1

Introduction

I.M. Wright

Newmarket Equine Hospital, Newmarket, UK

Over the course of the last 50 years, the concept of fractures in horses has emerged from an association with inevitable euthanasia to an expectation, in many cases, for restoration of full athletic function. This has been the result of major developments in understanding pathogenesis, imaging, anaesthesia, internal fixation, pharmacology and minimally invasive surgical techniques. However, although previous progress was slow, there were inklings of latent knowledge. This should not be surprising: in 1722 W. Gibson [cited in 1] wrote, 'As the general use and service of horses has rendered them more worth the notice and regard of mankind than any other of the brute creatures; so there has in most ages of the world been a more than ordinary care taken, not only to model and fit them for their respective services, but also of their breed and preservation.'

Historical Review

The following review makes no claim to be comprehensive but aims to be sufficiently representative to illustrate the temporal recognition, development of understanding, diagnosis and treatment of fractures in horses.

The Ancient World

Fractures have occurred in wild (non-domesticated) animals throughout their evolution. It has been suggested that horses were initially domesticated in the late Neolithic period: first for food and later for transportation and war [2]. Domestication of Equidae introduced new environments and circumstances particularly as horses were used for work, often were ascribed special value (both economic and emotional) and played important cultural roles in human civilization. There is a dearth of documentation of equine fractures by the ancient Syrian, Egyptian, Persian and Greek civilizations, although in the latter Xenophen (380 BCE) described 'Rules for the Choice, Management and Training of Horses' and Aristotle (333 BCE) in 'The History of Animals' introduced the concept of gaits. An ancient Greek treatise called the Mulomedicina Chironis has been ascribed to a healer Chiron. There is evidence that this was a real person circa 700 BCE, but confusion is produced by later elevation to the mythologic status of centaur.

In paleopathologic investigations, three healed metacarpal bone fractures dating from the Iron Age (800 BCE–43 CE) have been found in different parts of Europe [3]. These included a compound fracture of what was considered most likely a working mare buried in a human cemetery of the fourth to seventh century BCE at Sindos, Greek Macedonia. The bone was markedly distorted but the animal is thought to have survived for at least three to four years after the injury, and it was suggested that this lame mare may have pulled her 'loving owner's' cart to the grave before being sacrificed and laid next to him [4]. A rib fracture in a horse from the Roman Imperial period (27 BCE–284 CE) was found at a site near Seinstedt, Germany [5]. The same group reported a 'neatly healed' fractured third metatarsal bone in a horse from the Iron Age sacrificial site of Skeddemosse, Sweden [6], and a fractured metacarpus from a similar period was found in a horse at Tiel-Passewaaij, the Netherlands [7].

According to Harcourt [cited in 8], an archeologic study of the Roman site of Tripontium, England, found a healed fractured humerus in a horse although there was no evidence to indicate intervention. The paucity of healed fractures in large animals was considered direct evidence of the associated bad prognoses [3]. No archeologic evidence of therapeutic intervention during this period has been found [7, 9]. The possibility had been suggested in a healed metacarpal of an Iron Age horse from Manching [10].

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However, the specimen had a complicated fracture that healed with 'distortion of the bone and development of an enormous callus', which appears to make this tenuous.

The writings of Hippocrates (considered the father of medicine) in the fourth to fifth century BCE included a text 'De Fracturis', which is the first known treatise devoted to the subject. The Hippiatrika, a text compiled in the fifth or sixth century CE, was a compilation of extracts of Greek technical literature on the care and healing of horses. This included a contribution from Apsyrtus, a 'well-known horse specialist' from the fourth century CE [10], who was of the opinion that 'all fractures below the knee have a good chance of healing'. Later manuscripts published as Hippiatria (1531) or Hippiatrica (1543) also cite Apsyrtus treating fractures below the knee with splints and bandages with cures expected in about 40 days (which must question the diagnosis), while fractures above the knee were considered incurable [11].

The Romans appeared to document little in veterinary medicine until the end of their Western empire when the Byzantine Publius Vegetius (circa 450–500 CE) recognized that diseases of the horse were similar to those suffered by men. Vegetius is often considered the first to have documented hippiatric beliefs and practices. These were almost certainly preceded but records are lacking.

Middle Ages/Mediaeval Period

Throughout the Middle Ages (circa 500–1500 CE), horses continued to play a major role in warfare with increasing numbers employed in agriculture and transport. In the early Middle Ages, Western medicine in general was dominated by religious (Christian) doctrine; science in the currently accepted sense was neither considered nor applied. Further discussion on fractures is found in republications of the ancient works of Chiron the Centaur (circa 400 CE) and Vegetius Ranatus (450–500 CE). The latter was translated from Latin to English in 1748 as 'Distempers of Horses' and includes a chapter (two pages) on fractures. Open limb fractures were recognized as 'almost incurable'. For closed fractures, bandages, splints and slings were recommended. The latter fitted so that the horse 'may not touch the ground with his foot, lest the fracture should move to and fro in a lamentable manner'. Vengetius Ranatus instructed that the horse must not be allowed to stand on the fractured limb for 40 days 'for that is the time when things that are broken, or torn asunder, or disjoined, are consolidated' [11].

The Mamluks, who ruled Egypt and Syria between 1250 and 1517, are thought to have used orthopaedic bandages containing resins from *Boswellia* plants and pitch from cedar and tannűb trees to heal broken bones in horses [12]. There is also iconographic evidence of care of horses with fractures: binding a fractured metacarpus in a horse suspended in a sling is illustrated in *Mending the fractured metacarpal of the horse (1390)* from *Libro de menescalcia e de albeyteria et fisica de las bestias* (a Spanish text from the Middle Ages) and in the fifteenth-century work of Johan Alvares de salami Ella's. A fractured pelvis from the fourteenth to sixteenth century was recovered from the Cumanian settlement of Karcag-Organdaszentmiklós, Hungary. The fracture involved the ilial shaft and was displaced, but there was sufficient adjacent new bone to suggest that this was of multiple months' duration during which period the horse was considered to have been 'immobilized' [13].

The Renaissance/Reformation

From a medical/scientific perspective, the Middle Ages may be considered to have ended with the introduction of mechanical printing at the end of the fifteenth century. 'Proprytes and medicynes of hors' was thought to be first printed in 1497 or 1498. This was followed by 'Medicines for Horses' somewhere between 1510 and 1560. There are no ascribed authors to either. However, such texts made little comment on traumatology, concentrating on remedies, topical applications, bloodletting and similar (now considered illogical) insults [1].

Equine fractures were mentioned by a French author Rusius in 1559 and Thomas Blundeville, an English mathematician (who invented the protractor), in *The fower chiefyst offices belonging to Horsemanshippe* published in 1565 described fractures as a form of 'evil' that, in common with wounds and ulcers, causes a 'loosening or division of the unity' [14]. Gervase Markham made comment on veterinary matters in books commencing with 'A Discourse of Horsemanshippe' in 1593. This was followed by Thomas De Grey's 'The Compleat Horse-man and Expert Farrier' in 1639 and 'The Anatomy of a Horse' by A. Snape in 1674.

The Enlightenment and Industrial Revolution

Reference to anaesthesia and analgesia (albeit not in such terms) occurs in a series of experiments in the 1650s and 1660s when animals were injected with a solution of opium [A H Machle 1998 cited in 1].

The concept of musculoskeletal biomechanics appears in print in the mid-seventeenth century when individuals like the physician Giovanni Alfonso Benelli (1608–1679) applied the concepts of physics and mechanics, thus viewing bones and joints as levers. Further reference is made in 'The Compleat Horseman' [15], a 1702 translation by Sir William Hope of 'Le Parfait Marschal' by Jacques de Solleysel. Of note is the absence, to this time, of veterinarians. Solleysel is said to have combined riding school training with veterinary practice (largely performed by farriers). It was not until 1762 that Claude Bourgelat founded the first veterinary college in Lyon. W. Gibson in 'The Farriers New Guide' published in London in 1722 noted that although broken bones might be corrected, a horse that had a fracture 'with a large wound in the flesh' was unlikely to recover satisfactorily. In 1766, von Suid described a sling system designed to prevent horses from lying down and reported healing of 10 horses with fractures of distal bones.

Youatt (1843) in the 'Fractures' chapter of 'The Horse' [16] stated that 'Accidents of this description are not of frequent occurrence but when they do happen it is not always that the mischief can be repaired: occasionally, however and much more frequently than is generally imagined, the life of a valuable animal might be saved if the owner, or the veterinary surgeon would take a little trouble' [17]. This concept was reinforced by Williams (1893) [18] who noted that 'a ridiculous idea has prevailed amongst horsemen that fractured bones never unite. This is incorrect . . . provided that fractured ends can be kept at rest.' Both authors placed great emphasis on the use of slings, but splints of green wood [16] and leather [18] are also described.

Clater's 'Every Man His Own Farrier' (1853) [19] suggested that 'a horse is often condemned without cause, on account of fracture of the bones of the fore-legs: either the practitioner dislikes the trouble of the case, or the proprietor is loath to make the proper remuneration. There is but one circumstance that would justify the abandonment of a horse with fractured leg, and that is it being a compound fracture, i.e. the integument and muscular parts being lacerated; then, indeed the case is hopeless. The cure of a fracture of the pastern or the shank bone may be undertaken with a fair prospect of success. All that is to be done is to cut the hair closely from the parts; to bring, – and as gently as may be, – the divided edges of the bone in apposition; to retain them there by a pitch plaister; and then to bind on splints, which shall reach a considerable way above and below the injured part. This should be done in the box in which it is intended that the horse should remain. He should be bled, and a dose of physic should be given to keep down inflammation, and then he should be left to himself. He will take care of his broken leg; he will not press upon it for many a day; and not at all, until he can do so without much pain: and, in many more cases than some have imagined, the fractured bone will unite, and the horse will do well. A sling should rarely, I would say almost never, be used. The sad excoriations, and other inconveniences occasioned by the long use of a sling, have, more than anything else, brought the treatment of fractures into disrepute. The horse does not like pain, and will generally take all the care of his injured limb that we could wish him to take. Fractures of the hind extremities are more serious affairs, and should be undertaken with caution.'

Fitzwygram (1869) [20] described bone structure, as far as it was understood, and gave a rudimentary classification of fractures. The following paragraphs provide a summary that endured. 'In the human subject, the treatment of broken bones is comparatively easy, because the patient can be placed without difficulty or opposition on his part on his back in bed, the position most favourable for relieving the broken limb of all weight and pressure. Whilst in this position splints and other restraints can be conveniently imposed, and the patient is blessed with sense enough to induce him to submit to such restraints and to remain quiet. In the horse, we have none of these advantages. We cannot without hurtful violence throw the animal on his back, nor can we by any persuasion induce him voluntarily to remain in that position. Hence fractures of important bones are generally incurable. In most cases therefore of such injuries it is better to have the animal destroyed at once. Again the horse is an animal, whose value as a general rule consists in his power of locomotion. In man on the other hand the surgeon, though he may not be able to make a perfect cure, is often well content, if he can produce such re-union of the bones, as may enable the patient, in case of broken leg for instance, to walk about. A horse is of no value, unless he can walk, trot and gallop sound and level. An exception however to this general rule occurs in the case of valuable brood mares or stallions.'

Fitzwygram [20] also understood the concepts of monotonic and fatigue (cumulative stress/strain imbalance) fractures, and described fractures caused either by violence to the bone or from excessive strain. Diagnosis was entirely clinical. Treatment objectives were reported as 'setting', i.e. the bringing together of the broken ends and when the bones were 'thus adjusted . . . to keep them in their place', which was described as 'a very difficult matter and needs expertise and ingenuity' which is equally applicable today. Splints padded with tow (flax or hemp), bandages and strips of adhesive plaster were described. The starch bandage, which had been in human use since Roman times (reported by Celsus in 30 CE), was considered particularly useful and could be stiffened with an external wooden splint. It was also suggested that in some cases the horse may be slung with a view of taking the weight off the part affected.

In 1884, Smith [21] reported sling management of horse, which was non-weight-bearing on a hindlimb and which subsequently (at post-mortem) was found to have an axial fracture of the lateral condyle of the femur. The first surgical repair of an equine fracture appears to be in 1891 when Prieur [cited in 22] referred to repair of an equine jaw fracture with a drilled wire suture in Cairo, Egypt.

Around 1800, William Eton [23] described the creation of a gypsum (calcium sulphate) plaster mould to immobilize fractured legs that he had observed in Turkey. First documented use in man is attributed to a Dutch surgeon

Antonius Mathijsen in 1852 and it was adopted into military service in the 1850s during the Crimean War by a Russian surgeon Nikolai Pirogor (1810–1881). The earliest reference to attempted use of plaster of Paris in horses was in 1872 [24], although it was not recommended. However, in 1883 plaster of Paris splints were described as a successful method of fracture management [25].

Near the end of the century, one of the first identifiable movements to reduce the incidence of fractures in horses was the 1889 formation of the Horse Accident Prevention Society (Slippery Roads), which campaigned against asphalt road surfaces.

The Twentieth and Twenty-first Centuries

The Farm Vet published by an anonymous veterinarian in 1914 noted that 'chloroform can be used to render animals insensible and relaxes muscles which oppose the necessary extension of limbs in order to get fractured bones in apposition'. Horses are noted as 'the worst subjects for fractures and sheep the best. Horses must be able to work sound. Sheep and cattle need only to put on sufficient flesh to bring them to the block.'

In 1905, Wotley Axe [26] commented on the emergency care of equine fractures; 'if an ambulance cart can be procured without much delay, it would be desirable to convey him at once where he may be required to go' and that 'it should be kept in mind that the success of treatment is greatly facilitated by the speedy readjustment of the broken bone'. Potential limitations of temperament were also recognized; 'a horse's highest intelligence fails to realise the advantage of that perfect quiet upon which the surgeon sets so much store, in guarding against an extension of the injury and in bringing about its reparation. The moment the fracture is suspected every means should be adopted at once to restrain the animals movements and to provide as far as possible against any undue use or disturbance of the injured limb.'

Röentgen discovered X-rays in 1895 and the potential of radiographic diagnosis in horses was first recognized as early as 1927 [27]. Radiographs produced on photographic films were first documented in equine fracture evaluation in 1950 [28]: until this time diagnosis was entirely clinical [20]. Radiographic diagnosis came to public attention in 1966 with the diagnosis of a distal phalangeal fracture in champion steeplechaser Arkle.

The 1962 publication of the eponymous 'Lameness in Horses' [29] signalled the arrival of the speciality. It also provided a series of radiographic images of equine fractures and recommended specific treatments including suitability for fragment removal. Although at this time the desirability for reconstruction was recognized, techniques and suitable equipment were not yet available. In 1963, Salter and Harris [30] described a classification of growth plate fractures in children. Its applicability to horses was soon recognized, and its adoption into veterinary orthopaedics was rapid and enduring.

Internal fixation of fractures was first reported by Lambotte in 1913 [cited in 31]. Techniques for active repair of fractures in horses appeared in the first half of the twentieth century, but progress was slow. Roberts [cited in 17] concluded that intramedullary pins were impractical in horses because of fragment rotation and implant bending. Problems associated with plates available at this time included bending at screw holes and shearing of screws. These issues were addressed by the combined mathematical, physical, engineering and medical collaboration in establishing the Arbeitsgemeinschaft fűr Osteosynthesfragen (AO) group in 1958. This was translated in the United States into the Association for the Study of Internal Fixation (ASIF). The terms are synonymous, interchangeable and sometimes used concurrently (AO/ASIF). Central to the early AO goals were accurate anatomic reconstruction, fracture compression, rigidity of fixation and preservation of blood supply [32]. This promoted primary bone healing, a concept first published in 1947 [33]. In 1968, an osteotomized third metacarpal bone was repaired *in vivo* with a human plate [22]. AOVET was founded in 1969, and in the following year a report documented the repair of diaphyseal fractures of third metatarsal bones in two ponies using primordial compression plates and cortical screws [34]. Initial progress was slow. In a well-documented seven-hour marathon surgery in 1972, a third metacarpal lateral condylar fracture was repaired in Derby winner Mill Reef. The owner was charged £25 000 [35] (which equated to approximately £330 000 in 2020). As interest increased, an exponential growth in the publication of papers on equine fractures followed (Figure 1.1). The first *Manual of Internal Fixation in the Horse* was published in 1982 [36]. Development of an equine fracture documentation system was attempted [37], but the discipline progressed too quickly for this to be viable. In 1996, Alan Nixon edited the multi-author 'Equine Fracture Repair' [38], which provided an excellent state of knowledge summary for the time. A second edition was planned 10 years later but did not reach fruition until 2020 [39]. In the interim, 'AO Principles of Equine Osteosynthesis' was published in 2000 [40]. The rapid relief of pain that follows a stable fracture repair is remarkable and, in addition to preventing secondary, and often life-limiting clinical problems such as overload laminitis, has made a major contribution to animal welfare. On a personal basis, this remains one of the greatest motivating forces.

Implants used in equine fracture repair have also evolved; while cortical bone screws have been a consistent mainstay throughout, plate design has increased in sophistication. The originally used dynamic compression plate (DCP) [41]

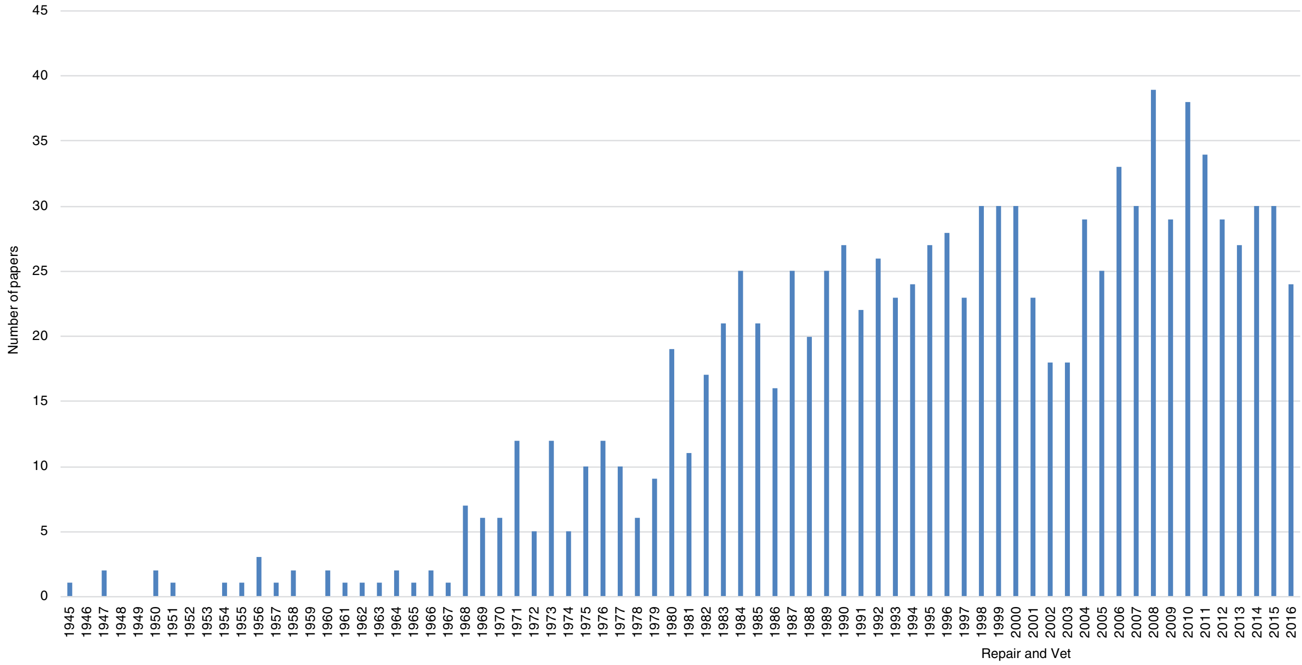

Figure 1.1 Number of papers on equine fractures published in the veterinary literature between 1945 and 2016. *Source:* Data from PubMed (https://www.ncbi.nlh.gov/pubmed/).

remains in use. Although not identified in horses, stress protection and remodelling osteoporosis were associated with DCP application in man and this led to development of first the limited contact dynamic compression plate (LC-DCP) and subsequently the locking compression plate (LCP) [42].

Safe and effective adaptation of AO/ASIF techniques relied on developments in anaesthesia, operating theatre and table design, asepsis, evolution of suture material, medication, cast materials and imaging. Fracture repair under general anaesthesia is almost always optimal. Justification for standing techniques was based on historic mortality risk data [43]. Development of anaesthesia training programmes, improvements in pharmacology and centralized hospital experience have subsequently resulted in significantly reduced risk [44].

Understanding the importance of soft tissues in successful fracture management has been an important although less well-documented concept [45–47]. Refinements have occurred and prognoses improved by the use of minimally invasive surgical techniques, principally arthroscopy first in removing articular fracture fragments [48] and more recently in guiding reduction and repair [49, 50]. Minimally invasive plate application has also been adopted into clinical practice [51]. Accurate three-dimensional imaging and the repeatability/predictability of work/fatigue fractures have also permitted percutaneous repair with consequent preservation of soft tissue.

Use of resin-bonded fibreglass to create casts for horse limbs was reported in 1963 [52], and use of fibreglass to reinforce plaster of Paris casts was first documented in 1966 in treating people [53]. Equine use of an experimental tape was reported in 1971 [54], and its material advantages were documented in 1973 [55]. Subsequent commercial development of fibreglass casting materials suitable for use in horses [56–59] enhanced acute support before surgery and recovery from general anaesthesia. It has also permitted more protracted immobilization of fractures that are not amenable to reconstruction or to augment or protect constructs. Severely comminuted and/or complex fractures can also be managed with transfixation casts used alone or in conjunction with selective internal fixation [60, 61]. These techniques have now replaced external fixation devices for distal limb fractures [42, 62].

Distal limb amputations with replacement prostheses have been documented [63], but complication rates are high, longevity is usually limited and the ethics are questionable. Other prosthetic techniques have also not made a significant impact in equine orthopaedics [64]. Nonetheless, veterinarians have always been capable of lateral thought and have been prepared to try alternative approaches. Plato's adage that 'necessity is the mother of invention' is readily applicable to equine fracture management. Examples include standing fracture repair, long-term suspension of horses [65, 66] and relief of load on fractured bones or limb segments [61, 62, 67–71]. Attempts to hasten bone healing (Chapter 6) have largely been unfruitful.

Nuclear medicine (scintigraphy) was adopted into equine orthopaedics in the 1980s [72]. Determination of increased metabolic activity in bone allowed identification of suspected fractures in areas of limited imaging capability or in some cases in advance of identifiable (usually radiographic) morphologic changes [73].

After nearly a century of interpreting radiographic information on photographic film, digital imaging became the norm and with it substantially more information on bone structure and fracture identification. However, radiographs are two-dimensional assessments of a three-dimensional object with superimposition of other structures. They are therefore limited in assessing the geometry of fractures that are not simple and uniplanar. Introduction of computed tomography (CT) in the last decade provided three-dimensional radiographic information and has been a great step forward resulting in the re-classification of many fractures from incomplete to complete, uniplanar to spiral and simple to comminuted. Confident identification of fractures has not only directed optimal management but has also permitted minimally invasive repair.

Ex vivo (post-mortem) use of CT and magnetic resonance imaging (MRI) to evaluate equine fractures was reported in 1995 [74]. Both produce sectional multiplanar images, but these are based on different information sources. CT relies on tissue attenuation of X-rays; MRI principally maps the presence of hydrogen atoms (particularly in water and fat), and structural information of the skeleton is inferred from this [75]. CT identification of a two-dimensional radiographically occult fracture was reported in 1999 [76], and in 2001 Tucker and Sande [77] identified the potential for CT to better delineate fracture orientation and assist in surgical planning in horses. Subsequent development and adoption of mobile in-theatre units made this a reality, and CT is currently considered the gold standard in assessing and directing repair of equine fractures. *In vivo* diagnostic use of MRI for the evaluation of equine fractures started to appear in 2010 [78] with subsequent contributions to understanding pathogenesis [79], surgical planning [80] and risk assessment [81].

Inherent surgical limitations are now recognized in veterinary medicine [82]. Those who regularly deal with equine fracture repair understand the importance of team work, attention to detail, communication and planning. The ideas crystallized in the publications of Atul Gawande [83–85] are as relevant to equine surgeons as their human counterparts. An international World Health Organisation (WHO) study demonstrated that adoption of a surgical checklist reduced human post-operative morbidity and mortality by 36% and 48%, respectively [86]. Multiple subsequent studies have upheld these findings in man, and similar results have been reported in veterinary anaesthesia [87] and small animal surgery [88, 89].

The Future

Ethereal debate centred on the question of 'what is a fracture?' is anticipated. The dictionary definition of 'being broken, of a crack, division or split' [90] is clear, but at what level? Division of a bone into two or more pieces is indisputable and all would agree that incomplete fissures in cortical or subchondral compacta are fractures. But should disrupted trabeculae in spongiosa be similarly classified? Do some enostoses represent fractures in trabecular bone [91]? Are the recently adopted terms of 'bone failure', 'bone bruising' and 'fatigue failure' manifestations of fractures at a microscopic level?

If the veterinary profession wishes to retain its role as guardians of animal welfare, then future endeavours will need to include measures targeting prevention or reduction of fracture incidence in horse sports, particularly racing. Elements of society have and will continue to question whether use of horses for competitive sport is ethical and, rather more directly, whether 'horseracing is too dangerous?' [92]. In some countries, animals are also gradually moving from the legal status of chattel to sentient beings: with that will come rights and this may herald a change in society's attitudes. The veterinary profession is best positioned to provide objective guidance. Suggestions that with the right insight nearly every catastrophic fracture in flat racehorses could be foretold [93] are not justifiable. However, the prevention of some work/stress-related fractures through conditioning and training methods, surface design and maintenance [94] and potentially from genetic studies [95] appears feasible goals. Robust epidemiological studies should identify risk factors, enable change to be rational and, if both are correct, reduction in work-related (stress) fractures is a reasonable expectation. Unfortunately, epidemiologic evidence thus far is inconsistent [96]. Previously heralded mineral-based dietary influences appear unlikely to contribute [97]. Screening of horses in training or monitoring at-risk individuals by biomarkers as yet appears to lack sensitivity and specificity [98]. Assessment by diagnostic imaging is an attractive concept but remains unproven [95, 99–104]. Longitudinal studies, of which there are few in man [105], are a laudable goal [95] but unlikely to be practical in equine athletes.

Notwithstanding the above, monotonic fractures that result from trauma will continue to present and challenge veterinarians. The potential for survival, humane preservation of life and return to useful function continues to progress proximally in the horse's limb. Development of CT equipment that will allow three-dimensional evaluation of the proximal appendicular and axial skeleton appears close to the horizon. Variable angle LCPs (VA-LCP) are now in production for man and should soon join the veterinary surgeons' armamentarium [42]. Refinements such as the addition of hard carbon film to improve drill efficiency and reduce bone temperature may become the norm [106]. Further development of biodegradable plates and screws is anticipated together with drug, osteoconductive and osteoinductive coatings to implants [42, 107, 108]. Customized implants made using 3D printing technology are also an enticing prospect but access to adequate technological knowledge and appropriate materials is unlikely to be widespread in equine surgery. Computer-assisted surgery in horses is in its infancy [109, 110] but will not be a substitute for anatomic knowledge or surgical skill. There is little current evidence to support clinical application of cellular, growth factor or cell signalling molecules in improving the rate or quality of fracture healing [42]. However, in common with other regenerative disciplines, targeted nuclear manipulation appears rational and holds promise.

It has been stated that orthopaedic surgery may be reduced to three key factors: knowledge, understanding and accuracy [111]. Publications (hopefully this included) add to the body of corporate knowledge. Competent equine fracture repair requires a trained and experienced team including imagers, surgeons, anaesthetists, theatre technicians and nurses. Accuracy is aided by technology but requires discipline, training and experience. Understanding is a never-ending personal challenge. Technical errors are inevitable when even 'simple' fractures are repaired by inexperienced personnel. Technology aside, size, behaviour and temperament will always be challenges to equine fracture management. However, if the rate of progress seen in the last 50 years continues, then many of these will be met and current limitations will be confined to historical perspective.

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