhere else in the world except for the two studies done in Sydney (0.3) and Melbourne (0.6), Australia and two studies done in the UK (0.6, 0.38) [1, 3, 4, 15]. The highest individual incidence occurred at Turffontein racetrack in the 2000 racing year with an incidence rate of 1.45 injuries / 1000 starts (number of starts = 3459). This high incidence is due to Turffontein racetrack having its lowest number of starts in the 2000 racing year compared to all its other years in the study period while the number of CMIs stayed relatively constant. The reason for this uncharacteristic low number of starts is unclear but the three other racetracks did show an increase in their number of starters in that year. The reason for this is not known. This incidence is only exceeded by a couple of studies performed in North America in California (1.7) and Ontario (1.99) and in the UK (6.3 and 3.97) [6, 8, 19, 60]. The high incidences that are recorded in the UK were confounded by the fact that these results included all race types including steeplechasing and hurdling in the first study and in the second reported on all injuries that had occurred and not just those that resulted in euthanasia.

The factors which most likely contributed to the relatively low incidence of CMI in Gauteng over the study period time frame are as follows:

- Strict rules governing the use of medications which may have precluded horses with CMIs from participating.
- The majority of racing in Gauteng takes place on turf which has been shown to have a lower risk than sand tracks. The Vaal racetrack is the only track on which racing takes place on either a turf or a sand surface. Horses, however train on both surfaces in Gauteng.
- The track surfaces at the four Gauteng tracks appear to be of equal quality and are probably managed very similarly.
- The climates of the four racetracks are similar.
- With modern training practices based on scientific research, racehorses are in a good racing condition with their limbs having been strengthened via repetitive cycles of training strains and stresses.

5.3 Racetrack

The greatest annual total starts for all four racetracks was during the 2000 racing year with 16174 starts, while the lowest annual total starts for all four racetracks was during the 2007 racing year with 12773 starts, likely as result of the closure of the Newmarket racetrack. The most individual annual starts were also during the 2010 racing year at Vaal with 8573 starts. The least amount of individual annual starts was during the 2001 racing period at Gosforth Park with 1968 starts. These results most likely were not confounded by the fact that Gosforth Park and Newmarket racecourses closed at the end of the 2001 and 2006 racing years respectively, as most of the horses would have been stabled and training at Turffontein or Randjiesfontein already. Therefore, they would not stop racing and the remaining two tracks would just have their number of starts increase. It is interesting that the number of starts increased significantly at Newmarket, Vaal and Turffontein after the closure of Gosforth Park but when Newmarket closed there was no appreciable increase in the number of starts at the remaining two race tracks. Also while Vaal's number of annual starts has continued to increase annually, Turffontein's has showed a trend of plateauing off. A possible explanation for this could be that the Vaal racecourse offers racing on a turf and sand track where as Turffontein only has a turf track.

Possible explanations for the similar incidence of CMI found between the four different racetracks and fourteen individual racing periods may be that:

- The condition and going at the four Gauteng racetracks is similar.
- The Gauteng tracks are managed similarly.
- Similar track standards are set by the NHA throughout Gauteng.
- The horses are rotated and raced on different racetracks in South Africa.

5.4 Catastrophic musculoskeletal risk factors

Age:

The majority, 54.72% (29/53 horses), of horses that obtain a CMI in this study were between the ages of 1-3 years old and close behind were horses aged 4-6 years old with 43.40% (23/53). These results fall in line with what has been published in the literature and reflect the theory that there is not much of a greater risk in running younger horses compared to older ones [20,31,32]. We only had one horse that was 7 years or older that obtained a CMI feel this reflects that the older horses are more skeletally mature and conditioned for the workload and so are at a lower risk even, if they do run more races [20].

Gender:

Similar to previous reports, the majority of CMIs occurred in male horses (79.25%). A possible explanation for these findings is that geldings generally have a longer career than fillies, mares or colts, which are later used for breeding purposes or sold. [19, 29].

Age at 1st race:

Most of the horses in this study which obtained a CMI had their first race between the ages of 25 to 36 months (69.81%). This means that they would have started training as two year olds. It has been shown that horse that begin training at two were at a marginal advantage, i.e. they obtained fewer CMIs over their racing career, over horses that only started training at three in terms of their risk of sustaining a CMI [20, 31] however this fact was not reflected in our results, as horses that had their first race at 36 months of age or older i.e. they started training later had a lower occurrence of CMIs (26.42% of the study population). Two of the horses had their first race at two years of age, which implies that they had very little training prior to the race since Thoroughbreds are only backed at eighteen months. Further speculation is limited because the total number of horses that start racing at this age is unknown. Therefore, cannot say if it has a significant effect or not on a horse's risk for CMI.

Total number of previous starts:

It is clear that the majority of the horses injured were very early in their racing career. In this study we saw that 64.15% of the study population had only run 15 or less races prior to obtaining their CMIs. Thus they had very little prior racing experience or conditioning, Horses that had more than one season of racing and thus had more than 30 starts proved to be in the lowest category of injury. It has been shown that the relative risk for obtaining a CMI decreases as the horse ages and have sustained additional racing seasons [20].

Days since previous race:

The number of days between races that a horse has, also referred to as its racing interval, influences recovery time. We found the most CMIs (66.04%) in horses with a racing interval of 30 days or less and. This may be attributed to a short recovery time, limiting repair of musculoskeletal tissues. Horses that had 61 to 90 days of rest between races had the least number of CMIs (9.43%). A minimum of a 3-4 week interval between races is has been recommended in order to lower the number of injuries occurring [13]. A good point to remember is that a long racing interval can be an indication of prior soundness or health issues that needed time to recover. A previous study has identified that an extended interval between races was caused by a pre-existing injury particularly in the SDFT [48]. Our study also established that there was a positive association between CMI and an interval of greater than 60 days between the race in which the horse was injured and the previous race date [48]. In another study horses that had a racing interval of more than 33 days prior to a race were 2.5 times more likely to sustain a CMI during the race as were horses that raced less than 13 days before [47]. A hypothesis has been established that horses that return to training or racing after an extended period of reduced exercise may have insufficient bone mass to prevent micro-damage with exercise, with the resultant development of stress fractures due to continued repetitive loading [47].

Track type and condition:

All four of the race tracks that were evaluated in this study had a turf track. The Vaal race track is unique in that it also has a sand track for racing as well. When reviewing the 20 CMIs that occurred at the Vaal racetrack during the study population, 55% of them were on the sand track and 45% were on the turf track. This slightly higher occurrence on the sand may just be because the Vaal is the only sand track and so more horses run on its sand track than on its turf track.
The majority of the CMIs on the turf track occurred when the going was classified as good (82.93%). Hard/firm going is usually associated with greater speeds. In Gauteng, RSA and the UK, the aim is

to provide racing surface that would be classified as good-firm but not truly firm for flat racing. A study in the UK showed that the occurrence of musculoskeletal injury i.e. not catastrophic, was lowest from racing on turf that was soft and the rate of problems increased as the surfaces became firmer (all types of racing) [8]. This may be due to harder turf tracks having less cushioning effect, as horses have greater forces exerted on them than on tracks with a higher moisture content. Overall racing fatality also tended to decrease as racing became softer (all types of racing) [8]. The overall race speed decreases on the softer surface leading to a decrease risk of injury. This trend however was only marginally significant for flat racing and this study did not truly follow the pattern described above. We had the lowest number of injury occurring on the firm tracks (7.32%) but soft track induced CMIs were only marginally higher at 9.76% of the study population.

Distance:

The horses that sustained a CMI in this study raced over a distance ranging from 800m to 2400m. It was found that just over half (50.94%) of all the horses in the study population were injured in mile races (1300-1800m) and 28.3% of the study population sustained a CMI in the sprint races. This is slightly contradictory to what has been published in the literature where it has been shown in studies conducted in Kentucky, USA that when the distance of the race was shorter and the number of turns less, there were more catastrophic injuries [13, 46]. So while the general trend of shorter distances resulting in more CMIs holds true, one would have expected to see the sprint races having the most amount of CMIs occurring. This discrepancy seen could be due to the fact that most first season runners in South Africa are entered into mile races and as has been explained previously the younger runners are at a higher chance of obtaining a CMI. The least amount of CMIs occurred over the longer distances, 1801-2400m. A possible explanation for the low number of injuries seen in the long distance races in South Africa is that it is mainly older horses that run in these races and they run less often compared to the younger horses in the sprint and mile races. They are more skeletally mature and conditioned for the work and since they run less they experience less opportunities to obtain a CMI.

Jockey weight:

The majority of the CMIs occurred when the jockey weighed between 56-60kg, 60.38%, and we only had one horse, that obtained a CMI, that had a jockey of more than 61kg in weight, which is exceptionally heavy for a jockey and not the norm. It must be kept in mind that the heavier the jockey is, the more weight the horse has to cope with resulting in increased weight being distributed over the forelimbs during the gallop thereby putting the horse at greater risk of injury when compared to a horse carrying less weight. However, the jockey's weight is not necessarily the only determining factor, the effective and balanced position of a skilled rider must also be taken into account. In other disciplines of riding it has been demonstrated that an inexperienced, rider will cause more hindrance to the horse's balance and way of going than a relatively over-weight but experienced rider.

Of the factors discussed above, the following: age of the horse, the distance of the race, the horse's gender, the number of previous starts and the age of the horse at its first race were all evaluated to assess if they had an association with the following CMI characteristics; if the left versus right forelimb obtained the CMI, if the PSB fracture that occurred was uniaxial or biaxial and if the fracture was comminuted or not. None of the factors evaluated were shown to have any significant associations with any of the CMI characteristics except for distance of race verses uniaxial or biaxial PSB fracture. It was determined that short distance races had less of an effect on uniaxial PSB fractures than was predicted statistically and that horses running in short distance races i.e. sprints (<1200m) had a greater chance of sustaining a bi-axial PSB fracture than in any other distance. This is an interesting occurrence which has not been documented in other studies. A possible explanation for this could be that since sprint races are done in a straight line and no turns are involved the horses are at all times placing equal pressure on both the lateral and medial aspects of the legs and so no one side is strained more than another, resulting in failure occurring in both PSBs. Also, if the injury is the result of overreaching, the hind leg coming forward and cutting into the back of the forelimb in front of it, since the race is in a straight line the hind leg will more likely strike the front leg directly across both PSBs not just to one side which would be more likely when going around the turn and the horse is bent around the turn.

5.5 Limitations of this study

Small study population:

The biggest limitation that occurred was that only 53 out of the total 114 horses that suffered a CMI in our study time period were available for evaluation. Also Since this was a retrospective study there also was not a control group against which results could be compared.

Identification of limbs:

The method used for identifying the amputated limbs that were sent to the ERC for analysis was not optimal and caused a few minor problems. Since all the horse's info is typed up and taped to the leg should any water or moisture make contact with the paper, during the time stored in the freezers or when being defrosted, the ink runs and become illegible. Possible solutions to fix this problem that have been suggested are placing the letter with all the horse's information into a sealable plastic bag or to use a waterproof tag attached directly to the leg. Although not feasible, it would be ideal if all the limbs received could be processed immediately on their arrival to the ERC and have an examination done on them as soon as possible after the CMI has occurred. These suggestions will help eliminate the problems with identification and make results available for review.

CMI database:

The NHA database is currently the only available resource for obtaining records on racing in South Africa. It was positive to see that there was less than 0.001% error in the records with only or two minor human errors in placing injuries into the wrong categories.

Currently the NHA does not a have standardized definition for classifying CMIs. Injuries and conditions occurring at the racetracks are classified in the database based on if they involved soft tissue structures i.e. the horse "broke down", if a fracture occurred or if the horse was euthanized at the racecourse. A suggestion of recreating a special division and code for CMIs would allow for easier identification of them. Also a standardised form for CMI could be drawn up on which all the details of the horse, particular injury sustained, limb involved, date of race, racetrack and location on track where the injury occurred can be noted by the official NHA track veterinarian. These details could then be added to the horse's normal racing history in the NHA database.

Methods evaluating limbs at the racetrack:

With modern portable digital radiograph machines being widely available the use of them for diagnosing injuries at the racetrack would allow for real time imaging of the injury. While this would allow the NHA track vet to make a more accurate diagnosis of the injury it is not a realistic possibility when the racetrack veterinarian has to deal with the injured horse on the racetrack.

Post mortem investigations:

A limitation on this study was that not all the horses that sustained a CMI on one of the four Gauteng racetracks had their affected limb submitted for a post mortal investigation. Only those with a suspected CMI pertaining to the suspensory apparatus or major fracture were forwarded. It is important that all CMIs are investigated so that accurate risk factors can be identified so as to help reduce the incidence of CMIs. Injuries involving the distal limbs are easily identifiable and only require a brief post-mortal evaluation focusing on the region involved but those CMIs positioned further proximally e.g. the pelvis, may require a more extensive examination to establish the extent of pathology. It is clear that most CMIs are not of an acute nature but are the result of remodelling of the bone which takes place enabling the horse to adapt to different strains and stresses placed on the limbs that are very specific for racing [39, 40, 59, 61].

5.6 Future use of the study

In order for the incidence rates of CMIs to remain low, further research is required into predicting with a larger degree of accuracy, which individuals are at significant risk of sustaining a CMI and also reviewing the density of the bones in particular the areas surrounding the fracture bed by the use of densitometry, CT, and/or bone ash evaluation. For this to occur as many limbs as possible should be evaluated, and particularly bilateral limb submission to compare CMI and non-CMI limbs. Institutions internationally around the world are currently working on this and there is the possibility of future collaboration. *In vivo* nuclear bone scintigraphy of the distal limbs after so many starts, may also shed a great deal of light on the pathogenesis and progress of the adaptation of bones in racing Thoroughbred horses.

Ultimately, whatever strategy is used, research must continue in this field and the cooperation between racing officials and researchers must remain if there are to be new developments and improvements to lower the injury risk to the racehorses.

5.7 Review of the objectives

- The characteristics of catastrophic musculoskeletal injuries leading to immediate euthanasia in racing Thoroughbreds in South Africa were described thoroughly and will be reported on in a peer-reviewed article.
- The overall incidence of catastrophic musculoskeletal injuries in racing Thoroughbreds from the four Gauteng racetrack in South Africa is similar to that reported elsewhere in the world by previous studies.
- Risk factors associated with catastrophic musculoskeletal injuries of the distal forelimb in racing Thoroughbreds in South Africa were similar but not identical to those reported in other countries.
- The left forelimb is the limb most frequently involved in catastrophic musculoskeletal injuries in South African racehorses, similar to what has been reported in other countries.

Chapter 6: Conclusion

The following conclusions were deduced from this study:

- The overall incidence of CMI in flat racing Thoroughbreds is similar to that reported elsewhere in the world.
- The left forelimb is the most frequently involved in CMI.
- The CMI occurred unilaterally, almost exclusively.
- Damage to the forelimb suspensory apparatus is the predominant CMI observed.
- Fractures of the proximal sesamoid bones represent the most common CMI fracture.
- Most CMIs occurred over distance of 1300 - 1800m.
- Age of horse, distance of race, gender, age of horse at its first race, number of previous starts do not have a significant association on the left or right limb being injured, if the PSB fracture is uniaxial or biaxial or if the fracture is comminuted or not. The only exception to this, was that horses racing over short distances (<1200m), had a greater chance of obtaining a biaxial PSB fracture.

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Appendix A

List of data obtained for each horse from the National Horseracing Authority of Southern Africa

- Horse's number
- Horse's racing name
- Horse's age when it ran its first race
- Horse's age when it ran its last race
- Horse's gender
- Date of last race
- Date of previous race prior to last
- Racetrack at which it ran its last race
- Distance of last race
- Distance of previous race prior to its last
- Track type on which last race was run on
- Ground conditions of racetrack prior to racing
- Horse's starting position
- Field size
- Weight of jockey at its last race
- Number of starts horse had in its career
- On site veterinarian's initial diagnosis and report

Appendix B

Group 1 – Horse identification of all horses that suffered a CMI on the four Gauteng racetracks from 1998-2012 (Total: 114)

CMI no.	Horse's name	Date fo CMI	Racetrack	Limb Affected	Area Affected	Comment
1	French Kiss	15/11/1998	Gosforth Park	LF	Sesamoids	Compound #
2	Planet News	17/11/1998	Newmarket	LF	Sesamoids	Compound #
3	Sprightly Step	15/12/1998	Newmarket	RF	Sesamoids	Compound #
4	Signor Grande	12/01/1999	Newmarket	LF	Knee	#
5	Danzair	06/06/1999	Turffontein	RF	Knee	#
6	Fast Count	20/06/1999	Turffontein	RF	Cannon	Compound #
7	Burne's Lake	05/08/1999	Vaal	LF	Sesamoids	Biaxial #
8	Byron	12/09/1999	Vaal	LF	Sesamoids	Comminuted #
9	Jallianda	26/09/1999	Turffontein		Pelvis	#
10	Ace of Hearts	12/10/1999	Newmarket	LF	Sesamoids	Biaxial #
11	Stage Bouquet	07/03/2000	Newmarket	LF	Sesamoids	Biaxial #, comminuted
12	House on the hill	07/03/2000	Newmarket	RF	Sesamoids	Biaxial #, comminuted
13	Gold Planner	25/09/2000	Turffontein	RF	Sesamoids	Comminuted #
14	Meddler	30/09/2000	Turffontein	LF	Sesamoids	Biaxial #, comminuted
15	Sublime Sky	19/10/2000	Newmarket	LH	Fetlock & cannon	Sub-luxation
16	Allied Prince	06/01/2001	Gosforth Park	LF	Fetlock	Luxation, Biaxial #
17	Excalibur	24/02/2001	Turffontein	LF	Fetlock	Biaxial #, comminuted
18	Confidential	11/03/2001	Turffontein	LF	Fetlock	Medial #
19	Surf the Net	16/04/2001	Turffontein	RF	Sesamoids	Medial #, comminuted
20	Gold Spinner	12/05/2001	Gosforth Park	LF	Sesamoids	Biaxial #, comminuted
21	Mister Morse	18/08/2001	Turffontein	LF	Sesamoids	Biaxial #, comminuted
22	Boy's Brigade	19/01/2002	Gosforth Park	LF	Sesamoids	Medial #, comminuted
23	Settler City	09/02/2002	Newmarket	LF	Knee	Comminuted #
24	Peak Power	30/03/2002	Turffontein	LF	Sesamoids	Biaxial #
25	Courting Justice	02/04/2002	Vaal	LF	Knee	#
26	Northern Darling	25/05/2002	Newmarket		Pelvis	#
27	Richard the First	28/05/2002	Newmarket	RF	Fetlock	Medial #, lat condylr
28	Air Force Club	09/06/2002	Turffontein	LF	Knee	Comminuted #
29	Honeymooner	26/06/2002	Turffontein	LF	Knee	#
30	Katherine Dee	09/07/2002	Vaal	LF	Knee	#
31	Final Krysalis	07/09/2002	Turffontein	LF	Sesamoids	Medial #, comminuted
32	The Convertor	26/09/2002	Vaal	LH	Tibia	#
33	Space Adventure	29/10/2002	Newmarket	RF	Cannon	#
34	Broad Ruler	28/11/2002	Vaal	LH	Cannon	#
35	Opening Title	14/01/2003	Newmarket	LF	Cannon	#
36	Feng shui	23/01/2003	Vaal	LF	Knee	Comminuted #
37	Sebastino	15/02/2003	Turffontein	LH	Pastern	Comminuted #
38	The Boogieman	29/03/2003	Turffontein	LF	Fetlock & sesamoids	Medial #, comminuted, lat condylr
39	Outaspace	14/08/2003	Vaal		Fetlock & sesamoids	Luxation, #
40	Barcelona	27/11/2003	Newmarket	RH	Tibia	#
41	Boris the First	09/03/2004	Newmarket	LH	Cannon & sesamoids	#
42	Lunar Launcher	08/04/2004	Vaal	LF	Sesamoids	Biaxial #, comminuted
43	Kalola	16/05/2004	Turffontein	LF	Knee	#
44	Delta Echo	29/05/2004	Turffontein	LF	Cannon	Compound #
45	Solo Captain	29/05/2004	Turffontein	LH	Tibia	#
46	Big Brother	01/08/2004	Turffontein	RF	Sesamoids	distal sesm ligs
47	Kaduna River	19/08/2004	Vaal	RF	Knee & sesamoids	#
48	Mega VIP	09/09/2004	Vaal	RF	Cannon	#
49	City Life	23/12/2004	Vaal	LF	Sesamoids	Sub-luxation, Biaxial #
50	Winter Fancy	01/01/2005	Turffontein	RH	Pastern	Comminuted #
51	Big Bru	08/01/2005	Turffontein	RF	Sesamoids	Biaxial #
52	Western Summer	26/02/2005	Turffontein			Comminuted #
53	Delilah	26/03/2005	Newmarket	LF	Fetlock	Sub-luxation
54	Astral Beauty	12/05/2005	Vaal	LF	Scapular	#
55	Mitumba	22/05/2005	Turffontein	RF	Knee	#
56	Beauvallet	28/05/2005	Turffontein	LF	Sesamoids	#
57	Shipboard Romance	12/06/2005	Turffontein	RF	Condylar	#, Sub-luxation
58	Kraken	18/06/2005	Turffontein	RF	Knee	#
59	Ettiene's Double	23/06/2005	Vaal	RF	Pastern	#
60	Brock	01/10/2005	Vaal	RF	Pastern	#, Sub-luxation
61	Shoniba	31/10/2005	Turffontein	LF	Sesamoids	Biaxial #
62	Qui Attraction	21/04/2006	Newmarket	LF	Fetlock	Sub-luxation
63	Wottayank	09/05/2006	Newmarket	LF	Sesamoids	Biaxial #
64	Wolf 'em down	16/05/2006	Newmarket	RF	Sesamoids	Comminuted #, luxation
65	Spanish School	16/07/2006	Turffontein	RF	Sesamoids	#
66	Belsive Park	23/11/2006	Vaal	LF	Condylar	# distal cannon
67	Seatle Lagoon	14/03/2007	Vaal	LF	Sesamoids	Biaxial #
68	Christamas Bonus	12/04/2007	Vaal	LF	Sesamoids	Biaxial #
69	National Praise	17/05/2007	Vaal	RF	Sesamoids	Biaxial #
70	Bombani	15/09/2007	Turffontein	LF	Sesamoids	Biaxial #
71	Mr Petal	18/10/2007	Vaal	LH	Femur	Biaxial #
72	Worldwide	02/01/2008	Vaal	LF	Sesamoids	Biaxial #
73	Bold Lazer	03/01/2008	Vaal	LF	Sesamoids	Luxation, Biaxial #
74	Nobule	08/03/2008	Turffontein	LF	Scapular	#
75	Eastern Flame	22/05/2008	Vaal	LF	Cannon	#
76	My Mozart	12/08/2008	Vaal	RF	Condylar	Lat condylr #, Sub-luxation
77	Glandford Hill	01/09/2008	Vaal	LF	Knee	#, Sub-luxation
78	Awesome Double	09/10/2008	Vaal	RF	Condylar & Sesamoids	# med sesm & lat condylr
79	Touch of Africa	25/10/2008	Turffontein		Sesamoids	Biaxial #
80	Galliodor	11/12/2008	Vaal	LF	Sesamoids	Medial #
81	I'm awake	07/02/2009	Turffontein	RF	Fetlock	#, Sub-luxation
82	Sign of Style	21/02/2009	Turffontein	RH	Condylar	#
83	Winter Promise	13/04/2009	Turffontein	RF	Cannon	#
84	Bay Salt	02/07/2009	Vaal		Cannon, Sesamoids & Pastern	#
85	Flaming Torch	02/07/2009	Vaal	LF	Cannon	#
86	Pharaoh's Fortune	26/07/2009	Turffontein	RH	Pastern	#
87	The Sire's Song	26/07/2009	Turffontein	RF	Sesamoids	#
88	Press North	13/10/2009	Vaal	LF	Sesamoids	Biaxial #, luxation
89	El Padrino	07/11/2009	Turffontein	RF	Cannon	Compound #
90	Wie lil' Sally	27/12/2009	Turffontein	RF	Sesamoids	Medial #
91	Trojan	13/03/2010	Turffontein	RF	Sesamoids	Medial #
92	Air Bridge	03/06/2010	Vaal	LF	Knee	Compound #
93	Majestice Idol	03/06/2010	Vaal	LF	Cannon	Compound #
94	Instant Karma	22/06/2010	Vaal	RH	Sesamoids	#
95	Ash for cash	25/11/2010	Vaal	LF	Sesamoids	Biaxial #, luxation
96	Strike a deal	12/12/2010	Turffontein	RF	SA	#
97	Victory Serenade	20/01/2011	Vaal	LF	Sesamoids	Biaxial #
98	Charlatan	26/07/2011	Vaal	LF	Cannon	Comminuted #
99	Discography	30/07/2011	Turffontein	LH	Pastern	#
100	Retempo	13/08/2011	Turffontein	LF	Condylar & sesamoids	Lat Condylr, comminuted psb #
101	De la patrie	18/03/2011	Vaal	LH	Sesamoids	#
102	Divine Mercy	01/10/2011	Turffontein	RF	Sesamoids	Biaxial #, luxation
103	Silver Bull	03/11/2011	Vaal	RF	Sesamoids	#
104	Goddess of Peace	11/11/2011	Turffontein	LF	Sesamoids	Medial #
105	Fort Petersburg	26/11/2011	Turffontein	LF	Sesamoids	Biaxial #
106	Earl de Grey	20/12/2011	Turffontein	LF	Sesamoids	Comminuted #
107	Running Rogue	12/01/2012	Vaal	LF	Sesamoids	Comminuted #
108	Stake the Claim	17/03/2012	Turffontein	RF	Sesamoids	#
109	First up	22/03/2012	Vaal	LF	Pastern	#
110	Grey Goose	15/04/2012	Turffontein	RF	Sesamoids	Biaxial #, sub-luxation
111	Grey Poet	24/04/2012	Vaal	LF	Cannon	Comminuted #
112	Barracus	05/05/2012	Turffontein	LF	Sesamoids	Biaxial #, sub-luxation
113	George Cross	05/05/2012	Turffontein	LF	Sesamoids	Comminuted #
114	Cruella	26/05/2012	Turffontein	LF	SA	

Key: [green box] = Horses of Group 2 (Total: 52)

Appendix C

Group 2 – Horse identification and relevant racing history for 52 horses from the National Horseracing Authority of Southern Africa

	Horse details			Racing History			Injury details																		Racetrack details				
CMI no.	HOERSE NAME or ID	Age (yrs)	Gender	Total no. of previous starts	Age at 1st race (months)	Days since previous race	Date of CMI	Limb affected	uniaxial psb #	biaxial psb #	apical #	midbody #	basal #	axial #	abaxial #	comminuted #	distal sesamoidean lig	condylar #	Proximal P1 #	MC3 #	subluxated MCP J	luxated MCP J	open #	closed #	Racecourse	Track type	Track condition	Distance (m)	Jockey Weight (kg)
A	ELUSIVE GUEST	3	Gelding	7	29	14	31/03/1998	RF		•	L	M				L								•	Newmarket	Turf	Firm	2400	57
B	SONGANDAPRAYER	3	Colt	2	25	14	30/06/1998	LF		•	L	M												•	Gosforth Park	Turf	Good	1600	54.5
7	BURNE'S LAKE	2	Filly	12	22	4	05/08/1999	LF		•			ML			L							•		Vaal	Turf	Good	1000	57
8	BYRON	3	Colt	1	34	17	12/09/1999	LF	•			L				L							•		Vaal	Turf	Firm	1700	57
10	ACE OF HEART	2	Colt	0	25	0	12/10/1999	LF		•		ML												•	Newmarket	Turf	Good	800	57
11	STAGE BOUQUET	4	Filly	64	29	2	07/03/2000	LF		•	L	M				B								•	Newmarket	Turf	Soft	2000	54.5
12	HOUSE ON THE HILL	6	Gelding	29	32	7	07/03/2000	RF		•		ML				L								•	Newmarket	Turf	Soft	1300	56.5
13	GOLD PLANNER	9	Gelding	70	31	23	25/09/2000	RF	•				L			L								•	Turfontein	Turf	Good	2000	55.5
14	MEDDLER	3	Gelding	2	32	93	30/09/2000	LF		•		M		L		M								•	Turfontein	Turf	Firm	1200	59.5
16	ALLIED PRINCE	2	Colt	3	23	13	06/01/2001	LF		•	L	M										•	•		Gosforth Park	Turf	Good	1000	57
17	EXCALIBER	3	Gelding	4	31	42	24/02/2001	LF		•		ML				B								•	Turfontein	Turf	Soft	1000	59.5
18	CONFIDENTIAL	3	Gelding	7	30	23	11/03/2001	LF	•						M									•	Turfontein	Turf	Good	1400	55.5
19	SURF THE NET	3	Mare	17	27	18	16/04/2001	RF	•		M					M								•	Turfontein	Turf	Good	2450	57
20	GOLD SPINNER	3	Gelding	10	39	20	12/05/2001	LF		•		ML				L								•	Gosforth Park	Turf	Good	1000	59.5
21	MISTER MORSE	3	Gelding	5	29	34	18/08/2001	LF		•		L	M			L								•	Turfontein	Turf	Good	1200	56
22	BOY'S BRIGADE	3	Gelding	2	40	19	19/01/2002	LF	•			M				M								•	Gosforth Park	Turf	Good	1600	54
24	PEAK POWER	3	Gelding	13	32	18	30/03/2002	LF		•	L	M											•		Turfontein	Turf	Good	1400	60
27	RICHARD THE FIRST	4	Gelding	45	31	12	28/05/2002	RF	•			M				M		L					•		Newmarket	Turf	Good	1600	60
31	FINALLY KRYSALIS	6	Mare	53	35	7	07/09/2002	LF	•				M			M								•	Turfontein	Turf	Good	1600	58
38	THE BOOGIEMAN	3	Colt	10	29	21	29/03/2003	LF	•			M				M		L					•		Turfontein	Turf	Good	1800	57
42	LUNAR LAUNCHER	3	Gelding	1	38	123	08/04/2004	LF		•		L	M			M								•	Vaal	Turf	Good	1300	58
46	BIG BROTHER	6	Gelding	7	44	51	01/08/2004	LF									•							•	Turfontein	Turf	Good	1600	56.5
49	CITY LIFE	5	Gelding	26	39	24	23/12/2004	LF		•		ML				ML					•		•		Vaal	Sand	Good	2000	53
51	BIG BRU	3	Gelding	12	30	11	08/01/2005	RF		•		ML				M								•	Turfontein, Outside track	Turf	Good	1160	60
60	BROCK	5	Gelding	33	31	55	01/10/2005	LF									•				•			•	Vaal	Turf	Good	2400	52
60	BROCK	5	Gelding	33	31	55	01/10/2006	RF									•		•					•	Vaal	Turf	Good	2400	52
61	SHONIBA	4	Filly	25	29	80	31/10/2005	LF		•		ML												•	Turfontein, Inside track	Turf	Good	1200	55
63	WOTTAYANK	4	Gelding	21	37	18	09/05/2006	LF		•		ML				L								•	Newmarket	Turf	Good	1200	51
64	WOLF 'EM DOWN	3	Gelding	9	34	15	16/05/2006	RF		•		L	M			M						•	•		Newmarket	Turf	Good	1600	50.5
65	SPANISH SCHOOL	5	Gelding	14	35	19	16/07/2006	RF	Incorrect leg submitted																Turfontein Standside track	Turf	Good	1600	49
67	SEATTLE LAGOON	3	Gelding	9	31	31	14/03/2007	LF		•		L	M											•	Vaal	Turf	Good	1400	58
68	CHRISTMAS BONUS	3	Colt	10	47	6	12/04/2007	LF		•		L	M											•	Vaal	Sand	Good	1400	55
69	NATIONAL PRAISE	3	Filly	7	40	32	17/05/2007	RF		•		ML												•	Vaal	Turf	Standard	1200	56.5
70	BOMBANI	4	Gelding	18	31	4	15/09/2007	LF		•		M	L											•	Turfontein, Standside track	Turf	Good	1800	56.5
72	WORLDWIDE	4	Gelding	20	36	17	02/01/2008	LF		•		ML												•	Vaal	Turf	Good	1400	58.5
73	BOLD LASER	5	Gelding	17	41	48	03/01/2008	LF		•		ML				ML						•	•		Vaal	Sand	Good	1600	60
76	MY MOZART	5	Gelding	15	37	24	12/08/2008	RF										L			•		•		Vaal	Sand	Standard	1600	54.5
78	AWESOME DOUBLE	4	Gelding	6	37	158	09/10/2008	RF	•			M						L					•		Vaal	Sand	Standard	1600	56
88	PRESS NORTH	4	Gelding	7	40	12	13/10/2009	LF		•		ML										•	•		Vaal	Sand	Standard	1000	57
90	WIE LIL' SALLY	3	Filly	5	34	34	27/12/2009	RF	•			M												•	Turfontein, Standside track	Turf	Soft	1600	58
95	ASH FOR CASH	5	Mare	15	34	6	25/11/2010	LF		•		ML										•	•		Vaal	Turf	Good	1000	62
97	VICTORY SERENADE	3	Gelding	20	27	22	20/01/2011	LF		•		L	M											•	Vaal	Sand	Standard	1450	59
98	CHARLATAN	3	Gelding	2	42	69	26/07/2011	LF								•				•			•		Vaal	Sand	Standard	1000	60
100	RETEMPO	3	Gelding	5	30	24	13/08/2011	LF		•	L					M		L					•		Turfontein, Standside track	Turf	Good	1400	55.5
102	DEVINE MERCY	4	Filly	4	45	13	01/10/2011	RF		•		ML										•	•		Turfontein, Inside track	Turf	Good	1800	60
104	GODDESS OF PEACE	3	Filly	7	30	23	11/11/2011	LF	•			M												•	Turfontein, Standside track	Turf	Good	1400	58
105	FORT PETERSBERG	5	Gelding	27	35	31	26/11/2011	LF		•		L	M											•	Turfontein, Standside track	Turf	Good	3200	55
106	EARL DE GREY	3	Gelding	8	34	41	10/12/2011	LF		•	L		M			M								•	Vaal	Sand	Good	2600	53
107	RUNNING ROGUE	4	Filly	27	31	43	12/01/2012	LF		•		ML				M								•	Vaal	Sand	Standard	1450	52.5
110	GREY GOOSE	3	Gelding	7	29	21	15/04/2012	RF		•	L	M					•				•		•		Turfontein, Inside track	Turf	Good	1800	52.5
111	GREY POET	4	Gelding	21	34	39	24/04/2012	LF		•	L	M				ML		L	•	•	•		•		Vaal	Sand	Rain affected	1000	54.5
112	BARRACUS	3	Gelding	13	36	12	05/05/2012	LF		•	M		L		ML						•		•		Turfontein, Standside track	Turf	Good	2450	60
113	GEORGE CROSS	5	Gelding	23	35	13	05/05/2012	LF	•			M				M								•	Turfontein, Standside track	Turf	Good	2450	59

Key: [blue box] = Limbs 1 - 22 that were from a previous study [51]

[white box] = Limbs 23 - 53 that were analysed in this study

Groupings:

- Age (years) - A: 1-3, B: 4-6, C: 7<
- No. of previous starts - Low: 0-15, Intermediate: 16-30, High: 31<
- Age at 1st race (months) – Category 1: <24, Category 2: 25-36, Category3: >37
- Days since previous race – Category 1: 0-30, Category 2: 31-60, Category 3: 61-90, Category 4: 91<
- Distance – Sprint: <1200m, Mile: 1300-1800m, Intermediate: 1801-2200m, Long: 2400m<
- Jockey weight – Category 1: <55kg, Category 2: 56-60kg, Category3: >61kg

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: City Life   Date: 22/05/2013

CMI no.: 49

History: 29/08/2003 – lame
12/09/2003 – short in stride on LF post-race
10/05/2004 – lame in LF prior to race (scratched)
19/07/2004 – scratched from race due to injury of LH

Articular fracture	X
Non-articular	

Open fracture	X
Closed fracture	
Displaced	X
Non-displaced	

Proximal metacarpus		
Mid metacarpus		
Distal metacarpus		
Proximal sesamoid bones	X	
Proximal phalanx 1		
Phalanx 2		
Phalanx 3		
Other		

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base	
Midbody – transverse (medial & lateral)	X
Apex	
Abaxial	
Axial	
Comminuted	X

Report

Medial MCIII condyle	
Lateral MCIII condyle	

DPa view:
Mild soft tissue swelling around MCP joint with gas accumulation s/c
Medial PSB: Complete transverse midbody fracture with comminution of basal fragment into multiple pieces. Apical fragment markedly displaced proximally.
Lateral PSB: Complete oblique midbody fracture with comminution of apical fragment into multiple pieces. Apical fragment markedly displaced proximally.

LM view:
Gas accumulation intra-articularly and interdigital flexor tendon sheath.
Multiple small mineralised chip fragments in vicinity of PSBs

DLPaM Oblique view:
Subluxation of MCP joint
PSBs displaced approx. 35mm proximally
DMPaL Oblique view:
Same as above

Dx
Open LF MCP subluxation with biaxial midbody and comminuted PSB fractures.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Big Bru   Date: 22/05/2013

CMI no.: 51

History: 21/07/2004 – Injury to knee of RF, lame

Articular fracture	X
Non-articular	

Open fracture	
Closed fracture	X
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	X
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base	
Midbody – oblique (lateral) - Transverse (medial)	X
Apex	
Abaxial	
Axial	
Comminuted (medial)	X

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Mild soft tissue swelling around MCP
Lateral PSB: Complete oblique displaced midbody fracture. Apical fragment displaced proximally. Fracture gap = 12.0mm
Medial PSB: Complete transverse displaced midbody fracture (best seen on DMPaLO) with comminution of the basal fragment into multiple pieces. Apical fragment displaced proximally. Fracture gap = 10.0mm at widest point. Several smaller fragments in vicinity of PSBs
Mild sclerosis of P1 condyles

LM view:
Multiple small mineralised chip fragments palmarly to PSBs
Two large fragments, 10.0x11.5mm and 16.0x10.5mm, located distally to PSB and palmarly to P1 condyle

DLPaM Oblique view:
Same as above

DMPaL Oblique view:
Basal fragment of medial PSB comminuted into several pieces.

Dx
Closed RF biaxial midbody PSB fractures with comminution of basal fragment of medial PSB.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Brock   Date: 24/05/2013

CMI no.: 60 (LF)

History: No previous history of lameness

Articular fracture	
Non-articular	

Open fracture	
Closed fracture	
Displaced	
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	
Lateral proximal sesamoid bone	
Base	
Midbody	
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Moderate soft tissue swelling around MCP joint
Both sesamoids intact. Displaced markedly proximally due to rupture of distal sesamoidean ligaments
Sclerosis of proximally P1
LM view:
Subluxation of P1 joint palmarly
Multiple mineralised chip fragments palmar-o-proximal to MCP joint
Clubbing of basal points of PSB – early DJD

DLPaM Oblique view:
Same as above
DMPaL Oblique view:
Same as above

Dx
Closed subluxation of LF with rupture of distal sesamoidean ligaments biaxially. Early mild DJD.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Brock	Date: 24/05/2013
CMI no.: 60 (RF)	
History: No previous history of lameness	

Articular fracture	
Non-articular	X

Open fracture	
Closed fracture	X
Displaced	
Non-displaced	X

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	
Proximal phalanx 1	X
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	
Lateral proximal sesamoid bone	
Base	
Midbody	
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	X
Lateral MCIII condyle	

Report

DPa view:
Mild soft tissue swelling around MCP joint
PSBs displaced 15.0mm proximally but intact.
Due to rupture of distal sesamoidean ligaments

LM view:
Gas in digital flexor tendon sheath
Two mineralised chip fragments dorsoproximal to P1 condyles
Multiple mineralised fragments distal to PSBs
Slight flattening of MC3 condyle
Mild osteophytic clubbing of basal PSBs.
DLPaM Oblique view:
Dorso-medial proximal P1 triangular 9x7mm minimally displaced fragment with associated smaller fragments
Prominent but not widened vascular channels of lateral and medial PSB.
DMPaL Oblique view:
Same as above

Dx
Biaxial Rupture of distal sesamoidean ligaments with chip fracture of dorso-medial proximal P1. Biaxial mild proximal sesamoiditis and mild DJD.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Shoniba   Date: 03/05/2012

CMI no.: 61

History: No previous history of lameness

Articular fracture	X
Non-articular	

Open fracture	
Closed fracture	X
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	X
Proximal phalanx 1	X
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base	
Midbody - transverse	X
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Biaxial midbody fractures of PSB. Fracture gap medial = 8.2mm; lateral = 12.2mm.

LM view:
Transverse midbody fracture visible.
Gas visible in digital flexor tendon sheath.
Small chip fragment of dorsal aspect of P1.

DLPaM Oblique view:
Same as above

DMPaL Oblique view:
Same as above

Dx
LF closed biaxial midbody PSB fractures

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Wottayank	Date: 08/04/2013
CMI no.: 63	

History: No previous history of lameness

Articular fracture	X
Non-articular	

Open fracture	
Closed fracture	X
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	X
Proximal sesamoid bones	X
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base	
Midbody	X
Apex	
Abaxial	
Axial	
Comminuted	X

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Medial PSB: Complete transverse displaced mid-body fracture. Apical fragment displaced proximally. Fracture gap = 9.4mm.
Lateral PSB: Comminuted fracture, complete transverse displaced mid-body fragment with a fragment gap of 14.1mm. Apical portion displaced proximally.
Axial fragment off proximal end, displaced 1mm. Vertical to oblique orientated non-displaced fracture apical fragment.

LM view:
Chip fracture on dorsal surface of distal MC3.
Basal fracture line on lateral PSB, 8.2mm. Fragment gap increased to 18.5mm between apical fragments on lateral PSB.
9.0mm by 17.8mm fragment off palmar surface of lateral PSB.
Marked sclerosis palmar condyles

DLPaM Oblique view:
Same as above

DMPaL Oblique view:
Palmar recess fragments. Rest same as above

Dx

LF biaxial PSB fracture. Medial PSB mid-body fracture. Lateral PSB mid-body fracture with comminution. Small osteochondral fragment (chip fracture) visible dorsal to distal metacarpus.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Wolf 'em down Date: 03/05/2013

CMI no.: 64

History: No previous history of lameness

Articular fracture	X
Non-articular	

Open fracture	X
Closed fracture	
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	X
Proximal sesamoid bones	X
Proximal phalanx 1	X
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base	
Midbody - lateral - transverse	X
Apex	
Abaxial	
Axial	
Comminuted - medial	X

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Complete open luxation of metacarpophalangeal joint. Distal MC3 displaced palmarly and laterally. Biaxial PSB fractures. Medial PSB: complete displaced basal fracture. Proximal fragment displaced proximally. Fracture gap = 8.8mm.Sagittal midbody fracture line seen thru proximal fragment. Clearly seen in DLPaMO view.
Lateral PSB: complete displaced midbody fracture that is slightly more oblique. Proximal fragment displaced proximally. Fracture gap = 5.0mm.
Marked sclerosis on condyles.

LM view:
Gas in inter-articular space as well as in tendon sheath.

DLPaM Oblique view:
Complete displaced abaxial fracture of proximally fragment of medial PSB. Fracture gap =1.2mm

DMPaL Oblique view:
Same as above.

Dx: RF Complete open luxation of MC3 palmarly and laterally. Biaxial PSB fractures. Medial PSB comminuted fracture and lateral PSB midbody fracture.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Spanish School   Date: 15/05/2013

CMI no.: 65

History: No previous history of lameness

Articular fracture	
Non-articular	

Open fracture	
Closed fracture	
Displaced	
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	
Lateral proximal sesamoid bone	
Base	
Midbody	
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:

LM view:

DLPaM Oblique view:

DMPaL Oblique view:

Dx: No catastrophic injury, incorrect limb sent.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Seattle Lagoon   Date: 07/05/2013

CMI no.: 67

History: No previous history of lameness

Articular fracture	X
Non-articular	

Open fracture	
Closed fracture	X
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	X
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base (medial)	X
Midbody (lateral)	X
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Complete transverse displaced distal midbody lateral PSB fracture. Apical fragment displaced mildly proximally. Fracture gap = 3.7mm.
Small amount of sclerosis seen on both condyles.
Loss of radiolucency of medial condyle edge and edge of PSB.
Mild soft tissue swelling.
Medial PSB: minimally displaced transverse basilar # - indistinctly seen.

LM view:
Mild soft tissue swelling around joint
Bony changes similar to above.

DLPaM Oblique view:
Same as above, but medial PSB fracture more distinct.

DMPaL Oblique view:
Medial PSB: Complete transverse displaced basal fracture. Basal fragment displaced moderately.
Fracture gap = 3.9m
All fracture edges crisp.

Dx:
LF closed displaced biaxial PSB fractures. Midbody fracture of lateral PSB. Basal fracture of medial PSB.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Christmas Bonus Date: 10/05/2013

CMI no.: 68

History: No previous history of lameness

Articular fracture	X
Non-articular	

Open fracture	
Closed fracture	X
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	X
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base – transverse (medial)	X
Midbody – oblique (lateral)	X
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Lateral PSB: Complete displaced oblique midbody fracture. Apical fragment displaced proximally. Fracture gap = 7.0mm. Small fragments in vicinity.
Medial PSB: Complete displaced transverse basilar fracture. Apical fragment displaced proximally. Fracture gap = 3.0mm

LM view:
Mild soft tissue swelling.
2x1mm osteophyte dorsal proximal P1.

DLPaM Oblique view:
Same as above

DMPaL Oblique view:
Same as above

Dx
Closed LF Biaxial PSB fracture. Basilar fracture of medial PSB and midbody fracture of lateral PSB.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: National Praise Date: 07/05/2013

CMI no.: 69

History: No previous history of lameness

Articular fracture	X
Non-articular	

Open fracture	
Closed fracture	X
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	X
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base	
Midbody - transverse	X
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Biaxial midbody fractures of PSB.
Medial PSB: Complete transverse displaced midbody fracture. Apical fragment displaced proximally. Fracture gap =15.0mm
Lateral PSB: Complete obliquely transverse proximally displaced midbody fracture that is slightly more oblique. Apical fragment displaced proximally. Fracture gap = 7.8mm
Chip fragment seen off lateral condyle.
Marked soft tissue swelling around metacarpophalangeal (MCP) joint.

LM view:
Gas present in digital flexor tendon sheath and MCP joint.
Dorsally at proximal aspect of sagittal ridge the MC3 has a moderate concavity (possible synovial pad hyperplasia). At least 2 bony fragments dorsally.
Chip fragment seen in flexed view, dorsally to distal sagittal ridge of MC3.

DLPaM Oblique view:
Multiple chip fragments seen around proximal fragment of lateral PSB.

DMPaL Oblique view:
Same as above

Dx:
RF closed biaxial midbody PSB fractures with smaller associated bony fragments. Possible early synovial pad hypoplasia.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Bombani Date: 15/05/2013

CMI no.: 70

History: No previous history of lameness

Articular fracture	X
Non-articular	

Open fracture	
Closed fracture	X
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	X
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base – oblique (lateral)	X
Midbody – transverse (medial)	X
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Medial PSB: Complete transverse displaced mid-body fracture. Apical fragment displaced proximally. Fracture gap = 6.0mm.Lateral PSB suspect transverse basilar fracture.
Loss of lucency

LM view:
Moderate soft tissue swelling with gas lucencies proximal aspect proximal palmar recess MCP and a few distally in distal palmar recess.
Mildly club-shaped apices of both PSBs - early DJD.

DLPaM Oblique view:
Lateral PSB: Complete oblique displaced basilar fracture - 9mm fracture gap. Apical fragment displaced proximally Rest same as above

DMPaL Oblique view:
Same as above

Dx
LF closed biaxial PSB fracture. Midbody fracture of medial PSB and basal fracture of lateral PSB. Possible early signs of DJD.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Worldwide   Date: 30/04/2013

CMI no.: 72

History: No previous history of lameness

Articular fracture	X
Non-articular	

Open fracture	
Closed fracture	X
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	X
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base	
Midbody - transverse	X
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Biaxial midbody fractures of PSB.
Medial PSB's fracture further distal than that of the lateral PSB. Fracture gap medial = 5.5mm; lateral = 12.1mm.

LM view:
Multiple inter-articular fragments palmarly.
Transverse midbody fracture visible.
Marked sclerosis on palmer condyles

DLPaM Oblique view:
Same as above

DMPaL Oblique view:
Same as above

Dx:
LF closed biaxial midbody PSB fractures.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Bold Laser	Date: 24/05/2013
CMI no.: 73	
History: 18/05/2006 – Scratched, lame in RF due to jarring of knee	

Articular fracture	X
Non-articular	

Open fracture	X
Closed fracture	
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	X
Proximal sesamoid bones	X
Proximal phalanx 1	X
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base	
Midbody – transverse (medial) - Oblique (lateral)	X
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Gas accumulation intra-articular and subcutaneously.
Mild soft tissue swelling around MCP joint
Subluxation of MCP joint. Medially concave angulation.
Medial PSB: Complete transverse midbody fracture with comminution of basal fragment into at least two pieces (17x7.5m). Apical fragment displaced proximally. Fracture gap = 14mm
Lateral PSB: Complete oblique midbody fracture with markedly comminuted apical fragment displaced proximally. Fracture gap = 18.5mm

LM view:
Gas in digital flexor tendon sheath
Multiple mineralised chip fragments in vicinity of PSBs

DLPaM Oblique view:
Same as above

DMPaL Oblique view:
Same as above

Dx
Open subluxation of LF MCP with biaxial midbody PSB fractures with biaxial severe comminution.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: My Mozart   Date: 08/04/2013

CMI no.: 76

History: No previous history of lameness

Articular fracture	X
Non-articular	

Open fracture	X
Closed fracture	
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	X
Proximal sesamoid bones	
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	
Lateral proximal sesamoid bone	
Base	
Midbody	
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	X

Report

DPa view:
Marked soft tissue swelling with loose skin/tendon/IOM branch. Fascial and intraocular gas.
Open complete oblique displaced lateral condylar fracture involving the distal MC3 RF.
The fracture arises just parasagittal to the sagittal ridge articularly laterally. The fracture line continuous proximally and exits the lateral cortex at a height of about 75.5mm from the articular surface.
Lateral condylar fragment is triangular in shape with a sharp proximal point. The fragment is 75.5 mm in length and displaced abaxially by 5.6mm.
The fracture bed on the remaining cortex has an irregular but sharp border.
The lateral PSB is superimposed over its distal aspect and appears to be intact.
The medial PSB also appears to be intact but is displaced medially from normal position.

LM view:
Triangular like mottled appearance of distal MC3 mainly over central of MC3 = fracture bed. Medial PSB displaced palmarly. Increased space in metacarpophalangeal joint of 7.7mm

DLPaM Oblique view:
Joint shows subluxation. MC4 distally fractured dorsally.

DMPaL Oblique view:
Same as above

Dx
Recent complete compound lateral condylar fracture of MC3. Luxation of medial PSB. Subluxated MCP joint. SRBI condyles.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Awesome double   Date: 30/04/2013

CMI no.: 78

History: One previous record of lameness in RF limb. Scratched from race.

Articular fracture	X
Non-articular	

Open fracture	X
Closed fracture	
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	X
Proximal sesamoid bones	X
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	
Base	
Midbody - transverse	X
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	X

Report

DPa view:

Marked soft tissue swelling on medial side and inter-articular gas.

Open complete oblique displaced lateral condylar fracture involving the distal MC3 RF. The fracture arises just parasagittal to the sagittal ridge on its lateral side. The fracture line continues proximally and exists the lateral cortex at a height of about 91.2mm from the articular surface. Lateral condylar fragment is triangular in shape with a very sharp proximal point. The fragment is 91.2mm in length and displaced abaxially by 3.0mm. The fracture bed on the remaining cortex has a sharp border.

The lateral PSB is superimposed over its distal aspect and appears to be intact.

The medial PSB has a complete transverse displaced midbody fracture. Apical fragment displaced proximally. Fracture gap = 12.2mm

Marked sclerosis on condyles

LM view:

Triangular like mottled appearance of distal MC3 mainly over central of MC3 = fracture bed.

Multiple small inter-articular fragments dorsally and palmarly.

Gas in digital flexor tendon sheath

DLPaM Oblique view:

Same as above

DMPaL Oblique view:

Same as above

Dx

RF Open complete compound lateral condylar fracture of MC3. Midbody fracture of medial PSB. SRBI condyles.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Press North Date: 22/05/2013

CMI no.: 88

History: Two prior incidence of lameness: 31/03/2009 – Bruised sole
11/07/2009 – Lame on way up to start

Articular fracture	X
Non-articular	

Open fracture	X
Closed fracture	
Displaced	
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	X
Proximal sesamoid bones	X
Proximal phalanx 1	X
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base	
Midbody	
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Gas accumulation intra-articularly and subcutaneously.
P1 luxated medially to MC3with over riding 41mm but moves when limb is manipulated for positioning.
All condyles are intact
Medial PSB: transverse basilar fracture, only basal fragment present
Lateral PSB: complete oblique midbody fracture. Apical fragment missing.
LM view:
Moderate soft tissue swelling and severe soft tissue damage
Gas accumulation in distal end of digital flexor tendon sheath
Complete luxation of MCP joint with MC3 displaced palmaro-distally.
Multiple small body chip fragments present
DLPaM Oblique view:
Same as above

DMPaL Oblique view:
Same as above

Dx
Complete open luxation of LF with biaxial midbody PSB fractures.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Wie lil' Sally   Date: 07/05/2013

CMI no.: 90

History: No previous history of lameness.

Articular fracture	X
Non-articular	

Open fracture	
Closed fracture	X
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	X
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	
Base	
Midbody – oblique	X
Apex	
Abaxial	
Axial	
Comminuted	

Report

Medial MCIII condyle	
Lateral MCIII condyle	

DPa view:
Medial PSB: Complete displaced slightly oblique midbody fracture
An additional 13x10mm axial fragment is displaced proximally and laterally. Fracture gap at widest point = 6.5mm.
Lateral PSB: Appears WNL.
Sclerosis of proximal P1 condyles.

LM view:
Slight concavity seen dorsally at proximal aspect of sagittal ridge the MC3. (Possible beginnings of synovial pad hyperplasia).
Multiple small chip fragments palmarly to PSBs.
Thin radiolucent line seen running parallel to mid metacarpus, possible gas accumulation in tendon sheath.
Mild soft tissue swelling

DLPaM Oblique view:
Same as above
DMPaL Oblique view:
Same as above
Dx:
RF Closed midbody fracture of medial PSB with several smaller fragments. Possible beginnings of synovial pad hypoplasia. Sclerosis of condyles.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Ash for cash   Date: 10/05/2013

CMI no.: 95

History: Extensive lameness history.
22/01/2009 pulled muscle in near hind limb
23/05/2009 lame in hind limb, post-race
09/08/2009 lame in LF limb, post-race
08/10/2009 post race distress

Articular fracture	X
Non-articular	

Open fracture	X
Closed fracture	
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	X
Proximal sesamoid bones	X
Proximal phalanx 1	X
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base	
Midbody (medial & lateral)	X
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Gas accumulation intra-articularly and subcutaneously.
P1luxated laterally to MC3 with overriding 51mm
All condyles appear to be intact.
Complete transverse displaced medial and lateral PSB mid-body fracture.
Multiple smaller fragments in vicinity. Apical fragment of lateral PSB missing as well as basal fragment of medial PSB.

LM view:
Gas accumulation in digital flexor tendon sheath
Complete luxation of MCP joint with MC3 displaced palmaro-distally

DLPaM Oblique view:
Same as above

DMPaL Oblique view:
Same as above

Dx

LF complete open luxation of MCP joint with biaxial mid-body PSB fractures and absence of parts of the PSBs.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Victory serenade   Date: 30/04/2013

CMI no.: 97

History: No previous history of lameness

Articular fracture	X
Non-articular	

Open fracture	
Closed fracture	X
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	X
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base - medial	X
Midbody – lateral - transverse	X
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Medial PSB: Complete displaced basal fracture. Apical fragment displaced proximally. Fracture gap = 5.0mm
Lateral PSB: Complete transverse displaced midbody fracture. Apical fragment displaced proximally. Fracture gap = 5.8mm

LM view:
Marked sclerosis on condyles.
Inter-articular fragments palmarly

DLPaM Oblique view:
Same as above

DMPaL Oblique view:
Same as above

Dx

LF closed biaxial PSB fracture. Medial PSB basal fracture. Lateral PSB midbody fracture.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Charlatan	Date: 15/05/2013
CMI no.: 98	

History: 17/05/2011 – Lame in both forelimbs and thus scratched from race

Articular fracture	
Non-articular	X

Open fracture	X
Closed fracture	
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	X
Distal metacarpus	X
Proximal sesamoid bones	
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	
Lateral proximal sesamoid bone	
Base	
Midbody	
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Gas accumulation subcutaneously.
Severely comminuted fracture of mid-diaphysis of MC3 as well as additional comminuted fractures of proximal diaphysis (one hairline fracture visible) and abnormal alignment / angulation of the bone.
Complete displaced transverse fracture of distal MC3. Fracture gap multiple sizes.
Multiple fragments around fracture with large fragment (51 x 13mm) on lateral side proximally to PSBs.
All fracture lines are crisp.
PSBs are intact

LM view:
Mild soft tissue swelling
Mildly club-shaped apices of both PSBs - early DJD.

DLPaM Oblique view:
Same as above

DMPaL Oblique view:
Same as above

Dx: Open LF comminuted fracture of mid MC3. Early signs of DJD.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Retempo	Date: 09/05/2013
CMI no.: 100	
History: No previous history of lameness	

Articular fracture	X
Non-articular	

Open fracture	X
Closed fracture	
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	X
Proximal sesamoid bones	X
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base	
Midbody	
Apex - Lateral	X
Abaxial	
Axial	
Comminuted - Medial	X

Medial MCIII condyle	
Lateral MCIII condyle	X

Report

DPa view:
Marked soft tissue swelling and s/c gas medially.
Open complete oblique displaced lateral condylar fracture involving the distal MC3 LF. The fracture arises distally just parasagittal to the sagittal ridge on its lateral side. The fracture line continues proximally and exists the lateral cortex at a height of about 93.5mm from the articular surface. Lateral condylar fragment is triangular in shape with a very sharp proximal point. The fragment is 70.8mm in length and displaced abaxially by 5.5mm with a few mineralised fragments in the vicinity.
The fracture bed on the remaining cortex has a sharp border.
The lateral PSB has an apical fracture – 6.2x9.3mm non-displaced.
The medial PSB has sustained a comminuted fracture - at least 3 large fragments displaced proximally and multiple smaller fragments in vicinity.
Marked sclerosis on condyles proximal P1.
LM view:
Medial PSB: Midbody comminuted fracture.
Multiple small intra-articular fragments dorsally intra-articularly and palmar to PSBs.
Marked amount of gas in digital flexor tendon sheath
5.7mm diameter well-marginated chip fracture dorsoproximomedial aspect P1 – minimally displaced – fracture bed in P1 consistent with size.
DLPaM Oblique view:
Similar to above.
DMPaL Oblique view:
Similar to above

Dx:
LF Open L MC3 condylar fracture and severely comminuted fracture medial PSB. Apical fracture L PSB. Incidental proximal P1 chip fracture.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Devine Mercy Date: 15/05/2013

CMI no.: 102

History: No previous history of lameness

Articular fracture	X
Non-articular	

Open fracture	X
Closed fracture	
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	X
Proximal sesamoid bones	X
Proximal phalanx 1	X
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base	
Midbody-transverse (medial & lateral)	X
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Gas accumulation intra-articularly and subcutaneously
P1 luxated completely laterally to MC3 with overriding 55mm
Complete transverse fractures medial and lateral PSB mid-body, proximal fragments associated with Mc fragment. Multiple smaller fragments in vicinity.
All condyles appear to be intact.

LM view:
Gas accumulation in digital flexor tendon sheath.
Complete luxation of MCP joint with P1 displaced ay region depending on how positioned by radiographer.

DLPaM Oblique view:
Same as above

DMPaL Oblique view:
Additional complete displaced oblique axial fracture of lateral PSB. Fracture gap = 2.5mm. Fragment: 7x4mm

Dx
LF complete open luxation of MCP joint with biaxial mid-body PSB fractures.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Goddess of Peace Date: 09/05/2013

CMI no.: 104

History: No previous history lameness

Articular fracture	X
Non-articular	

Open fracture	
Closed fracture	X
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	X
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	
Base	
Midbody – transverse & sagittal	X
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Transverse abaxially displaced distal midbody fracture of medial PSB.
LM view:
2x1mm mineralised fragment dorsoproximal P1.

DLPaM Oblique view:
Incomplete obliquely sagittal fracture from apex to proximal third of med PSB. Fracture line wide apically – 2mm.

DMPaL Oblique view:
Incomplete fractures of apical fragment of med PSB.

Dx
LF closed transverse midbody fracture of medial PSB with incomplete comminution of apical fragment.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Fort Petersburg   Date: 09/05/2013

CMI no.: 105

History: Horse had one previous incident of lameness in the right forelimb on the 30th September 2012.

Articular fracture	X
Non-articular	

Open fracture	
Closed fracture	X
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	X
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Medial –Basal	X
Lateral – Midbody (transverse)	X
Apex	
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Lateral PSB: Complete transverse displaced midbody fracture. Apical fragment displaced proximally. Fracture gap = 4.9mm. Apical fragment additional oblique incomplete fracture line. Medial PSB: Complete transverse displaced basal fracture. Fracture line is more clearly seen in DLPaMO view.

LM view:
Intra-articular fragments located palmarly and also extra-articular palmar fragments.

DLPaM Oblique view:
Fracture gap of medial PSB basal fracture = 4.7mm. Suspect hairline fracture palmarly. Rest same as above.

DMPaL Oblique view:
Rest same as above.

Dx
LF closed biaxial proximal sesamoid bone fractures. Medial PSB basal fracture. Lateral PSB midbody fracture and incomplete oblique fracture of apical fragment.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Earl de Grey	Date: 09/05/2013
CMI no.: 106	

History: No previous history of lameness

Articular fracture	X
Non-articular	

Open fracture	
Closed fracture	X
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	X
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base - Medial	X
Midbody	
Apex - Lateral	X
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Marked soft tissue swelling around MCP joint.
Medial PSB: Complete comminuted basilar fracture. Proximal fragment is displaced proximally 5.5mm and abaxially.
Lateral PSB: Complete transverse displaced apical fracture. Proximal fragment is displaced proximally 3.3mm smaller apical fragment in vicinity.

LM view:
Multiple small chip fragments palmarly to PSBs.
Osteophyte off of dorsal surface of distal end of MC3.
Bony changes same as above.

DLPaM Oblique view:
Same as above, but medial and lateral PSB fracture more distinct. Medial PSB fracture gap = 4.4mm, Lateral PSB fracture gap = 5.5mm.

DMPaL Oblique view:
Same as above.

Dx
LF closed displaced biaxial PSB fractures. Apical fracture of lateral PSB. Comminuted basal fracture of medial PSB. Inter-sesamoidean (palmar) ligament tear.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Running Rogue　　Date: 08/04/2013

CMI no.: 107

History: No previous history of lameness

Articular fracture	X
Non-articular	

Open fracture	
Closed fracture	X
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	X
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base	
Midbody – transverse (medial) Oblique transverse (lateral)	X
Apex	
Abaxial	
Axial	
Comminuted	X

Medial MCIII condyle	
Lateral MCIII condyle	X

Report

DPa view:
Medial PSB: Complete transverse displaced midbody fracture with mild medial comminution. Apical fragment displaced proximally. Fracture gap = 6.9mm
Lateral PSB: Complete oblique transverse displaced apical fracture. Apical fragment displaced proximally. Fracture gap = 11.1mm
Incomplete axial fracture proximal fragment.

LM view:
Multiple small inter-articular fragments dorsally and palmarly
Intra-articular gas
Gas in digital flexor tendon sheath

DLPaM Oblique view:
Chip fragment off palmarolateral proximal P1. Rest same as above.

DMPaL Oblique view:
Chip fragments on dorsolateral proximal P1. Rest same as above.

Dx
LF biaxial mid-body PSB fractures

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Grey Goose	Date: 09/05/2013
CMI no.: 110	
History: No previous history of lameness	

Articular fracture	X
Non-articular	

Open fracture	X
Closed fracture	
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	X
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base	
Midbody - transverse (medial)	X
Apex (lateral)	X
Abaxial	
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Gas seen intra-articularly and in surrounding soft tissues.
Proximal and lateral subluxation of MCP joint (4.2mm proximal).
Lateral PSB: Complete displaced slightly oblique apical fracture. Fracture gap = 5.0mm. Fracture lines appear sharp and crisp. Proximal fragment is displaced proximally. Distal fragment displaced abaxially. Small fragments in vicinity.
Medial PSB: Complete displaced transverse midbody fracture. Proximal fragment is displaced proximally and angled. Small fragments in vicinity.
LM view:
Marked soft tissue swelling.
Gas in digital flexor tendon sheath and s/c
Bony changes same as above.
DLPaM Oblique view:
Same as above
DMPaL Oblique view:
Medial PSB: Fracture gap = 28.0mm
Rest same as above
Dx
RF open subluxation of MCP joint with displaced biaxial PSB fractures. Midbody fracture of medial PSB. Apical fracture of lateral PSB. Tear in palmar ligament. Collateral ligaments possible torn.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Grey Poet   Date: 10/05/2013

CMI no.: 111

History: No previous history of lameness

Articular fracture	X
Non-articular	X

Open fracture	X
Closed fracture	
Displaced	X
Non-displaced	

Proximal metacarpus	X
Mid metacarpus	X
Distal metacarpus	X
Proximal sesamoid bones	X
Proximal phalanx 1	X
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base	
Midbody -transverse (medial)	X
Apex – oblique (lateral)	X
Abaxial	
Axial	
Comminuted	X

Medial MCIII condyle	
Lateral MCIII condyle	X

Report

DPa view:
Marked gas accumulation in subcutaneous tissue and in the MCP joint.
Open complete displaced oblique proximal diaphyseal MC3 fracture. Fracture gap = 23.5mm at widest point.
Complete displaced sagittal mid MC3 fracture. The fragment is 102mm in length and displaced laterally 5.5mm. Oblique displaced lateral condylar fracture involving the distal MC3 LF. The fracture arises distally just parasagittal to the sagittal ridge on its lateral side. The fracture line continues proximally and exists the lateral cortex at a height of about 95.3mm from the articular surface. Lateral condylar fragment is triangular in shape with a very sharp proximal point. The fragment is 95.3mm in length and displaced abaxially by 5.0mm. The fracture bed on the remaining cortex has a sharp border. Fracture lines are crisp.
Lateral PSB: comminuted 5.7x5mm apical fracture.
Medial PSB: complete displaced transverse midbody fracture with apical fragment comminuted into minimum of three separate fragments and multiple smaller fragments in vicinity. Fracture gap = 16.0mm.
Proximal and lateral subluxation of MCP joint (4.0mm proximal).
LM view:
Marked soft tissue swelling.
Gas accumulation in digital flexor tendon and carpal sheathes.
Small mineralised chip fragments off of dorsal surface of distal MC3
DLPaM Oblique view:
Incomplete hairline fracture of lateral P1 condyle palmarly.
DMPaL Oblique view:
Complete transverse minimally displaced hairline fracture of proximal aspect of lateral condylar fracture fragment. Fracture line 16.5mm in length and displaced 0.5mm at widest point.
Multiple mineralised chip fragments palmarly around medial PSB.

Dx: Open subluxation of the LF MCP with biaxial PSB fractures, apical and comminuted fracture of lateral PSB and midbody and comminuted fracture of medial PSB. Displaced oblique proximal diaphyseal MC3 fracture with a displaced sagittal mid MC3 fracture and an oblique displaced lateral condylar fracture in the distal MC3.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: Barracus   Date: 22/05/2013

CMI no.: 112

History: 01/03/2012 – lame in LF

Articular fracture	X
Non-articular	

Open fracture	X
Closed fracture	
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	X
Proximal sesamoid bones	X
Proximal phalanx 1	X
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	X
Base	
Midbody	
Apex- oblique (medial)	X
Abaxial – oblique (lateral)	X
Axial	
Comminuted	

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Marked soft tissue swelling
Gas accumulation intra-articularly and s/c
Subluxation of MCP joint approximately 4mm medially.

LM view:
Gas in digital flexor tendon sheath
Complete oblique displaced apical fracture of medial PSB with at least two apical fragments up to (8x9mm).
Incomplete hairline fracture of medial PSB.

DLPaM Oblique view:
Medial PSB: at least one abaxial fragment of 24x11mm which is displaced dorsomedially
Lateral PSB: oblique abaxial fracture of lateral PSB with comminution and displaced proximally.

DMPaL Oblique view:
Additionally a minimally displaced basilar fragment 9x9mm seen only on this view.

Dx

Open subluxation of LF MCP with biaxial PSB fractures, apical and abaxial fracture of medial PSB and abaxial and basilar fracture of lateral PSB.

Appendix D

Equine distal limb radiology reports

Equine distal limb fracture radiology report

Patient: George Cross   Date: 10/05/2013

CMI no.: 113

History: Kicked on RH hock in pens before race on 21/04/2012, subsequently scratched.

Articular fracture	X
Non-articular	

Open fracture	
Closed fracture	X
Displaced	X
Non-displaced	

Proximal metacarpus	
Mid metacarpus	
Distal metacarpus	
Proximal sesamoid bones	X
Proximal phalanx 1	
Phalanx 2	
Phalanx 3	
Other	

Medial proximal sesamoid bone	X
Lateral proximal sesamoid bone	
Base	
Midbody - oblique	X
Apex	
Abaxial	
Axial	
Comminuted	X

Medial MCIII condyle	
Lateral MCIII condyle	

Report

DPa view:
Mild soft tissue swelling on medial side of MCP joint.
Completely displaced slightly oblique midbody fracture of medial PSB (foreshortened due to obliquity). Apical fragment fractured into 3 large fragments. Smaller fragments in vicinity.
Lateral PSB intact.

LM view:
Mild soft tissue swelling
Multiple small chip fragments palmarly to PSBs.
Concavity and moderate loss of radiolucency on dorsal surface of distal MC3.
Bone fragment from medial PSB fracture displaced palmarly.

DLPaM Oblique view:
Same as above

DMPaL Oblique view:
Proximal fragment of medial PSB comminuted into three separate fragments. Fragment 1 is 29 x 14mm, fragment 2 = 27 x 11mm and fragment 3 = 12 x 15mm.

Dx: LF closed comminuted midbody fracture of medial PSB.

Appendix E

Equine distal limb dissection reports

<u>CMI no.</u> 51 **<u>Name:</u>: Big Bru**

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	√
Deep Digital Flexor tendon:	4,5cm longitudinal tear; dorsal surface @ level of fetlock
Interosseous medius body and branches:	Medial : Branch √ Lateral: Fibre separation, 16cm long by 2cm wide; 7cm up into body on lateral side
Annular ligament:	9cm oblique tear from medial to lateral 3cm proximally 3cm proximally
Distal Sesamoidean ligaments **Straight:**	√
Oblique:	Medial: 2cm tear palmar surface.; fibre separation Lateral: √
Cruciate:	√
Sesamoidean Collateral ligaments:	Medial: Base fracture with that comminuted Lateral: Oblique
Collateral ligaments of distal interphalangeal joint:	Lateral: √ Medial: 0,5cm tear off distal portion
Palmar ligament:	•Ligament palmar 6cm oblique tear •Scratches on condyles and chips off ridge & condyles
Fracture characterisation:	
General comments:	•No outward signs of injury •Oedema proximal to fetlock

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

CMI no. 61 **Name: Shoniba**

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	√
Deep Digital Flexor tendon:	Stretching of tendons @ distal end of fetlock @ level of abaxial surface of sesamoids 10cm long, 1cm wide tear on medial side of dorsal surface extending through to palmar surface but not through 3cm x 1.5cm
Interosseous medius body and branches:	Body √ Both branch fibres are severely stretched
Annular ligament:	Proximal intact Distal severed on medial side, cone loose – no longer attached
Distal Sesamoidean ligaments **Straight:**	Vertical 3.5cm tear right through. Straining on fibres
Oblique:	Fibres stretched/separated by strain but ligament is intact
Cruciate:	Intact
Sesamoidean Collateral ligaments:	√
Collateral ligaments of distal interphalangeal joint:	√
Palmar ligament:	Horizontal severing
Fracture characterisation:	
General comments:	External cut on medial side of limb distal to fetlock. Oblique 2.4cm x 1.5cm

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

CMI no. 63 **Name:** Wattayank

Common Digital Extensor tendon:	•Intact •No damage •Lateral appear to have fibres stretched
Superficial Digital Flexor tendon:	•Severed distally at the level of the fetlock. •Point of insertion 2.5cm long.
Deep Digital Flexor tendon:	•1cm wide by 3.5 cm long oblique tear @ distal end of fetlock - lateral side. •7cm long tear on dorsal surface on medial side at level of sesamoids. •0.25cm wide by 0.5cm sever in lateral aspect.
Interosseous medius body and branches:	•Medial branch intact •Body intact •Lateral branch badly torn. Fibres stretched.
Annular ligament:	•Lateral distal branch severed & 4cm long oblique tear on lateral aspect. •Proximal annular ligament intact.
Distal Sesamoidean ligaments **Straight:**	3cm Long oblique tear. 1cm Wide
Oblique:	√
Cruciate:	√
Sesamoidean Collateral ligaments:	√
Collateral ligaments of distal interphalangeal joint:	√
Palmar ligament:	√
Fracture characterisation:	
General comments:	•Extensive oedema •Comminuted fracture of sesamoid

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection report

<u>CMI no.</u> 64 **<u>Name:</u> Wolf 'em down**

Common Digital Extensor tendon:	•Common flexor tendon intact but torn loose from bone •Common Flexor tendon laterals but torn loose from bone; • Common Flexor tendon stretching of fibres, torn loose off bone. Subcutaneous tissue connection gone
Superficial Digital Flexor tendon:	√
Deep Digital Flexor tendon:	4cm vertical tears in deep @ level of fetlock on dorsal surface @ fibre stretching & fraying
Interosseous medius body and branches:	•Both branches intact. Fibres shredded and frayed. •15cm vertical tear severed up body from wear branches split. Body stretched. •Lateral branch: 5cm long by 1cm oblique tear
Annular ligament:	Torn loose on lateral side
Distal Sesamoidean ligaments **Straight:**	5cm vertical tear proximal section of Str8; stretched fibres proximal
Oblique:	Lateral fibres stretched
Cruciate:	Severed both
Sesamoidean Collateral ligaments:	Lateral side completely severed Medial: Ash
Collateral ligaments of distal interphalangeal joint:	5cm long x 1cm oblique tear
Palmar ligament:	Distal portion severed
Fracture characterisation:	
General comments:	

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

<u>CMI no.</u> 65 **<u>Name:</u> Spanish School**

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	√
Deep Digital Flexor tendon:	Scratching on dorsal surface @ level of fetlock
Interosseous medius body and branches:	•Body swollen •Medial: Shredded, fibre separation, stretched & severed off. •Lateral: Sever fibre separations & stretching. Shredding
Annular ligament:	√
Distal Sesamoidean ligaments Straight:	√
Oblique:	Medial: stretched Lateral: √
Cruciate:	√
Sesamoidean Collateral ligaments:	√
Collateral ligaments of distal interphalangeal joint:	
Palmar ligament:	Scratches on ridge & condyles
Fracture characterisation:	
General comments:	Mass oedema & swelling

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

CMI no. **67** **Name: Seattle Lagoon**

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	Oblique tear on medial side distal to fetlock joint 2cm long by 0.5cm
Deep Digital Flexor tendon:	•2 x 5cm long longitudinal tears on dorsal surface @ distal end of fetlock joint. •1.5cm long by 1cm wide oblique tear on medial side @ level of superficial tear •4cm longitudinal tear of palmer surface midbody
Interosseous medius body and branches:	Body √ Lateral: 7cm longitudinal right through branch starting @ insertion to the sesamoid and extending proximally Medial: √
Annular ligament:	Oblique tear on lateral side 2cm long Distal torn loose on medial side
Distal Sesamoidean ligaments **Straight:**	2,5c m longitudinal midbody tear
Oblique:	Both √
Cruciate:	Medial : √ Lateral : severed
Sesamoidean Collateral ligaments:	Lateral : √ Medial : Oblique tear at proximal end
Collateral ligaments of distal interphalangeal joint:	
Palmar ligament:	Oblique tear - length of palmar ligament
Fracture characterisation:	
General comments:	Lines on the cartilage of the sagittal ridge

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

CMI no. 68 **Name:** **Christmas Bonus**

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	√
Deep Digital Flexor tendon:	3cm longitudinal tear on dorsal surface @ level of fetlock Stretching of fibres
Interosseous medius body and branches:	Medial branch: √ Lateral: Severe fibre separation, stretching & tearing 12cm tear from attachment of branch to sesamoid proximally, up into lateral side of body. Some fibre separation on lateral side of body
Annular ligament:	1cm wide tear midbody, severing 1cm off of medial attachment. Distal intact. 1cm wide by 3cm long tear from attachment medial side towards lateral
Distal Sesamoidean ligaments **Straight:**	0,5cm longitudinal tear
Oblique:	√ but stretched
Cruciate:	√
Sesamoidean Collateral ligaments:	Lateral: Intact Medial: 1cm oblique tear off distal end
Collateral ligaments of distal interphalangeal joint:	
Palmar ligament:	4,5cm oblique tear Chipping of cartilage off of ridge (palmer surface) also scratches, more distally Lateral sesamoid : midbody fracture Medial: sesamoid abaxial
Fracture characterisation:	
General comments:	

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

CMI no. 69 **Name: National Praise**

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	On medial side @ level of fetlock 12cm long tears (vertical) with fibre separation. Dorsal surface. Not through to palmar
Deep Digital Flexor tendon:	Body √ Damage to dorsal surface Numerous vertical tears 15cm long severing on medial side 1cm wide right off lateral side of tendon 10cm x 0.5cm long severing off dorsal surface
Interosseous medius body and branches:	Body √ Lateral 7cm x 1cm midbody tear just proximal sesamoid Med stretching of fibres and 0.5cm tear @ collateral ligament
Annular ligament:	Torn loose from lateral side Distal √
Distal Sesamoidean ligaments **Straight:**	2,5cm long tear vertically from attachment stretched fibres
Oblique:	√
Cruciate:	1 Attaching to medial sesamoid intact but stretched & fibres separated 1 attached to lateral sesamoid, severed
Sesamoidean Collateral ligaments:	√
Collateral ligaments of distal interphalangeal joint:	Intact lateral side Medial tearing at proximal end
Palmar ligament:	Horizontally severed
Fracture characterisation:	
General comments:	

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

CMI no. 70 **Name:** Bombani

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	•2cm wide oblique tear through on medial side going inwards •4cm longitudinal tear on dorsal surface of lateral side •1cm oblique tear lateral side directly opposite medial tear
Deep Digital Flexor tendon:	•6cm longitudinal tear on palmer surface of medial side. •Severe tearing on dorsal surface. •6cm longitudinal tear on palmer surface of lateral side. •1cm by 4cm oblique tear through
Interosseous medius body and branches:	Body √ Medial : Fibre separation; 2.5cm tear on attachment to sesamoid Lateral: Fibre separation; 1.5cm tear on attachment to sesamoid
Annular ligament:	1cm wide by 3.5cm long tear in distal annular ligament connection to sesamoid on lateral side. Same on medial side
Distal Sesamoidean ligaments Straight:	√
Oblique:	Medial stretched Lateral stretched
Cruciate:	√
Sesamoidean Collateral ligaments:	• 0,5cm wide tear off of lateral • midbody tear on medial
Collateral ligaments of distal interphalangeal joint:	√
Palmar ligament:	2 Abaxial fractures Palmar ligament: 4cm oblique tear distal half Scratches on condyles ridge
Fracture characterisation:	
General comments:	•Mass oedema. Lots of bleeding. •External 12cm longitudinal tear of epidedimous on medial side, distal to carpal joint

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

CMI no. 72 **Name: Worldwide**

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	•Lateral oblique tear 2cm long proximal to fetlock •Medial oblique tear 1cm long proximal to fetlock •Vertical tear extending 1,5cm up from end of medial tear on dorsal surface Both right through tendon
Deep Digital Flexor tendon:	•1.5cm long horizontal tear on lateral side proximal to fetlock. Right through tendon 0.5cm wide •3.5cm long vertical tear 0.5cm wide on medial side @ level of fetlock on proximal surface
Interosseous medius body and branches:	√ •Lateral branch •Medial branch
Annular ligament:	•Severe midbody through whole length of ligament. 10cm long, 2.5cm wide •Still intact @ points of insertion
Distal Sesamoidean ligaments **Straight:**	Fibres stretched
Oblique:	Fibres strained
Cruciate:	√
Sesamoidean Collateral ligaments:	√
Collateral ligaments of distal interphalangeal joint:	•Lateral intact •Medial: horizontal tear 5cm long 1cm wide
Palmar ligament:	•Horizontal severing at point of fracture •Vertical between bones on flexor surface 3cm long
Fracture characterisation:	
General comments:	•No external wounds or signs of injury •Abaxial on fracture of medial sesamoid bone •Abaxial on fracture of lateral sesamoid bone

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

CMI no. **76** **Name: My Mozart**

Common Digital Extensor tendon:	Intact
Superficial Digital Flexor tendon:	Fully intact
Deep Digital Flexor tendon:	Oblique tear 4.5cm long 1.5cm wide, media side @ level of fetlock
Interosseous medius body and branches:	Oblique tear of body & medial branch intersection. Medial branch completely severed. Lateral branch intact.
Annular ligament:	Palmore severed Digital proximal annular ligament severed.
Distal Sesamoidean ligaments **Straight:**	2cm Vertical midbody tear
Oblique:	√
Cruciate:	Severed
Sesamoidean Collateral ligaments:	Severed vertically
Collateral ligaments of distal interphalangeal joint:	√
Palmar ligament:	√
Fracture characterisation:	
General comments:	Vertical fracture of sesamoid Lateral oblique fracture of Mc3 disabled

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

CMI no. 78 **Name:** **Awesome Double**

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	√
Deep Digital Flexor tendon:	On dorsal side @ level of fetlock 3cm long by 1cm wide tear. Stretching of fibres
Interosseous medius body and branches:	Body √ Lateral √ Medial : severed
Annular ligament:	Medial attachment torn loose. 2 holes 2cm long by 1cm wide Lateral intact
Distal Sesamoidean ligaments **Straight:**	1cm vertical tear
Oblique:	√
Cruciate:	Lateral medial severed
Sesamoidean Collateral ligaments:	√
Collateral ligaments of distal interphalangeal joint:	Lateral intact
Palmar ligament:	Severed vertically between sesamoids
Fracture characterisation:	
General comments:	Open wound on lateral side 2cm long by 1cm wide distal to fetlock joint 10cm up. Lateral sesamoid intact. Medial comminuted.

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

CMI no. 88 **Name: Press North**

Common Digital Extensor tendon:	Torn loose from cannon bone, distal portion
Superficial Digital Flexor tendon:	•3,5cm longitudinal tear on dorsal surface @ level of fetlock, lateral side •6,5cm longitudinal tear on dorsal surface @ level of fetlock on lateral edge of tendon
Deep Digital Flexor tendon:	•6cm longitudinal tear, palmer surface middle •6cm longitudinal tear, palmer surface medial •5,5cm longitudinal tear, palmer surface lateral •Extensive fibre tears & scratching of dorsal surface @ level of fetlock •Fibres stretched
Interosseous medius body and branches:	•Fibre separation & stretching on lateral side of body •Lateral branch torn loose, stretching and separation •Medial intact but stretched. 3cm tear @ attachment to sesamoid
Annular ligament:	Fully severed. 1,5cm left intact proximal end
Distal Sesamoidean ligaments **Straight:**	2cm longitudinal tear
Oblique:	Severed
Cruciate:	Intact but badly stretched & fibre separation
Sesamoidean Collateral ligaments:	Severed. Non detectable
Collateral ligaments of distal interphalangeal joint:	√
Palmar ligament:	√
Fracture characterisation:	
General comments:	•Luxation of fetlock joint •Medial PSB comminuted midbody main sagittal through distal portion •Lateral PSB oblique axial •Interphalangeal co-lateral ligament severed; non-detectable

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

CMI no. **90** **Name:** **Wee 'lil Sally**

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	√
Deep Digital Flexor tendon:	Tearing on dorsal surface
Interosseous medius body and branches:	Body √ Lateral: √ Medial : Longitudinal tears, fibre separation (intact)
Annular ligament:	Distal severed from lateral side
Distal Sesamoidean ligaments **Straight:**	4cm long vertical severing midbody
Oblique:	√
Cruciate:	Lateral intact Medial severed
Sesamoidean Collateral ligaments:	√
Collateral ligaments of distal interphalangeal joint:	√
Palmar ligament:	Oblique severing of the palmar
Fracture characterisation:	
General comments:	

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

CMI no. 95 **Name:** **Ash for Cash**

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	1,5cm wide by 7cm long tear off lateral side. Scratching on dorsal surface @ level of fetlock
Deep Digital Flexor tendon:	1,5cm wide by 6cm long tear off lateral side @ fetlock level. Fibre separation. Scratching/fraying
Interosseous medius body and branches:	Body: √ Lateral:: √ Medial: 4cm tear from insertion onto sesamoid proximally
Annular ligament:	Gone
Distal Sesamoidean ligaments **Straight:**	0,5cm tear, longitudinal
Oblique:	√
Cruciate:	√
Sesamoidean Collateral ligaments:	Medial: Intact Lateral: Gone due to sesamoid bone fracture
Collateral ligaments of distal interphalangeal joint:	Short & long. (Lateral & medial) – severed due to limb be luxated @ fetlock joint.
Palmar ligament:	Oblique tear right across midway
Fracture characterisation:	
General comments:	Scratches on condyles & sagittal ridge. Chips off ridge.

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

<u>CMI no.</u> 97 **<u>Name:</u> Victory Serenade**

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	√
Deep Digital Flexor tendon:	√
Interosseous medius body and branches:	Body √ Lateral branch : Fibres torn
Annular ligament:	Horizontal tear full length 12cm long
Distal Sesamoidean ligaments **Straight:**	√
Oblique:	√
Cruciate:	√
Sesamoidean Collateral ligaments:	√
Collateral ligaments of distal interphalangeal joint:	Both sides severed midbody
Palmar ligament:	Distal portion of palmar torn – 1cm vertically
Fracture characterisation:	
General comments:	No external damage

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

CMI no. 98 **Name: Charlatan**

Common Digital Extensor tendon:	Shredding on palmer surface @ fracture site. Stretching
Superficial Digital Flexor tendon:	√
Deep Digital Flexor tendon:	√
Interosseous medius body and branches:	Body :] Shredding on Lateral:] dorsal surface @ Medial:] Site of fracture√
Annular ligament:	√
Distal Sesamoidean ligaments **Straight:**	√
Oblique:	√
Cruciate:	√
Sesamoidean Collateral ligaments:	√
Collateral ligaments of distal interphalangeal joint:	√
Palmar ligament:	√
Fracture characterisation:	
General comments:	

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

<u>CMI no.</u> 100 **<u>Name:</u> Retempo**

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	√
Deep Digital Flexor tendon:	Small longitudinal laceration on dorsal surface @ level of fetlock
Interosseous medius body and branches:	Body : √ Lateral: √ Medial : Stretching & separation of fibres Longitudinal tears from origin of branch to attachment of sesamoid bone Severely damaged
Annular ligament:	Severed @ medial attachment point
Distal Sesamoidean ligaments **Straight:**	1,5cm longitudinal tear
Oblique:	Both intact- no damage
Cruciate:	√
Sesamoidean Collateral ligaments:	
Collateral ligaments of distal interphalangeal joint:	√
Palmar ligament:	Longitudinal tear of whole length. Oblique tear 2cm long from medial side Medial sesamoid: axial fracture (top Hp) Cartilage: 2 scratches of ridge
Fracture characterisation:	
General comments:	Puncture wound on dorsal exterior surface on lateral side @ proximal to fetlock joint

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

CMI no. 102 **Name:** **Devine Mercy**

Common Digital Extensor tendon:	Intact. Lateral: fibre separation
Superficial Digital Flexor tendon:	0,5cm wide by 4cm long oblique tear off medial side at level of fetlock
Deep Digital Flexor tendon:	10cm longitudinal tear right through tendon on medial side. 1,5cm wide
Interosseous medius body and branches:	Lateral: 1,5cm tear up into body from attachment to sesamoids Medial: Fraying & stretching @ attachment to sesamoids
Annular ligament:	Shredded
Distal Sesamoidean ligaments **Straight:**	3,5cm longitudinal
Oblique:	Intact (both)
Cruciate:	Medial : √ Lateral : severed
Sesamoidean Collateral ligaments:	Lateral: √ Medial : 2.5cm oblique tear
Collateral ligaments of distal interphalangeal joint:	Collaterals of joint: severed Scratches on ridge & condyles
Palmar ligament:	4cm oblique tear off lateral side
Fracture characterisation:	
General comments:	

√ = structure is intact with no signs of any pathology

Appendix E

Equine distal limb dissection reports

CMI no. 104 **Name:** **Goddess of Peace**

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	Severed off @ distal end of fetlock joint
Deep Digital Flexor tendon:	•4cm longitudinal tear on palmer surface @ level of fetlock •2cm longitudinal tear on palmer surface @ level of fetlock going through to dorsal surface •Mass shredding of fibres due to rubbing against sesamoid fractures Longitudinal tears
Interosseous medius body and branches:	Body : √ Lateral : √ Medial : √
Annular ligament:	•Distal half of lateral insertion torn loose •Distal annular ligament: 1cm proximally torn loose from lateral side
Distal Sesamoidean ligaments **Straight:**	Longitudinal tear 2cm off lateral side
Oblique:	Medial intact Lateral oblique tear right through @ point of origin
Cruciate:	Medial intact Lateral severed @ printed origin
Sesamoidean Collateral ligaments:	
Collateral ligaments of distal interphalangeal joint:	Lateral intact but stretched Medial: midbody tear whole length
Palmar ligament:	•Longitudinal tear 1,5cm long on medial side •Oblique tear proximal end 2cm long
Fracture characterisation:	
General comments:	

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Appendix E

Equine distal limb dissection reports

CMI no. 105 **Name:** **Fort Petersburg**

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	4,5cm long by 1cm tear on lateral side
Deep Digital Flexor tendon:	4cm longitudinal tear on dorsal surface
Interosseous medius body and branches:	Body √ Lateral:: 3,5cm long by 0.5cm tear off @ point of connecting to extensor slip & insertion @ sesamoid Medial: Stretching fibres
Annular ligament:	2cm oblique tear on medial side of distal annular ligaments insertion point proximal: √
Distal Sesamoidean ligaments **Straight:**	2,5cm longitudinal midbody
Oblique:	Medial: √ Lateral:: √
Cruciate:	Intact but Lat. stretched
Sesamoidean Collateral ligaments:	Both sides midbody tears
Collateral ligaments of distal interphalangeal joint:	
Palmar ligament:	Oblique right across @ distal end
Fracture characterisation:	
General comments:	

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Appendix E

Equine distal limb dissection reports

CMI no. 106 **Name:** **Earl de Grey**

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	√
Deep Digital Flexor tendon:	Small longitudinal tears rubbing on dorsal surface of DDFT @level of fetlock
Interosseous medius body and branches:	Body : √ Medial: √ Lateral:: 1cm wide by 2,5cm long tear @ attachment to sesamoid
Annular ligament:	4cm oblique tear from medial to lateral side
Distal Sesamoidean ligaments **Straight:**	Stretched
Oblique:	√
Cruciate:	√
Sesamoidean Collateral ligaments:	Lateral : √ Medial : Midbody tear
Collateral ligaments of distal interphalangeal joint:	
Palmar ligament:	4cm longitudinal tear
Fracture characterisation:	
General comments:	Scratches on ridge on lateral side

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Appendix E

Equine distal limb dissection reports

CMI no. 107 **Name:** **Running Rogue**

Common Digital Extensor tendon:	•Small horizontal tear in dorsal aspect of Superficial flexor tendon at level of fetlock joint. 2cm long by 1mm wide. Palmer aspect fine.
Superficial Digital Flexor tendon:	•Palmer annular ligament severed both sides straight. •Proximal digital ligament severed straight.
Deep Digital Flexor tendon:	•Small vertical tears on dorsal aspect of deep f.t. 7cm long @ level of fetlock joint. •Small vertical tears/stretches on palmer @ fetlock level. •Lateral digital extensor. No signs of damage/injury intact. •Common digital extensor tendon. No signs of damage/injury intact. •5cm Long on lateral aspect going right through. •4cm by 0.5 wide tear midbody. •Dorsal aspect @ fetlock level small tears/stretches.
Interosseous medius body and branches:	•Body: Intact. No signs of trauma. •Lateral branch: Oblique tear 5cm long, 1.5 cm wide. Extensor slip intact. •Medial branch: 1cm tear along abaxial aspect of sesamoid @ fetlock level distal end
Annular ligament:	√
Distal Sesamoidean ligaments **Straight:**	Vertical midbody tear in Str8 sesamoidean ligament 2.5cm long by 1.5cm wide.
Oblique:	Lateral : 4cm long tear through bone
Cruciate:	Medial lateral torn La. t medial intact
Sesamoidean Collateral ligaments:	
Collateral ligaments of distal interphalangeal joint:	√
Palmar ligament:	Abaxial fracture medial sesamoid oblique/fracture lateral
Fracture characterisation:	
General comments:	Extensive oedema Comminuted fracture of sesamoid

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Appendix E

Equine distal limb dissection reports

CMI no. **110** **Name:** **Grey Goose**

Common Digital Extensor tendon:	Torn loose from bone @ point of laxation Stretched!
Superficial Digital Flexor tendon:	1cm wide by 3cm long tear on medial side @ level of fetlock
Deep Digital Flexor tendon:	5cm long longitudinal tear on palmar side. Severe longitudinal tearing on dorsal surface 2cm long by 1cm wide cut on medial side dorsal surface @ fetlock level
Interosseous medius body and branches:	Body : √ Medial extension slip torn loose Medial branch √ but fibre separation Lateral : 5,5cm midbody longitudinal tear from insert @ sesamoid going up 1cm wide
Annular ligament:	Distal torn loose from lateral side. Badly damaged
Distal Sesamoidean ligaments **Straight:**	2,5cm Longitudinal tear
Oblique:	√ but look stretched
Cruciate:	Medial: intact but stretched. Lateral torn loose
Sesamoidean Collateral ligaments:	√
Collateral ligaments of distal interphalangeal joint:	Lateral : √ Medial torn midbody Other collateral on medial side severed Axial fracture of lateral sesamoid Abaxial fracture of medial sesamoid
Palmar ligament:	5cm oblique tear through palmer ligament laxation of joint (fetlock) Scratches on ridge and sides
Fracture characterisation:	
General comments:	External wound on medial side distal to Fetlock 2,5cm long by 1cm wide

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Appendix E

Equine distal limb dissection reports

CMI no. **111** **Name: Grey Poet**

Common Digital Extensor tendon:	Torn off bone
Superficial Digital Flexor tendon:	√
Deep Digital Flexor tendon:	3cm midbody longitudinal tear Small longitudinal tears on dorsal surface
Interosseous medius body and branches:	Body intact but severe tearing on dorsal surface Lateral:: √ Medial: Tearing @ insertion to sesamoid bones. 2cm long by 1cm wide
Annular ligament:	Intact but tears in medial attachment
Distal Sesamoidean ligaments **Straight:**	1cm Longitudinal tear
Oblique:	√
Cruciate:	Both intact Medial stretched
Sesamoidean Collateral ligaments:	Lateral: √ Medial: Tear off of fibres from proximal end
Collateral ligaments of distal interphalangeal joint:	√
Palmar ligament:	3,5cm longitudinal tear Scratching on ridge and condyles
Fracture characterisation:	
General comments:	

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Appendix E

Equine distal limb dissection reports

CMI no. 112 **Name:** Barracus

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	√
Deep Digital Flexor tendon:	Slight tearing on palmar surface @ fetlock level. Same on dorsal
Interosseous medius body and branches:	Body intact Medial: Tearing & shredding @ attachment sesamoid. Slip intact; 6cm tear longitudinal Lateral: Severe fibre stretching, separation & tearing from body split to attachment point. 10cm
Annular ligament:	Severe shredding & multiple tears in it
Distal Sesamoidean ligaments **Straight:**	√
Oblique:	Lateral: √ Medial : stretched
Cruciate:	√
Sesamoidean Collateral ligaments:	Lateral : Only 2cm remain of distal portion Medial: √
Collateral ligaments of distal interphalangeal joint:	Lateral : severed Medial : Fibres stretched
Palmar ligament:	√
Fracture characterisation:	PSBs: Medial apical oblique fracture Lateral: Sagittal midbody. Lateral piece missing
General comments:	Subluxation Marked lines on cartilage. Scratches. Missing cartilage on medial condyle Large open wound on lateral side @ level of fetlock, exposing sesamoid bones & M3C (distal end) as well as tendons

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Appendix E

Equine distal limb dissection reports

CMI no. 113 **Name:** George Cross

Common Digital Extensor tendon:	√
Superficial Digital Flexor tendon:	√
Deep Digital Flexor tendon:	Fibres shredded on dorsal surface @ level of fetlock
Interosseous medius body and branches:	Body: √ Lateral : Fibre separation & stretching @ attachment to sesamoid bone Medial: √
Annular ligament:	Intact but torn on medial side
Distal Sesamoidean ligaments **Straight:**	2cm oblique tear
Oblique:	Lateral:: √ Medial: stretched & fibre separation
Cruciate:	Medial: √ Lateral: severed
Sesamoidean Collateral ligaments:	Lateral: √ Medial: Oblique midbody tear
Collateral ligaments of distal interphalangeal joint:	√
Palmar ligament:	3cm longitudinal tear from base Scratches either side of sagittal ridge palmer surface
Fracture characterisation:	
General comments:	

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