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CASE REPORT

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The cloven hoof in legal medicine

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Abstract The injury of a horse's leg needed to be investigated to answer the question whether the fracture had been caused by an accident or by intentional manipulation. By toxicology and using scanning electron microscopy with an energy dispersive X-ray spectrometer (SEM-EDX) the suspicion obtained by morphology could be confirmed. Toxicologically a short term anaesthetic was found, and by EDX ferric oxide particles could be detected in the wound indicating that the injury was caused by a sharp pointed metallic instrument and not as stated by the owner by a wooden bar. As the result of the interdisciplinary investigation using modern techniques, there is no doubt that the owner attempted to fraudulently claim on an insurance policy.

Keywords Veterinary medicine · Insurance fraud · Toxicology · EDX microanalysis

Introduction

Insurance fraud seems to be an increasing phenomenon [1, 2, 3], and in the minds of some people it has become considered a sport. Only in a very small number of cases in which insurance fraud is suspected is a medico-legal investigation required, mainly in cases of self-mutilation involving hand and finger injuries among physicians [4] or of acceleration/deceleration trauma of the spine [2]. In some cases special techniques and methods have to be used to solve complex questions and problems.

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One interesting case from the area of veterinary medicine will be reported.

Case report

The owner claimed that a horse had injured itself during free jumping. He stated that a falling horizontal bar (made of wood, diameter about 15 cm) collided with the inner side of the right anterior leg causing a laceration. The veterinarian diagnosed a fracture of the long pastern bone (phalanx III) including the joint area. On the day after the "accident" a public health veterinarian was consulted and certified that the horse could no longer be used for sports. The owner immediately arranged for the horse to be put down and informed the insurance company, who were liable to pay in case of "accidental death" or if the horse had to be put down due to injury.

Because the insurance value was much higher than the "real sporting value" of the horse, the insurance company initiated an investigation and the injured leg was placed in safe keeping.

There were two questions which had to be answered:

1. Would surgical treatment of the fracture have been possible?
2. Was the injury due to an accident or was it caused by intentional manipulation?

Medico-legal investigation

Morphology

The 35 cm long distal part of the foreleg showed an L-shaped laceration (4.3 × 1.5 cm) on the inner side 7 cm proximal to the hoof (Fig. 1). On the inner side a 11 × 8 cm haematoma of the tissue could be observed (Fig. 2), with a central defect of the fascia 2.5 × 1.2 cm in size and a 2.5 cm long channel-like defect, ending at the joint of the long pastern bone (Fig. 3), at the peak of a pyramidal bone fragment (Fig. 4). The joint area was also involved. The basis of the broken bone fragment was 2 × 2.6 cm in size, leading to a cartilaginous defect of the roll of the corresponding bone (Fig. 5). A second haematoma could be found on the outside of the leg in the soft tissue (17 × 6 cm). On histological examination hair fragments were observed in the injury near the fractured bone. The haematoma was infiltrated by granulocytes and a fibrin network was also present.

Toxicology

Muscle specimens were taken during preparation and the toxicological investigation was carried out using the GC/MS technique (increasing column temperature 80 °C–280 °C, 25 m quartz capil-

Fig. 1 L-shaped laceration of the skin (4.3 × 1.5 cm) on the inner side of the horses leg

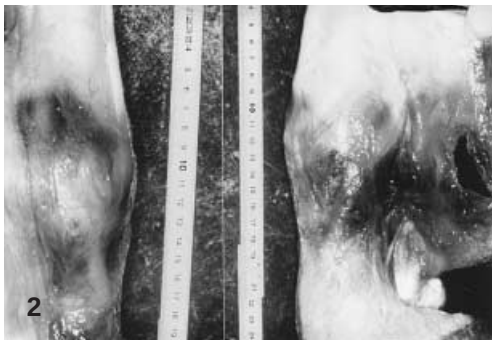

Fig. 2 Two different haematomas in the subcutaneous tissue: on the left side the 17 × 6 cm haematoma on the outside of the leg is shown; on the right side the inner haematoma including the laceration of the skin is demonstrated

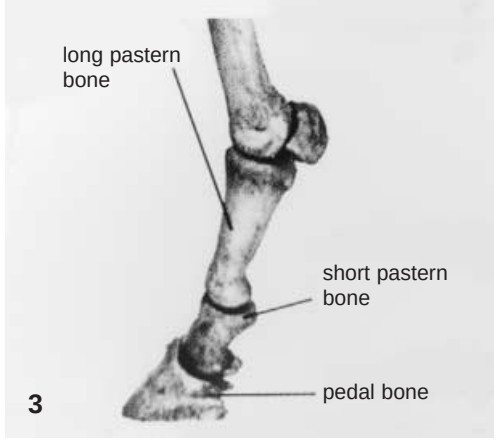

Fig. 3 Skeleton of the lower part of a horse leg

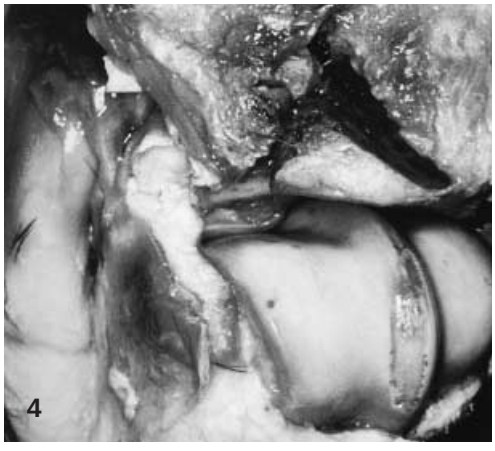

Fig. 4 The pyramidal-shaped fragment of the long pastern bone and the cartilaginous defect of the role of the corresponding joint area are shown

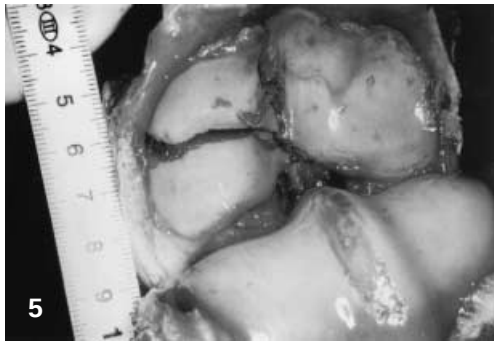

Fig. 5 Fracture lines in the joint area of the long pastern bone

Fig. 6 Backscattered electron (BSE) image showing a small metallic particle (diameter 200 µm) in the tissue on the surface of the bone fragment (Variable pressure mode of the SEM, pressure in the specimen chamber 50 Pa, accelerating voltage 20 kV)

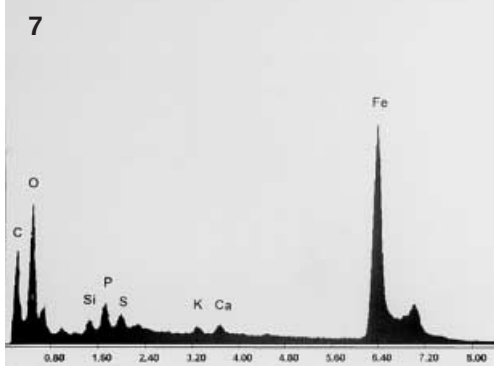

Fig. 7 Energy dispersive X-ray spectrum showing two main peaks (oxygen, iron) indicating that ferric oxide was transmitted into the wound

lary, 5% phenylmethylsilicon, mass specific detector ITD 800). As a result, ketamine and diazepam could be detected in the extracts.

Detection and identification of foreign particles in the wound

Specimens taken from the edge of the bone fragment and from the soft tissue at the end of the channel-like tissue defect were investigated using a variable-pressure scanning electron microscope (SEM). In the variable-pressure mode the wet and non-conductive bone and soft tissue specimens could be investigated. No specimen preparation techniques such as drying were necessary which reduces the risk of contamination by foreign particles. Additionally no spatter coating for electric conductivity was required. Using backscatter electrons for imaging (Robinson detector), metallic particles with a diameter up to 200 µm were found. These particles were

partially embedded in the surface of the bone and tissue (Fig. 6). The energy-dispersive X-ray (EDX) microanalysis [5, 6] of these particles showed a spectrum with energy lines typical for the presence of ferric oxide (Fig. 7), low levels of some mineral substances and traces of high-grade steel.

Discussion

The morphological investigation showed two different haematomas, one on the inner side and the other on the outside of the leg, indicating two different areas of violence. The laceration on the inner side of the leg is rather atypical for the type of blunt force caused by a round bar and also could not be caused by the bone fragments from inside. Also the channel-like tissue damage indicates that the injury may have been caused by a sharp pointed instrument. This suspicion became more evident by the results of electron microscopy and EDX analysis. Due to the detection of ferric oxide particles in the wound it has to be assumed that a metallic pointed instrument, like a pick-axe or a chisel, could have been used to produce this injury. The low level of particles from high-grade steel could have been transposed during the investigation.

The substance ketamine is used in veterinary medicine as a short-term anaesthetic and was not administered by the veterinarian to treat the horse after the "accident". Ketamine could have been used to anaesthetise the horse before the injury was made. The haematoma on the outside of the leg could be interpreted as an indication of pressure on the ground.

In conclusion, the results of the interdisciplinary medico-legal investigations performed in this case provided proof of an intentional mechanism causing the fracture of the horse's leg. There is no doubt that the owner attempted to fraudulently claim on an insurance policy.

Last but not least, the veterinary surgeon stated that the fracture of the long pastern bone could have been treated surgically with a high probability of success and it would not have been necessary to put the horse down.

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