

**“SURGICAL REPAIR OF SUPRACONDYLAR FRACTURE OF
FEMUR IN DOGS - A CLINICAL STUDY”**

By

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B.V.Sc.**

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CERTIFICATE

Dr.M.GANGADHAR has satisfactorily prosecuted the course of research and that the thesis entitled “**SURGICAL REPAIR OF SUPRACONDYLAR FRACTURE OF FEMUR IN DOGS - A CLINICAL STUDY**” submitted is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination. I also certify that the thesis or part thereof has not been previously submitted by him for a degree of any University.

Date: 20/10/2008.
Place: Hyderabad.

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CERTIFICATE

This is to certify that the thesis entitled “**SURGICAL REPAIR OF SUPRACONDYLAR FRACTURE OF FEMUR IN DOGS - A CLINICAL STUDY**” submitted in partial fulfillment of the requirements for the degree of **MASTER OF VETERINARY SCIENCE (SURGERY AND RADIOLOGY)** for SRI VENKATESWARA VETERINARY UNIVERSITY, Hyderabad is a record of the bonafide research work carried out by **Dr.M.GANGADHAR**, under my guidance and supervision. The subject of the thesis has been approved by the student’s Advisory committee.

No part of the thesis has been submitted for any other degree or diploma. The published part has been fully acknowledged. All the assistance and help received during the course of investigation have been duly acknowledged by the author of the thesis.

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DECLARATION

I, **M. GANGADHAR** hereby declare that the thesis entitled “**SURGICAL REPAIR OF SUPRACONDYLAR FRACTURE OF FEMUR IN DOGS - A CLINICAL STUDY**” submitted to Sri Venkateswara Veterinary University for the degree of **Master of Veterinary Science (Surgery and Radiology)** is a result of original research work done by me. It is further declare that the thesis or any part there of has not been published in any manner.

Date: 20.10.2008

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ABSTRACT

The present clinical study was conducted on 11 dogs with supracondylar fractures of the femur presented for treatment at Teaching Veterinary Clinical Complex, Bhoiguda and Campus Veterinary Hospital, College of Veterinary Science, Rajendranagar, Hyderabad. Out of the 11 dogs, 6 dog were males and 5 were females. Out of 11 dogs 6 dogs (54.5%) were in the age group of 0-6 months and 2 dogs (18.18%) were in the age group of 6-12 months, and 2 dogs were in the age group of 12-18 months and 1 dog was (9.09%) more than two years of age.

The causes were found to be automobile accident in 4 (36.36%) dogs, fall from a height in 5 (45.45%), stamping by its owner in 2 (18.18%) dogs.

The dogs presented for treatment of supracondylar femoral fractures exhibited symptoms like sudden onset of pain and lameness immediately after a traumatic injury, swelling in the stifle area, dangling of the limb, non-weight bearing, abnormal angulation of the limb at the fracture site and crepitation.

Radiography revealed that all the supracondylar femoral fractures were transverse fractures, except in one dog, where the fracture was found to be short oblique in orientation.

The supracondylar fractures were treated with cross pinning in 10 dogs and intramedullary pinning combined with cross pinning in one dog.

Post-operative radiographs taken immediately after the surgical correction and immobilization of the fractures revealed good anatomical reduction and immobilization of the fracture site in nine dogs and good alignment albeit with a perceptible gap at the fracture site in two dogs.

The present clinical study indicated that supracondylar fractures of femur in dogs is most commonly encountered in young dogs, with a majority of them occurring in puppies below 18 months of age. The results of the present clinical study conclusively proved that cross pinning technique is well suited for the surgical repair of supracondylar fractures of femur in dogs. The techniques employed also fulfilled the concept of adaptation osteosynthesis that is meant to preserve and protect the growth

plates or physis with the use of weak implants. The complications encountered were consequent to implant failure resulting from repeated trauma in one dog and hyperactivity and excessive excitable nature in two other dogs. The present study indicated that cross pinning technique is well suited for surgical repair of supracondylar fractures of femur in young dogs.

CHAPTER - I

INTRODUCTION

In dogs, distal femoral fractures are classified as supracondylar, condylar and intercondylar. They may be simple or communicated and may be complicated by damage to the joint capsule and rupture of stifle joint ligaments. The types of fractures encountered in dogs differ in growing and adult animals (Prieur, 1988). Although encountered less frequently, distal metaphyseal fractures of femur are difficult to deal with and their repair is challenging (Gilmore, 1998). In the immature animal, the presence of the growth plate must be born in mind since this makes fracture repair more difficult.

Dogs with supracondylar femoral fractures show signs of various degrees of lameness, ranging from a mild limp to a total disuse. The variability of lameness relates to the degree of bony displacement. Swelling of the stifle region, apparently more proximal location of patella, difficulty in palpation of patella, laxity of quadriceps muscles and crepitus on palpation are the other signs of supracondylar femoral fractures (Newton, 1985). A diagnosis of supracondylar fractures is confirmed by obtaining lateral and antero-posterior radiographs of the stifle region. Radiographs help to determine the presence of fracture, the type of fracture, the number of fragments and the site of fracture (Prieur, 1988).

Supracondylar fractures can be treated by various methods. Intramedullary pinning (Stigen, 1999; Beale, 2004), cross pinning (Gilmore, 1998; Whitney and Schrader, 1987), intramedullary pinning combined with cross pinning (Prieur, 1988), rush pinning (Coetzee, 1983), lag screw fixation (Gilmore, 1998) and plate fixation (Prieur, 1988) are some of the treatment modalities recommended. A search of the published literature revealed scarcity of clinical reports concerning the occurrence of supracondylar fractures of femur.

Therefore, the present clinical study on the surgical treatment of supracondylar fractures of femur was undertaken with the following objectives:

1. To record the clinical cases of supracondylar femoral fractures
2. To study the clinical and radiographic findings in cases of supracondylar fractures of femur
3. To surgically treat the cases of supracondylar fractures of femur in dogs and
4. To record the instances of successful repair and complications in case of supracondylar fractures in dogs.

CHAPTER II

REVIEW OF LITERATURE

2.1 INCIDENCE OF SUPRACONDYLAR FEMORAL FRACTURE

Alcantara and Stead (1975) reported that fractures involving the distal metaphysis and epiphysis of femur are frequently reported in immature dogs.

Maala and Celo (1975) following a study of 163 cases of fractures in dogs reported that the highest incidences of 52.1 percent of fractures were found in femur. Among the different breeds of dogs, mongrel dogs have been reported to be the most frequently affected when compared to pure breed and imported dogs. They opined that this was due to the fact that 'local' dogs are usually let loose to roam freely and hence are more likely to suffer automobile accidents.

Phillips (1979) made a survey of 284 canine fractures over a period of 2 years and reported 14.8 percent incidence of fractures of femur. He observed that road accidents were the main cause of fracture and reported that the occurrence of fracture of femur to be more in younger dogs below three years of age (80%) with higher frequency in males (68.3%) than in females (31.7%).

Braden (1981), Alcantara and Stead (1975), Phillips (1979), Singh *et al.* (1983), Thilagar and Balasubramanian (1988) stated that diaphyseal fractures

constituted (63.88%) of total femoral fractures, more number of fractures recorded in the middle (42.42%) and distal (32.33%) third of the shaft than proximal third (25.25%). This was probably because distal femur being positioned away from the long axis of the limb, is generally under greater stress (specially bending) making it more susceptible for injury.

Grauer *et al.* (1981) reported that all 57 cases of distal femoral physis, were of Salter-Harris type-II fractures with an average age of 6.2 months. The majority of dogs were working breeds with an average weight of 27.5 pounds. Salter-Harris type-II fractures of the distal femur occur frequently in immature animals even though the physis is weaker than metaphyseal bone. Injury to the distal femoral physis is common, accounting for about 30 percent of all physeal injuries.

Singh *et al.* (1983) conducted a study on 511 clinical cases of fractures in dogs and stated that there was higher incidence of fracture in males than in females. In canine's occurrence of fractures were more in younger animals below one year of age.

Wong (1984) reported that more than 80 percent of the fractures occurred in animals less than two years old. Male dogs were more frequently involved. The most common cause of fractures was road traffic accidents. Transverse and oblique fractures were most often seen.

Thilagar and Balasubramanian (1988) reported that lower third (46.66%) and middle third (36.66%) of femur were mostly prone to fractures in dogs. It was reported that oblique transverse and epiphyseal separations of femur were commonly found.

Balagopalan *et al.* (1995) recorded that there was a higher incidence of fractures in the age group of 3-6 months (30%), followed by day old to three months (27.9%) age group. They also recorded that the incidence of fractures in males was higher than in females and it was highest in the age group of 0-3 months (72.4%).

Brinker *et al.* (1997) stated that femur has the highest incidence of fracture (45%) among all the long bones. Femur fractures accounted for 20-25 percent of all fractures in Veterinary practice. Although encountered less frequently, distal metaphyseal fractures of femur are difficult to deal with and their repair is challenging (Gilmore, 1998)

Aithal *et al.*(1998) reported a higher incidence of 38.56 percent of fractures in the femur and 30.3 percent of femoral fractures were communicated type. Majority of fractures were seen in animal aged less than one year (62%) and principle causes were fall (47.83%) and automobile accidents (46.74%), diaphyseal fractures constituted about 63.88 percent of total femoral fractures.

Aithal *et al.*(1999) conducted a study on 402 clinical cases of fractures in dogs and stated that of all bones, highest number of fractures were seen in femur (38.56%), middle and distal third of diaphysis more commonly affected with 20 percent supracondylar fractures.

2.2 PRE-OPERATIVE CLINICAL EXAMINATION

Campbell (1976) stated that fractures of the distal femur (or) distal epiphyseal separation, give rise in most instances to a particular type of displacement. Because of the pull of the large posterior thigh muscles which insert on the proximal tibia, there is a tendency for the distal fragment of the femur to be displaced posterior and proximally, the fracture end of the proximal shaft riding forward over the distal fragment to lie behind the patella, or even to penetrate the quadriceps muscle, though seldom protruding through the skin.

Tirgari (1978) stated the circulatory intervention and substantial properties of hind limb lameness as a result of injury / fracture of femur and rupture of the patellar, collateral and cruciate ligament. In supracondylar fracture he noticed soft tissue damage accompanied by a sizable haematoma, and the distal fragment usually is filled caudally and pulled upward andas to the femoral shaft.

Wong (1984) reported that most consistently noted clinical sign was loss of function of the affected region while crepitus was elicited in only 20 percent of the cases.

Brinker *et al.* (1997) stated that the visible signs at the fracture include one (or) more of following, pain or localized tenderness, deformity or change in angulations, abnormal mobility, local swelling, loss of function and crepitus.

Murali Krishna *et al.* (1997) reported that the most consistently noted clinical sign in supracondylar fracture was swelling, pain and abnormal mobility of the limb.

Johnson *et al.* (1998) reported that during surgery priority should be given to establishing anatomical structure and protecting vascularization of the bone rather than to its reconstruction. This kind of an approach is the basis of biological osteosynthesis.

Aithal *et al.* (1999) observed severe lameness, swelling and crepitation at the level of stifle joint, intense inflammation and edematous swelling up to paw in metaphyseal and epiphyseal fractures of femur in dogs.

Singh *et al.* (1999) opined that the musculoskeletal injuries not only cause pain but also loss of function of the affected limb depending upon the magnitude of the trauma.

Kumar (2000) stated that the fracture can be diagnosed by pain at the site of fracture, dysfunction, local trauma, abnormal posture and crepitus and most of the cases have history of injury and sudden onset of symptoms.

Ganesh *et al.* (2004) clinically noticed loss of function, non weight bearing with complete overriding of fragments in supracondylar femur fracture.

2.3 RADIOLOGICAL EXAMINATION

Alcantara and Stead (1975) opined that the growth plate was open if the radiolucent represent cartilage between the epiphysis and metaphysis.

Berg *et al.* (1984) diagnosed radiographically more Salter type II (58.8%) than type I (41.2%) of distal femoral physis in dogs. They also diagnosed more cranially displaced (23.5%) and non displaced (17.7%) fractures.

Iyer *et al.* (1985) diagnosed oblique and transverse fracture of the femur radiographically. There were more oblique fractures than transverse fractures.

Prieur (1988a) advised both medio-lateral and antero-posterior views of bone to check for additional features and accurate diagnosis of fracture in dogs.

Prieur (1988b) stated that lateral and antero-posterior radiographs helped to determine the site of affection, fracture type and number of fragments in distal femoral fractures.

Smith (1988) stated that definitive radiography, in a minimum of two planes enables full assessment of a fracture. Further damage to surrounding tissue, while taking radiograph increased the risk to the patient.

Brinker *et al.* (1997) opined that radiographs of at least two views at right angles to each other are essential for accurate diagnosis and selection of the best procedures for reduction and immobilization.

Hulse and Johnson (1999) stated that for adequate evaluation of affected bone two radiographs were made at 90 angles to each other. For evaluating fractures radiographs of long bones must include the joints above and below the bone of interest. They also stated that comparison between affected and normal limb radiographs might help in determining the problem.

Aithal *et al.* (1999) diagnosed distal metaphyseal – epiphyseal fractures of femur by mediolateral radiographs of stifle region. They diagnosed oblique and comminuted fractures.

Kumar (2000) reported at least two views including joints above and below the fracture are required for radiographic diagnosis. The radiographic signs include a break in the continuity of bone, a line of radiolucency when fragments are compressed (or) super imposed.

2.4 SURGICAL TREATMENT

Salter and Harris (1963) stated that all epiphyseal plate injuries should be repaired and immobilized as soon as possible. In general, type I, II, and III have a good prognosis for growth provided the blood supply to the epiphysis is intact. Damage to the epiphyseal blood supply is of more importance than the mechanical damage incurred by the epiphyseal plate, they opined that the reduction, alignment, and management of epiphyseal plate fractures was the main goal and should be conservative as possible. They stated that simple or paired intramedullary pinning and (or) closed casting procedures were usually adequate for proper immobilization in most instances they concluded that deformities could be satisfactorily reduced if accurate reduction had been performed and little time elapsed between injury and repair. A medial or lateral Para patellar arthrotomy allows access to the Salter I or Salter II type of fracture.

Hinko and Rhineland (1975) reported that in the fixation of long oblique fractures wire should be placed approximately 1 cm apart and one should be

within about 0.5 cm from the tip of each oblique fracture. A wire should not be placed in the fracture line.

Chaffee (1977) stated that by using stacked intramedullary pinning better rotational stability was achieved and the technique worked well when bone cortices were thin.

Rhineland and Wilson (1982) stated that the medullary circulation always get disrupted by intramedullary pin placement. The degree of vascular disruption is related directly to the size and number of pins used.

Coetzee (1983) stated that good results were obtained with single intramedullary pin method in small breeds of dogs and parallel Kirschner wire technique as well as rush pin method in large dog breeds. It was also stated that immobilization technique used, counteracted the forces acting across the fracture line. It was commented that plate fixation in veterinary is expensive.

Kagan (1983) reported that two factors necessary for fracture repair were stabilization and blood supply, using this procedure for fitting and passing stacked multiple intramedullary pins, the medullary canal could be filled to the fullest extent for maximal stability of the fracture without exerting disruptive forces on the cortex.

Brinker *et al.* (1984) reported that adaptation osteosynthesis involves fixation of fracture fragments in their normal anatomical position by weak implants. This technique will only withstand very small forces. In very young animals, compression of the physis is contraindicated, as this may cause growth disturbances. In these cases, Kirschner wires are used to immobilize the fragments after correct reduction.. Adaptation osteosynthesis is contraindicated in all slow healing fractures where bending and rotational forces produce high shearing forces during body movement.

Nunamaker (1985) stated that a round intramedullary pin could do little to prevent torsion instability in femoral fracture fixation. The Steinmann pin may allow torsional stability only when it leads to interdigitations of fracture fragment. When intramedullary pin alone is used for reduction and stability of a fractured long bone, it should contact as much of the medullary cortex as possible in order to provide some torsional stability. If intramedullary pin does not provide some adequate stability against rotation, multiple pinning, cerclage wiring (or) hemicerclage wiring must be used in conjunction with pinning.

Milton and Newman (1985) stated that supracondylar femoral fractures are difficult to treat because of the proximity of the fracture to the joint and also because the fractures are seen in young growing animals. The use of intramedullary

pins do not provide adequate fixation while the use of stainless steel bone plates to these fractures is limited due to the small distal fragment and the caudal bow of distal femur.

Franczuski *et al.* (1986) used paired smooth pins as fixation for distal femoral physeal fractures. They found that trauma to the growth plate was minimized and rigid skeletal fixation was achieved.

Stigen and Fjeld (1986) reported satisfactory results with intramedullary pinning of transverse and oblique fractures of femur. They also found good results after intramedullary pinning of supracondylar fracture of femur.

Denny (1991) stated that intramedullary fixation should be avoided in comminuted fractures in dogs as the pin provides no longitudinal support or resistance to shortening forces and so collapse rotational and non-union are expected. But wire can be generally used in combination with an intramedullary pin to provide rotation as stability in oblique or comminuted fractures.

Howard (1991) opined that filling or approximate 2/3 of the medullary cavity with intramedullary pin passing in a curved bone for maximizing stability is used in clinical practice.

Boudieau and Sinibaldi (1992) stated that effective reduction of distal metaphyseal and epiphyseal fractures of femur is difficult due to the small distal fragment, proximity of fracture to the joint and caudal bow of distal femur. It was stated that such cases should be carefully treated to preserve the joint function and allow early range of motion while providing rigid fixation. Intramedullary pinning is unsuccessful in treatment of distal metaphyseal fractures owing to inadequate purchase of the pin at the small distal fragment.

Muir *et al.* (1995) reported that the bending strength of an intramedullary pin is related to its diameter. A pins diameter should be 70-90% of the medullary cavity diameter in the diaphyseal region the greatest stability is attained when this device fills the entire medullary cavity at the fracture site, neutralizing bending, compression, shear and rotational forces the use of this method is at the expense of medullary circulation.

Aithal *et al.* (1998) stated that use of a single pin in the treatment of supracondylar femoral fractures failed to eliminate rotation at the fracture line while double pin technique provided relatively more stability.

Stigen (1999) stated that Supracondylar fractures are treated by various methods like intramedullary pinning.

Beale (2004) stated that Supracondylar fractures are treated by various methods like intramedullary pinning.

Ganesh *et al.* (2004) reported good fracture healing by about 4 weeks following fixation of a supracondylar femoral fracture in a dog by modified technique of single pin fixation along with cross pinning.

2.5 POST-OPERATIVE CLINICAL EXAMINATION

Iyer *et al.* (1985) reported that the dogs could use the operated leg moderately from the very first postoperative day. Acute inflammatory signs subsided completely within 3 to 4 days. They stated that process of healing depends on factors like age of the animal, blood supply to the region, structure of the involved bone and type of fracture.

Whitney and Schrades (1987) stated that most dogs began to use the affected limb in 24-48 hours after fixation of distal femoral fractures by means of dynamic intramedullary cross pinning. Most dogs were weight bearing lame at the time of suture removal (2 weeks after surgery), but the lameness usually was resolved by 3 to 4 weeks after surgery.

Aithal *et al.* (1998) reported that the dogs, operated to reduce supracondylar femoral fractures started bearing weight on the limb from the very first day dogs treated by single intramedullary pinning were slightly lame for a prolonged period,

where as, dogs treated by cross pinning technique were not lame for prolonged period. They recorded decrease in the range of stifle joint motion (extension and flexion) on day 15, which was attributed to inflammation and pain.

Stigen (1999) reported that 84% of dogs were found to be free of lameness after reducing the supracondylar pinning. He reported lameness in 13 dogs out of these dogs two were classified as permanently lame and remaining 11 as temporary.

Aithal *et al.* (1999) observed good weight bearing in all the dogs in the immediate post operative period the entire animal showed gradual improvement in weight bearing and functional recovery of the limb.

2.6 POST-OPERATIVE RADIOLOGICAL EXAMINATION

Parker and Bloomberg (1984) reported that all fractures healed in 3 to 4 weeks of surgery irrespective of technique or the animal's age. They conducted a radiographic follow up of healing in 17 dogs, which underwent treatment for distal femoral physeal fractures.

Whitney and Schrades (1987) stated that bony union developed in all the dogs which were operated to correct distal femoral fractures by dynamic intramedullary cross pinning technique. They graded the results in 93% of dogs as good to excellent in respect of bone healing.

Iyer *et al.* (1990) observed well formed callus extending to both proximal and distal fragments with a zone of radio transparent tissue, the presence of fibro cartilage and shadow of hollowness on the length of the bone with increased radio-density.

Aithal *et al.* (1998) recorded fewer gaps between the fragments in the dogs treated with cross intramedullary pinning technique for supracondylar femoral fractures than in the dogs treated by single intramedullary pin fixation. They reported cranio-caudal displacement of fracture fragments indicating that the intramedullary pins could not provide exact reduction. They observed bridging callus on day 30, complete obliteration of fracture line on day 60 and by day 90 they recorded good to excellent fracture healing with signs of fracture remodeling. They observed relatively early obliteration of fracture gap and remodeling of periosteal callus treated by cross pinning technique than by single intramedullary pinning technique.

Coetzee (1999) reported that the mean time of clinical bone healing was seven weeks (4 to 10 weeks). He noticed solid bridging periosteal callus formation in shortest period in young growing dogs than mature dogs. He also reported functional healing by secondary bone union with callus formation.

Emmerson and Pead (1999) observed progressive fracture healing and massive periosteal callus on radiographs after six weeks of surgery. They notice fracture union and remodeling of the callus on radiographs by 12 weeks following surgery.

2.7 POST-OPERATIVE CARE

Milton *et al.* (1980) stated that external support is optional but is rarely required following cross pinning of the distal femur.

Iyer *et al.* (1985) administered antibiotics systemically and applied benzoin seal on the fracture line for dogs treated for femur fracture by intramedullary pinning.

Whitney and Schrades (1987) advised restricted exercise on flat surface for the first two weeks after dynamic intramedullary cross pinning technique for repair of distal femoral fractures in dogs.

Brinker *et al.* (1997) opined that exercise should be restricted for 4 to 6 weeks to stop overstress on the repaired limb. They advised an off weight bearing sling for 2-3 weeks if restriction of dogs was not possible.

Aithal *et al.* (1998) administered antibiotics B.I.D. for 6 days and NSAID for 3 days. The surgical wounds were cleaned and antiseptic dressing was done

regularly. They advised complete cage rest for a week and restricted to leash exercise for another week.

Hulse and Johnson (1999) advised appropriate physical therapy methods after surgery passive physical manipulation, heat and cold were important consideration in rehabilitation of musculoskeletal injuries. Heat therapy reduces the pain and improves circulation. As heat does not decrease the swelling and should not be used in the initial 3 to 4 days after surgery passive physiotherapy was the best method, described as controlled stretching of muscles, tendon and ligaments, the joints above and below the area should be gently flexed and extended. They advised slow leash walking immediately after surgery and it should be maintained until rehabilitation and healing were complete.

2.8 COMPLICATIONS

Hickman (1964) reported that the complications of fractures and fracture healing were well recognized. The immediate complications were due to soft tissue damage while the late complication of fractures healing includes delayed union, non-union and mal union.

Morgan (1972) stated that fracture healing might be complicated by mal union or union of the fracture that was not anatomic. Mal union due to overriding

of the fragments that resulted in shortening of limb was acceptable in small animals.

Alcantara and Stead (1975) reported lameness, osteoarthritis and restricted joint movements as the major complications encountered after correcting the distal femoral fractures in dogs.

Vaughan (1975) observed osteomyelitis as one of the most serious complications. He described the clinical and radiological features in twenty five dogs and reported the treatment by debridement further fracture fixation and antibiotic therapy proved successful in majority of cases.

Piermattei (1979) reported that the animal was secured in right lateral recumbency and the femoral condyles were assessed through lateral parapatellar arthrotomy.

Hunt *et al.* (1980) reported 24 percent complications in the fractures of the femur. They observed that infection was a complication in pin fixation because pins of insufficient diameter were used. Other complications of internal fixation, were caused by errors of technique, such as choice of inappropriate method of fixation the use of implant of inadequate strength to stabilize the fracture errors in application of the implant and excessive damage to tissue during surgery.

Graver *et al.* (1981) stated that delayed union or non-union might result from inadequate internal fixation. Rotational or angular mal-union can occur if a single Steinmann pin is used or if the device is removed inappropriately prior to union. Migration proximally may result in open wounds and osteomyelitis. Shortening of femoral diaphysis can occur, if adequate provision is not made to stabilize comminuted fracture.

Whitney and Schrades (1987) observed pin migration in 7 percent of cases out of that distal pin migration was main complication with dynamic intramedullary pinning in reduction of distal femoral fractures in dogs. Pin migrated before bony union as the result of instability and collapse at the fracture site.

Eimaraghy *et al.* (1996) stated that retrograde femoral reaming and intramedullary nailing has become a popular option for the treatment of distal femoral and femoral shaft fractures, but concerns regarding the effect of reaming through an intraarticular entry portal have been raised. Experimental study found that after reaming perfusion of anterior cruciate ligament decreased by 52% and perfusion of posterior cruciate degrees by 49%. Diminished perfusion after reaming may delay healing or exacerbated existing injury to cruciate ligament and adversely affect the rehabilitation of the knee after femoral fracture.

Aithal *et al.* (1998) stated that in cases of supracondylar femoral fractures, single pin fixation through intracondylar fossa resulted in more prolonged lameness, more periosteal callus formation and took a longer time for the fracture line to disappear radiographically. These features indicated more instability and greater chance of complications. In comparison cross pinning provided greater stability leading to early fracture healing. Therefore the cross pinning technique was considered as the technique of choice in treating supracondylar fractures. They also suggested that further studies were needed to qualify their observations.

Stigen (1999) reported complications in 8 percent of dogs mainly infection, instability and muscle fibrosis after the normograde intramedullary pinning for the supracondylar femoral fractures.

Christodoulou *et al.* (2005) reported that supracondylar fracture of femur or very serious injuries for a long time they were considered difficult to heal and often led to a degree of disability. These difficulties become greater when they are associated with elderly patients who present with a high degree of osteopenia.

Watson (2008) reported that distal metaphyseal fractures of femur provided a challenge for repair. Fortunately, the rich blood supply to this trabecular bone promotes rapid bone healing in most cases.

CHAPTER III

MATERIALS AND METHODS

3.1 MATERIALS

The present clinical study was conducted on 11 dogs with supracondylar fractures of the femur presented for treatment at Teaching Veterinary Clinical Complex, Bhoiguda and Campus Veterinary Hospital, College of Veterinary Science, Rajendranagar, Hyderabad. Out of the 11 dogs, 6 dogs were males and 5 were females. Routine diagnostic procedures were used for diagnosis. Routine orthopedic instruments, techniques and drugs were used to carry out the clinical study of supracondylar femoral fractures in dogs.

3.2 METHODS

3.2.1 History Collection

Information about the dogs presented with supracondylar femoral fractures was collected. Details regarding age, sex, breed, chief complaint, history of other illness, previous injury or orthopedic disease, the manner of onset of chief complaint, duration of the signs and the past treatment, if any for the chief complaint were collected.

3.2.2 Clinical Examination

3.2.2.1 Pre-operative Clinical Examination

The dogs presented were subjected to thorough clinical examination. The dogs were examined for loss of function of the affected limb, pain and crepitation at the fracture site, signs of local swelling, abnormal mobility of the affected limb, deformity or change in angulations of the limb and for signs of infection and oozing of fluids or exudates from the fracture site. Soft tissue and neurological status, if any, were recorded during clinical examination of the patient.

3.2.3 Radiographic Examination

The dogs were subjected to radiographic examination. Medio-lateral and antero-posterior views of femur were obtained and supracondylar fractures of femur were diagnosed. The type and the site of the fracture were ascertained from the radiographs. Care was taken to include both hip and stifle joints, whenever possible, while taking radiographs. Post-operative radiograph (check x-ray) was taken immediately after surgical reduction of fracture. Follow-up radiographs were taken on day 15, 30, 45 and 60, whenever possible, to monitor the healing process.

3.3 SURGICAL TREATMENT

3.3.1 Pre-operative Preparation of the Dogs and Anesthetic Procedure

The owners of the patients were advised to withhold food for about 12 hours and water for about 6 hours prior to surgery. Triflupromazine hydrochloride¹ diluted with sterile distilled water was injected intravenously at the rate of 1 mg/kg body weight as pre-anesthetic medication.

The patient's hair was carefully clipped from a wide area surrounding the surgical site including upper and lower joints (Fig. 1). The operative site was shaved carefully and was then scrubbed using Chlorhexidine gluconate – Cetrimide² solution.

The dogs were then anesthetized by intravenous injection of 2.5 percent thiopentone sodium³ administered “to effect” and were intubated with endotracheal tubes of suitable size. Normal saline was infused intravenously. When found necessary, anesthesia was maintained by additional doses of thiopentone sodium. The Patient's limb was draped so that the entire limb was accessible during surgery (Fig. 2). The site was then painted with surgical spirit.

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1. Siquil Injection – Sarabhai Zydus Animal Health Ltd., Vadodara, India
 2. Savlon-Johnson & Johnson Ltd, Hyderabad
 3. Pentothal-Abbott Laboratories Ltd, Mumbai

3.3.2 Surgical Procedures

The 11 dogs that were part of the present study were subjected to surgical treatment depending upon the type of fracture as indicated in table 1.

Table 1: Surgical Procedures Adopted

S. No	Surgical Procedure	No. of cases
1.	Cross pinning	10
2.	Intramedullary Pinning Combined with Cross Pinning	1
	Total	11

3.3.2.1 Cross Pinning Technique for Supracondylar Fracture of Femur

A curved lateral para-patellar skin incision was made extending from the distal third of the femur over the trochlear ridge to the tibial tuberosity (Fig 3). The subcutaneous fascia and the joint capsule of the stifle were incised (Fig 4). The incision was deepened to excise the fascia lata and extended along the cranial border of the biceps femoris muscle. Biceps femoris and vastus lateralis muscles were separated and the fracture site was exposed (Fig. 5). Then the fracture was reduced anatomically and held in place using a suitable forceps (Fig. 6).

Two K-wires of 1 mm diameter size were selected. The first K-wire was introduced proximally from lateral condyle to the medial border of femoral diaphysis with the help of Jacob's Chuck (Fig 7). Then the second K-wire was directed distally from the lateral border of the femoral diaphysis to exit at the medial condyle, taking care to ensure that the K-wire exited through the non articular area of the condyle (Fig. 8). Extreme care was taken to also ensure that the pins crossed proximal to the fracture line (Fig. 9). Then the pins were cut very close to bone with the help of a pin cutter (Fig. 10). The muscles were sutured with chromic catgut No. 1-0 in a simple continuous pattern (Fig. 11). A row of subcuticular sutures of 2-0 chromic catgut was applied. The skin incision was closed in a row of horizontal mattress sutures using polyamide suture No.1 (Fig. 12).

3.3.2.2 Intramedullary Pinning Combined with Cross Pinning

This procedure was adopted in one dog. The fracture site was exposed as described above. Intramedullary pinning was performed to reduce and retain the fracture ends in position by retrograde insertion of a Steinman pin as per the standard procedure described (Gilmore, 1998). Following this, cross pinning procedure was followed as described above, resulting in fixation of fracture in one dog with both intramedullary pinning and cross pin fixation.

3.4 POST-OPERATIVE CARE

Cefotaxime⁴ injection at the rate of 25 mg/kg body weight once daily was injected intramuscularly for 7 days postoperatively to each dog. Meloxicam⁵ injection at the rate of 0.3 mg/kg body weight was administered intramuscularly for the first 3 postoperative days. The surgical wound was cleaned with povidine iodine⁶ and dressed daily with Framycetin⁷ skin cream. Any accumulations at the surgical site were drained daily.

The owners were advised to feed milk on the first day and to resume normal feeding from second day onwards. The owners were further advised to give 3 teaspoonfuls of calcium syrup⁸ twice a day. The cutaneous sutures were removed on the tenth postoperative day in all the operated dogs.

3.5 POST-OPERATIVE CLINICAL EXAMINATION

The dogs which were operated for correcting the fractures were observed for persistent clinical lameness, usage of the operated limb and weight bearing on the operated limb. They were examined for inflammatory or exudates from operative site. The clinical outcome of surgical procedures used was evaluated, complications, if any, resulting from these procedures were recorded.

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4. Taxim injection – Alkem Laboratories Ltd. Mumbai.
 5. Melonex injection – Intas Pharmaceuticle Ltd. Ahmedabad
 6. Steridine solution – Sterling Labs, Mumbai.
 7. Soframycin cream – Aventis Pharma Ltd. Mumbai.
 8. Ostocalcium pet – Glaxo Smithkline Beech, Mumbai.

CHAPTER IV

RESULTS

4.1 INCIDENCE

The patient history collection revealed that none of the dogs suffered from any previous orthopaedic disease, other than the chief complaint, i.e., supracondylar femoral fractures. History also revealed that in all the cases, invariably, the chief complaint was sudden occurrence, following a traumatic injury. The dogs were presented for diagnosis and treatment after four to seven days after the occurrence of symptoms. Four of the dogs were treated by field veterinarians during this time by application of soft bandaging and use of analgesics.

4.1.1 Age Wise Incidence

All the dogs, which underwent treatment, were categorized into different age groups. Out of 11 dogs 6 dogs (54.5 %) were in the age group of 0-6 months and 2 dogs (18.18 %) were in the age group of 6-12 months, and 2 dogs (18.18 %) were in the age group of 12-18 months and 1 dog was (9.09%) more than two years of age. The age wise distribution of supracondylar femoral fracture is presented in table 2.

Table 2: Age Wise Incidence of Supracondylar Femoral Fractures

S.No.	Age Group (months)	No. of cases	Percentage
1	0-6 months	6	54.5
2	6-12 months	2	18.8
3	12-18 months	2	18.8
4	More than 24 months	1	9.09
Total		11	100

4.1.2 Sex Wise Incidence

Among the 11 dogs studied for supracondylar femoral fractures 8 (72.72%) were males and the remaining 3 (27.28%) were females (Table. 3)

Table 3: Sex Wise Incidence of Supracondylar Femoral Fractures

S.No.	Sex	No. of cases	Percentage
1	Male	8	72.7
2	Female	3	27.3
Total		11	100

4.1.3 Leg Affected

Among the 11 dogs studied for supracondylar femoral fractures, 8(72.7 %) dogs had fracture in left leg and 3 (27.3 %) in the right leg.

4.1.4 Causes of Supracondylar Femoral Fractures

In all the dogs of the present clinical study, the causes of supracondylar femoral fractures were documented. The causes were found to be automobile accident in 4 (36.36%) dogs, fall from a height in 5 (45.45%), stamping by its owner in 2(18.18%) dogs (Table 4).

Table 4: Causes of Supracondylar Femoral Fractures

S.No.	Cause of occurrence	No. of cases	Percentage
1	Automobile accident	4	36.36
2	Fall from a height	5	45.45
3	Stamping by the owner	2	18.18
Total		11	100

4.1.5 Breed Wise Incidence

Among the 11 dogs studied, 6 (54.54%) were mongrels, 2 (18.18 %) were Spitz, 2 (18.18 %) were Dachshunds and 1 (9.09 %) was Labrador (Table 5)

Table 5: Breed Wise Incidence of Supracondylar Femoral Fractures

S.No.	Breed	No. of cases	Percentage
1	Mongrel	6	54.54
2	Spitz	2	18.18
3	Dachshund	2	18.18
4	Labrador	1	09.09
Total		11	100

4.2 CLINICAL OBSERVATIONS

4.2.1 Symptoms of Supracondylar Femoral Fractures

The dogs presented for treatment of supracondylar femoral fractures exhibited symptoms like sudden onset of pain and lameness immediately after a traumatic injury. There were symptoms like swelling in the stifle area (Fig. 13), dangling of the limb, non-weight bearing, abnormal angulation of the limb at the fracture site. In all the dogs, crepitation was noticed at the fracture site on physical manipulation. In one of the dog, there was open wound. No discharges were seen clinically in any of the dogs presented for treatment of supracondylar femoral fractures. All the eleven dogs presented had closed or simple fractures.

4.2.2 Pre-Operative Radiographic Observations

In the eleven dogs that formed part of the present study, medio-lateral and antero-posterior radiographs of the distal femur including the stifle joint were obtained. The radiographs confirmative of the tentative diagnosis of supracondylar femoral fractures in all the dogs (Figs. 14 & 15). The radiographs revealed non-involvement of stifle in all the dogs. The radiographs also revealed that in none of the dogs, the fractures affected the distal femoral physis. All the supracondylar femoral fractures were transverse fractures, except in one dog, where the fracture was found to be short oblique in orientation (Fig. 16). The fractures in all the dogs were seen to be at least about half an inch away from the stifle joint.

4.2.3 Operative Procedures

The lateral parapatellar incision and subsequent deep dissection resulted in good exposure of the stifle joint and the fracture site, thus enabling the proper anatomical reduction and fracture retention with cross pinning in 10 dogs (Fig. 17) and intramedullary pinning combined with cross pinning in one dog (Fig.18).

4.3 POST-OPERATIVE OBSERVATIONS

4.3.1 Post-operative Radiographic Observations

Post-operative radiographs taken immediately after the surgical correction and immobilization of the fractures revealed excellent anatomical reduction and good immobilization of the fracture site (Fig. 19) in nine dogs. In two dogs, the

immediate postoperative radiographs revealed that the fracture ends could not be brought into close alignment and a perceptible gap at the fracture site could be clearly observed (Figs. 20 & 21). However, in these two dogs also, manipulation of the fracture site after surgery revealed that the fracture site was rigidly immobilized.

Post-operative radiographic examination by the 30th post-operative day and later revealed good fracture healing in 8 out of the 11 operated dogs (Figs. 22 & 23). There was minimal callus formation and the fracture healing was considered satisfactory in these eight dogs.

Post-operative radiographs in the remaining three dogs revealed some complications associated with fracture fixation. In one dog, radiograph obtained on the 15th post-operative day revealed complete breakdown of osteosynthesis, since neither the intramedullary pin nor the K-wires were able to maintain the fracture reduction. Proximal migration of the Steinman intramedullary pin resulted in breakdown of fracture fixation and the K-wires were not strong enough to hold the fracture fragments together (Fig. 24). Non union resulted in this dog and the treatment adopted was considered as a failure.

In another dog, radiograph taken on the 30th post-operative day revealed distal migration of one of the K-wires. However, in this dog, the radiograph also

revealed satisfactory healing of the fracture site since the other K-wire held the fracture fragments in place and provided good immobilization (Fig. 25).

In the third dog, radiographs taken on the 15th post-operative day revealed that the two K-wires failed to hold the fracture site in reduction. This resulted in complete breakdown of the fracture fixation (Fig. 26) and this case was also considered as a failure.

4.3.2 Post-operative Clinical Observations

It was observed that all the eleven dogs tolerated the operative procedures well. All the dogs were able to bear weight on the operated limbs by the 3rd or the 4th post-operative day, although slight limping was observed in all the dogs up to one week after the surgery. Eight of the total eleven dogs that were part of the study went on to recover uneventfully. By the end of two weeks, these eight dogs were able to bear weight normally and regained their normal gait. These eight dogs continued to be normal up to the end of observation period of 60 days. The remaining three dogs were observed to have started developing complications by about three weeks of surgery. These three dogs started limping again and were non-weight bearing lame again. In one of the dogs, a seromatous swelling was observed in the region of the lateral condyle of femur. Palpation revealed the loosened end of the K-wire. Removal of the K-wire by making a small incision under local anesthesia, followed again by a course of Cefotaxime resulted in

recovery of this animal, so much so, that the limping disappeared and the gait returned to normalcy.

In the remaining two dogs, there was complete loosening of the implants used. These two dogs showed signs of swelling in the stifle region, dangling of the limb and the dogs again turned non-weight bearing lame. Loosening and failure of the implants in these cases was confirmed by post-operative radiography as described earlier.

The causes of implant failure and complications in these three dogs were found to be accidental fall from the owner's hands of one of the dogs, where, intramedullary pinning combined with cross pinning technique was adopted. In the other two dogs, hyperactivity and excessive excitable nature of the dogs was considered to be the cause of complications.

The surgical wounds in all the eleven dogs healed well with minimal scarring and no soft tissue complications. The skin sutures were removed by the tenth post-operative day in all the dogs.

4.3.3 Post-operative Care

The post-operative care comprising of parenteral antibiotics, analgesics and daily wound dressing was considered satisfactory and the wounds healed well. In one dog that developed a seromatous swelling in the stifle region, palpation

revealed the loosened end of the K-wire. Subsequent removal of this K-wire followed by antibiotic therapy resulted in uneventful recovery.

4.3.4 Complications

Post-operative complications were observed in three of the eleven dogs studied. The post-operative complications comprised of loosening and failure of the implants in three dogs. In two of these dogs, the entire surgical treatment failed to provide good clinical results. In one dog, however, loosening of one of the K-wires resulting in temporary lameness was resolved following the removal of the K-wire.

CHAPTER V

DISCUSSION

There are not many published reports on the incidence and surgical treatment of supracondylar fractures of femur in India. This fact prompted selection of the topic of present clinical study.

5.1 INCIDENCE

The patient history collection revealed that none of the dogs suffered from any previous orthopedic disease, other than the chief complaint, i.e., supracondylar femoral fractures.

Results of the present clinical study revealed that in all the cases, invariably, the chief complaint occurred suddenly following a traumatic injury. Phillips (1979), Singh *et al.* (1983), Wong (1984) and Aithal *et al.* (1998) also stated that the symptoms of Supracondylar fractures had sudden occurrence following a traumatic injury. The dogs were presented for diagnosis and treatment after four to seven days after the occurrence of symptoms. In a few cases, this resulted in certain difficulties in alignment of the fracture ends during surgery due to soft callus formation. Iyer *et al.* (1985), Hickman (1964) and Morgan (1972) also reported that in delayed cases, anatomical reduction of the fracture was difficult.

The results of the present clinical study also revealed that in 90.1% of the cases, supracondylar fractures were encountered in young dogs below 18 months of age. Alcantara and Stead (1975), Phillips (1979), Balgopalan *et al.* (1995) and Aithal *et al.* (1998) underscored the point that supracondylar fractures of femur in dogs occurred in young dogs. In the present study also revealed that of the 11 dogs with supracondylar femoral fractures 8 (72.72%) were males and the remaining 3 (27.28%) were females. Singh *et al.* (1983), Wong (1984) and Balgopalan *et al.* (1995) also find out that male dogs are more prone to fractures due to their aggressive and wandering nature. No reason could, however, be assigned to the observation that supracondylar femoral fractures in the present study was more common in left leg when compared to the right leg.

The results of the present clinical study are in concurrence with those of Phillips (1979) and Aithal *et al.* (1998) who stated that automobile accidents and fall from heights were the most common causes of supracondylar fractures of femur. The present study accounted for 81.81% of the dogs where automobile accident and a fall from a height was found to be cause of supracondylar fractures of femur

The breed wise incidence of supracondylar fractures of femur also concurred /did not concur with the published reports of Maala and Celo (1975) who also presented similar occurrence among the various breeds.

5.2 CLINICAL OBSERVATIONS

In all the dogs of the present clinical study, clinical symptoms like sudden onset of pain and lameness immediately after a traumatic injury, swelling in the stifle area, dangling of the limb, non-weight bearing, abnormal angulations of the limb at the fracture site, crepitation at the fracture site on physical manipulation were noticed. Similar observations were also made by

5.2.1 Pre-Operative Radiographic Observations

In the eleven dog's medio-lateral and antero-posterior radiographs of the distal femur including the stifle joint confirmed the tentative diagnosis of supracondylar femoral fractures. None of the dogs showed involvement of stifle joint. The radiographs also revealed that all the supracondylar femoral fractures were transverse fractures, except in one dog, where the fracture was found to be short oblique in orientation. Thilagar and Balsubramanian (1988) also reported that most of the supracondylar femoral fractures in dogs tended to be transverse in nature.

Salter and Haris, (1963) encountered intercondylar, condylar and other types of fractures in their study, but in the present study, these types of fractures were not encountered.

5.3 OPERATIVE PROCEDURES

The procedures adopted in the present study enabled proper anatomical reduction and fracture retention with cross pinning in 10 dogs and intramedullary pinning combined with cross pinning in one dog.

Aithal *et al.* (1998) and Ganesh *et al.* (2004) also stated that cross pinning is the method of choice in repair of supracondylar fractures in young dogs. In addition, Brinker *et al.*, (1984) stated that such fractures where the implants may damage the growth plates in young dogs, the procedure known as adaptation osteosynthesis, i.e., the use of weak implants like K-wires is the preferable method. Since in the present study, a majority of cases were found in young animals, cross pinning procedure with K-wires was used. Only in one dog that was old enough, cross pinning combined with intramedullary pinning was adopted.

5.4 POST-OPERATIVE OBSERVATIONS

5.4.1 Post-operative Radiographic Observations

Post-operative radiographs taken immediately after surgery revealed excellent anatomical reduction in nine dogs pointing to the suitability of the procedure adopted. In two dogs, a perceptible gap at the fracture site was discernible on radiographs, but in these two dogs also, the fracture site was found to be rigidly immobilized, underscoring the suitability of the techniques adopted. .

Post-operative radiographic examination at 30 days and later revealed good fracture healing in 8 (72.72 %) out of the 11 operated dogs. There was minimal callus formation and the fracture healing was considered satisfactory in these eight dogs.

Brinker et al. (1984), Aithal et al. (1998), Whitney and Schrades (1987) and Ganesh *et al.* (2004) also reported satisfactory healing after immobilizing femoral fractures with cross pinning.

Franczuszki *et al.* (1986), Stigen and Fjeld (1986), Denny (1991), Howard (1991), Boudieau and Sinibaldi (1992), Muir *et al.* (1995), Stigen (1999), Beale (2004), Hinko and Rhineland (1975), Chaffee (1977), Rhineland and Wilson (1982), Coetzee (1983), Nunamaker (1985) and Milton and Newman (1985) they used other methods of fracture treatment in their studies to obtain good results, but these methods were not used in the present study owing to the age of the dogs.

Post-operative radiographs in the remaining three dogs revealed some complications i.e. complete breakdown of osteosynthesis in two dogs due to implant failure and proximal migration of the K-wires in one dog. Proximal migration of the Steinman intramedullary pin resulted in breakdown of fracture fixation and the K-wires were not strong enough to hold the fracture fragments together. Non union resulted in these two dogs and the treatment adopted was considered as a failure.

Hickman (1964), Morgan, (1972), Grauer *et al.* (1981), Whitney and Schrader, (1987) and Stigen (1999) also reported similar complications. In another dog, radiograph taken on the 30th post-operative day revealed distal migration of one of the K-wires, although the healing of the fracture was considered satisfactory

5.4.2 Post-operative Clinical Observations

The fact that all the eleven dogs tolerated the operative procedures well emphasized the suitability of the techniques adopted. The observation of weight bearing lameness by the 3rd or the 4th post-operative day emphasized the safety of the procedures adopted. . Eight of the total eleven dogs that were part of the study went on to recover uneventfully and by the end of two weeks, these eight dogs regained their normal gait and continued to do so until the end of the observation period of 60 days. Similar observations regarding recovery following cross pinning of supracondylar femoral fractures were also recorded by Parker and Bloomberg (1984), Aithal *et al.*(1998),Coetzee (1999) and Emmerson, and Peard (1999).In one dog that developed complications, a seromatous swelling was observed in the region of the lateral condyle of femur. Palpation revealed the loosened end of the K-wire. Recovery of this animal following removal of the offending implant rendered this complication insignificant.

The fact that all the surgical wounds in the eleven dogs healed well with minimal scarring and no soft tissue complications vindicated the choice of the surgical procedures adopted and the post operative care provided. Similar results were also obtained by Aithal *et al.* (1999) and Stigen (1999).

5.4.3 Post-operative Care

The results indicated that the post-operative care comprising of parenteral antibiotics, analgesics and daily wound dressing provided satisfactory outcome. Iyer *et al.* (1985), Aithal *et al.* (1998) and Hulse and Johnson (1999) also recommended similar post-operative care.

5.4.4 Complications

The post-operative complications comprised of loosening and failure of the implants in three dogs. In two of these dogs, the entire surgical treatment failed to provide good clinical results. In one dog, however, loosening of one of the K-wires resulting in temporary lameness was resolved following the removal of the K-wire. Similar complications resulting out of implant failure were also recorded by Alcantara and Stead (1975) reported lameness, osteoarthritis and restricted joint movements as the major complications encountered after correcting the distal femoral fractures in dogs.

Whitney and Schrades (1987) observed pin migration in 7 percent of cases out of that distal pin migration was main complication with dynamic

intramedullary pinning in reduction of distal femoral fractures in dogs. Pin migrated before bony union as the result of instability and collapse at the fracture site.

Aithal *et al.* (1998) stated that in cases of supracondylar femoral fractures, single pin fixation through intracondylar fossa resulted in more prolonged lameness, more periosteal callus formation and took a longer time for the fracture line to disappear radiographically. These features indicated more instability and greater chance of complications. In comparison cross pinning provided greater stability leading to early fracture healing. Therefore the cross pinning technique was considered as the technique of choice in treating supracondylar fractures. They also suggested that further studies were needed to qualify their observations.

Christodoulou *et al.* (2005) reported that supracondylar fracture of femur or very serious injuries for a long time they were considered difficult to heal and often led to a degree of disability. These difficulties become greater when they are associated with elderly patients who present with a high degree of osteopenia.

The causes of implant failure and complications in these three dogs were found to be accidental fall from the owner's hands of one of the dogs, where, intramedullary pinning combined with cross pinning technique was adopted. In the other two dogs, hyperactivity and excessive excitable nature of the dogs was considered to be the cause of complications.

5.5 CONCLUSIONS

The present clinical study indicated that supracondylar fractures of femur in dogs is most commonly encountered in young dogs, with a majority of them occurring in puppies below 18 months of age. The results of the present clinical study conclusively proved that cross pinning technique is well suited for the surgical repair of supracondylar fractures of femur in dogs. The techniques employed also fulfilled the concept of adaptation osteosynthesis that is meant to preserve and protect the growth plates or physis with the use of weak implants. The complications encountered were consequent to implant failure resulting from repeated trauma in one dog and hyperactivity and excessive excitable nature in two other dogs. The present study indicated that cross pinning technique is well suited for surgical repair of supracondylar fractures of femur in young dogs.

CHAPTER VI

SUMMARY

The present clinical study was conducted on 11 dogs with supracondylar fractures of the femur presented for treatment at Teaching Veterinary Clinical Complex, Bhoiguda and Campus veterinary Hospital, College of Veterinary Science, Rajendranagar, Hyderabad. Out of the 11 dogs, 6 dogs were males and 5 were females. Out of 11 dogs 6 dogs (54.5%) were in the age group of 0-6 months and 2 dogs (18.18%) were in the age group of 6-12 months, and 2 dogs were in the age group of 12-18 months and 1 dog was (9.09%) more than two years of age. Among the 11 dogs studied for supracondylar femoral fractures, 8 (72.7%) dogs had fracture in left leg and 3 (27.3%) in the right leg.

The causes were found to be automobile accident in 4 (36.36%) dogs, fall from a height in 5 (45.45%), stamping by its owner in 2 (18.18%) dogs.

The dogs presented for treatment of supracondylar femoral fractures exhibited symptoms like sudden onset of pain and lameness immediately after a traumatic injury, swelling in the stifle area, dangling of the limb, non-weight bearing, abnormal angulation of the limb at the fracture site and crepitation.

Radiography revealed that all the supracondylar femoral fractures were transverse fractures, except in one dog, where the fracture was found to be short oblique in orientation. All the cases of fractures encountered were simple fractures.

The supracondylar fractures were treated with cross pinning in 10 dogs and intramedullary pinning combined with cross pinning in one dog.

Post-operative radiographs taken immediately after the surgical correction and immobilization of the fractures revealed good anatomical reduction and immobilization of the fracture site in nine dogs and good alignment albeit with a perceptible gap at the fracture site in two dogs.

The present clinical study indicated that supracondylar fractures of femur in dogs is most commonly encountered in young dogs, with a majority of them occurring in puppies below 18 months of age. The results of the present clinical study conclusively proved that cross pinning technique is well suited for the surgical repair of supracondylar fractures of femur in dogs. The techniques employed also fulfilled the concept of adaptation osteosynthesis that is meant to preserve and protect the growth plates or physis with the use of weak implants.

The complications encountered were consequent to implant failure resulting from repeated trauma in one dog and hyperactivity and excessive excitable nature in two other dogs. The present study indicated that cross pinning technique is well suited for surgical repair of supracondylar fractures of femur in young dogs.

It was concluded that cross pinning technique of adaptation osteosynthesis was well suited for supracondylar fractures of femur in dogs. The complications encountered were because of implant failure in two dogs due to repeated trauma in one dog and hyper excitable nature of the other dog.

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Fig. 1: Preparation of the surgical site



Fig. 2: Draping of the surgical site



Fig. 3: Lateral para-patellar skin incision

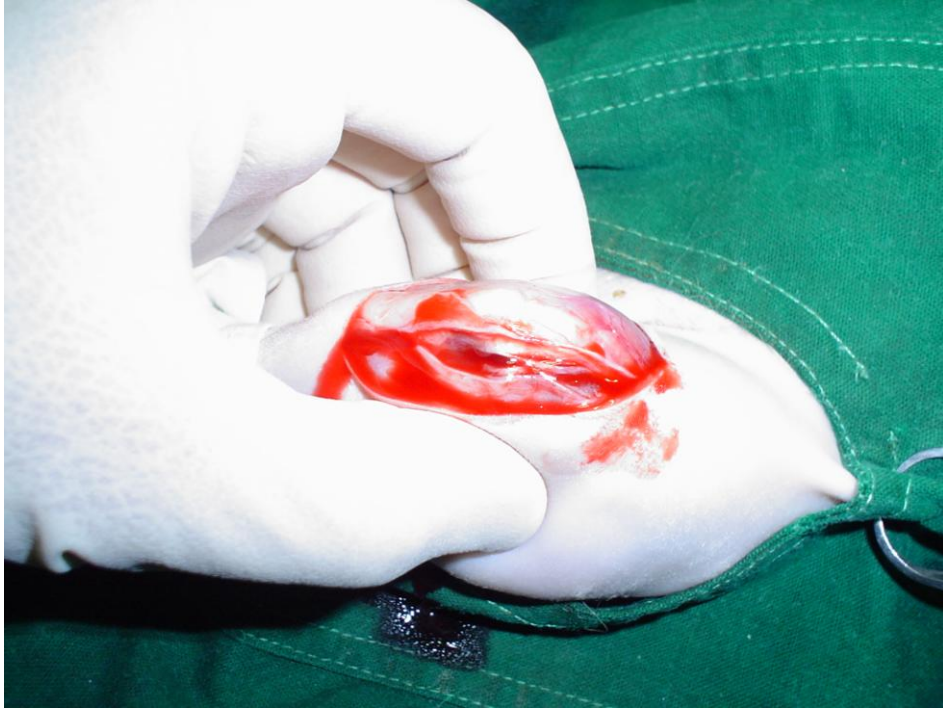


Fig. 4: Subcutaneous fascia and joint capsule incised



Fig. 5: The muscles and the patella pushed aside to expose the fracture site

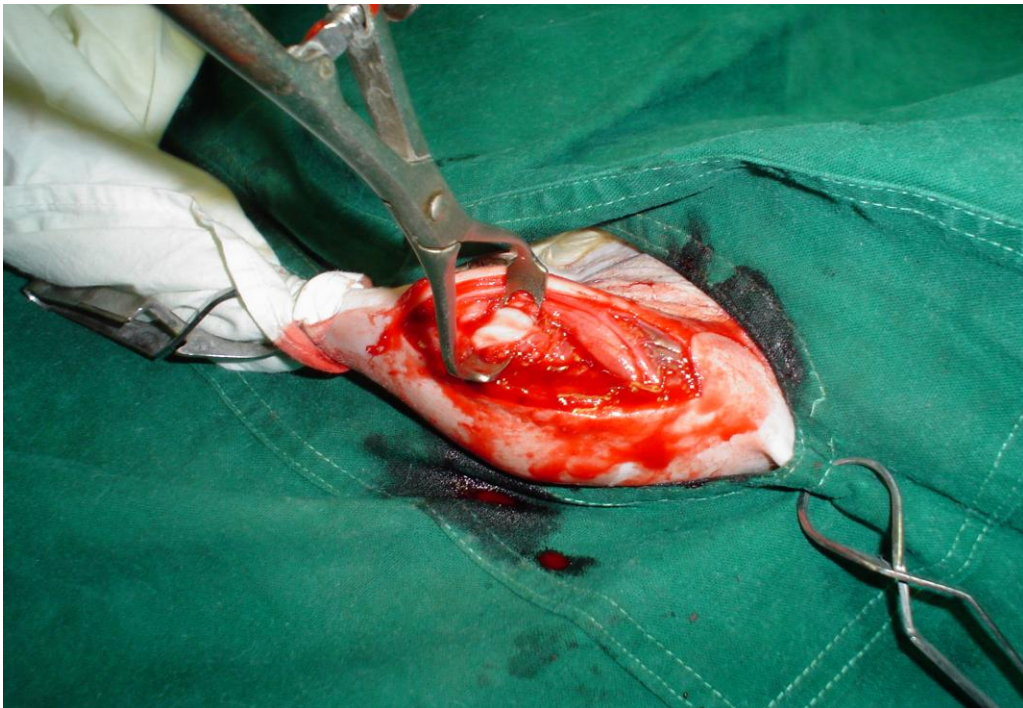


Fig. 6: The fracture anatomically reduced and held with suitable

forceps

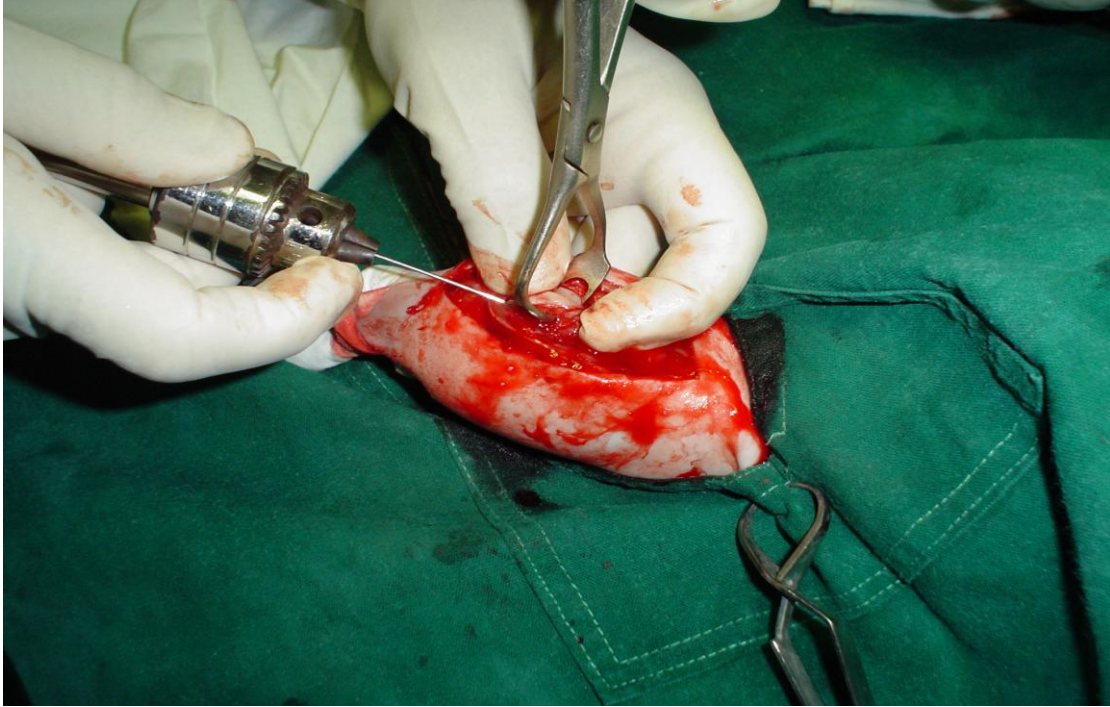


Fig. 7: The first K-wire being inserted from the lateral condyle

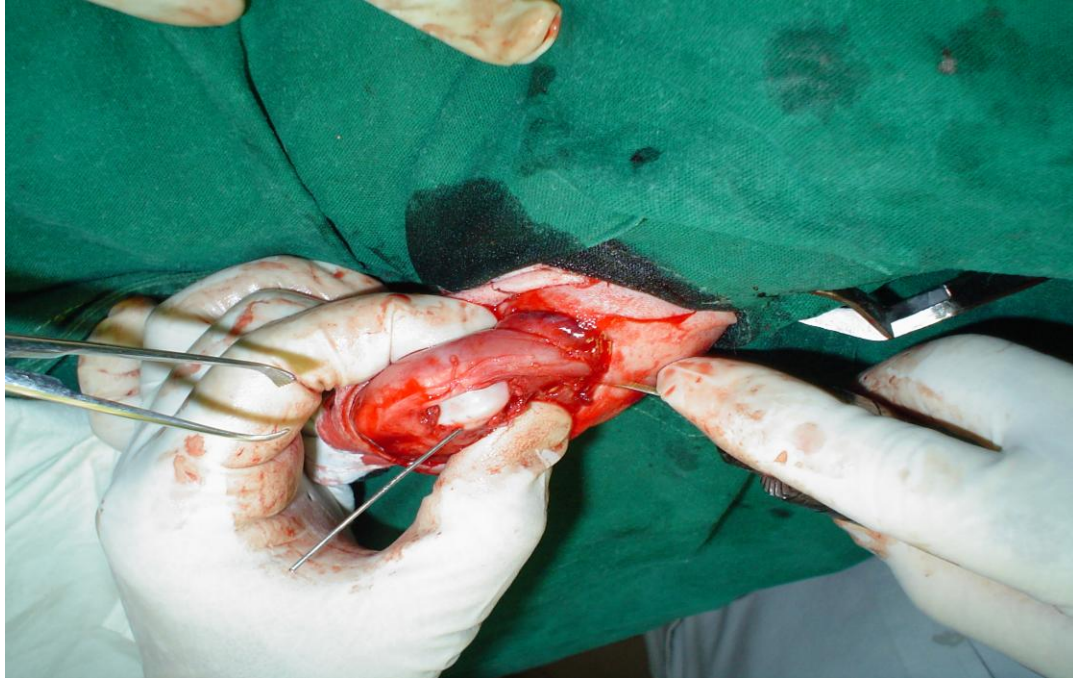


Fig. 8: The second K-wire being inserted from the lateral border of femoral diaphysis to exit at the medial condyle

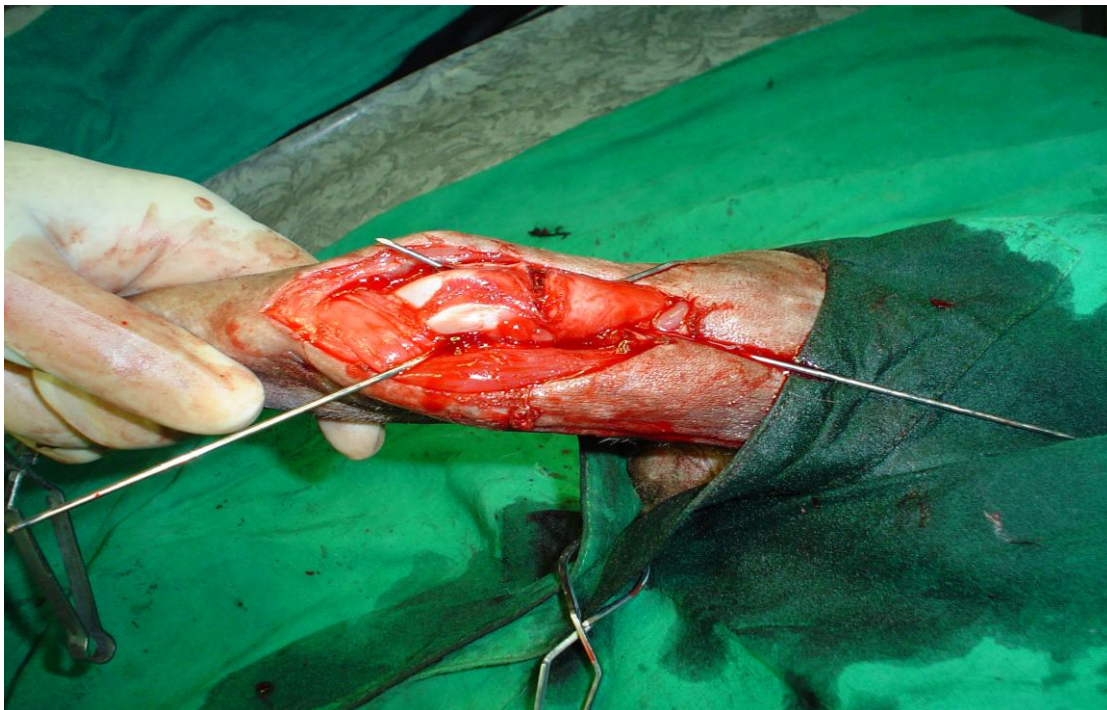


Fig. 9: Pins crossed proximal to the fracture line



Fig. 10: The K-wires were cut close to the bone

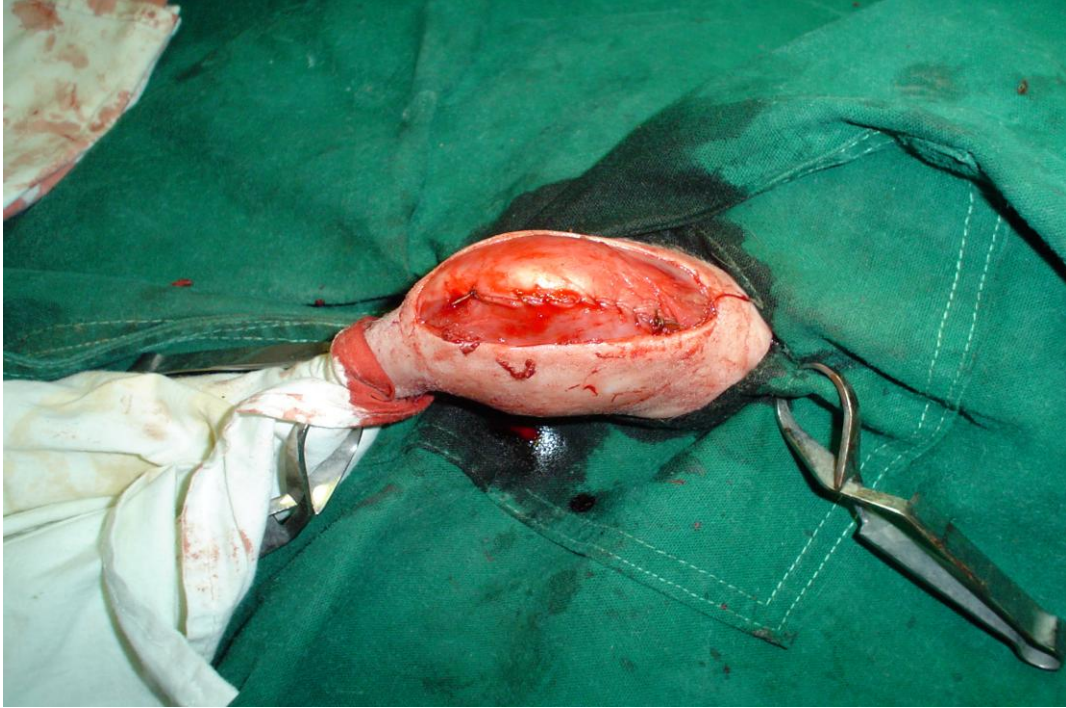


Fig. 11: Sub-cuticular sutures of chromic catgut were applied to unite the tissues



Fig. 12: Skin incision closed in a row of horizontal mattress sutures of No. 1 polyamide



Fig. 13: Supracondylar fracture of the femur showing swelling at the stifle joint



Fig. 14: Medio-lateral radiograph showing transverse supracondylar fracture of femur in a dog.



Fig. 15: Mediolateral radiograph showing transverse supracondylar fracture of femur in another dog.

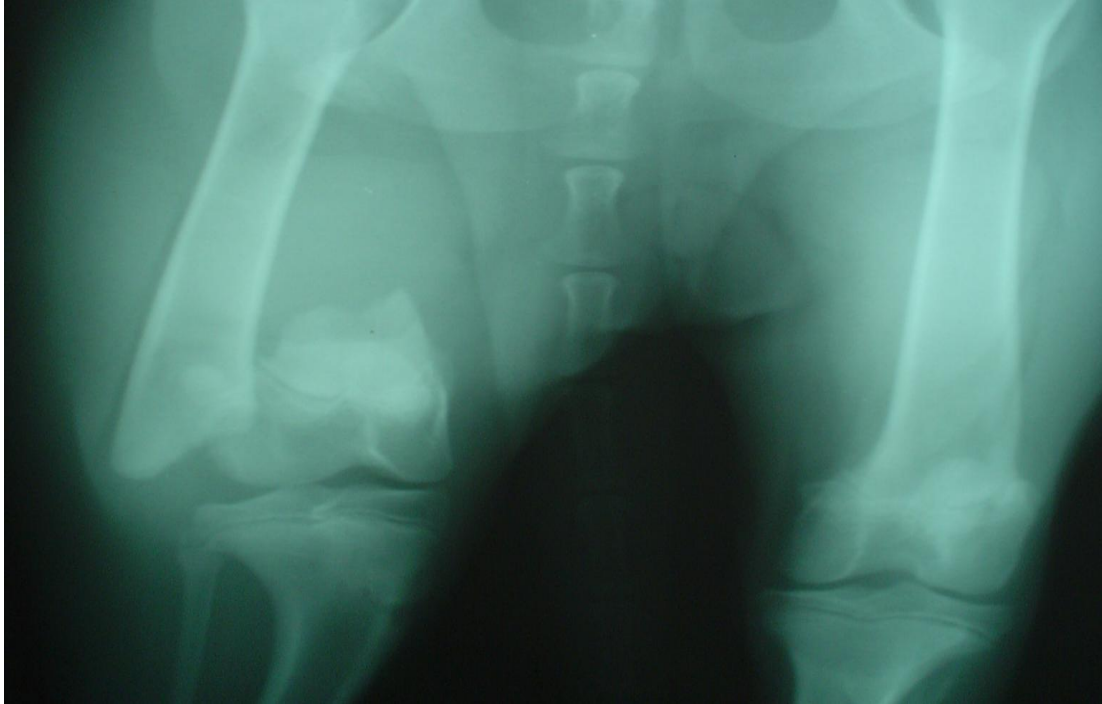


Fig. 16: Antero-posterior radiograph showing short oblique supracondylar femoral fracture in a dog.



Fig.17: Antero-posterior radiograph showing good anatomical reduction with cross pinning technique – immediately after surgery



Fig. 18: Medio-lateral radiograph showing anatomical alignment using cross pinning combined with intramedullary pinning – immediately after surgery

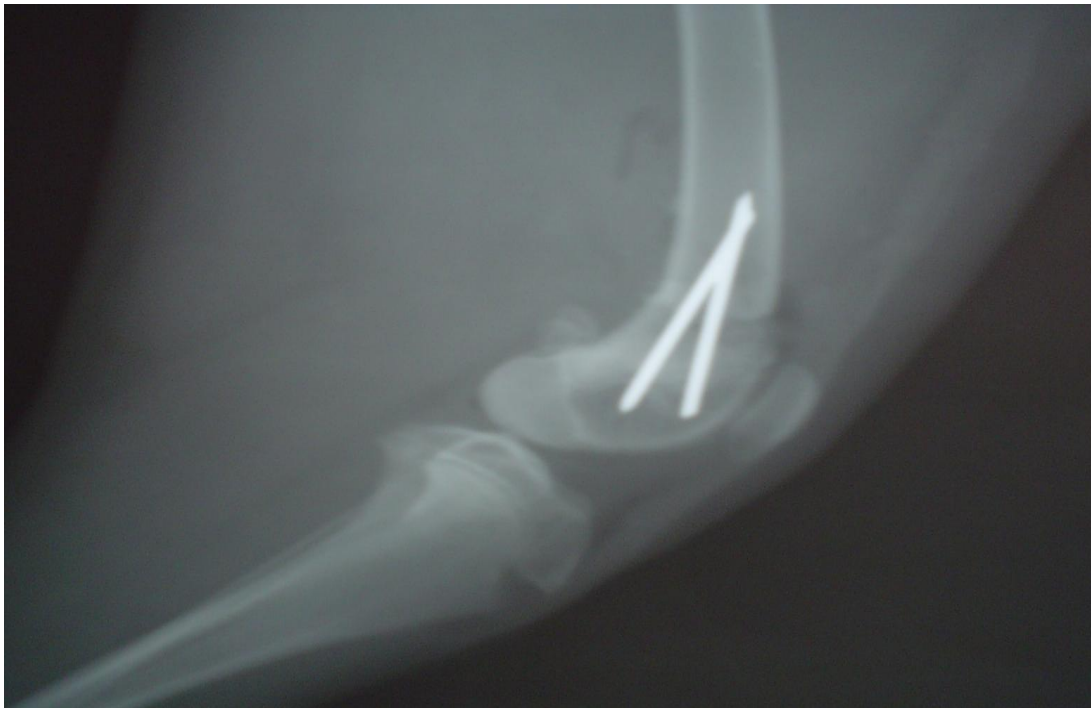


Fig. 19: Medio-lateral radiograph showing excellent anatomical reduction of the supracondylar femoral fracture with cross pinning – immediately after surgery



Fig. 20: Antero-posterior radiograph showing fracture alignment with a perceptible gap with cross pinning – immediately after surgery

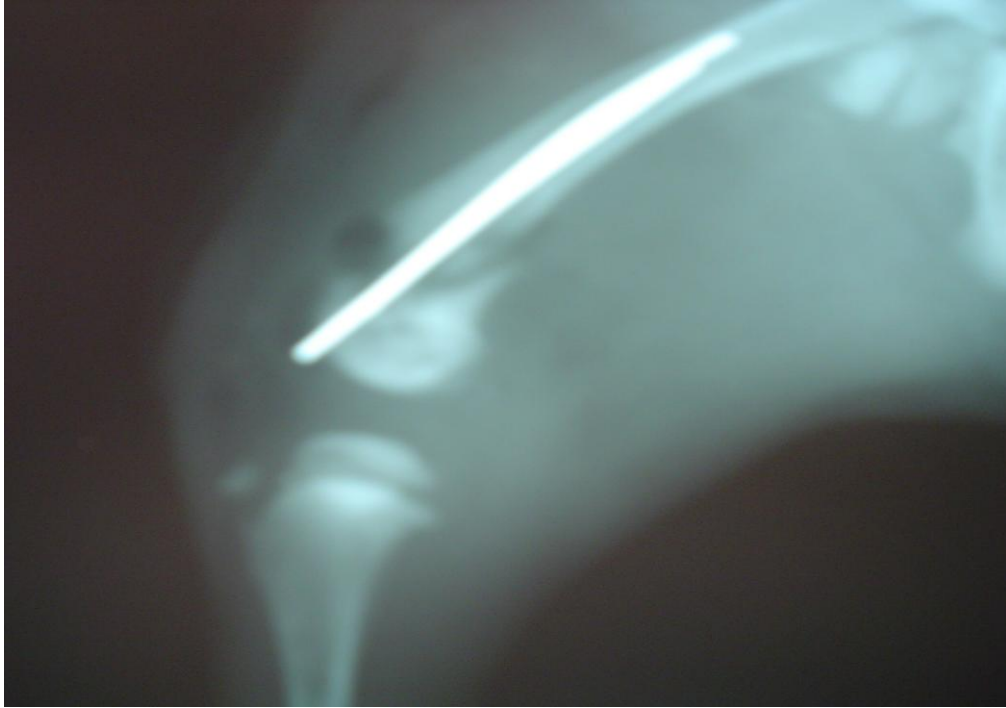


Fig. 21: Medio-lateral radiograph showing alignment of the fracture site with a perceptible gap with cross pinning technique in another dog – immediately after surgery



Fig. 22: Medio-lateral radiograph showing good healing of the supracondylar fractures of femur with cross pinning in a dog – 30th postoperative day



Fig. 23: Medio-lateral radiograph showing good healing of the supracondylar fracture of femur with cross pinning in a dog – 30th postoperative day

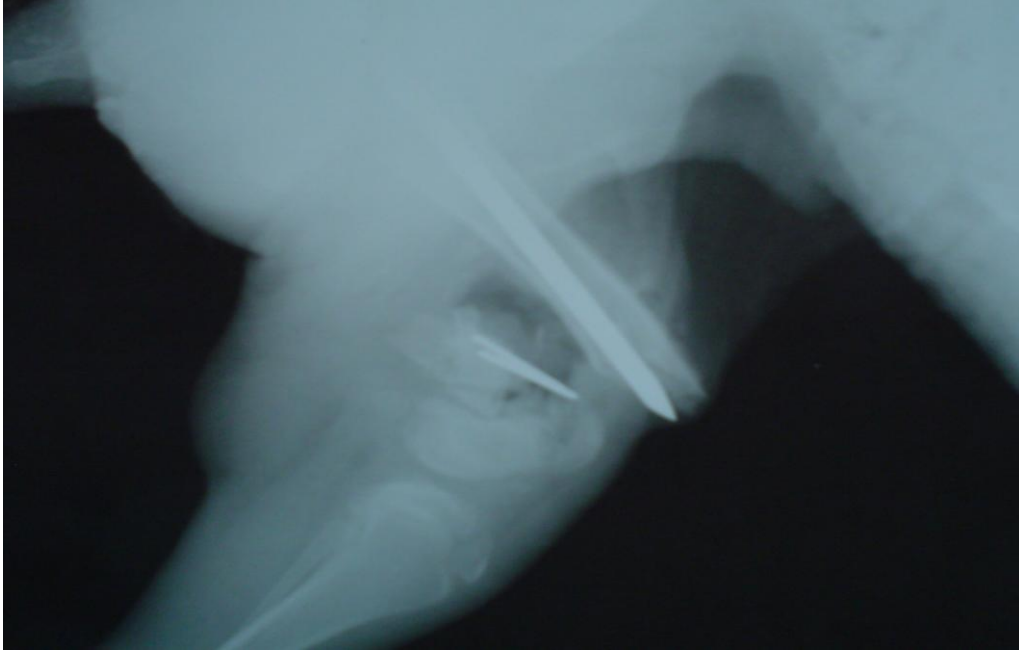


Fig. 24: Medio-lateral radiograph showing break down of the fracture fixation due to migration of the Steinmann & inability of the K-wire to hold the fracture fragments – 15th post operative day

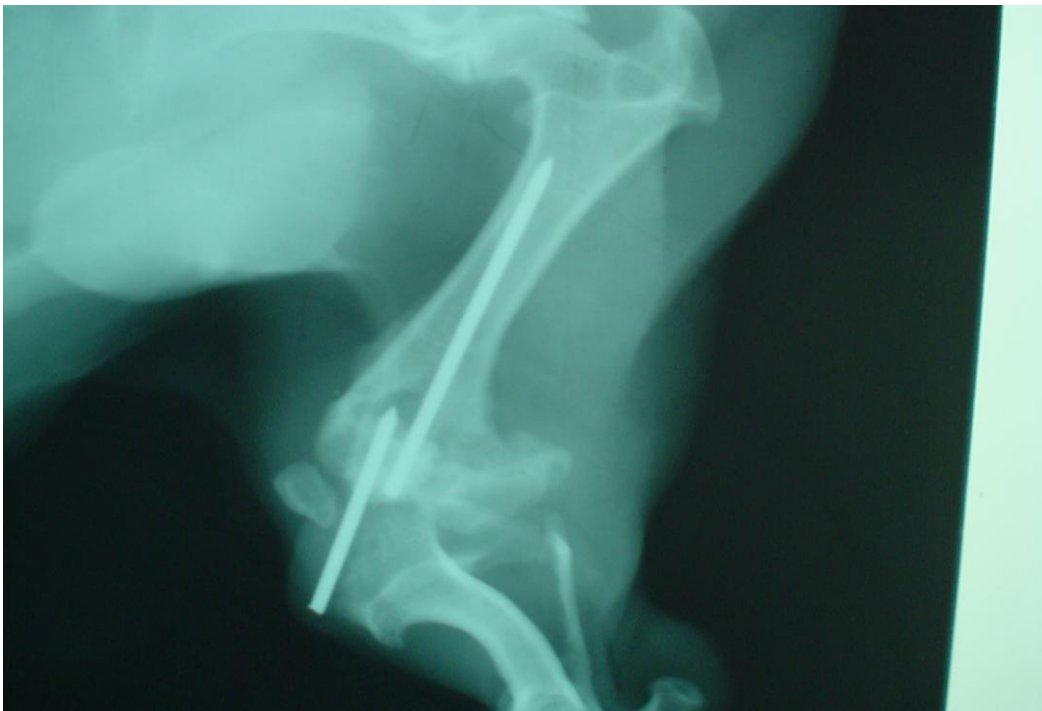


Fig. 25: Medio-lateral radiograph showing distal migration of

one of the K-wire. Note the satisfactory healing – 30th postoperative day

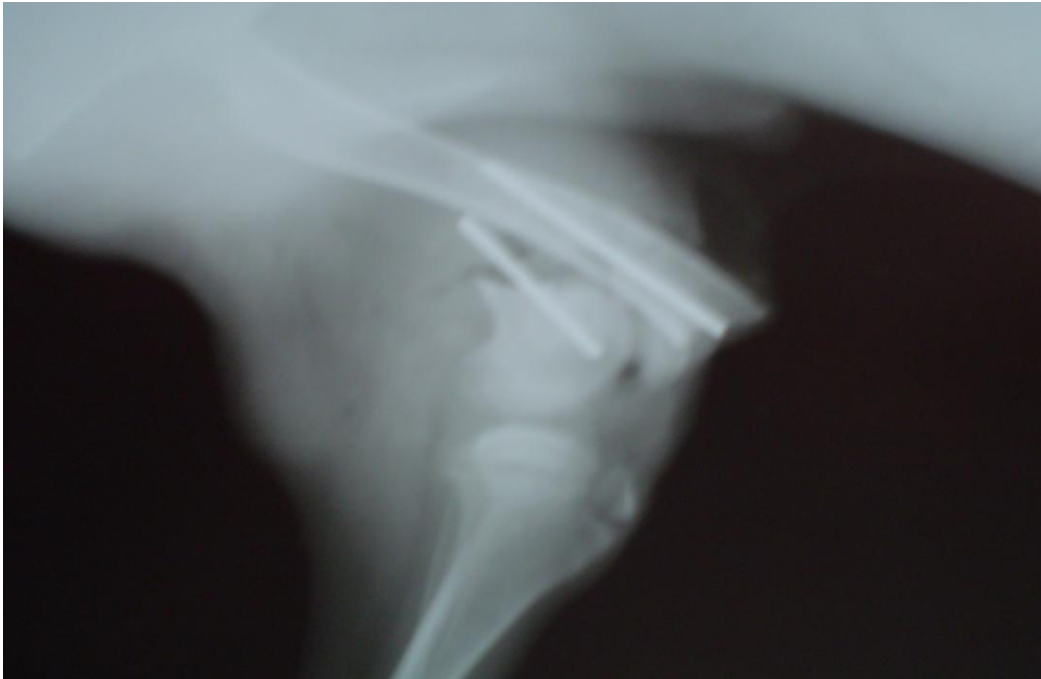


Fig. 26: Medio-lateral radiograph showing complete break down of fracture fixation with cross pinning – 15th postoperative day