International Journal of Livestock Research, Vol. 11 (2) Feb' 2021
http://www.ijlr.org
eISSN: 2277-1964
NAAS Rating 2020 – 5.36

Case Report

Successful Surgical Repair of Distal Diaphyseal Tibiotarsal Fracture Using an End Threaded Intramedullary Pin in a Goose (*Anser Anser domesticus*)

Vandana Sangwan*, Arun Anand, Ashwani Kumar and Shashi Kant Mahajan

Department of Veterinary Surgery and Radiology, College of Veterinary Science, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, INDIA

*Corresponding Author: drvandanasangwan@rediffmail.com

How to cite this paper: Sangwan, V., Anand, A., Kumar, A., & Mahajan, S. K. (2021). Successful Surgical Repair of Distal Diaphyseal Tibiotarsal Fracture Using an End Threaded Intramedullary Pin in a Goose (Anser Anser domesticus). *International Journal of Livestock Research,* 11(2), 179-184. http://dx.doi.org/10.5455/ijlr.20201027080606

Received : Oct 27, 2020
Accepted : Jan 02, 2021
Published : Feb 28, 2021

Abstract

Fracture of tibiotarsal bone is commonly encountered in birds. This report describes the successful surgical fixation of distal diaphyseal tibiotarsal fracture in a 1.5-year-old pet goose weighing 3.80 Kg. The bird had non-weight bearing lameness in the right limb due to unknown trauma as the bird was kept in a gaggle of 12-15. Orthopaedic examination and radiography confirmed complete, simple, distal third diaphyseal, transverse inter digitating fracture of right tibiotarsal with cranio-lateral displacement. The fracture was repaired under general anesthesia using a stainless-steel end threaded (negative threads) intramedullary pin (3.5mm) in a retrograde fashion. The bird started bearing partial weight on the operated limb from the 15th day and full weight bearing by 30th day. The pin was removed on the 57th post-operative day when bridging callus was evident, radiographically but the bird was showing marked limping from the operated limb. The bird was set free with other birds after 10 days of pin removal. Use of an end-threaded intramedullary pin proved to be a simple and quick technique providing adequate stability for tibiotarsal bone fracture in a goose. To the best of author's knowledge, no report using an end threaded intramedullary pin for the repair of tibiotarsal fracture has been reported in birds.

Keywords: *Anser Anser domesticus*, Avian, Bone, Fracture, Goose, Internal Fixation, Waterfowl

Introduction

Tibiotarsal fracture is commonly reported in birds (Duerr, 2010). Though, conservative management of fractures involving distal limbs or wings using splints and bandaging has been reported but internal stabilization is preferred in larger birds to allow early weight bearing (Duerr, 2010; Wright *et al.,* 2018). Various surgical techniques; external fixation (Kavanagh, 1997), interlocking nailing (Hollamby *et al.,* 2004) and interlocking plating (Slunsky *et al.,* 2018) have been described for the successful repair of tibiotarsal fracture in birds. This case study puts on record successful clinical use of end-threaded intramedullary pin for the management of tibio-tarsal fracture in a goose (*Anser Anser domesticus*).

A 1.5-year-old pet goose (sex unknown) weighing 3.80 kg was presented with non-weight bearing lameness in the right limb since 2 days. There was no known history of trauma as the bird was kept in a gaggle of 12-15 at the farm. The bird was otherwise alert and active with normal appetite and was able to stand for some time on one limb, but was not walking. Clinical and orthopaedic examination palpated crepitus and abnormal mobility at distal third diaphyseal region of right tibiotarsal. Immediate bandaging with polyvinylchloride (PVC) splint kept medially was done to avoid the fracture becoming open. Lateral radiograph revealed complete, simple, distal third diaphyseal, transverse inter digitating fracture of right tibiotarsal with cranio-lateral displacement (Fig. 1a). Radiographically, both proximal and distal fragments had faint longitudinal lines suggestive of splits. Considering the involvement of long bone of weight bearing limb, surgical intervention was recommended.

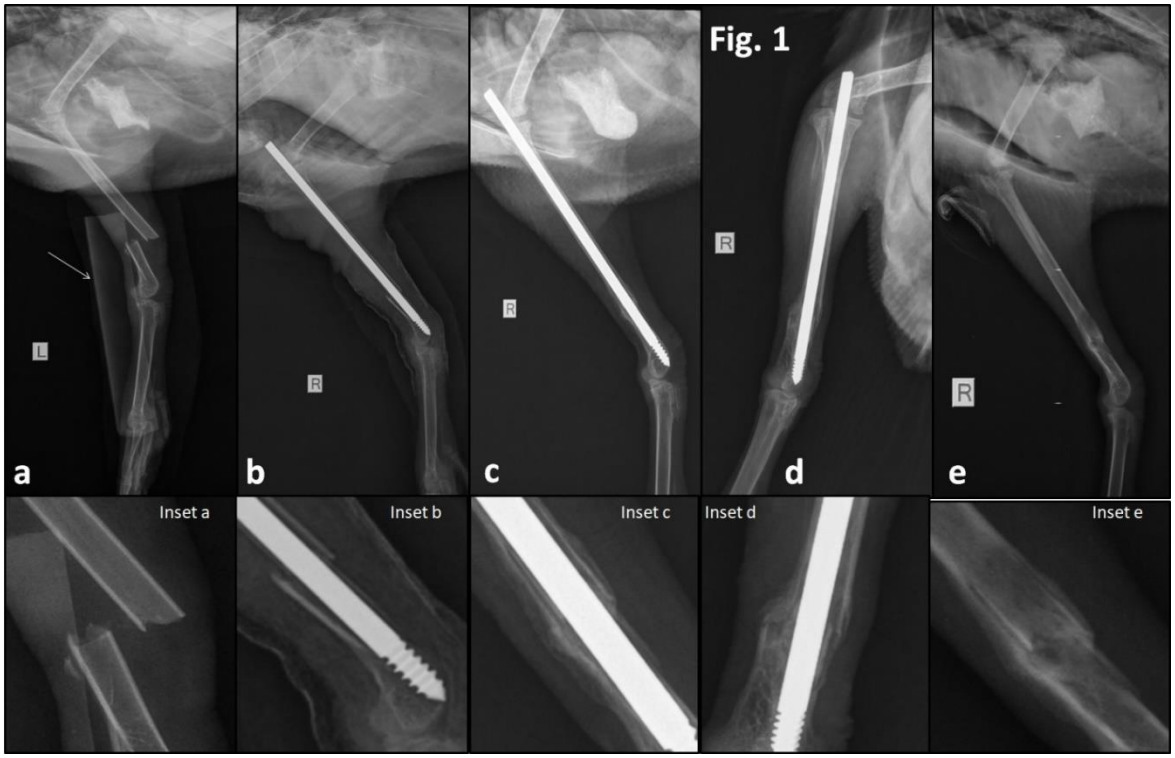

Figure 1: Radiographic case study of the Goose with right tibiotarsal bone fracture (a) pre-operative radiograph showing distal third transverse interdigitating fracture of tibiotarsal with a PVC splint on the medial aspect (white arrow) (inset 'a'); (b) Immediate post-operative radiograph of the tibiotarsal bone repaired with an end threaded (negative profile) intramedullary pin showing satisfactory apposition of fracture fragments and adequate seating of pin in the distal fragment (inset 'b'); (c and d) 43rd post-operative day radiograph in lateral and anterio-posterior views showing bridging callus at the fracture site and stable implant (inset c and d); (e) Lateral view of radiograph after removal of intramedullary pin showing stability and bridging callus at the fracture site.

Preoperative measurements, made from the lateral radiograph of the fractured bone using inbuilt calliper of the digital radiography system, revealed narrowest medullary canal diameter, length of proximal and distal fragment to be 0.56cm, 10.7cm and 3.5cm, respectively. The medullary cavity was narrow in the proximal and distal region (0.56cm) and broadest in the mid (0.66cm). The bird was kept off-feed and off-water for 12hrs before surgery. The bird was administered inj. ketamine (@ 20 mg/kg bwt, (Aneket, Neon laboratories limited, Mumbai, India) intramuscularly and it showed head down within 5 minutes. Induction was done with isoflurane 5% (Sosrane, Neon

laboratories limited, Mumbai, India) mixed in 100% oxygen using a face mask followed by endotracheal intubation with a 3.5mm non-cuffed tube. Further anaesthesia was maintained using isoflurane mixed in 100% oxygen using a Bain's circuit (Fig. 2). An intravenous cannula (22 Gauze) was fixed in the ulnar vein and inj. normal saline solution (20 ml total) was administered during the intraoperative period which was of about 15 minutes. The surgical site was prepared, aseptically, by first plucking the feathers (stifle to hock joint) followed by painting it with povidone iodine (Cipladine 5% lotion, Cipla ltd, Mumbai India) and 70% ethyl alcohol, thrice, alternatively.

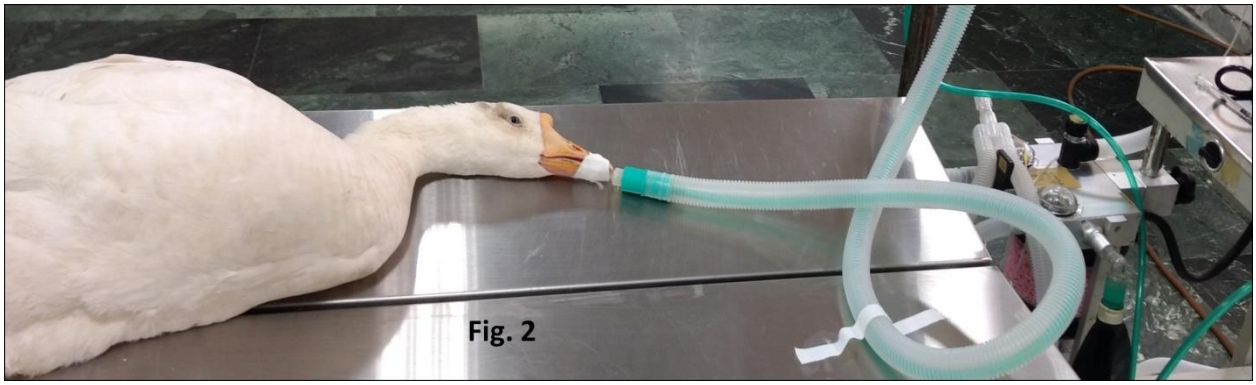

Figure 2: Photograph of the Goose with right tibiotarsal bone fracture under inhalation general anaesthesia using endotracheal tube and Bain circuit on the day of surgery

The bird was positioned in right lateral recumbency and the fracture was approached from the medial aspect of the tibia (Fig. 3a). About 3 cm long incision was made on the skin at the fracture site and the underlying muscles were incised to expose the proximal bone fragment. Normograde pinning technique was attempted once, but failed, so retrograde method of intramedullary pinning was followed.

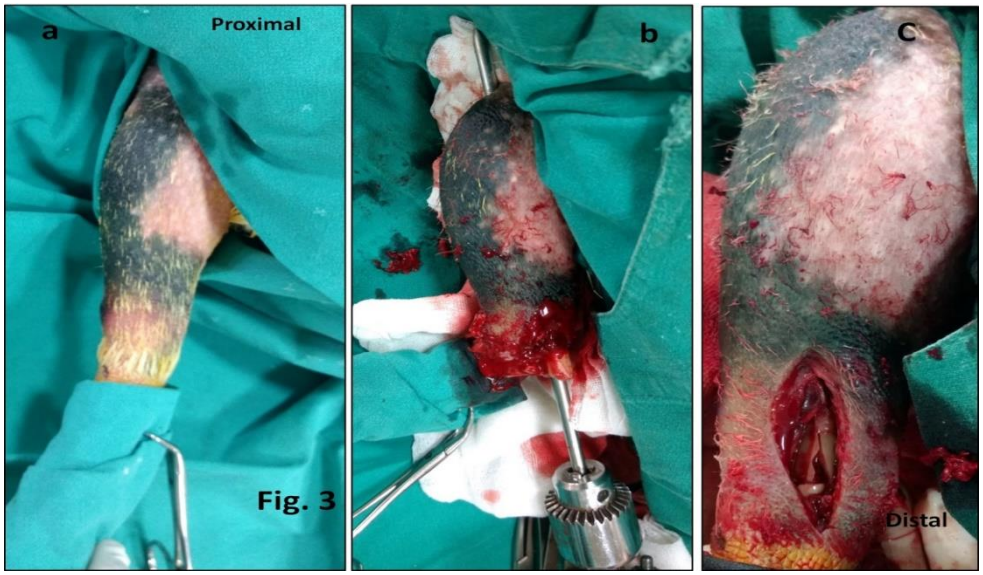

Figure 3: Photographic study of the Goose with right tibiotarsal bone fracture showing surgical procedure (a) aseptically prepared surgical site from the medial aspect of the bone (b) retrograde insertion of pin from the fracture site into the proximal fragment (c) fixation of pin in the distal fragment with the split in proximal fragment.

The pin was first inserted into the medullary canal of proximal bone fragment from the fracture site (Fig. 3b) and later in the distal fragment. A 4.5mm diameter stainless steel end threaded pin (Shanz pin) with 6 negative cancellous threads at the distal end of pin (local made) was used to repair the fracture. The pin was seated, adequately, into the distal metaphyseal region by making clockwise rotations. A split in the proximal fragment occurred while fixing the pin (Fig. 3c) but otherwise the fracture was stable. The position of distal end of the pin was assessed by matching it with the same length of another pin kept aside at the start of surgery. The extra pin lying outside the proximal end of the tibia was cut short with a pin cutter. No wiring was done to fix the split in the proximal fragment as it would have irritated the scanty soft tissues at the fracture site. The surgical site was flushed using sterile normal saline solution before suturing the muscles with 3-0 polygalactin 910 (Vicryl, Ethicon, Johnson and Johnson, Ahmedabad,

India) and the skin closure with nylon 2-0 (local made).

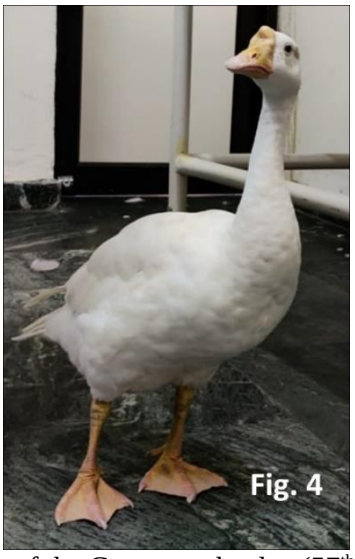

Figure 4: Photograph of the Goose on the day (57th) of implant removal.

Immediate post-operative radiograph revealed satisfactory reduction and placement of the pin with adequate seating in the distal bone fragment (Fig. 1b). Post-operatively, the fracture was supported with padded bandage (without splint) involving both stifle and hock joints. The bird recovered well from anesthesia and was administered inj. cefotaxime q12h (20mg/kg b.wt, Taxim, Alkem Lab Ltd., Mumbai, India) for 5 days and analgesic inj. Meloxicam q24h (@0.5mg/kg b.wt, Melonex, Intas Pharmaceuticals, Ahmedabad, India), for 3 days, intramuscularly. It was advised to keep the bird separated from the gaggle to avoid mutilation.

The bird started supporting weight on the operated limb from the 8th postoperative day and partial weight bearing on 15th day. The surgical wound healed uneventfully and skin sutures were removed on 12th postoperative day. As per the owner, the bird was full weight bearing on the limb with walking and running by 30th days, but lameness was always present. No bandaging was done thereafter. The lateral (Fig. 1c) and anterio-posterior (Fig. 1d) radiographs made on 43rd post-operative day revealed bridging callus with satisfactory fracture union; however, the fracture line was faintly visible. A uniform/smooth callus confined at the fracture site was observed. The bird was able to walk, jump and run with full weight bearing but mild lameness. On standing, the bird was shifting weight on the contralateral healthy limb (Fig. 4). The weight shifting and lameness was considered to be associated with irritation caused by proximal end of pin in the region of stifle joint. Therefore, the pin was removed on the 57th post-operative day under general anesthesia (inj. Ketamine and isoflurane mixed with 100% oxygen). The removal of the pin was difficult as it was firmly seated in the distal fragment. Post pin removal radiograph revealed stability of fracture with bridging callus (Fig. 1e). The bird was left with other birds after 10 days of pin removal.

Bandaging with splint is reported for the management of fractures in small birds and as a primary first-aid in larger birds (Duerr, 2010; Wright *et al.*, 2018). In the present goose, bandaging using cotton and PVC splint (on medial aspect) was done to avoid fracture becoming open in the preoperative period only. Inhalation anaesthesia with isoflurane or sevoflurane is the most common method used for induction of general anaesthesia in fowls (Gonzalez and Carrasco 2016). Bradycardia and apnea are the common findings when facemask is put on the beak for induction of anesthesia due to a stress response caused by stimulation of trigeminal nerve receptors (Butler, 1988).

Various surgical techniques; external fixation (Kavanagh, 1997), interlocking nailing (Hollamby *et al*., 2004) and interlocking plating (Slunsky *et al*., 2018) have been described in birds for the successful repair of tibiotarsal fracture but with certain complications like screws breakage and heat conduction in cooler climate. Medullary cavity fixation techniques are reported to be less traumatic to the periosteum and surrounding soft tissue structures (Kumar *et al*., 2020). Previous studies reported the successful use of end-threaded intramedullary pin for the stabilization of supracondylar (Kaur *et al.*, 2016; Gill *et al*., 2018) and distal diaphyseal fractures of long bones in dogs (Kaur *et al.*, 2015) and goats (Kumar *et al.*, 2019). End threaded, as compared to simple intramedullary pin, provides better holding of the distal bone fragment, thereby reducing the implant related complications (Kaur *et al.*, 2015; Kaur *et al*., 2016; Gill *et al*., 2018). However, being the proximal end of the pin smooth, the end threaded pin should be

used for fractures with stable configuration; otherwise collapse of the proximal bone fragment during loading may occur in tibia and femur bones of dogs (Kumar *et al.*, 2020). The end threaded (negative profile) intramedullary implant, used in the present goose, was found sufficiently stable leading to fracture union. The diameter of medullary cavity was almost uniform throughout the length of the tibiotarsal bone, thus avoiding displacement, rotation or collapse of the bone fragments. Besides, the ratio of medullary canal to implant used was also high (nearly 80% of the narrowest medullary cavity diameter) than that recommended in dogs which might be the reason for stable fixation with no complications.

Avian bone has thinner cortices and is more brittle than mammalian bone. It is more likely to shatter during surgery (Withrow, 1982) which also happened in this case where the proximal fragment got split while fixing the pin in the distal bone fragment. Faint split was visible on pre-operative radiograph also which shattered during fixing of pin. But, otherwise it did not lead to any bone healing related complications. Uniform bridging callus was visible on the radiograph made on 43rd post-operative day with faint visibility of fracture line, thus the implant was removed after 2 weeks later. Fracture healing in small birds is reported to be fast (as early as 9 days), even after tape splinting (Duerr, 2010) compared to larger birds where it usually takes 6-12 weeks for complete healing (Slunsky *et al.*, 2018). The intraoperative time required for long bone fracture fixation using interlocking nailing or external skeletal fixators is reported to be about one hour (Kavanagh, 1997; Slunsky *et al.*, 2018) while in this case; it was nearly 15 minutes, which was quite considerate realizing the risk of prolonged anesthesia in birds.

In summary, the report highlights the use of end-threaded intramedullary pin proved to be a simple and quick technique providing adequate stability for tibiotarsal bone fracture in a goose. The report also recommends bandaging of the distal long bones with splint and cotton in the preoperative period to prevent them becoming open in birds.

Acknowledgements

Authors are thankful to Indian Council of Agricultural Research (ICAR), India for the financial support provided under the project, 'All Indian Network Program on Diagnostic Imaging and Management of Surgical Affections in animals'. Authors also acknowledge Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India for providing necessary facilities to treat the bird.

Conflict of Interests

There is no conflict of interest.

Publisher Disclaimer

IJLR remains neutral concerning jurisdictional claims in published institutional affiliation.

References

1. Butler, P.J. (1988). The exercise response and the 'classical' diving response during natural submersion in birds and mammals. *Canadian Journal of Zoology*, 66, 29-39.
2. Duerr, R. (2010) Splinting avian fractures. Published by International Bird Rescue Research Center Cordelia, CA. 2nd Edition.
3. Gill, K.K., Kumar, A., Sangwan,V.**,** Anand, A., Mahajan, S.K. and Mohindroo, J. (2018). Comparative functional outcome of supracondylar femoral fractures stabilized with cross and end threaded intramedullary pinning in dogs. *Indian Journal of Animal Sciences*, 88(2), 161-69.
4. Gonzalez, M.S. and Carrasco, D.C. (2016). Emergencies and critical care of commonly kept fowl. *Veterinary Clinics Exotic Animals*, 19, 543-65.
5. Hollamby, S., Dejardin, L.M., Sikarskie, J.G. and Haeger, J. (2004). Tibiotarsal Fracture Repair in a Bald Eagle (Haliaeetus Leucocephalus) using an Interlocking Nail. *Journal of Zoo and Wildlife Medicine*, 35(1), 77–81.
6. Kaur, A., Kumar, A., Kumar, D., Mohindroo, J. and Saini, N.S. (2015). Feasibility of C-arm guided closed intramedullary pinning for the stabilization of canine long bone fractures. *Veterinary World*, 8 (12), 1410-15.
7. Kaur, A., Kumar, A., Sangwan, V., Anand, A. and Mahajan, S.K. (2016). Evaluation of end threaded

intramedullary pinning for the stabilization of distal diaphyseal and supracondylar fractures in dogs. *Indian Journal of Veterinary Surgery*, 7 (2), 105-08.

8. Kavanagh, M. (1997). Tibiotarsal fracture repair in a scarlet macaw using external skeletal fixation. *Journal of Small Animal Practice*, 38 (7), 296-98.
9. Kumar, A., Anand, A., Sangwan, V. and Singh, C. K. (2019). End-threaded intramedullary pinning for the stabilization of supracondylar femoral fracture in goats. *Indian Veterinary Journal*, 96 (8), 66-68.
10. Kumar, A., Qureshi, B. and Sangwan, V. (2020). Biological osteosynthesis in Veterinary Practice: A Review. *International Journal of Livestock Research*,10(10), 10-17. DOI: 10.5455/ijlr/20200718062546
11. Slunsky, P., Weiß, J., Haake, A., Shahid, M., Brunnberg, L. and M¨ uller K. (2018). Repair of a Tibiotarsal Fracture in a Pomeranian Goose (Anser anser) with a Locking Plate. *Journal of Avian Medicine and Surgery*, 32(1), 50–56.
12. Withrow, S.J. (1982). General principles of fracture repair in raptors. *Compendium of Continuing Education for the Practicing Veterinarians*, 4, 116-21.
13. Wright, L., Mans, C, Olsen, G., Doss, G., Amene, E.W., Britsch, G., Christman, J. and Heatley, J. (2018). Retrospective Evaluation of Tibiotarsal Fractures Treated with Tape Splints in Birds: 86 Cases (2006–2015). *Journal of Avian Medicine and Surgery*, 32(3), 205–09.

****