



## **TAWS OVERSEAS TRAVEL GRANT PROJECT REPORT 2010 HANNAH SMITH – EGYPT**

### Comparison of Fracture incidence, type and the associated pain between working equids in Egypt and horses in a UK based referral hospital

#### Abstract

A month was spent at Animal Care Egypt (ACE) a charity for the working horses and donkeys of Luxor, Egypt. During this time fracture management and pain associated with fractures were studied. In the case of splint bone fractures a protocol of bandaging, rest and analgesia can be employed to the same standard as a UK referral hospital giving a good prognosis to return to work. A higher level of analgesia was administered at The University of Liverpool's Philip Leverhume Equine Hospital (PLEH), which could be adopted at ACE to ensure that fracture cases are made comfortable as quickly as possible. From reviewing records at both ACE and PLEH it was found that the incidence of fracture was 19 times higher at PLEH. The most common fracture at PLEH was of the splint bone, at ACE this was the fourth most prevalent with fracture of the proximal phalanx being the most common. Pain was ascertained by means of a composite pain score (CPS) at ACE and the same scoring system was used retrospectively on matched cases at PLEH. It appears that horses presenting to PLEH were less painful than horses and donkeys presenting to ACE.

#### 1. Introduction

Many definitions of pain exist but it is widely agreed to be an adverse sensory stimulation. Animals are unable to verbally communicate their pain, therefore a more specific definition is necessary. This is acknowledged by Molony and Kent's definition of animal pain as, "an aversive sensory and emotional experience representing awareness by the animal of damage or threat to the integrity of the tissues...producing a change in physiology and behaviour directed to reduce or avoid the damage, reduce the likelihood of recurrence and promote recovery(Molony 1997)."

After initial injury noxious stimuli are sensed by specialised nerves including unmyelinated C fibers and thinly myelinated Ad fibres(Kuner 2010). Pain can persist long after initial injury partly explained by hypersensitisation, a phenomenon that occurs due to changes in the inflammatory mediators bathing nociceptor terminals following inflammation or tissue damage(Moberg 2000). In chronic pain there is evidence of neuromodulation, for example increased activity of nociceptors and changes in C fibre activity. The result of these changes is allodynia, which can be defined as pain resulting from a stimulus that would not normally provoke pain(Ashley 2005). Evoked withdrawal reflexes are examples of behaviour directed to reduce pain after injury and are used in research as measures of

hypersensitisation or mechanical allodynia (Ashley 2005; Kuner 2010). Bussieres and others (2008) suggest palpation of the fracture area in the horse to be a sensitive indicator of the level of pain, which can be used clinically to assess patients acutely following injury and during management to assess chronic pain.

Stress and distress are inextricably linked to pain. This is especially applicable in traumatic incidents such as those anticipated that may cause fractures in working equines, such as road traffic accidents. Stress instigates physiological responses such as activation of the hypothalamic-adrenal axis and autonomic nervous system as well as immune responses (Moberg 2000).

Heart rate and respiratory rate are commonly relied on by veterinarians to assess pain in the horse. However a review of pain in the donkey and horse by Ashley and others (2005), suggest that heart rate is an unreliable indicator of pain. Furthermore a study by Raekallio and others (1997) found that heart rate after arthroscopic surgery did not differ between horses receiving phenylbutazone and control horses receiving no analgesia (Raekallio 1997). Bussieres and others (2008) however, found non invasive blood pressure to be a more useful physiological parameter for orthopaedic pain in the horses.

Appearance and demeanour are also used by veterinarians to assess pain, which is perhaps hard in the donkey who is commonly described as dull and depressed in response to pain or to show "no obvious pain expression" (Ashley 2005). Through looking at working donkey fracture cases one aim was to ascertain whether donkeys are dull and depressed in response to orthopaedic pain. Posture can also be looked at to assess pain because animals typically alter their posture to reduce stimulation of hypersensitive tissues (Molony 1997).

The first aim of this study was to document and study fracture type and incidence commonly occurring in the working equid at the charity Animal Care Egypt (ACE) in Luxor, Egypt. The second aim was to see how this compared to fracture cases presenting to The Philip Leverhume Equine Hospital (PLEH), a referral hospital at The University of Liverpool. The final aim was to assess and compare the pain in fracture cases of the same type between working horses and donkeys in Luxor to horses in the UK.

## 2. Materials and Methods

### 2.1 Horses

Any horse or donkey that arrived at ACE between 28/07/10 – 28/08/10 that was suspicious of a fracture was included in the study. The type of fracture was diagnosed and horses were selected from records at PLEH to match them. Where multiple cases were similar the time of injury to presentation at hospital, the breed, weight and age of the horse were matched as closely as possible.

### 2.2 Records

Records at ACE were paper based they were available from January 2009 to present (September 2010). For each fracture case found in the records the type of fracture and the limb and the date on which it occurred were recorded.

Records at PLEH are largely computer based. Cases were limited to this same time period (January 2009 – September 2010) and any possible fracture case was reviewed. This involved utilising the PLEH hospital archive (Tristan computer software) For every fracture case found on the system the date, case number, fracture location and limb, where applicable, was recorded.

### 2.3 CPS

Multiple types of pain scoring systems exist such as numerical rating scales, descriptive scales, visual analogue scales and composite pain score scales (CPS). Pain scoring systems for animals need to be species specific taking into account normal physiological parameters and behaviour. (Ashley 2005)

A CPS in this study is a modification of a CPS that was developed and validated by Bussieres and others (2008) for assessing orthopaedic pain in the horse. However to get a pain score system that could be used easily out in Egypt and retrospectively when looking at records at PLEH this was simplified to only include the most sensitive and specific indicators of pain in the horse. A higher CPS corresponds to a more painful animal, a score of 0 being awarded for normality and with maximum score of 3(Bussieres 2008).

### 2.4 Study Design

Every case that came into ACE from the 28<sup>th</sup> of July until the 28<sup>th</sup> of August 2010 that looked like a possible fracture case was pain scored on arrival. This involved taking a heart and respiratory rate and looking at the animal's appearance and demeanour, response to palpation of the painful area, posture, appetite and how much they were sweating (see table 1) . Normal values were taken from The Professional Handbook of the Donkey and the Equine Formulary (Knottenbelt 2006; Svendsen 2008). If the case was then admitted a pain score was then taken 24 hours after initial treatment and then again daily whilst in the hospital.

Cases that were subsequently found not to have a fracture were excluded from the study. Five cases were euthanased on arrival and so further CPS's were not able to be taken. Case management for the inpatients was recorded and subsequently compared to management of similar cases at PLEH.

In order to compare fractures seen in Egypt to similar cases at PLEH the design had to be retrospective, which meant looking back at records to obtain the information needed for the CPS.

Table 1 Multifactorial numerical rating composite pain scale (CPS) adapted from (Bussieres 2008)

Physiologic data	Criteria	
Heart rate	Normal (40 for horses and 41 for donkeys; with increase <10%)	0
	11–30% increase	1
	31–50% increase	2
	>50% increase	3

Physiologic data	Criteria	
Respiratory rate	Normal (15 for horses and 20 for donkeys; with increase <10%)	0
	11–30% increase	1
	31–50% increase	2
	>50% increase	3
Response to palpation of the painful area	No reaction to palpation	0
	Mild reaction to palpation	1
	Resistance to palpation	2
	Violent reaction to palpation	3
Appearance and Demeanour	Bright alert and responsive, lowered head and ears, no reluctance to move	0
	Quiet alert and responsive, occasional head movements, no reluctance to move	1
	Dull but responsive. Restlessness, pricked up ears, abnormal facial expressions, dilated pupils. Reluctance to move.	2
	Dull and unresponsive. Agitated or anxious (abnormal facial expressions, muscle tremors). Reluctant to move.	3
Sweating	No obvious signs of sweat	0
	Damp to the touch	1
	Wet to the touch, beads of sweat are apparent over the horse's body	2
	Excessive sweating, beads of water running off the animal	3
Posture (weight distribution, comfort)	Stands quietly, normal walk. No evidence of discomfort.	0

Physiologic data	Criteria	
	Occasional weight shift, slight muscle tremors, and intermittent head movements. Lamé at walk.	1
	Non-weight bearing, abnormal weight distribution and increased head movements.	2
	Analgesic posture (attempts to urinate), prostration, muscle tremors) Continuous head movements (flank watching/looking at lame limb)	3
Appetite	Eats hay readily	0
	Hesitates to eat hay	1
	Shows little interest in hay, eats very little or takes hay in mouth but does not chew or swallow	2
	Neither shows interest in nor eats hay	3
Total CPS		21

### 3 Results

#### 3.1 Fracture type prevalence

The most commonly occurring fracture at ACE since 01/01/09 was the proximal phalanx (P1) (see Table 2). Fracture of P1 made up 25.9% of the fracture cases seen at ACE, whereas only 7.7% of the total fracture cases seen at PLEH during this time period. Fracture prevalence on fore and hind limbs was the same at ACE and only 10 more forelimb fracture cases were seen than hindlimb at PLEH. The most common fracture at PLEH was of the third phalanx (Table 3). A comparison in frequency of fracture types is illustrated in figure 1.

Table 2 Fracture cases occurring at ACE, Luxor Egypt in a nineteen month period

Fracture type	Frequency from 01/01/09-01/09/10				
	RF	LF	RH	LH	Total
Phalanx I	1	2		4	7
Phalanx II	2	1	1	1	5
Phalanx III	3	1		1	5
Phalanx II and III		1			1
Metatarsal II			1		1
Metatarsal III			1	1	2
Metatarsal IV			1	1	2

Proximal sesamoid		1	2		3
Radial		1			1
Ulna	1	1			2
Femur				1	1
Ischial			1		1
Sacral					1
Mandibular					1
Total	7	8	6	9	32

Table 3 Fracture cases occurring at PLEH, Liverpool, England in a nineteen month period

Fracture type	Frequency from 01/01/09-01/09/10				
	RF	LF	RH	LH	Total
Phalanx I	4	1		4	9
Phalanx II	1			1	2
Phalanx III	12	7			19
Hoof cartliages		1			1
Proximal sesamoids			2		2
Metacarpal II	2	1			3
Metacarpal III	2				2
Metacarpal IV	1	1			2
Metatarsal II		1	2	1	4
Metatarsal III			1	2	3
Metatarsal IV			5	7	12
Accessory carpal bone		1			1
Intermediate carpal bone		1			1
Third carpal bone	1				1
Fourth carpal bone	1				1
Calcaneus			1	2	3
Central tarsal bone			1	3	4
Radius	1	5			6
Ulna	1	1			2
Tibia			1	4	5
Humerus	2				2
Femur				2	2
Patella			1		1
Scapula	1	1			2
Ischium					3
Ilium					10
Mandible					7
Rib fracture					3
Dorsal spinous processes of thoracic vertebrae					1
Articular facets of cervical vertebrae					1

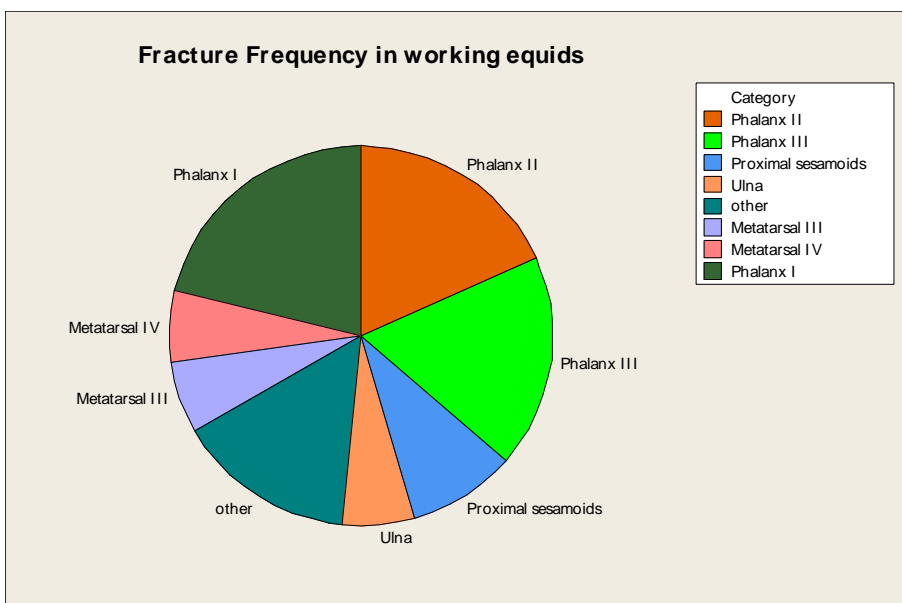
Temporal bone					1
Total	29	21	14	26	116

### 3.2 Incidenc

eA total of 20126 horses and donkeys presented to ACE in the 21 month period records were reviewed, during which 32 fracture cases were recorded.

Traumatic fracture incidence was 0.008/100 working equines/month.

A total of 3622 horses presented to PLEH in the 21 month period during which 116 fractures were recorded. Traumatic fracture incidence in horses at PLEH was 0.153/100 horses/month.



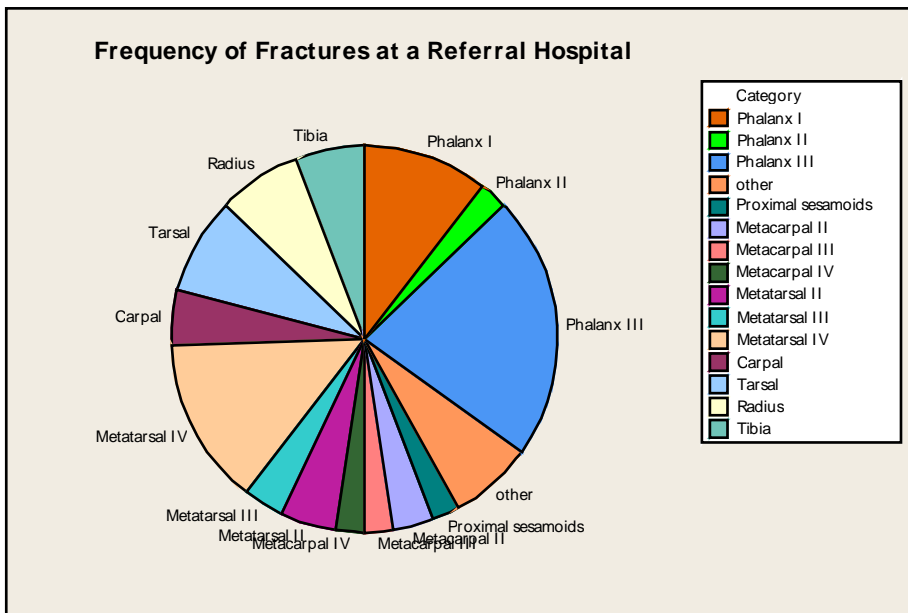


Figure 1 Frequency of different fractures in working equids in Luxor and in horses at PLEH a referral hospital in Liverpool. 3.3 CPS comparison between matched fracture cases at ACE and PLEH

The highest CPS (score of 14) on admission was a donkey with both a sesamoid fracture and fracture of metatarsal three on her right hind. The case match for this case at PLEH only had a CPS of 3 however this case presented 5 weeks after initial injury, whereas the donkey presented after initial injury. This is a major limitation of the study and is further discussed in the discussion. The highest CPS on admission at PLEH was a CPS of 5 for a horse with a fracture of the olecranon.

Cases that were admitted for treatment during the four week period showed a reduction in CPS from admission to 24hours following treatment. Only the two splint bone fracture cases CPS's were able to be followed as the other cases necessitated euthanasia at the time of admission; or after reviewing the case the following day as in the case of the donkey with the fracture of the second phalanx of the right fore.

Unfortunately accurate comparison between the CPS scores of case matched fractures was not possible as cases with records of response to palpation were not found to match the fractures closely enough. Instead the CPS was calculated from records excluding "response to palpation" part. However the CPS even with the addition of 3 points to the CPS (maximum score for response to palpation) of the horses presenting to PLEH in each case matched fracture was lower or equal to the CPS of the working equid at presentation at ACE.

Case	Horse or donkey at ACE	How long since fracture occurred to presentation (hours)	CPS on admission to ACE	CPS 24hr after initial treatment at ACE	CPS average during management	CPS of case matched horse at PLEH (on

						admission)
Mid Mt III fracture LH	Donkey	24	10	n/a	n/a	5*
Brown donkey PII RF	Donkey	168	10	9	n/a	3*
Proximal Mt IV	Horse	24	9	6	2	3*
Ulna fracture	Donkey	<24	12	n/a	n/a	5*
Sesamoid fracture with MTIII chip fracture	Donkey	n/a	14	n/a	n/a	3*
Comminuted fracture PI LH	Donkey	n/a	11	n/a	n/a	3*
Avulsed hoof capsule and PIII	Donkey	120	9	n/a	n/a	n/a
Proximal Mt II RH	Horse	n/a	n/a	7	2-3	4*

Table 4: Comparison of CPS at ACE at presentation, after initial treatment and during management. CPS of case matched horses at PLEH presenting with the same fracture. \* Horses where response to palpation was not recorded at admission, so CPS is excluding this data.

### 3.4 Comparison of case management of splint bone fractures at ACE and PLEH

#### Metarsal II Fracture

A bay stallion aged 6, 14.3hh, used as a calaèche horse in Luxor. He was admitted on 22/07/09, which was before the study period and so his initial CPS was not obtained. On admission he was non weight bearing on his right hind with multiple wounds at the level of his tarsus see Figure 4. Radiograph views included dorso-plantar (DP), dorsolateral plantar medial oblique (DLPMO), dorsomedial plantar lateral oblique (DMPLO) and lateromedial (LM) Error! Reference source not found.. Radiographs are underexposed but from the DLPMO view, a simple fracture below the head of the medial splint bone can be seen.



Figure 2: Radiographs taken after admission of the right hind limb of Metatarsal II fracture (Mt II) case. Figure 2A: DMPLO view of the tarsus and proximal metatarsal region shows discontinuity in the cortex of the medial splint bone with an area of lucency below the head of Mt II. Figure 2B: DLPMO of distal tarsus and proximal metatarsal region reveals an area of lucency in proximal Mt II consistent with a simple fracture of proximal Mt II.

From records at PLEH a three year old 14hh mare with a complete fracture of metatarsal II of her right hind was chosen for comparison. She was admitted the same day she fractured her leg after being found in the field caught in farm machinery.

#### Metatarsal IV Fracture

Bay mare aged 5, 15 hh, used as a calaecher horse in Luxor. She was admitted on 18/08/10 following a kick to her left hind hock the day before. On admission she was non weight bearing on her left hind with a wound on the distal lateral aspect of her tarsus. Her CPS on admission was 9/21. Radiograph views as for Mt II case revealed an open, articular, displaced fracture of proximal MtIV. The proximity to the tarsus meant that tarsometatarsal joint infection was a concern. On the DMPLO radiograph a radiolucent line can be seen running proximally from the distal head of MtIV towards the articular surface, giving the suspicion of an articular fracture. A separate smaller fragment of mineral opacity is present distal to the head of Metatarsal IV see Figure 3.



Figure 3: Radiographs taken after admission of metatarsal IV (Mt IV) fracture case at ACE, Luxor. Figure 3A: LM view of left hind tarsus and metatarsal region. A needle was inserted into the wound, which can be seen as the opaque linear line extending from the skin to Mt IV, indicating the fracture is open. Figure 3B: DMPLO view showing a chip fracture off the head of Mt IV.

From records at PLEH a 14 year old, 16hh mare with a comminuted, articular open fracture to the proximal head of Metatarsal IV was chosen. She was admitted after a kick to her right hind tarsus the night before. The referring vet gave gentamicin and depocillin but no analgesia. Her retrospective CPS from records on arrival was 3/21. However this is without response to palpation of painful area, because this data was not available whereas the mare at ACE scored 1 out of three in response to palpation, as she showed a mild reaction.

#### Treatment of splint fracture cases

Initial treatment for both cases at ACE included oral phenylbutazone (2.2mg/kg orally SID) and a course of penicillin (10mg/kg BID IM) and gentamicin (6.6mg/kg BID IM ) for 5 days. A supportive bandage was applied initially. After radiographical examination a Robert jones bandage was applied in both cases. Surgery was considered in the case of the Mt IV fracture.

Initial treatment for both the splint bone cases at PLEH was similar with phenylbutazone (2.2mg/kg IV), and gentamicin (6.6mg/kg SID IM) and depocillin (12mg/kg BID IM) for 5 days. The main difference being that phenylbutazone was administered twice a day and by the IV route rather than orally. The mare with the metatarsal IV fracture was taken to surgery to remove bone fragments and for tenoscopy of the tarsal sheath. The mare with the metatarsal II fracture also underwent tenoscopy of her digital flexor tendon sheath and her wound was cleaned and debrided to move bone fragments at surgery. Post operatively the phenylbutazone dose for both cases was 4.4mg/kg IV BID for 24 hours. A Robert jones bandage was applied with a dorsal splint and heel wedge.



Figure 4: Photographs from ACE, Luxor. A shows the wounds on the right hind limb of the metatarsal II fracture case at a bandage change 2 weeks after admission. B shows the wound distal to the tarsus on the lateral aspect of the left hind limb of the metatarsal IV fracture case at admission.

#### Management of splint fracture cases

Phenylbutazone was continued daily during the course of treatment at ACE at 2.2mg/kg SID orally. Whereas at PLEH IV phenylbutazone was continued at 2.2mg/kg IV BID for 4 days (after the higher dose post surgery), which was then changed to oral phenylbutazone but still at 2.2mg/kg twice a day rather than once a day.

After the initial course of antibiotics both horses were placed on 10% oral enrofloxacin (at 7.5mg/kg SID). The mare developed a respiratory infection and was subsequently put on penicillin again until this cleared. At PLEH in the case of the metatarsal IV case match broad spectrum antibiotic was still required after 6 days of penicillin and gentamicin but there were concerns over prolonged use of gentamicin, therefore the mare was put on to TMPS oral powder.

Both cases at ACE were managed conservatively by stabilizing the leg with a Robert Jones bandage. In both cases a plantar splint made from plastic piping and conformed to the leg by molding with a flame.

These were put on when the piping became available at day 30 for metatarsal II stallion and day 3 for metatarsal IV mare.

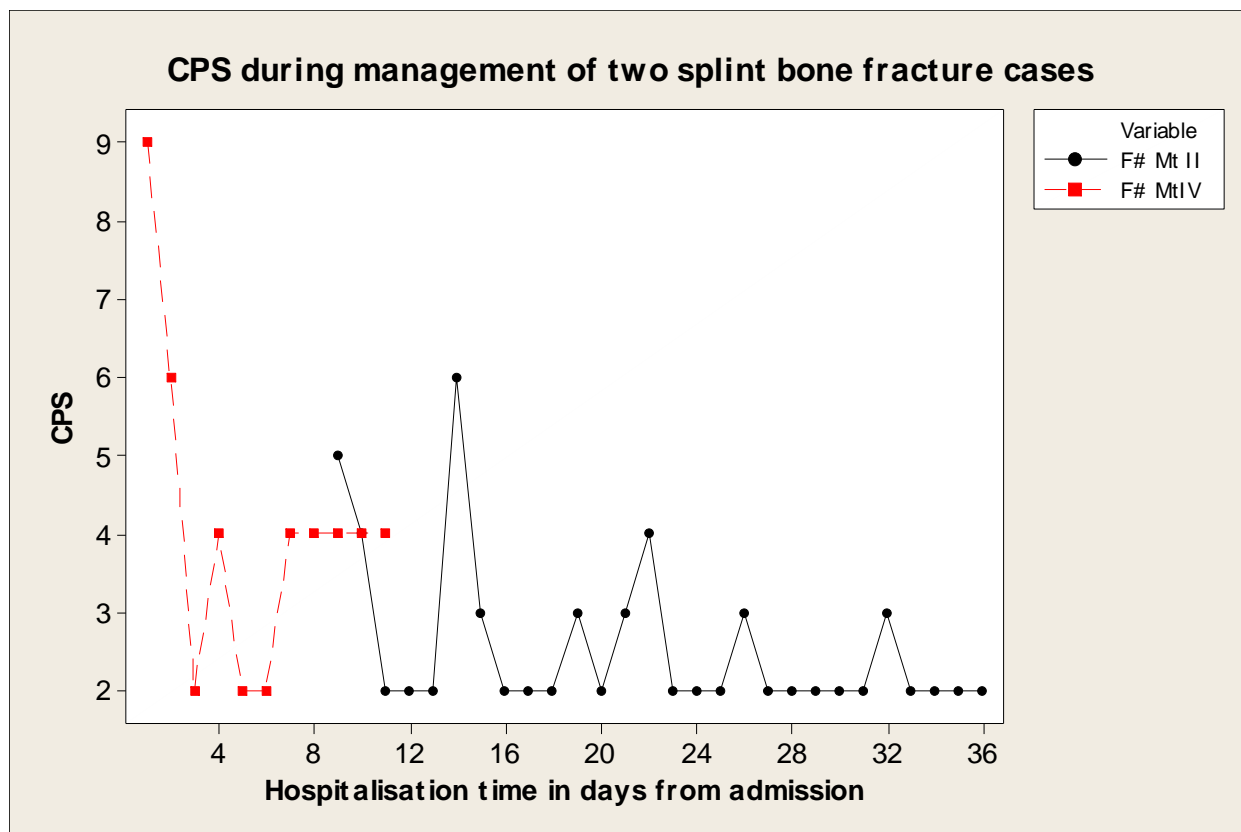


Figure 5: Daily CPS of two splint bone fracture cases during August 2010 at Animal Care Egypt, Luxor.

Both horses at ACE were pain scored daily during the course of the study but this was limited as a true response to “palpation of painful area” could not be obtained due to the Robert Jones bandage. The bandages were changed weekly. Both horses were radiographed at weeks 3 and 4 to monitor progress. Figure 5 shows daily changes in CPS during management of the splint bone cases at ACE to compare their CPS the scores are plotted against days from admission. Unfortunately data from the first week Mt II was hospitalised and from after day 12 for Mt IV were not available because only a month at ACE was possible. Both cases had an average pain score below 5, and looked comfortable with this score. Data for both cases were available for days 9 to 11 for both horses and on average Mt II had a lower CPS.

Peaks on day 9 and 14 for the Metatarsal II fracture case correspond to bandage changes where it was possible to palpate the painful area to get a complete CPS.

Whereas on bandage changes Metatarsal IV fracture case showed a mild reaction to palpation on day 1 and 2 of admission and no reaction to palpation of the painful area after this. The peak for metatarsal IV was on day 1 at admission when she had not yet received any analgesia. Her CPS rises on day 6 and remains high this corresponds to her developing a respiratory infection and subsequently an increased

respiratory rate. In light of this it is probable despite an average CPS higher than that's of Mt II fracture case between days 9 to 11 she was more comfortable during this stage of fracture management.

Records at PLEH reveal the CPS of both fracture cases to be on average 1/21, corresponding to a score of 1 out of 3 for posture as both horses were lame at walk. However again this is without "response to palpation of the painful area".

#### 4. Discussion

The most common fractures in the working equines were of the proximal phalanx (P1) followed by fractures of the middle and distal phalanx (P3). Whereas fracture of the splint bones (McII, McIV, MtII, and Mt IV) followed by P3 and then P1 were the three most common fractures at PLEH. The causes of the fractures in Luxor seen during the month at ACE were mostly road traffic accident and, bite and kick wounds. The causes of fracture at PLEH in the case matched cases were mostly kick injuries.

A prospective study over a two year period on UK racehorses in training found that pelvic and tibial stress fractures were the most common fracture type, but these results are only representative of the race horse population (Verheyen 2004). A study by Sherlock and Archer in 2008, found that splint bone fractures were the most common fracture type presenting to six UK veterinary hospitals, one of which was PLEH, The University of Liverpool (Sherlock 2008). The findings of this study are in support of this fractures of the splint bones grouped together were the most prevalent fracture presenting to PLEH (see Table 3).

The overall incidence of fractures in the working equid population in Luxor presenting to ACE is 0.008 cases per 100 working equines per month. This includes all the animals presenting to ACE, which include up to 100 a day not seeking veterinary attention that come in to be given water, fed and washed down. Therefore the incidence rate gives an estimate of fracture occurrence in the working population in Luxor. The incidence calculated is slightly lower than the true figure because many fracture cases are euthanased on arrival in which case records are not kept for them. One of the Egyptian vets estimated that there would have been about 10 fractures where this was the case, but these were not included in calculations.

The overall incidence of fractures presenting to PLEH was 19 times greater than the number at ACE. This was a surprise finding because of the load of work and working conditions of the horses and donkeys in Luxor a higher incidence of fractures was expected at ACE. However the incidence calculated for ACE includes a lot of healthy animals in contrast to the incidence calculated at PLEH, as all horses presenting to PLEH were seeking veterinary attention.

Results for CPS from case matching fracture types seen at ACE to cases in PLEH lack reliability because data in records for the subjective parameters such as appearance and demeanour are not described as fully as in the CPS (see Table 1). However objective measures such as heart rate and respiratory rate

were easily obtained from records. Unfortunately in a review on pain in the horse and donkey, Ashley et al, suggest heart rate and respiratory could not predict pain level(Ashley 2005).

The CPS results suggest that horses or donkeys presenting at ACE with the same fractures to horses presenting to PLEH have higher CPS, implying they are in more pain on presentation to ACE (see Table 4). Contrary to this finding, Ashley (2005) suggests working equids in particular donkeys have a more stoical nature therefore show signs of pain less overtly to horses in the UK so this. One explanation for horses at ACE having higher CPS is the role of the two hospitals, ACE is the first place owners in Luxor seek veterinary attention, whereas horses usually present to PLEH after seeing a first opinion vet. This means that horses presenting to PLEH may have already received analgesia and be presenting when the injury is less acute. The administration of analgesia obviously reduces the degree of pain experienced and therefore the physiological and behavioural response to pain thus altering results of CPS(Molony 1997).

It is not possible to draw valid conclusions from the data because some data needed to accurately CPS horses from records at PLEH was lacking. Most often the data lacking was "response to palpation of painful area", which was found to be the most sensitive measure of assessing orthopaedic pain in the horse by Bussieres et al 2008 (Bussieres 2008). A lack of data is a common problem with retrospective studies and could be overcome by a prospective study design if the study was to be repeated.

A higher level of analgesia was given during management of splint bone fractures at PLEH compared to at ACE. At ACE on day 1 the splint bone fractures were given 1 sachet of phenylbutazone only and this was continued during management. Current recommendations on the data sheets recommend two sachets to be administered twice daily (equivalent to 4.4mg/kg BID) on day one, followed by one sachet twice daily for four days, dropping to one sachet daily or alternate days after this((NOAH) 2010). The average CPS (see Figure 5) suggest that both horses were comfortable, but if this protocol was instigated the horses may become comfortable much faster. Using the CPS in this study it was found horses appeared comfortable with a CPS under 5/21 suggesting horses with a CPS of 6 or more need analgesics or an increased level of analgesia.

Metatarsal IV of the hindlimb has only a small proximal articulation and minimal weight transfer through this articulation compared to other splint bones, allowing surgical options(Sherlock 2008). The mare at PLEH with a proximal fracture of Mt IV underwent surgery to remove bone fractures. Proximal fractures of MtIV can be treated conservatively but complications include callus formation, chronic lameness and non union (Jackson 2001; Sherlock 2008). In a retrospective study comparing the outcomes of splint bone fractures managed conservatively or surgically, results suggested that in the case of open comminuted fractures of metatarsal IV results were comparable(Sherlock 2008). Furthermore surgical treatment and complication rates are based on surgery at UK facilities with strict asepsis and orthopaedic specialists, which unfortunately is not possible at charity hospitals such as ACE.

## 5. Conclusion

The type and incidence of fractures presenting at the two hospitals vary with less fractures presenting to ACE, Luxor than to PLEH, a referral hospital in Liverpool. Fractures of P1 appear to be over represented at ACE. The most common fracture at PLEH was of the splint bones.

The CPS of horses presenting to PLEH appear to be lower than at ACE but this cannot be fairly concluded as discussed.

Conservative management of splint bone fractures is achievable and successful in working equines. A protocol of bandaging, rest and analgesia can be employed to the same standard as a UK referral hospital giving a good prognosis to return to work. A higher level of analgesia was administered at PLEH, which could be adopted at ACE to ensure that fracture cases are made comfortable as quickly as possible.

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