International Journal of Veterinary Sciences and Animal Husbandry

ISSN: 2456-2912
VET 2024; 9(2): 957-960

www.veterinarypaper.com
Received: 01-11-2023
Accepted: 06-01-2024

Patil Harshal
Mumbai Veterinary College, Parel, Maharashtra Animal and Fishery Sciences University Nagpur, Mumbai, Maharashtra, India

Rutuja Sawant
Mumbai Veterinary College, Parel, Maharashtra Animal and Fishery Sciences University Nagpur, Mumbai, Maharashtra, India

Patil DJ
Jijai Animal Clinic and Surgical Centre, Byculla East, Mumbai, Maharashtra, India

Kulkarni MK
Jijai Animal Clinic and Surgical Centre, Byculla East, Mumbai, Maharashtra, India

Khandekar GS
Mumbai Veterinary College, Parel, Maharashtra Animal and Fishery Sciences University Nagpur, Mumbai, Maharashtra, India

Corresponding Author:
Rutuja Sawant
Mumbai Veterinary College, Parel, Maharashtra Animal and Fishery Sciences University Nagpur, Mumbai, Maharashtra, India

Management of spinal fractures in small animals: Surgical repair with K-Wires, screws and polymethylmethacrylate bone cement

Patil Harshal, Rutuja Sawant, Patil DJ, Kulkarni MK and Khandekar GS

DOI: https://doi.org/10.22271/veterinary.2024.v9.i2m.1354

Abstract
Thoracolumbar spinal fractures and luxations are frequently seen in dogs and cats due to various causes, with the most common being vehicular trauma, bite wounds, and gunshot injuries. The lumbar vertebrae are the most common site for these injuries, followed by the thoracolumbar and lumbosacral junctions. Surgical stabilization techniques for these fractures include the placement of screws and K-wires through safe implantation corridors, often supplemented with polymethylmethacrylate (PMMA) for additional support. This article describes a study in which these techniques were applied to three cats and two dogs, each with different origins of spinal trauma, leading to varying degrees of neurological dysfunction. Additionally, this study underscores the factors contributing to successful outcomes, including the use of appropriate screw placement and PMMA application, as well as the risks and potential complications associated with these methods. Ultimately, the findings support the technique's applicability in treating vertebral.

Keywords: Spinal fracture, spinal surgery, application of PMMA

Introduction
Thoracolumbar spinal fractures and luxations in dogs and cats most commonly result from vehicular trauma, bite wounds, and gunshot wounds. The lumbar vertebrae exhibit the highest frequency of spinal injuries, followed by the sacrococcygeal, thoracic, and cervical vertebrae. Additionally, there is a notable incidence of fractures or luxations occurring at the thoracolumbar and lumbosacral junctions (Diamante *et al*. 2020) [2, 3]. Spinal trauma can lead to varying degrees of neurological dysfunction, attributed to factors such as hemorrhage, hematoma, medullary edema, compressive lesions, and lacerations of the medullary or associated roots (Grasmueck and Steffen, 2006) [5]. Spinal cord injuries can result in serious conditions, ranging from localized pain to paresis, paraplegia, or tetraplegia (Inglez *et al*., 2017) [6]. The diagnostic approach for patients with spinal lesions should include a neurological examination, determination of the localization of the lesion, compiling a list of potential differential diagnoses, and conducting additional diagnostic testing. The treatment options for vertebral fracture-luxations encompass both surgical intervention and conservative management strategies. Minimal compression and contusion injuries may be managed conservatively, particularly if there is no additional neurological damage. Surgical decompression and stabilization are essential to prevent further damage to the injured spinal cord and alleviate existing compression. Various techniques have been described for stabilizing the vertebral column, including spinous process plating, laminar plating, vertebral body plating, pin penetration of the canal, polymethylmethacrylate (PMMA) with pin or screw application, external fixators, pin-cerclage applications, and the pedicle screw-rod technique (Karabulut 2018) [7]. The use of pins or screws with polymethylmethacrylate (PMMA) has become increasingly common due to the efficacy and versatility of this technique for spinal stabilization (Vallefuoco *et al*. 2014) [9]. The recovery of spinal patients is significantly influenced by the severity of the spinal cord injury at the time of primary damage, the extent of secondary damage, and complications arising from the impairment of motor, sensory, and autonomic functions (Bruce *et al*., 2008) [1].

The aim of this study was to present our clinical experience, regarding the surgical treatment of different vertebral fracture-luxations. This treatment involved the placement of screws and k-wire through optimal safe implantation corridors, along with the use of polymethylmethacrylate (PMMA).

Materials and Methods

The study material comprised three cats and two dogs that were brought to the Jijai Animal Clinic and Surgical Centre in Mumbai. The cases involved three instances of falls from height, one case of a traffic accident, and one case with an unknown cause. Clinical signs observed included depression, anorexia, dehydration, urinary incontinence or retention, and paralysis. In all cases, evaluation included assessing deep pain sensation and anal reflex. Additionally, lateral and ventrodorsal radiographs were obtained for each case.

Table 1: Patient record

Sr. No.	Patients	Site of fracture
1	Cat (Baghera)	L7-S1
2	Cat (Kimi)	T13-L1
3	Dog (Chocolate)	T12-13
4	Dog (Ali)	T11-12
5	Cat (Kaira)	L6-7

The animals were fasted for 8 hours prior to surgery and surgical site was prepared as per standard protocol. Inj. Atropine Sulphate @ 0.03 mg per kg b.wt s/c was given as premedication along with antibiotics. Sedation was done with butorphanol @ 0.2 mg per kg iv and dexmedetomidine @ 5-7 mcg per kg slow iv. Induction of anaesthesia with 1:4 combination of ketamine and midazolam up to the effect. Following smooth induction of anaesthesia endotracheal intubation with the appropriate size ET tube was done. The cuff of the endotracheal tube was inflated with air and maintenance of anaesthesia with (1-3%) isoflurane along with Fentanyl CRI @ 5- 20mcg/kg/h for pain management. For cats “kitty magic” combination butorphanol @ 0.2ml + dexmedetomidine @ 0.2ml + Ketamine @10-15 mg/ kg intramuscular and maintenance with isoflurane.

Surgical procedure

The animals were positioned in sternal recumbency with sandbag placed at inguinal region and hindlimbs were hanging freely over the table 1. A dorsal midline skin incision was made, extending from at least two vertebrae above and below the luxation site. This was done aseptically to maintain a sterile field. The epaxial fascia was incised and sacrocaudalis dorsalis lateralis and medialis muscles were elevated, taking care to preserve their attachment to the articular facets. After making a dorsal fascial incision, the luxated spinal segments were reduced and stabilized using double-pointed bone forceps. These forceps were placed on the dorsal spinous processes, allowing gentle upward traction to restore normal anatomical alignment of the spine. To stabilize fractured and dislocated spinal segments, 2-3 screws or K-wires were inserted into the affected vertebra and one or two vertebrae above and below the fracture site. The screw holes were directed dorsolateral to ventromedial direction in vertebral body as there was large amount of bone present there. Additionally, polymethylmethacrylate (PMMA) was applied to further secure the fixation as the similar fixation device found to provide adequate protection against excessive spinal cord rotation. The area was Lavaged with saline during time of PMMA curing as the exothermic reaction may case damage to adjustment tissue. The wound was then closed in routine manner. Post-operative radiographs were obtained to evaluate position of implants and reduction of fracture.

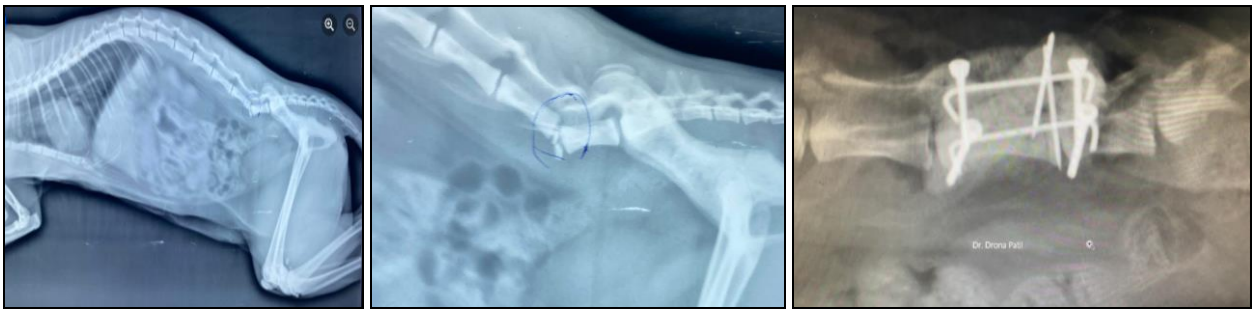
Results and Discussion

Falling from a height is the most common cause of spinal injury in cats, while in dogs, the leading cause is usually automobile accidents. This aligns with the findings of Yayla *et al*. (2023) [3], where it was noted that 84% of spinal injuries in cats were due to falls from heights, and 50% of spinal injuries in dogs were attributed to automobile accidents The thoracolumbar junction (T11-T13 and L1) is the most commonly affected site in spinal injuries, followed by the last lumbar vertebra and the lumbosacral junction. Yayla *et al*. (2023) [3] reported that the most frequently affected area in spinal fractures is the L4-L7 region, with an incidence of 48% in cats and 54% in dogs. This is followed by the T3-L3 region, accounting for 46% of spinal fractures in cats and 36% in dogs. The C6-T2 region represents 3% of spinal fractures in cats and 1% in dogs, while the S1-S3 region accounts for 1% in both cats and dogs.

Stabilization of spinal fractures or luxations with the placement of screws and K-wires through optimal safe implantation corridors, combined with the use of polymethylmethacrylate (PMMA), results in satisfactory outcomes. Diamante *et al*., 2020 [2, 3], and Orgonikova *et al*., 2021 [8] reported that among the various techniques used for stabilization in vertebral fractures or luxations, common applications include the use of polyaxial screws, stabilization with polymethylmethacrylate (PMMA), and plate applications.

Complications associated with these stabilization methods include iatrogenic spinal cord injury, pin migration, and postoperative infections, particularly in relation to polymethylmethacrylate (PMMA) implants. Additional risks encompass inappropriate screw placement, iatrogenic pneumothorax, screw and plate migration, plate slippage, fractures of the dorsal spinous process, and fatigue fractures of pins and wires. In our study, postoperative complications were minimal due to the young age, low weight, and small body size of the cats. However, we encountered one case involving a dog named Ali, who developed a postoperative infection at the surgical site, which was managed with regular dressing and antibiotics.

In conclusion, the technique described in this report proved to be useful due to its ease of application, relative affordability, and suitability for most vertebral fractures or luxations, especially in cats.

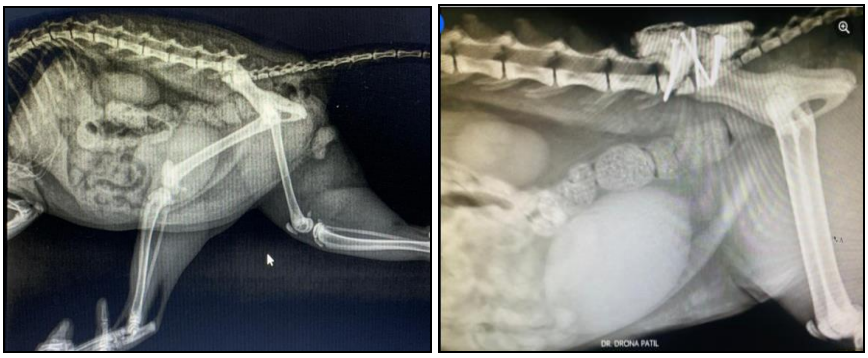


Case 1: Cat-Baghera

Case 2: Cat-Kimi

Case 3: Dog-Ali

Case no 4: Dog- Chocolate



Case no 5: at-Kiyara

Conclusion

The described surgical technique for stabilizing spinal fractures or luxations, involving premedication, induction of anesthesia, careful positioning, reduction of the affected segments, and fixation with screws, K-wires, and polymethylmethacrylate (PMMA), yielded satisfactory outcomes. This method, known for its ease of application, cost-effectiveness, and versatility in addressing vertebral injuries, particularly in cats, offers a promising approach to managing such cases. While complications like postoperative infections were minimal in our study, careful monitoring and prompt intervention remain crucial in ensuring successful outcomes.

References

1. Bruce CW, Brisson BA, Gyselinck K. Spinal fractures in dogs and cats: a retrospective evaluation of 95 cases. Veterinary and Comparative Orthopaedics and Traumatology. 2008;21:280-284.
2. Diamante GAC, Marinho PVT, Zani CC, Arias BMV. Ex-vivo evaluation of the three-column concept in canine thoracolumbar fractures. Arq. Bras Med Vet Zootec. 2020;72(4):1221-1230.
3. Yayla S, Altan S, Çatalkaya E, Ersöz Kanay B, Saylak N, Kilinç M. Retrospective Evaluation of Spinal Trauma Treatments in 58 Cats and 12 Dogs. International Journal of Veterinary and Animal Research. 2023;6(1):23-27.
4. Gönenci R, Yurtal Z, Deveci MZY. Operative treatment of traumatic thoracolumbar luxations in two cats by a method of simple spinal process stabilization. Van Veterinary Journal. 2017;28(3):169-172.
5. Grasmueck S, Steffen F. Survival rates and outcomes in cats with thoracic and lumbar spinal cord injuries due to external trauma. Journal of Small Animal Practice. 2006;45:284-288.
6. Inglez De Souza MCCM, Ferreira RJR, Patricio GCF, Matera JM. Neurophysiological assessment of spinal cord injuries in dogs using somatosensory and motor evoked potentials. Acta Vet Scand. 2017;59(37):1-7.
7. Karabulut E. Stabilization of Vertebral Fracture-Luxations with Polymethylmethacrylate (PMMA) and Stainless Steel Wire In Cats. IOSR J Agri. Vet. Sci. 2018;11:45-48.
8. Orgonikova I, Brocal J, Cherubini GB, Palus V. Vertebral fractures and luxations in dogs and cats, Part 1: evaluation of diagnosis and prognosis. Companion Animal. 2021;26(2):1-10.
9. Vallefuoco R, Manassero M, Leperlier D, Scotti S, Viateau V, Moissonnier P. Surgical repair of thoraco-lumbar vertebral fracture-luxations in eight cats using screws and polymethylmethacrylate fixation. Veterinary and Comparative Orthopaedics and Traumatology. 2014;27(04):306-312.