Use of ASYM® Plates to repair diaphyseal femoral fractures in two cats

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Abstract

Two intact domestic shorthair cats were presented at our clinic because of grade four signs of lameness at right forelimb. The cats have been hit by car and radiographs revealed a slightly displaced long oblique diaphyseal femoral fractures .The patients tolerated the implant and had a very good functional recovery. Radiographic follow-up after 60 days revealed sign of osseous union. The plates were not removed. This report describes the surgery and outcome of dyaphiseal femoral fractures in two cats repaired by ASYM® Plates.

Keywords: *ASYM® Plates, cat, dyaphisis, femur, fracture.*

Introduction

The incidence for fractures of the femur is about 20% to 25% of all fractures in most veterinary practices; this rate is higher than for any of the other long bones in the body. Diaphyseal fractures account for 56% of femoral fractures (Braden et al. 1995). In addition, femur fractures represent 45% of all long-bone fractures, a rate more than double that of other bones (Unger et al. 1990). Diaphyseal fractures are usually the result of direct trauma and are accompanied by various degrees of soft-tissue damage and hematoma (Brinker 1974; Olmstead 1984). Because of the eccentric loading of the femur during weight bearing, the surgeon must be most cognizant of the tension/compression cortices and their effect on implants in this bone. Bone plates are applicable to almost all diaphyseal fractures and are likely the most common implant used for their repair. Bone plates have the distinct advantage of providing uninterrupted, rigid internal fixation. Depending on the fracture type, the plate may be used as a tension-band compression plate in short oblique, transverse, and some segmental fractures; as a neutralization plate in long oblique and reducible wedge fractures; and as a buttress or bridging plate in nonreducible wedge fractures (DeCamp et al., 2016). When plating fractures in the proximal or distal third of a bone, unless the surgeon resorts to either using a shorter plate than desirable or modifying the plate to remove holes at one end, standard ‘off-the-shelf’ compression plates can be impossible to apply whilst maintaining the gap between the two sets of screw holes over the fracture line. This is because these plates are essentially symmetrical. Plate modification to remove holes is time consuming, wasteful and without the right equipment and attention to detail, can leave a sharp or rough end that can hold bacteria and irritate soft tissues or leave contaminants on the plate surface. ASYM® Plates (asymmetric plates) offer a simple 'off-the shelf' solution to this familiar problem and are available in the same standard thicknesses and widths as standard compression plates, but with an asymmetric hole arrangement that makes them significantly more suitable for these fractures

(veterinary-instrumentation.co.uk). The shorter side of ASYM® Plates carry either three or four round holes. Round holes have some benefits. They can be packed closer together than compression slots. This helps the surgeon to maximize screw count in the smaller fragment and makes ASYM® Plates more adaptable to fragment length (veterinary-instrumentation.co.uk). Round holes are also intrinsically more stable than compression slots and where space is at a premium, this may make all of the difference between success and failure. The longer side carries regular compression holes in standard spacing to permit compression as normal (veterinary-instrumentation.co.uk). ASYM® Plates are priced to match the equivalent length of compression plates. There are 70 plates in the ASYM® range, which covers 2.0 mm, 2.4 mm, 2.7 mm, 3.5 mm and 3.5 mm broad sizes. This report describes the surgery and outcome of dyaphiseal femoral fractures in two cats repaired by ASYM® Plates.

Material and methods

Two intact male domestic shorthair cats was presented for right hind limb lameness of approximately 1-week and 3 days duration. Owners reported no improvement in the lameness after these days of rest. On physical examination, pain and crepitus were evident on palpation of the right femur. No other abnormalities were recorded. The cats were admitted and a lateral and ventrodorsal radiographs indicated comminuted (cat 1) and simple (cat 2), severe displaced fractures at the femoral diaphysis (Fig. 1 and 2). A femoral plating was recommended. A craniolateral surgical approach to the femur shaft (Johnson, 2014) facilitated exposure and reduction. The two fragments were stabilized with one 1 mm Kirshner (K) wires in the cat with comminuted fracture (Fig. 3). An 8-hole 2.7-mm ASYM® Plates (Veterinary Instrumentation, Sheffield, UK) was applied to the lateral aspect of the femur in cat 1 (Fig. 3). A 9-holes 2.7-mm ASYM® Plates (Veterinary Instrumentation, Sheffield, UK) was applied to the lateral aspect of the femur in the second cat (Fig. 4).

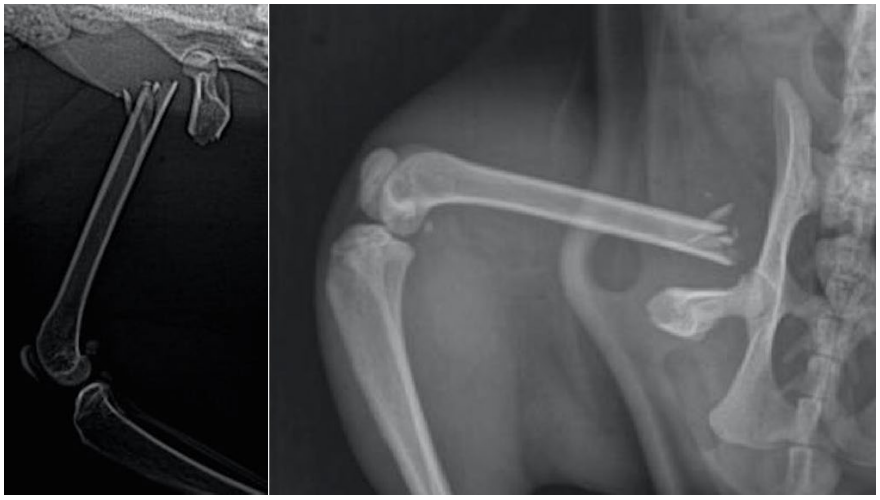

Fig. 1 Lateral and ventrodorsal radiographs of the cats demonstrating femoral dyaphiseal comminuted fracture of the right hindlimb with evidence of severe displacement (cat 1)

Fig. 2. Lateral and ventrodorsal radiographs of the cat demonstrating femoral dyaphiseal simple fracture of the right hindlimb with evidence of severe displacement (cat 2)

Fig. 3. Postoperative ventrodorsal and lateral radiographs showing fracture reduction and stabilisation with an 8 holes 2.7 mm ASYM® Plate (Veterinary Instrumentation, Sheffield, UK) and Kirshner (K) wire (cat 1).

Fig. 4. Postoperative ventrodorsal and lateral radiographs showing fracture reduction and stabilisation with a 9 holes 2.7 mm ASYM® Plate (Veterinary Instrumentation, Sheffield, UK) (cat 2).

Results and discussions

Re-evaluation three weeks postoperatively revealed the cats to be very good weight-bearing on the affected hind limb with normal bone healing. Surgery time was estimated to be approximately 110 minutes in the first cat and 80 minutes in the second one. Oblique and spiral fractures are the most common fracture patterns recognized in patients of all ages, whereas comminuted and open fractures are more common in mature animals than in immature animals (Boone et al., 1986; Unger et al., 1990). Intramedullary pin fixation alone should be strictly limited to stable fractures in small dogs and cats with good healing potential (Piermattei, 2006). We used normograde pinning for case 1 to realign the fragments and to have the possibility to apply the plate accurately.

Today, the two implants that are most compatible with biological osteosynthesis are the bone plate, alone or in combination with an IM pin, and the angle-stable interlocking nail (DeCamp et al., 2016). With few exceptions, a lateral approach is used to expose the femoral shaft for reduction and internal fixation (Johnson 2014). In middle to proximal femoral fractures, the proximal fragment rotates caudally, inducing excessive anteversion of the femoral head. Oblique or multiple wedge fractures develop considerable overriding and can be very difficult to reduce, especially in large breeds or when several days have elapsed since the injury. We did not have this problem in the cat, because of the small size of the patient. The use of reduction by means of an IM pin was very helpful in our case. Using a lateral approach to the diaphysis, the pin was inserted in the proximal segment, the fracture was reduced and maintained by using self-retaining bone forceps, and the pin was then inserted into the distal segment. After clinical union, the IM pin may

be removed but we did not remove it in our case because no reactions appeared at the tip of the pin.

Contouring of the plate to closely fit the bone was critical especially in case 1 for satisfactory repair of fracture. Failure to contour can result in marked deformity of the limb. In the first case we applied the plate in a bridging mode. The plate for the second case was used with a neutralization role.

Because of the small amount of bone available for regular plate placement, the ASYM® Plates was a good option in our cases after reduction. Compression bone plate fixation is a very simple and highly effective method of treatment in animals of all sizes, especially in large and giant breeds dogs. The ASYM® Plates cannot be used in compression fixation because the holes are round. Anyway, the cats are small size species and we think compression in these fractures is not a key point.

Activity was restricted, and no additional fixation was indicated. Healing was rapid with clinically united in 3 weeks in our cases. Physical rehabilitation was recommended to maintain good range of motion, prevent the formation of adhesions, and optimize functional recovery during first three weeks.

In conclusion, the fact that we could maximize screw count in the smaller fragment in these fractures was the main advantage for using ASYM® Plates. We mention these advantages in tibial diaphyseal fractures in dogs also (Ober et al. 2017). Of course, the limitation of the study is the number of cats and the retrospective nature of it. An enough representative population of cats should be observed, to analyse the diferences between the outcomes after femoral fractures managed with ASYM® Plates compared with other types of plates. We agree that using ASYM® Plates is a good option to repair femoral fractures in cats, especially when the proximal or distal fragment is smaller.

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