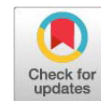


Case Report



Surgical Correction of Thoraco-Lumber Vertebra Fracture in Dog

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Abstract | Dogs with severe spinal deformity and spinal cord compression can be treated with vertebral column fracture surgery. In our study, a four-year-old street dog from Patiya was taken to CVASU after being hit by a car. The dog appeared to have a fractured vertebral column and had little ventrolateral displacement. It was also suspected that the dog had spinal cord compression at the level of T₁₃, L₁, and L₂, resulting in paralysis. However, this was confirmed by X-ray. Prior to surgery, the blood's CBC and biochemical parameters were checked. A combination of an inhalation anesthetic and analgesic was administered. The surgery was carried out to stabilise and realign the vertebral column by repositioning the two split parts in the normal anatomic position using a dorso-lateral approach and a metallic plate with two screws that was specially made for the patient and according to the requirements of the fracture difficulty. Although the surgery was performed five days following the accident, we concluded that the lower part of the body healed quickly and completely because of immediate diagnosis, prompt intervention, adjuvant therapy, analgesics, antibiotics, and antiseptic.

Keywords | Bone fracture, X-ray, Metallic plate, Gaseous anesthetics, Surgery, CBC

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INTRODUCTION

Small animals frequently suffer from spinal fractures or luxations, which are usually brought by car accidents and falls from great heights. Other causes include animal attacks, gunshot wounds, and nontraumatic conditions like neoplasia, infection, and metabolic disorders (Caterino *et al.*, 2022). The majority of additional causes include gunshots, particularly airgun pellet injuries in dogs and cats, falls from considerable heights, and road traffic accidents, which account for 40% to 60% of Vertebral fractures and luxations (VFL) in dogs and cats (Bali *et al.*, 2009; Bruce *et al.*, 2008). After the thoracolumbar region, the lumbar tract

is the area of the spine most frequently afflicted by fractures and luxations (Jeffery and Nick, 2010). Approximately 6% of individuals with neurologic impairments suggestive of spinal cord dysfunction are presented with these injuries, which are most frequently linked to severe external trauma (Marioni *et al.*, 2004; Fluehmann *et al.*, 2006). Traumatic or non-traumatic spinal injuries can result in fractures and luxations from extrinsic forces that are unpredictable in direction and can be stronger than the spine's structural elements' capacity to protect the spinal cord from compression, laceration, and concussion (Jeffery and Nick, 2010). Vertebral fractures and luxations (VFL) are normally easy to suspect since individuals typically

present with spinal pain, neurologic abnormalities, or both, after clear external trauma. However, injured animals frequently sustain several wounds to other body systems, some of which may be fatally serious. The evident spinal injuries must be treated in addition to these secondary disorders, which may not be immediately apparent and include dysrhythmias and stress pneumothorax (Crowe *et al.*, 2009). Due to the risk of iatrogenic nerve injury, lumbar vertebral fractures and luxations are difficult to stabilize surgically (Silva *et al.*, 2020). Steinmann pins and polymethylmethacrylate offer good spinal stabilization and can be applied to any part of the spine, regardless of age or body size (Camacho *et al.*, 2014). The benefit of this surgical method is that it doesn't require specialized tools or instruments. Neurologic impairments and discomfort are virtually always side effects of VFL. Compression or contusion of neural tissue results in neurologic impairments, whereas mesenchymal tissue instability and mechanical harm to the body can produce discomfort. An impact lesion on the spinal cord will certainly result in some degree of tissue loss. Demyelination, increasing axonal damage, and neuronal and axonal death are further effects of ongoing compression of the spinal cord or the nerve roots (Jeffery and Nick, 2010). External forces, such as those resulting from falls or car accidents, are the most common cause of VFL because their force overpowers normal structures. Since there are few reports in the literature of the use of metallic plates with two modified screws, particularly for the repair of thoracic and lumbar vertebra fracture and dorsocranial luxation in young dogs, and because spine and spinal cord traumas are common in small animals with an unfavorable prognosis, the present paper aims to report the surgical treatment of a transversal fracture across the body of thirteenth thoracic vertebra, with dorsocranial displacement of the caudal fragment by using a metallic plate.

CASE PRESENTATION

A street dog about 4 years old was brought to CVASU from Patiya. The dog was unable to walk after an accident on the road. He was first taken to Karnaphuli Upazila Veterinary Hospital and from there referred to SAQTVH at Chattogram Veterinary and Animal Sciences University (CVASU). The dog was brought to CVASU and registered in the Pet Animal Unit. The duty doctor observed the dog and took its general history. Clinical examination revealed that the patient's body temperature was 105 °F, heart rate was 75–80, and respiration rate was 20–25 breaths per minute. The mucous membrane was pink, and there was no sign of dehydration. Initially, he was given NSAIDs (Meloxicam) @ 0.2mg/kg, S/C as a pain killer to ease his pain. Then X-ray was taken to detect bone fracture. The X-ray revealed injuries to his T₁₃, L₁, and L₂ vertebrae. Moreover, his T₁₃ vertebra was fractured. After that, he

was referred for surgery, and his blood parameters were examined before the operation was performed.

CONFIRMATION OF THE FRACTURE THROUGH RADIOGRAPHIC IMAGING

The patient was prepared before the X-ray. Following that, images of the injured location were taken. Radiographs disclosed a transverse fracture in the thirteenth thoracic and lumbar vertebra's body, with the caudal piece being displaced dorsocranially (Figure 1). Based on the radiographic diagnostic and clinical symptoms, open reduction and internal fixation of the fracture were decided to be performed as the surgical approach.



Figure 1: Radiological findings of the fracture in the Thoraco-lumbar vertebrae (T₁₃, L₁, L₂).

HEMATOLOGY ANALYSIS

Blood was collected from the cephalic vein and transferred to the clinical lab. Following the test, the blood examination results and biochemistry report were as follows: Khan *et al.* (2011).

BIOCHEMICAL ANALYSIS

The following parameters were measured using a biochemical analyzer: calcium, phosphorus, magnesium, total protein, and glucose (Model: PLD-951/951A/951B).

According to Tables 1, 2, 3, the hematological report shows that all the blood parameters of the dog were normal for this reason there were no contraindications for surgery (Khan *et al.*, 2011).

THE METHOD IMPLEMENTED DURING THE SURGERY

Due to anemia, the patient had to be admitted to the hospital for ten days. As a pre-anesthetic xylazine

1 mg/kg was injected intramuscularly (IM) before surgery. Dissociative anesthetics Ketamin 6 mg/kg was administered intravenously (IV) along with halothane (starting at 2.5, then 2, 1.5, then 0) to induce anesthesia, and a closed anesthetic circuit with 100% oxygen was utilized for maintenance of anesthesia. For epidural infiltrative analgesia, lidocaine without a vasoconstrictor (Jasocaine 2%, 5 mg/kg) was given to patients. During the surgery, Opioids 1 mg/kg, (IV) and Fentanyl 2mg/kg (IV) were injected intravenously as painkillers. A dorsal midline incision was made from the eleven thoracic vertebrae to the second lumbar vertebra after the dog had placed in ventral recumbency for surgery. A complete piece of the spinal cord was visible because the thoracic fascia was dissected down to disclose the eleven, twelve, thirteen, and lumbar fascia as first, and second spinous processes. All muscle attachments were elevated from both sides of the pedicles using periosteal elevators and laterally retracted to the level of the articular processes (Figure 2).

Table 1: Hematology report of the patient.

Name of the test	Results	Reference Value
Hemoglobin	9.6	11.9-18.9 g/dl
ESR	8	6-10 mm/hr
PCV	31	35-37 %
TEC (RBC)	6.50	4-8 million/cumm
TLC(WBC)	12.5	5-14 million/cumm

Khan *et al.* (2011).

Table 2: Differential Leucocyte Count (DLC).

Name	Result	Reference value
Neutrophil	55	58-85
Lymphocyte	36	8-21
Eosinophil	2	0-9
Monocyte	7	2-10
Basophil	0	0-1

Khan *et al.* (2011).

Table 3: Biochemical analysis of the blood.

Serum type	Results	Reference value
Calcium	8.35 mg/dl	9.1-11.7 mg/dl
Phosphorus	5.67 mg/dl	2.9-5.3 mg/dl
Magnesium	2.15 mg/dl	1.6-2.4 mg/dl
Glucose	57.85 mg/dl	76-119 mg/dl
Total protein	5.06 mg/dl	5.4-7.5 mg/dl
ALT (SGPT)	69.50 U/L	10-109 U/L
AST (SGOT)	29.68 U/L	16-55 U/L
Creatinine	1.62 mg/dl	0.5-1.7 mg/dl

Khan *et al.* (2011).

The fracture-luxation was manually decreased, then

laminectomy was performed, and finally stabilization. The thirteenth thoracic vertebra, which was severely fractured, was removed from the fractured part. The bone plate was placed at T-12 to L-1 vertebrae for initial stabilization, two crossed 1.5 mm Kirschner wires were inserted into the caudal articular surfaces of the first lumbar vertebra then the bone plate was fixed with intramedullary pinning (Figure 3).



Figure 2: Opening of the surgical area at the time of the operation.



Figure 3: After stabilizing the Thoraco-lumber vertebrae with a bone plate.

A polyglactin absorbable suture (Vicryl 2-0) was used for suturing the muscle and subcutaneous tissue using interlocking and simple continuous suture patterns, respectively. The skin was closed with an interrupted suture using a nylon non-absorbable suture (3-0) (Figure 4a, b).

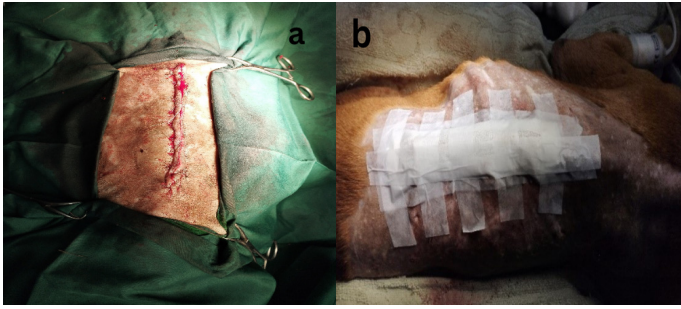


Figure 4: (a) The stitching of the skin at the operation site after surgery. (b) Surgical area of the patient after a successful procedure



Figure 5: Two weeks post-surgery, the patient achieved a successful recovery.

POST-OPERATIVE MANAGEMENT OF THE PATIENT

Penicilline (Duplicillin LA 30,000 IU/kg, SC), Chlorpheniramine maleate (Histavet 22.5 mg/kg, IM), and meloxicam (Melvet 0.1 mg/kg, SC) were injected in the immediate postoperative phase. Penicillin is a broad-spectrum antibiotic against secondary bacterial infections and soft tissue injury. Chlorpheniramine maleate acts as an antihistaminic to prevent hypersensitivity. In addition to these drugs, a tropical antiseptic was applied to relieve post-operative pain. The owner of the dog was instructed to control the dog's movements. Physical therapy was suggested as a way to restore balance and manage the pain.

RESULTS AND DISCUSSION

Like the present case, thoracic and lumbar vertebral injuries usually occur after significant trauma (such as being hit by a car) and appear to have a distinctive fracture pattern (Mendes *et al.*, 2012). Extrinsic forces were linked to the caudal segment's dorsocranial displacement (Jeffery and Nick, 2010). On the other hand, extrinsic forces acting on the sacrum and pelvis were assumed to be the cause of the cranioventral displacement of the caudal segment (Lewis *et al.*, 1989). The dog in the current case was an

intact male canine, and research indicated that street access is more common among non-neutered males (Araújo *et al.*, 2017). Due to the spinal cord injury lack of sensitivity and difficulty in feces and urine elimination, the patient developed paraplegia (Pereira *et al.*, 2019). This may be related to a subsequent vascular and inflammatory event that results in the progressive loss of neural tissue (Mendes *et al.*, 2012; Olby, 2010) which was related to this study. In this case, an X-ray was used to determine that the lesions to the spine and spinal cord included anamnesis which was supported by Araújo *et al.* (2009). According to Jeffery and Nick (2010) There are restrictions on the use of radiographic exams, such as their moderate sensitivity for detecting intrinsic bone fragments in the spinal cavity and their ability to detect only mild subluxations. However, there had been found dissimilarities with Hage *et al.* (2009) who used magnetic resonance imaging (MRI) and computed tomography (CT) for further diagnostic techniques for spinal diseases. The number of broken compartments and the existence or absence of compression determined how the current case was treated. Surgery is indicated if there are fractures in two or more compartments which was similar to Jeffery and Nick (2010). According to Camargo *et al.* (2017), Duarte *et al.* (2016), and Greve *et al.* (2001) Open reduction surgery with metallic plate internal fixation was the surgical procedure used, which was also supported by this author. But Puricelli *et al.* (2011) and Camacho *et al.* (2014) advised that the thoracic and lumbar vertebrae can be repaired surgically using cortical screws and vertebral body plates, also known as spinous processes. These methods can be combined or applied separately to improve stabilization (Jeffery and Nick, 2010). Baram *et al.* (2016) utilized the Z-plate methods in the management of thoracic fracture surgery, achieving positive outcomes in facilitating fracture healing as an alternative process of this surgery. Silva *et al.* (2020) Claimed that complications of these procedures include implant migration and loss of fracture reduction. Walker *et al.* (2002) Steinmann pins served the same purpose as block plates in creating a rigid fixing system which was related to this study and added that for the fracture stabilization in the lumbar and thoracic vertebrae, according to this author, steinmann pins had the following benefits: less soft tissue damage during dissection than with other procedures, improved visualization, and protection of the spinal nerves and blood vessels. Metallic plates also play this role. However, Silva *et al.* (2020) reported that compared to Steinmann pins, bone screws are more difficult to remove and less prone to migrate. This case could be treated non surgically, in a research Hawthorne *et al.* (1999) showed that out of 38 dogs treated non-surgically, 25 showed improvement and 13 were unable to recover. The use of antibiotics for 15 days after surgery was successful in this case (Figure 5) because the dog showed no symptoms of infection,

which resembles the literature of Silva *et al.* (2018). The prognosis was considered poor because the patient had lost severe pain sensation, a sign of paraplegia. The common complication of this surgery is surgical site infection, Urinary tract infections, and Gastro-Intestinal tract infections. The prevalence of subclinical gastroduodenal ulcers was determined by endoscopy in a study conducted by Dowdle *et al.* (2003). Dogs receiving acute spinal surgery frequently develop urinary tract infections (UTIs). A common complication during the preoperative period was haematuria without pyuria (Olby, 2010) which was not present in this case. Ramalho *et al.* (2015) recommended physiotherapy rehabilitation to reduce the pain.

CONCLUSIONS AND RECOMMENDATIONS

In this particular case, we report that using the initial method of positioning a modified metallic plate may result in a decent stabilization of the broken spine. X-ray, clinical history and physical examination helped to diagnose this fracture. The additional advantages of this surgery include lower costs, shorter recovery times, less anesthetic dosage, and fewer surgical supplies needed.

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NOVELTY STATEMENT

Many street dogs in Bangladesh die every year in road accidents, but no established research paper has addressed this issue. This paper will help the future veterinarian by providing a guideline for accidental fracture cases in the thoraco-lumber region.

AUTHOR'S CONTRIBUTION

AKMS conceptualized and developed the methodology with the help of SKMAI. MI, SDG, and MAR wrote the first draft of the manuscript and assisted in the surgery. MI and SDG reviewed and edited the manuscript. NH took the follow-up of the patient. MSA-F supervised the research work.

CONFLICT OF INTEREST

The authors have declared no conflict of interest.

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