Complications associated with different internal fixation techniques in the management of comminuted femoral fracture in dogs

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Several techniques were tried to treat comminuted femoral fractures with different success rate (Denny 1991, Jones 1994, Saravanathan et al. 2002, Ganesh et al. 2003, Ayyappan et al. 2003). The present study was therefore undertaken to innumerate different complications associated with the management of comminuted diaphyseal femoral fracture by 3 different internal fixation techniques in dogs.

Clinically healthy, adult Mongrel dogs (15) of either sex were randomly divided into groups A, B and C of 5 animals each. In all the animals unilateral comminuted diaphyseal femoral fractures was created under general (thiopental – 5%) anesthesia and immobilized with intramedullary (IM) pinning with cerclage wiring (group A), neutralization bone plating (group B) and neutralization bone plating with cerclage wiring (group C) respectively. All the animals were administered broad spectrum antibiotic streptopenicillin @ 1 g intramuscularly (dog/day) and analgesic (diclofenac sodium @ 1mg/ kg b. wt. daily) and surgical wounds were dressed daily with povidone iodine and antibiotic cream for 5 days postoperatively.

Lateral and oblique views of the operated site were radiographed just after the operation and subsequently on days 15, 30, 45 and 60 postoperatively.

In group A, radiograph taken immediately after surgery, showed satisfactory reduction of fracture fragments with Steinmann pin and wires in proper position. However, slight fracture gap was present in almost all the animals. In 1 animal, the pin had crossed the distal cortex of the bone and it was later slightly retracted and left in position. However, fixation was maintained and no other complication was seen in this animal till the end of the observation period. In 3 animals, in which IM pin was placed almost occupying 80-90% of the medullary cavity facilitating 3-point fixation, fracture healing was normal without any complication. In 1 animal (20%), on day 30 signs of fixation failure like proximal pin migration with collapse of fixation and osteomyelitis occurred due to slippage of cerclage wire into the defect site and rotational instability were found (Fig. 1). By day 60, signs of osteomyelitis like extensive periosteal reaction and lytic areas around the Steinmann pin had developed in this animal. Inadequate and improper Steinmann pin placement in the distal fragment or instability at the fracture site will lead to the complication of proximal pin migration (Nunamaker 1985). Cerclage appliances generally cause non union when used simultaneously with intramedullary fixation (Newton and Holn 1974).

In group B, radiographs taken immediately after surgery showed excellent reduction and alignment of fracture fragments in all the animals. The fixation was maintained in 4 animals up to the end of observation period. Radiographs at different intervals revealed primary bony union that took place in 4 animals without any type of complications. In 1 animal of this group, in which screw loosening was evident, a fluid space was noticed between plate and bone interface on day 30. By day 45, radio-opaque area was noticed at the fracture fragments with periosteal callus formation (Fig.2). By day 60, diffuse bony callus was evident at the fracture site. In this animal, bending and loosening of screws were evident.

In all the animals of group C, the radiographs taken immediately after surgery, also showed good reduction and alignment of fracture fragments. However, in only 2 animals fixation was maintained throughout the observation period and fracture site showed normal course of fracture healing. In 1 animal of this group, osteopenia and concurrent osteomyelitis was evident on day 30. In this animal, osteolytic area was noticed in the proximal fragment at the level of second screw, in between plate and bone. On day 45, it extends to whole length of the bone adjacent to the plate and bone. By day 60, it developed into an oblique fracture at the level of second proximal screw (Fig. 3). In 1 animal of this group, fixation failure had occurred on day 14, due to slippage of wire and loosening of screw (Fig. 4), re-operation was done immediately but again collapse of fixation devices occurred.
Figs 1-6. 1. Medio-lateral radiographs of group (A) showing proximal pin migration with angulations at the fracture site on day-30. 2. Medio-lateral radiographs of group (B) showing screw bending and bone plate loosening at the fracture site on day-30. 3. Medio-lateral radiographs of group (C) revealed osteopenia beneath the bone plate with secondary fracture at the level of proximal screw on day-30. 4-5. Medio-lateral radiographs of group (C) showing fixation failure by days 14-16. 6. Medio-lateral radiographs of group (C) showing secondary supra-condylar fracture on day 45.

on day 18 (Fig. 5). In another animal of this group, in which supracondylar fracture was noticed in the distal fragment on day 45. However, fracture healing continued at the comminuted fracture site till day 60 (Fig. 6). Occurrence of secondary supracondylar fracture and osteopenia followed by osteomyelitis by 45 days in 2 animals might be due to the fact that compression plate excessively protected the bone from loading stresses. The collapse of fixation devices in these animals might be due to loosening and slippage of cerclage wires into the fractured line, which was evident in radiographically. Fixation of bone fragment by cerclage wiring had a deleterious effect on cortical blood circulation, subsequent bone healing and callus bridging. This is based on the concept that longitudinally directed afferent blood vessels are present in mature periosteum normally and during fracture fixation and that an encircling wire would 'strangle' this vascular supply (Newton and Hohn 1974).

SUMMARY

Mongrel adult dogs (15) of either sex were divided into 3 groups of 5 animals were used to innumerate different complications associated with the management of comminuted diaphyseal femoral fracture by 3 different internal fixation techniques in dogs. Identical comminuted femoral fracture were created under general anaesthesia in all the animals and immobilized by using intramedullary Steinmann pinning and cerclage wiring, neutralization bone plating and neutralization bone plating with cerclage wiring in groups A, B and C respectively. In group A, in 2 animals (40%) signs of fixation failure likes proximal IM pin migration, sciatic nerve entrapment and osteomyelitis were observed. In group B, in 1 animal (20%), bending of bone plate and screw loosening was evident in group C, in 3 animals (60%), different signs of fixation failure like osteopenia, osteomyelitis, supracondylar fracture, loosening and breaking of cerclage wires and loosening of bone plate and screw were observed.

REFERENCES


