RESEARCH ARTICLE

# Surgico-Therapeutic Management of Supracondylar Fractures in Felines using Arrow-Pin Technique

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## Abstract

The "Arrow pin technique" is a modified version of using intramedullary pins to mend femoral diaphyseal/ metaphyseal (supracondylar) fractures. The arrow pins were "custom made" by cutting locally available stainless-steel rod into predetermined lengths pins, further flattening one end, creating groves on either side of the flattened end with a file to give the appearance of an arrowhead, and shaping the opposite end as a trocar point. The pin insertion was accomplished aseptically through lateral approach on the distal femur, through the trochlear groove under general anaesthesia in cats. The clinical efficacy of this arrow pin technique was evaluated in six cats. All the cats (n=6) were client owned and < 1-year-old, with supracondylar distal femoral fractures. Following the clinical and radiological examinations, the type and location of the fracture, details of the fixation method applied, postoperative clinical and radiological results were assessed. After radiographic evaluation, long bone fractures were classified as supracondylar fractures of type I overridden closed fractures. Following the insertion of an intramedullary arrow pin, robust stability was accomplished, as evidenced radiographically. The patients were able to bear weight on the affected limb in 3-5 days and began walking normally on day 14 after surgery. The study found that the single "custom made" arrow pins provided adequate stability and resistance to rotational and axial forces in distal femoral fractures, and it confirmed that it would provide a significant fracture reduction in long bone fractures in young cats at a low cost.

**Key words:** Arrow-pin, Fracture healing, Feline, Intramedullary pinning, Supracondylar.

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## Introduction

The ultimate aims of fracture treatment are to achieve rapid bone healing, provide a fast return to complete function of the injured leg, and prevent damage to soft tissues and the bone (Deyoung and Probst, 1993). These principles are true for all species of animals. Modern cats, particularly in urban areas, are becoming integral family members, raising concerns about stray populations. Despite their unique qualities, recent studies highlight the high incidence of orthopaedic injuries due to trauma, falling, and fighting (Griffon *et al.,* 1994).

Numerous fixation methods in cats have been tried which includes external coaptation, intramedullary pinning (single pin, stacked pins), cerclage wire, external skeletal fixation, external skeletal fixation with intramedullary pinning, bone plates, lag screw, plate rod and interlocking nails (Scott, 2005; Scott and McLaughlin, 2007). While these techniques have been defined for different types of fractures in cats and dogs, the search for cost-effective, readily available, easily applicable device with minimal post-operative complication is still in progress. Intramedullary pinning has been found to fulfil all the criteria mentioned above and being the most effective technique to reduce long bone fractures in cats. The advantages of this technique include that it is relatively inexpensive and quick procedure with limited tissue trauma and surgical exposure. Implant is easy to remove after complete biological healing of bone tissue. However, in spite of several advantages, there are certain disadvantages associated with this technique like pin migration and implant failure as the implant is unable to neutralize the torsional and compression forces especially in cats.

A thorough orthopaedic examination and radiography are crucial for determining fracture structure, with preoperative radiographs aiding in presurgical planning, implant selection, and pin recontouring (Zurita and Craig, 2022). In case of adult

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cats, the most common type of fractures are supracondylar fractures (Chandler and Beale, 2002), which are most often seen in young cats (Rathnadiwakara *et al.,* 2020). In the view of the above, the "Arrow pin technique", a modified form of intramedullary pin application for the stabilization of femur and diaphyseal/ metaphyseal (supracondylar) fractures, is currently being promoted as a surgical option for fracture repair. These specially made pins are made of 316L stainless steel with a preset length. One end is flat and smooth, and the other is shaped like a trocar point with groves made with a file on either side to resemble an arrowhead (Rathnadiwakara *et al.,* 2020). Arrow-pin technique for small animals is not standardized or well-defined, making it crucial to relieve postoperative pain in orthopaedic procedures in veterinary surgical patients (Crane, 1987), and NSAIDs can yield higher pain reductions compared to opioids (Holdgate and Pollock, 2004). This study was aimed to evaluate surgico-therapeutic management of supracondylar fractures in felines using arrow-pin technique.

## Materials and Methods

The present clinical study on the long bone fractures management in cats with Arrow-pinning technique was undertaken on six clinical cases with a history of having long bone fracture with bone loss, presented to the Department of Veterinary Surgery and Radiology, Mumbai Veterinary College, Parel, Mumbai, and the affiliated Bai Sakarabai Dinshaw Petit Hospital, (BSDPH) Parel, Mumbai (India).

### Anamnesis and Arrow-Pin Preparation

All the cats (n=6) weighing 1.8±0.7 kg referred to Bombay Society for Prevention of Cruelty in Animals (BSDPHA) Hospital, Parel, from Mumbai Veterinary College, Parel were assessed by physical examination and radiographs of the affected limbs to identify the type of fracture and its severity (Fig. 1, 2). Among the six cats, the age varied from 6 months to 1 year, of these 4 were male and 2 females, 4 NDs and 2 Persian, one had history of automobile accident and rest

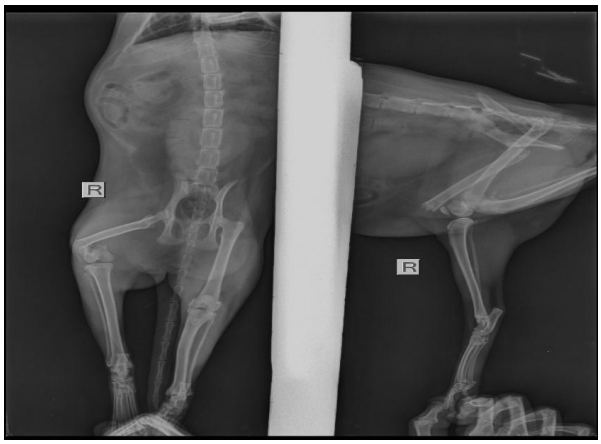


**Fig. 1:** Post-operative X-Ray showing reduction of fracture using Arrow-headed pin

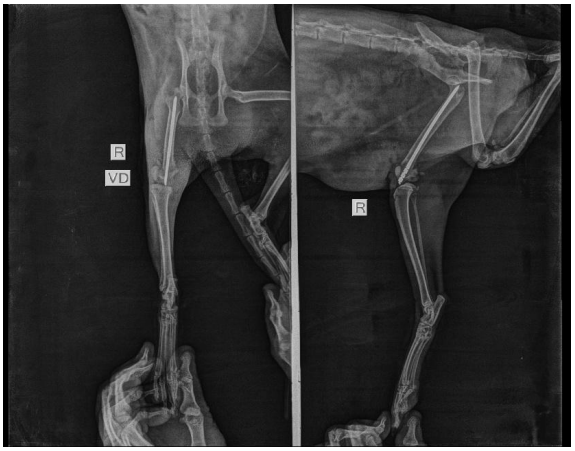


**Fig. 2:** Post-operative X-Ray showing reduction of fracture using Arrow-headed pin

were fallen from a height, all having supracondylar fracture, 4 in right femur and 2 in left femur, with a duration of 1 to 4 days. Based on the radiograph and the size of the bone marrow of the patient, diameter of the rod to be used to make Arrow-pin was determined. Then the pin was "custom made" by cutting the pin into required length and one end was prepared manually to make flat and smooth. This was achieved by pounding with a hammer on the heated end of the pin (Ramesh *et al.,* 2018). Finally, the flat end was given arrow shape by making grooves using a file, while the other end was shaped like a trocar. Finished pin resembled an "arrow" (Fig. 3).

**Fig. 3:** A custom made Arrow pin having total length 11 cm with length of Arrow-head of 2.5 cm.

### Premedication, Anaesthesia and Surgical Approach

On the day of presentation, all six patients received first aid for their fractures, which included administering analgesics

(meloxicam 0.2 mg/kg b.wt. subcutaneously) and stabilizing the fracture with a Robert Jones bandage to prevent further damage. Full blood count and serum biochemistry revealed no abnormalities. All feline patients were administered Butorphanol tartrate at 0.2 mg/kg b.wt. and Propofol at 4 mg/kg b.wt. as an induction agent, with an additional dose of 2-4 mg/kg b.wt. as needed for maintenance of anaesthesia. The surgical site was aseptically prepared by trimming the hair and cleaning with isopropyl alcohol, chlorhexidine gluconate, and povidone iodine. The patient was positioned lateral recumbent, with the injured limb facing upwards. Sterile drapes were used to cover the distal part of the limb and rest of the patient leaving only the site of operation opened.

## Surgical Procedure

A skin incision was made over the cranio-lateral aspect of the stifle joint starting at a point below the mid shaft of the femur extending distally up to the lateral aspect of the tibial crest (Fig. 4). Then the subcutaneous tissue was incised to expose the fascia lata and patella tendon. Next the fascia lata muscle and the joint capsule were incised to expose the distal articular surface of the femur (Fig. 5, 6). After reduction of the fracture fragments to their normal position, the "arrow pin" was inserted in a normograde fashion through the trochlear groove directing the trocar end towards the medullary cavity of the proximal fracture fragment (Fig. 7). Arrow end part of the pin was inserted into the trochlear by gentle tapping on the "arrow head" without causing damage to the articular cartilage. Arrowhead of the pin was lodged inside the cancellous bony part of the distal femur in a way that stifle movement was not interfered (Fig. 8). After the fracture repair, the surgical site was flushed with sterile normal saline, joint capsule and the fascia lata were sutured with simple interrupted sutures using chromic catgut (2-0) (Fig. 9) and the skin closure was accomplished using 2/0 suture ethilon in simple interrupted pattern. Finally, modified Robert Johns bandage was applied.

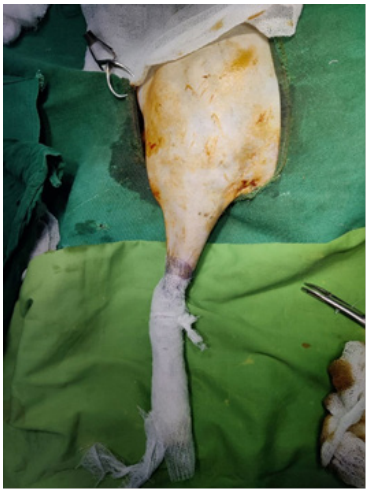

**Fig. 4:** Draping of right femoral area along with stifle joint

**Fig. 5:** Incision on the stifle joint area and distal part of tight femur

**Fig. 6:** Exposure of supracondylar area of distal femur after Selecting middle patellar ligament

**Fig. 7:** Fixation of Arrow-pin after reduction of fracture ends

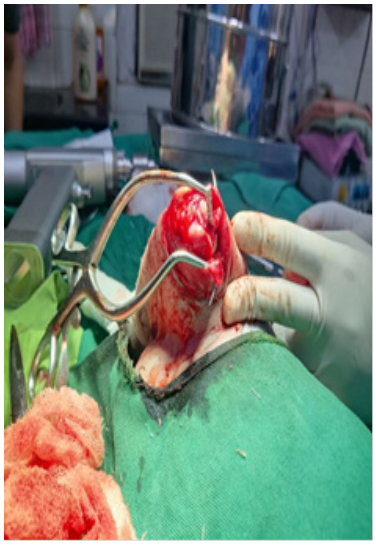

**Fig. 8:** Fixation of Arrow-head in the trochlea of femur using millet

**Fig. 9:** Closure of surgical site using simple continuous 2-0 catgut.

## Results and Discussion

The study demonstrated that the single "custom made" arrow pins provided acceptable resistance to rotational and axial forces in long bone fractures and confirmed that it would provide a significant fracture reduction in supracondylar distal femoral fractures in young cats.

All the six cats in this study gained their partial weight bearing (Fig 10, 11) ability from the 3-5 days post-operatively. History of the all six cases revealed that the main cause of fracture was traumatic injury by fall from height (High rise syndrome) and automobile accident. All six patients were treated with post-operative antibiotic therapy and it showed effective control of secondary bacterial infections in the patients, since none of them developed post-operative swelling or discharges in the surgical site. The challenges posed to veterinarian in correcting long bone fractures are insufficient bone mass for orthopaedic implants, presence of soft cancellous bone and availability of minimal area for considerable bending forces (Harasen, 2002).

Several techniques for stabilization of supracondylar fractures in femur were reported such as intramedullary pins, rush pins, crossed pins, mini plates, and Collison in cruciate screws (Stigen, 1999). Intramedullary pins resist bending forces but are very poor in countering the rotational and axial forces (Syam *et al.*, 2010). Certain study found that crossed pins to be significantly stronger than single intramedullary pins and also crossed pins are indicated in cats (Sukhiani and Holmberg, 1997). Treatment of supracondylar fractures of femur by crossed pin technique provides more than one point fixation and increase the stabilization of the fracture fragment which leads to early fracture union (Aithal *et al.,* 1998).

Some of the few well-established treatments for healing distal femoral fractures have intrinsic problems, such as poor reduction or pin placement, muscle tie-down, soft tissue irritation, and joint pain or arthritis caused by pin cuts and pin migration. Furthermore, some procedures require additional surgical intervention to remove the implants. Finally, several difficulties resulted in the loss of function and motion of the stifle joint (Dehghani *et al.,* 2013). To overcome these obstacles, arrow pins combined with external fixation (Robert Jones Bandage) were proven to be beneficial in distal end femoral fractures.

There are several methods that are being practiced in BSDPHA, hospital affiliated to Mumbai Veterinary College, Parel, for the correction of long bone fractures such as, Steinmann pin or Kirschner pin insertion, external coaptation using plaster of paris bandage application with or without splints, and application of slings. During the period of last one and half year, 54% of fractures in cats presented to the hospital were corrected with intramedullary pin insertion. This method was commonly used to correct femoral, ulna-radius, tibia-fibula, and humeral fractures. Arrow pin technique which was used in stabilization of supracondylar femoral fractures maintained proper fracture fixation and immobilization in the six cats. During the present case study patient preparation before the surgery and the anaesthetic protocols followed during the surgery were found satisfactory in all the patients with regards to the reduction of fracture and quality of recovery of the patients along with weight bearing achieved in 3-5 days (Fig. 10, 11).

**Fig. 10:** Weight bearing on affected limb 3 day post-operatively

All the six cats were recovered without post-operative complications. Fixation of the supracondylar fractures of femur was accomplished successfully with the arrow pin technique in comparison to the other methods that were being used. This method provided a successful fracture repair with minimum trauma to the condyles and the other structures of the stifle joint. However, there is a potential to claim that the arrow pin technique is a better method for fixation of supracondylar femoral fractures in young cats provided that proper scaled-based assessment for mobility and pain is used in extended study in future using fundamental results we obtained.

**Fig. 11:** Weight bearing on affected limb with partial touching of toe 10 day post-operatively

## Conclusion

Our study confirmed that the single arrow pin technique provided proper stability and acceptable resistance to rotational and axial forces in distal femoral fractures and confirmed that it would provide a significant fracture reduction in supracondylar femoral fractures in young cats. The results could not be compared due to dearth of literature and first reported case study on arrow pin technique in cats in India.

## Acknowledgement

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## References

Aithal, H.P., Singh, G.R., Sharma, A.K., & Amarpal (1998). Modified technique of single pin fixation and cross intramedullary pin fixation technique for supracondylar femoral fracture in dogs: A comparative study. *Indian Journal of Veterinary Surgery, 19,* 84-89.

Crane, S.W. (1987). Perioperative analgesia: A surgeon›s perspective. *Journal of American Veterinary Medical Association, 19*(1), 1254-1257.

Dehghani, N.S., Raayat, J.A.R., Foroud, M., Vesal, N., & Hooman, F. (2013). Surgical repair of distal femoral fracture in a wild gray wolf (*Canis lupus*). *Iranian Journal of Veterinary Research, 14,* 165-168.

Deyoung, D.J., & Probst, C.W. (1993). Methods of internal fracture fixation. In: *Text Book of Small Animal Surgery*. 2nd ed., Philadelphia, PA, USA: WB Saunders Company, pp. 1610-1627.

Griffon, D.J., Walter, P.A., & Wallace, L.J. (1994). Thoracic injuries in cats with traumatic fractures. *Veterinary and Comparative Orthopaedics and Traumatology, 7*(3), 98-100.

Harasen, G. (2002). Fractures involving the distal extremity of the femur: Part 2, the mature patient. *Journal of Small Animal Practice, 43,* 131-132.

Holdgate, A., & Pollock, T. (2004). Systematic review of the relative efficacy of non-steroidal anti-inflammatory drugs and opioids in the treatment of acute renal colic. *British Medical Journal 328*(7453), 1401-1404.

Ramesh, N., Anil, M., Rahavender, K.B.P., Kumar, V.G., & Sekhar, E.L.C. (2018). A clinical study on the use of single arrow-pin technique for management of supracondylar femoral fractures in young dogs. *Journal of Entomology and Zoological Studies, 6,* 1047-1050.

Rathnadiwakara, R.W.M.H., De Silva, D.D.N., & Wijekoon, H. (2020). Treatment of supracondylar femoral fractures in Young cats and dogs using "Arrow Pin" technique. *Journal of Veterinary Medicine & Animal Science, 3*(1), 1017-21.

Scott, R. (2005). Repair of long bone fracture in cats. *In Practice, 27,* 390-397.

Scott, H.W., & McLaughlin, R. (2007). Introduction to feline orthopedic surgery. In: *Feline Orthopedics,* Manson Publishing, London. p384.

Stigen, O. (1999). Supracondylar femoral fracture in 159 dogs and cats treated using a normograde intramedullary pinning technique. *Journal of Small Animal Practice, 40,* 519-523.

Sukhiani, H.R., & Holmberg, D.L. (1997). *Ex vivo* biomechanical comparison of pin fixation techniques for canine distal femoral physeal fractures. *Veterinary Surgery, 25,* 398-407.

Syam, K.V., Venkateswaralu, B., Sarada, A.T., Raji, T.A., & Ranjith, M. (2012). External skeletal fixation in combination with intra-medullary pinning. and cerclage wiring for the measurement of comminuted fractures of humorous in dog. *Indian Journal of Canine Practice, 4,* 54-55.

Zurita, M., & Craig, A. (2022). Feline diaphyseal fractures: Management and treatment options. *Journal of Feline Medicine and Surgery, 24*(7), 662-674.