Incidence, causes, and outcomes of lameness cases in a working military horse population: a field study

J.R.C. PUTNAM, L.M. HOLMES†, M.J. GREEN AND S.L. FREEMAN.

School of Veterinary Medicine and Science, University of Nottingham, Sutton Bonington Campus, Leicestershire, LE12 5RD, UK, tel. +44 (0)115 951 6116, fax. +44 (0)115 951 6415, email. svybjrcp@exmail.nottingham.ac.uk. † Household Cavalry Mounted Regiment, Hyde Park Barracks, Knightsbridge, London SW7 1SE **Keywords:** horse; lameness; working population; incidence;

Acknowledgements The authors would like to acknowledge the support of the soldiers and farriers of the Household Cavalry Mounted Regiment, and the Royal Army Veterinary Corps, in particular, Commandant Douglas MacDonald and Major Iain Rose.

Summary

Reasons for performing study: Lameness is a common problem in the horse. Despite this, information on the incidence of lameness in horses in the UK is restricted to studies of lameness in performance horses, racehorses, or referral hospital populations.

Objectives: To determine the overall incidence, and common causes of lameness in a working horse population, and the incidence, duration and outcome of the conditions observed.

Study design: 13 month prospective study using questionnaires

Methods: Questionnaires were used to record lameness episodes in 294 horses in an equine military establishment. Information recorded included age, years of service, type of work, causal lesion, time taken to return to work and outcome. Lameness problems

could be reported by any staff involved in the horses' care, and were diagnosed by a veterinary surgeon or qualified farrier. Trends between lame and non-lame populations were compared using chi-square analysis. Lameness diagnoses were grouped and analysed by disease category.

Results: Completed questionnaires for 273 horses were analysed. The mean monthly incidence of lameness was 2.1%, equivalent to an annual rate of 25.4 cases per 100 horses per annum, with a mean of 1.2 lameness episodes per horse in the lame population. Horse age and duration of service were not significantly different between the lame and non-lame populations. The most common diagnoses were cellulitis (18.6%), skin wounds (16.3%) and foot/shoeing problems (11.6%). Eighty eight % of cases were known to have returned to previous levels of work.

Conclusions: This initial field study showed that lameness is a common occurrence, and the majority of cases make a full return to work. The most common causes of lameness identified in this study and the outcomes of these conditions differ from existing literature.

Potential relevance: This study highlights the need for further studies of lameness in the wider horse population.

Word count 299

Introduction

Lameness is one of the most prevalent health problems in the horse [1, 2, 3]. It can be caused by a wide range of conditions and both the severity of the disease and the prognosis for return to previous function can vary markedly. Currently, there is limited information on the common causes of lameness across the horse population. Previous studies have concentrated on specific diseases in referral hospital populations [4, 5, 6], specific ages [7] or specific disciplines (racing and eventing) [8, 9]. These studies represent selected populations, and there are no published data on other UK horse populations.

This field study investigated the incidence, causes and outcomes of lameness in a working equine population.

Materials and Methods

A prospective study of lameness in a working military equine population was performed over a 13 month period (October 2008 to October 2009). The main purpose of these horses is to perform ceremonial duties. Preparation for this includes activities such as road work at walk and trot, hacking, schooling and jumping. The horses are stabled and worked throughout most of the year, but have annual rest with pasture turn out at a separate site. The horses are checked daily when stabled and turned out, and there is a dedicated team of staff providing health care on site, including a veterinary surgeon, veterinary technician and qualified farriers.

All horses within the population were recruited to the study. Data were collected using lameness questionnaires, which consisted of two parts. The first part, completed for every horse at the outset of the study, collected general population information, including the age and height of the horse, type of work, duration of service, any previous or existing health problems (lameness or other), and any current medication. The second part was completed for any horses that became lame during the study. Lameness was defined as 'unevenness or unlevel strides when moving on an even surface (walk, trot or canter)', and it was specified that this should include horses with mild or brief episodes of lameness, or ongoing pre-existing disease. Information recorded in this second 'lameness episode' section of the questionnaire included whether any initiating cause was identified, the condition diagnosed, who initially reported the problem, the duration of time off work and the outcome of the lameness. Lameness questionnaires were distributed via the veterinary team and placed in each horse's record file. These files are open to all personnel, and any staff responsible for caring for the horses (veterinary surgeons, veterinary technicians, farriers and riders) could initially identify lameness

episodes. All lameness cases were examined, diagnosed and treated by the veterinary surgeon on site ,with the exception of some foot problems which were diagnosed and treated by qualified farriers under veterinary supervision. On site facilities include diagnostic anaesthesia, radiography and ultrasound. Cases requiring more detailed investigation or long term rehabilitation are referred to the Veterinary Division Equine Hospital (Melton Mowbray) for further investigation by Royal Army veterinary surgeons and University Specialists.

The questionnaires were collected at the end of the 13 month duration, and therefore represented the population remaining at the conclusion of the study. There is some movement of horses into and out of the population during each year. Therefore horse records held at a separate site were also reviewed. This retrieved records for any horses at pasture turn out, horses at the veterinary hospital still under further investigation or rehabilitation at the conclusion of the study, and horses that had been retired or euthanased.

Data analysis

Data were analysed to calculate the monthly incidence rate of lameness, and incidence by type of work. Monthly incidences rates were calculated using the month of the first (index) case of lameness for each horse in the lame population, and were calculated as a proportion of the 'at risk' population, i.e. once a horse had experienced one episode of lameness it was removed from the denominator population. An overall annual incidence rate was estimated by multiplying the mean monthly incidence rate by 12. Comparisons of trends between lame and non-lame populations were made using chi-square analysis or two-sample t-test (Minitab 15; Minitab Inc., 2007), with significance probability set at $P<0.05$.

There were a wide range of different conditions reported; these were analysed by listing all diagnoses, and then categorising them according to disease type. Data were analysed to determine the total number of horses affected, any initiating causes that were

identified, duration of time off work and outcomes for each disease category. Numbers of cases returning to work were calculated from the number of horses that were recorded as having returned to their previous level of work for any period of time. The number of horses in each individual disease category was low, and therefore descriptive analysis only was performed on these data.

Results

Response rate for the lameness questionnaire was 93% of the total population (based on the number of horses present in the study population at the end of the study). Lameness questionnaires were not completed for the remaining 7% of cases. Data from a total of 273 completed questionnaires were analysed; of these, 69 horses (25.3% of the population) experienced lameness between October 2008 and October 2009. Monthly incidences of first case lameness episodes are shown in Table 1. Mean monthly incidence rate was 2.12% (range 0.00-5.73), equivalent to an annual rate of 25.44 cases per 100 horses per annum. Some horses had multiple lameness episodes; the total case number recorded was 85 (mean of 1.23 episodes per horse in the lame population). Fifty five horses experienced one episode of lameness, 12 experienced two episodes and two horses experienced three episodes.

The lameness episode was initially identified by a veterinary surgeon (64.7% of cases), farrier (22.3% of cases), veterinary technician (10.6% of cases) or rider (2.4% of cases). All diagnoses were made by a veterinary surgeon, or qualified farrier (for some foot conditions). The diagnoses, time to return to work and outcome is recorded in Table 2.

The mean age of the total population was 11.0 years, range 3-22 years and the mean years of service was 6.4 years, range 0 to 17 years (unknown for 8/273 horses). Age

and years of army service were not significantly different between lame and non-lame horses. The mean height of both the lame and non-lame horses was 16.3 hands, and there was no significant difference between these groups. The sex of the horses was not recorded.

Horses undertook a range of different types of work, according to their military role. The types of work were reviewed according to the type and intensity of exercise the horses required within their role. Based on this, exercise levels were classified into three categories: 11.4% of the horses did walking exercise only, 59.3% did fast work (exercise included trot, canter or gallop), and 29.3% did fast work and jumping (exercise included trot, canter or gallop and jumping). A similar incidence of lameness was observed across each work type category.

Eleven horses in the 'non-lame' population had a reported history of previous health problems in the preceding 12 months, including five recorded with lameness of unknown origin, two with cellulitis, two with tendon / ligament injury, one with exertional rhabdomyolosis and one with sole abscess. Twenty two horses in the 'lame' population had a reported history of previous health problems in the preceding 12 months, including eight recorded with lameness of unknown origin, four with cellulitis, three with osteoarthritis, and one each with exertional rhabdomyolosis, tendon / ligament injury, sole abscess, trauma from kick, 'stiffness', one non-specified, and one with multiple problems including ocular and urinary disease. The number of horses that had previous health problems (lameness or other health problems) was significantly higher in the 'lame' horse population when compared with 'non-lame' horses ($P<0.0001$).

'Cellulitis' was the most common cause of lameness; all affected horses returned to normal work and the condition only recurred in one of the 15 horses. Two horses had a history of cellulitis in the 12 months preceding the study. Cases were diagnosed on the

basis on clinical signs and history. 'Scabs', wounds or skin lesions were recorded as possible inciting causes in seven of the 16 cases.

A total of 17 horses had lameness related to foot problems – this was subdivided into two categories: foot abscesses, and other causes of foot or shoeing related pain. These cases were diagnosed by the farrier or vet on the basis of foot pain on a foot examination only, including hoof testers, and paring of the sole for infections.

Foot abscesses were diagnosed in seven horses; five of these occurred whilst the horses were unshod during periods of pasture turn out. Ten horses were reported as having lameness arising with foot or shoeing problems, excluding sole infections. These were diagnosed on foot examination and response to hoof testers, and the specific conditions identified in this category were described as 'bruised foot' (seven cases) and one case each described as 'foot sore', 'nail bind' and 'sole proud'.

Nine horses were diagnosed with tendon/ligament injuries (specifically injuries of the superficial digital flexor tendon, accessory ligament of the deep digital flexor tendon or suspensory ligament), on the basis on ultrasonographic findings. All nine horses undertook fast work (trot, canter or gallop). Follow-up on outcome and return to work was only available on five horses in this category, as some horses were still in rehabilitation at the conclusion of the study. Of these five, three returned to work at the same or lower level, one was retired and one euthanased.

Nine horses were diagnosed with osteoarthritis, based on responses to perineural and intrasynovial anaesthesia and radiographic examination. Four had a history of intermittent lameness and three had a history of lameness due to osteoarthritis in the 12 months before the start of the study.

There were seven cases diagnosed with lameness due to 'muscle bruising' secondary to trauma (becoming cast, falling or being kicked). Six of the seven returned to work within 10 days, and one was euthanased due to severe and concurrent other injuries.

Four horses were recorded as 'Other' causes of lameness. Diagnoses recorded in these cases were: two horses had laminitis (diagnosed on clinical and radiographic signs), one horse had painful inflammation of a splint bone, and one was described as having a 'stiff back' (both diagnosed on the basis on clinical examination only).

Exertional rhabdomyolysis was diagnosed in three horses, based on clinical signs and blood biochemistry, none of these cases had a history of this condition in the 12 months preceding the study.

The total number of cases that were recorded as returning to full work at the end of the study was 88% of cases (75 out of 85 lameness episodes). The remaining 10 cases either had final outcomes on return to work unrecorded (5 cases), or were in rehabilitation, retired or euthanased at the conclusion of the study (5 cases).

Discussion

This is the first study to investigate the incidence of lameness in a working (non-competition) UK equine population. There is little comparable data on incidence of lameness from other studies. Previous studies have looked at the incidence of specific conditions [10], incidence of lameness as a proportion of all health problems [2, 3], lameness in different types/ages of equine populations [9, 11, 12], or in other countries [13]. In addition, most research has reported veterinary diagnosed conditions, therefore mild or brief lameness and 'undiagnosed cause' episodes are unlikely to have been captured. As an example, Egenvall et al. (2009) reported incidence rates for locomotor problems in riding school horses in Sweden as 1116 events of veterinary care per 10,000 horse years at risk, and within this group of horses, there were 524 deaths per 10,000 horse years at risk. Their methodology identified more severe conditions, compared to the present study, as evidenced by their lower incidence rate, but high mortality rate. Ireland et al. (2012) reported on health problems in geriatric (>15 years old) horses during a veterinary clinical examination. Their methodology provides an accurate picture of

disease at the time of the examination, and their reported prevalence rate for lameness was 50.5% of the 200 horses examined.

The methodology in the present study involved all personnel involved in the care of the horse, and the lameness definition included mild and short duration incidences of lameness. This may still not reflect the true incidence of lameness; mild or recurrent cases in particular may not have always been recognised or recorded. Diagnosis was made by a vet or farriers, but one limitation is that mild or short duration lameness were often diagnosed on physical examination findings only, therefore definitive diagnoses were not achieved in all cases. This approach is likely to provide a closer reflection of the true disease incidence over a longer duration and this study also provides data on the impact on a horse's ability to work. It demonstrates that lameness is a common problem within a working horse population, but the majority of cases are of short duration, and with only a short term impact on the horse's ability to work. The study has a relatively small population monitored over a short duration of time, and extension of the study would be beneficial to improve the strength of evidence and provide long term follow up of cases.

The monthly incidence rate was lower later on in the study, which probably reflects less compliance as the study progressed. No cases were recorded in July, August and September, which may reflect that this is a rest and turn out period for many of the horses, and also that recording was probably lower at the end of the study. Themonthly incidence numbers are not high enough to draw conclusions about effect of time of year. Mean age and mean years of army service were higher in the lame population than in the non-lame population, but this was not statistically significant. This is consistent with other studies that also reported no significant association between age and risk of lameness [14, 15, 16]. It is possible that this is a statistical power issue, as a large range of different causes of lameness were identified, and only some conditions, such as osteoarthritis, may be related to age or duration of work. The significantly higher percentage of horses with previous health problems in the lame population compared to

238 the non-lame population, is likely to be due to chronic or recurrent conditions, for
239 example three horses had a diagnosis of osteoarthritis prior to the start of the study.

240 A wide range of different problems were reported; as a result, there were low
241 case numbers for each condition. This limits the conclusions that can be drawn about
242 specific diseases, and therefore only descriptive analysis was considered appropriate for
243 individual lameness diagnoses. There were however some interesting trends which
244 warrant further investigation.

245 Cellulitis was identified as the most common cause of lameness. This condition
246 receives scant attention in the veterinary literature, both in textbooks and peer-reviewed
247 published studies. There are currently three published studies of limb cellulitis; all three
248 were referral hospital studies which reported severe problems with a high rate of
249 recurrence (e.g. four out of nine horses) and euthanasia due to complications such as
250 laminitis or skin loss as a frequent outcome [4, 5, 6]. In comparison, in this study the
251 condition was common and no severe complications were seen. All horses returned to
252 their previous level of work, and the condition only recurred in one of 15 horses.

253 Foot problems were common, but there were a range of different conditions seen,
254 and most were diagnosed by the farriers on the basis of clinical findings on foot
255 examination only. The incidence of foot abscesses was lower than might be expected,
256 which probably reflects that this population is stabled for the majority of the time and
257 ridden on an even surface. Cases during pasture turn out may be under-reported as
258 during this period the horses feet are examined less frequently and this occurred
259 towards the end of the study when compliance may have been less.

260 Skin wounds were the second most common cause of lameness in this study. The
261 results of an owner questionnaire by Owen et al. (2012) reported an incidence of 40% of
262 horses sustaining traumatic injuries over a one year period. This current study concurs
263 that they are a common occurrence, but showed minimal long term impact. All of the
264 horses where case outcome was known returned to full work, but this study does

demonstrate the impact of this problem on the horse's ability to work in the short term, as evidenced by the time off work.

Other main causes of lameness (foot problems, osteoarthritis, tendon / ligament injury) were anticipated, and their outcomes were consistent with current literature. Osteoarthritis and tendon / ligament injury both had a poorer prognosis for return to full work in this study, compared to the other lameness categories. This is consistent with previous studies, and probably explains their prominence in terms of attention in veterinary research and literature.

There were only two reported cases of laminitis. This may be due to the management of this population, with limited pasture turn out. However, Ireland *et al*. 2011 also reported a lower than expected incidence of laminitis. Again, the potential severity of this disease probably explains its prominence in veterinary literature and research.

This was an initial field study and is limited in terms of the numbers of horses and duration of the study. However, it highlights that we should appreciate the spectrum of different lameness conditions. Some of the less severe problems may be common in the horse population, and although they may not affect the horse's ability to return to work, they still have an impact in terms of time off work.

This population was interesting to study, because management and exercise levels were standardised, which allowed valid comparison between lame and non-lame populations, and professional health care is constantly available on site. Despite their differing roles, the type and workload of the horses in this study are not likely to be dissimilar to some components of the general horse population. The study findings are therefore not only useful in terms of evaluating lameness in working military horses, but also highlight a need for more research relevant to the general horse population. The common causes and outcomes of lameness were different from those reported in other studies, highlighting the need for investigation across different populations, and to

capture data at an owner / rider level. Some of the conditions identified (cellulitis, skin wounds and muscle bruising) receive little attention in veterinary literature. This study highlights a need to review what is actually a 'common' cause of lameness, and to ensure that the veterinary research and literature reflects this.

References

1. Egenvall, A., Bonnett, B.N., Olson, P., Penell, J. and Emanuelson, U. (2006) Association between costly veterinary-care events and 5-year survival of Swedish insured warmblooded riding horses. Prev. Vet. Med. 77, 122-136.

2. Kaneene, J.B., Ross, W.A. and Miller, R. (1997) The Michigan equine monitoring system. 2. Frequencies and impact of selected health problems. Prev. Vet. Med. 29, 277-292.

3. Penell, J.C., Egenvall, A., Bonnett, B.N., Olson, P. and Pringle, J. (2005) Specific causes of morbidity among Swedish horses insured for veterinary care between 1997 and 2000. Veterinary Record 157, 470-477.

4. Adam, E.N. and Southwood, L.L. (2007) Primary and secondary limb cellulitis in horses: 44 cases (2000-2006). JAVMA-J. Am. Vet. Med. Assoc. 231, 1696-1703.

5. Fjordbakk, C.T., Arroyo, L.G. and Hewson, J. (2008) Retrospective study of the clinical features of limb cellulitis in 63 horses. Vet. Rec. 162, 233-236.

316 6. Markel, M.D., Wheat, J.D. and Jang, S.S. (1986) Cellulitis associated with coagulase-
317 positive staphylococci in racehorses - 9 cases (1975-1984). J. Am. Vet. Med. Assoc. 189,
318 1600-1603.

319

320 7. Ireland, J.L., Clegg, P.D., McGowan, C.M., McKane, S.A., Pinchbeck, G.L. (2011) A
321 cross-sectional study of geriatric horses in the United Kingdom. Part 2: Health care and
322 disease. Equine Vet J. 43(1):37-44

323

324 8. Jeffcott LB, Rossdale PD, Freestone J, Frank CJ, Towers-Clark PF. (1982) An
325 assessment of wastage in thoroughbred racing from conception to 4 years of age. Equine
326 Vet J. 1982 Jul;14(3):185-98

327

328 9. Singer, E.R., Barnes, J., Saxby, F. and Murray, J.K. (2008) Injuries in the event
329 horse: training versus competition. Vet. J. 175, 76-81.

330

331 10. Ely, E.R., Avella, C.S., Price, J.S., Smith, R.K.W., Wood, J.L.N. and Verheyen, K.L.P.
332 (2009) Descriptive epidemiology of fracture, tendon and suspensory ligament injuries in
333 National Hunt racehorses in training. Equine Vet. J. 41, 372-378.

334

335 11. Preston, S.A., Trumble, T.N., Zimmel, D.N., Chmielewski, T.L., Brown, M.P. and
336 Hernandez, J.A. (2008) Lameness, athletic performance, and financial returns in yearling
337 Thoroughbreds bought for the purpose of resale for profit. J. Am. Vet. Med. Assoc. 232,
338 85-90.

339

12. Ireland, J.L., Clegg, P.D., McGowan, C.M., McKane, S.A., Chandler, K.J., Pinchbeck, G.L. (2012) Disease prevalence in geriatric horses in the United Kingdom: veterinary clinical assessment of 200 cases. Equine Vet J. 1982 Jul;14(3):185-98.

13. Egenvall, A., Lonnell, C. and Roepstorff, L. (2009) Analysis of morbidity and mortality data in riding school horses, with special regard to locomotor problems. Prev. Vet. Med. 88, 193-204.

14. Ross, W.A. and Kaneene, J.B. (1996a) An individual-animal-level prospective study of risk factors associated with the occurrence of lameness in the Michigan (USA) equine population. Prev. Vet. Med. 29, 59-75.

15. Ross, W.A. and Kaneene, J.B. (1996b) An operation-level prospective study of risk factors associated with the incidence density of lameness in Michigan (USA) equine operations. Prev. Vet. Med. 28, 209-224.

16. Ross, W.A., Kaneene, J.B. and Gardiner, J.C. (1998) Survival analysis of risk factors associated with the occurrence of lameness in a Michigan horse population. Am. J. Vet. Res. 59, 23-29

17. Owen, K.R., Singer, E.R., Clegg, P.D., Ireland, J.L., Pinchbeck, G.L. (2012). Identification of risk factors for traumatic injury in the general horse population of north-west England, Midlands and north Wales. Equine Vet J. 44(2):143-8

363

364

365 **TABLE 1. Monthly lameness incidence rate for 273 working military horses over**

366 **a 13 month monitoring period**

367

Month	Incidence rate (%)
October 2008	2.96
November 2008	5.73
December 2008	0.81
January 2009	1.63
February 2009	3.73
March 2009	3.45
April 2009	3.13
May 2009	2.76
June 2009	1.90
July 2009	0.00
August 09	0.00
September 2009	0.00
October 2009	1.45

368

Word count 4,019 plus table 2 (357) = 4376