Study on Surgical Correction of Thoraco-lumber Vertebrae Fracture: A Case Report

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List of Acronyms Symbols Used

Abbreviation	Elaboration
%	Percentage
No.	Number
et. al	And his associate
VFL	Vertebral fractures and luxations
RBC	Red Blood Cell
WBC	White Blood Cell
DLC	Differential Leukocyte Count
TEC	Total Erythrocyte Count
PCV	Packed Cell Volume
TLC	Total Leukocyte Count
ESR	Erythrocyte Sedimentation Rate
MRI	Magnetic Resonance Imaging
CT scan	Computerized Tomography scan
g/dl	Grams per deciliter
mm/hr	Milimeters per hour
mg/dl	Miligrams per deciliter
SSC	Secondary School Certificate
HSC	Higher Secondary School Certificate
CVASU	Chattogram Veterinary and Animal Sciences University

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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 brought to CVASU after being struck by a car. The canine displayed indications of a broken spinal column with negligible ventrolateral movement, and the diagnosis of paralysis resulting from compression of the spinal cord at the T13, L1, and L2 levels was confirmed by x-rays. Prior to surgery, the blood's CBC and biochemical parameters were checked. An inhalation kind of anesthesia combined with a pain killer was used. By repositioning the two split parts of the vertebral column in the normal anatomic position using a dorso-lateral approach and a specially-made metallic plate with two screws was used during the surgery to realign and stabilize the spinal column, depending on the patient's demands and the severity of the fracture. Even though the surgery was performed five days after the vehicle accident, we came to the conclusion that the quick diagnosis and prompt intervention along with the aid of adjuvant therapy, painkillers, antibiotics, and antiseptic were responsible for the quick and full healing of the back region of the body. After two months of follow-up, the patient was getting better day by day.

Keywords: Bone fracture, Metalic plate, Gaseous anesthetics, X-ray.

CHAPTER 1: INTRODUCTION

Small animals frequently suffer from spinal fractures or luxations, which are typically caused by vehicle collisions and high-altitude falls. 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 magnitude 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) is 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. It is crucial that these secondary ailments, including dysrhythmias and stress pneumothorax, which may not be immediately noticeable, are not disregarded in favor of treating the obvious spinal injuries (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). One advantage of this surgical technique is that it doesn't require any specialist equipment. 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. The degree of tissue loss that ensues from an impact lesion to the spinal cord is unavoidable. Demyelination, increasing axonal damage, and neuronal and axonal death are further effects of ongoing compression of the spinal cord (Jeffery and Nick, 2010). The most frequent cause of VFL is external force, such as that brought on by falls or car accidents, where the magnitude of the force overwhelms the typical structures. Since reports of the use of metallic plate with 2 screws adapted and modified especially for the patient for repair of thoracic and lumbar vertebra fracture and dorsocranial luxation in young dogs are uncommon in the literature and spine and spinal cord traumas have an unfavorable prognosis and are quite common in small animals. So the present paper aims to report the surgical treatment of transversal fracture through the body of the thirteen thoracic vertebra, with dorsocranial displacement of the caudal fragment by using metallic plate.

CHAPTER 2: MATERIALS AND METHODS

2.1 Case Presentation

A four-year-old street dog from Patiya was brought to CVASU in 4th September 2023. The dog lost his ability to walk after an accident on the road. He was initially taken to Karnaphuli Upazila Veterinary Hospital and from there referred to SAQTVH at Chattogram Veterinary and Animal Sciences University (CVASU). After being transported to CVASU, the dog was registered in the Pet Animal Unit. The duty doctor Professor Dr. A. K. M. Saifuddin and Dr. Khandakar Nurul Islam observed the dog and recorded its general history. Clinical examination indicated a body temperature of 105 ° F, respiration was 20-25 breaths per minute, and heart-beat was 75-80. His 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. After this, an X-ray was taken for further confirmation. The x-ray revealed that his T13, L1, and L2 bones were injured and the T13 bone was fractured. He was conveyed to the surgery unit. After visiting the surgery unit, Dr Bibek Chandra Sutradhar recommended him undergo surgery.

2.2 X-Ray

The animal was prepared prior to the radiography. Following that, images of the injured location were captured. Radiographs showed a transverse fracture in the thirteenth thoracic and lumbar vertebra's body, with the caudal piece being displaced dorsocranially (Figure 1). Based on clinical manifestations and radiographic diagnosis, open reduction and internal fixation of the fracture site were chosen as the surgical approach.

Figure 1: Radiology of Injured Dog.

2.3 Blood Report

About 5 ml of blood was aseptically taken from the cephalic vein and transmitted to the clinical laboratory in order to assess the patient's health. Of that blood, 2 ml were transferred to a sterile vial containing anticoagulant (K3 EDTA) in order to measure hematological parameters (Hemoglobin, Erythrocyte sedimentation rate, Packed cell volume, Total erythrocyte count, and Total leukocyte count), and 3 ml were transferred to a vail devoid of anticoagulant to measure biochemical parameters (Calcium, Phosphorus, Magnesium, Glucose, and Total protein). Leukocytes are count by Haemocytometer. The blood Calcium and Hemoglobin level was low which was 8.35 mg/dl and 9.6 g/dl.

Table 1: Hematological test results

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

Table 2: Differential Leucocyte Count (DLC)

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

Table 3: Serum biochemical test results

Serum Type	Results	Normal Range
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

2.4 Surgery Technique

In order to treat anemia, the patient was admitted to the hospital for ten days. Prior to the surgery, pre-anesthetic medication including Xylazine @1 mg/kg, intramuscularly (IM), and main anesthetic agent such as Ketamin @6 mg/kg was administered intravenously (IV) as induction dose. Gaseous anesthetics such as Halothane (started at 2.5, followed by 2, 1.5, and finally 0) and 100% oxygen were used in a closed anesthetic circuit for maintenance of anesthesia. Local anesthetics for example Lidocaine (Jasocaine 2%, @5 mg/kg) was used for epidural infiltrative analgesia. Opioids (@1 mg/kg, IV) and Fentanyl (@2mg/kg, IV) were employed as painkillers during the surgery. Following the dog's ventral recumbency during the surgical procedure, a dorsal midline incision was given from the eleven thoracic vertebrae to the second lumbar vertebra. A whole segment 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).

Figure 2: Opening of Surgical Site.

After manually reducing the fracture-luxation, a laminectomy was carried out, and stabilization followed. The thirteenth thoracic vertebra, which was fatally 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 pining (Figure 3).

Figure 3: After fixation of the bone by bone plate.

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

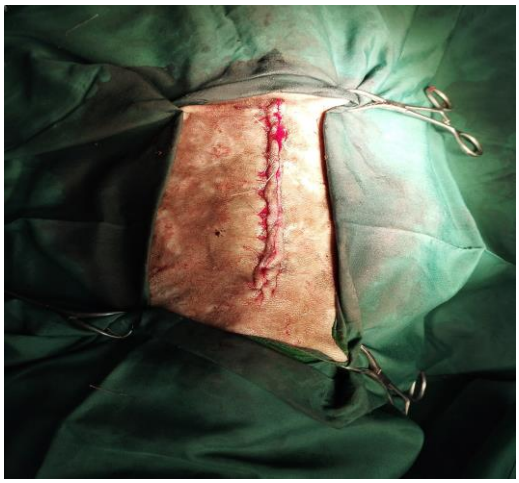

Figure 4: Apposition of the suture in the operation site.

2.6 Post-Operative Management

Penicilline (Duplicillin LA @30,000 IU/kg, SC) along with Chlorpheniramine maleate (Histavet @22.5 mg/kg, IM) and meloxicam (Melvet @0.1 mg/kg, SC) were administered in the immediate postoperative phase. In addition to this, a tropical antiseptic was suggested to apply to the operative site. The owner of the dog was instructed to limit the dog's movements as much as possible. Physical therapy was suggested as a way to restore equilibrium and manage the pain.

Figure 5: After Surgery.

Figure 6: After 2 weeks of surgery.

CHAPTER 3: RESULTS AND DISCUSSION

As in the present case, thoracic and lumbar vertebral injuries typically follow 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 thought to be the cause of the cranioventral displacement of the caudal segment (Lewis et al., 1989). In this current case, it 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's 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, radiographic exams to detect the fracture which was similar to the study of another author (Araújo et al., 2009). However, there were dissimilarities with Hage et al. (2009) who used Magnetic resonance imaging (MRI) and computed tomography (CT) for further diagnostic techniques for spinal diseases. The current case was treated depending on the number of broken compartments and the existence of compression. Surgery is indicated if there are fractures in two or more compartments (Jeffery and Nick, 2010). Previous studies show that open reduction surgery with metallic plate internal fixation was the main surgical procedure that was supported by this author (Camargo et al., 2017, Duarte et al., 2016, Greve et al., 2001). However other studies advised that the thoracic and lumbar vertebrae can be repaired surgically using cortical screws and vertebral body plates, also known as spinous processes (Puricelli et al., 2011, Camacho et al., 2014). These methods can be combined or applied separately to improve stabilization (Jeffery and Nick, 2010). Implant migration and loss of fracture reduction are among the problems associated with these treatments (Silva et al., 2020). According to 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 for the fracture stabilization in the lumbar and thoracic

vertebrae. Moreover, this author reported that 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. But bone screws are less susceptible to migration and are more difficult to pull out than Steinmann pins claimed another author (Silva et al., 2020). Since the dog in this case did not exhibit any signs of infection, the usage of antibiotics for 15 days following surgery was effective similar to the literature of previous author (Silva et al., 2018). After two months of observation, the patient was recovered day by day. In order to reduce the patient's suffering and early cure, physiotherapy rehabilitation was recommended which was followed in this study (Ramalho et al., 2015).

LIMITATIONS

The report would be more informative if additional tests such as MRI, CT scan and Ultrasonography, could be employed. One dog was used to conduct the experiment. The goal of this study would be much more effectively achieved if the above tests and more samples were included.

CONCLUSION

In this case, we report that using the initial method of positioning the modified metallic plate may result in a decent stabilization of the broken spine. A metallic plate was quickly adapted for connecting and stabilizing the spine. Additional advantages include reduced anesthetic dosage, fewer surgical supplies needed, quicker recovery times, and lower expenses due to the use of a single-side incision technique.

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BIOGRAPHY

I am Majharul Islam, son of Abdul Karim and Hasina Begum from Chauddagram Thana under the Cumilla district. Currently doing my graduation in Doctor of Veterinary Medicine (DVM) at Chittagong Veterinary and Animal Sciences University. I completed my Secondary School Certificate Examination (S.S.C) from Mia Bazar Latifunnecha High School in 2014 and my Higher Secondary School Certificate Examination (H.S.C) from Comilla Victoria Govt. College in 2016. As a veterinarian, I enjoy serving animals and I want to spend the rest of my life serving dumb animals.