

DOG VERTEBRAL COLUMN SURGERY IN A T12 FRACTURE USING A RECONSTRUCTION METALLIC PLATE ADAPTED AND MODIFIED: A CASE STUDY

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Abstract

Vertebral column fracture surgery in dogs is used to correct severe cases of spinal deformity and spinal cord compression. In the last years more and more cases of vertebral column fractures or luxation in dogs by car accidents as our case are met with varying degrees of injury to the spinal cord. In our study we present a dog hit by a car, which presented clinical sign of vertebral column fracture with little ventro-lateral displacement and suspected of spinal cord compression at the level of T12-T13 with paralysis; this was confirmed by x-rays and Magnetic Resonance Imaging (MRI). The anesthesia used was an inhalation type. The surgery was made to stabilize and reposition the vertebral column through repositioning the two splitted parts of the vertebral column in the normal anatomic position using a dorso-lateral approach and a metallic plate with 3 screws adapted and modified especially for the patient and for the fracture difficulty's needs. We concluded that the recovering was fast and with complete motion on the back part of the body due to rapid diagnosis and intervention even if the surgery came was performed five days later after the car accident and also with the help of the adjuvant therapy (vitamin B therapy, pain-killers, antibiotics, Myodine).

Key words: column dog fracture, metallic plate surgery.

INTRODUCTION

Spinal fractures, especially those with displacement, have a poor prognosis, due to the compression effect exerted on the spinal cord. For this reason, a preoperative neurological evaluation and a better stabilization of the fracture site is necessary (Matis, 2007; Tobias and Spencer, 2012). For appropriate postoperative recovery, both neurostimulatory therapy and physiotherapy sessions are used.

Our study case is about a male dog a cross-breed Teckel (Duchhound) of the age of 1 year old, who present a severe fracture of the vertebral column at the level of T12 vertebra caudal joint facet with a ventral displacement causing a spinal cord compression.

This helps us to a very good fixation of the modified plate in the spaces between vertebral articular processes (cranial and caudal) and the vertebral spinous processes together with the screws ensuring a good stability of the spine which does not allow the plate to move from the fixed position while allowing an elasticity

enlargement of the spine in the area relative to the simple rectangular thick metal plates.

Due to the way the metal plate is placed with this figure of 8 lying down the middle area between the screws, it is based on the cranial and caudal vertebral articular processes that are "well" molded which does not allow the plate to move either in the cranial direction or caudal and not in lateral or medial direction.

Over all the assembly is also fixed by the 3 screws placed obliquely at the base of the spinous processes and in slightly different directions to decompose the forces resulting from the forces of traction, torsion and pressure existing on the spine in different planes.

A torn column with displacement and paralysis described above were later shown to be very efficient, the operated dog recovered very quickly its motor and sensory functions along with a very good recovery of the muscle mass (Kube and Olby, 2008; William, 2018), (Douglas and Slatter, 2003). The dog operated walks and runs very well.

MATERIALS AND METHODS

Place of the research activity:

Private veterinary Clinic, Ploiesti, Prahova county, Romania and Faculty of Veterinary Medicine in Bucharest, Romania.

Period of the case study:

11 November, 2019 - 1 March, 2020

Case presentation

An 1-year-old intact male Teckel (Duchhound) cross-breed dog ("Rocky"), weighting 6.9 kg was presented at the veterinary clinic after a car accident in November 13, 2019 (Figure 1).



Figure 1. The patient before surgery

Clinical presentation: the dog presented paralysis in the back half of the body, inability to move on the hind legs, inability to stand, apathy, body temperature of 38.8° C.

The cause of traumas: road accident; trampled over the thorax area.

Position: the dog is in lateral decubitus and cannot stand on the paralyzed hind limbs.

Neurological reaction: absent at the pinching of the extremities; almost absent reaction to deep pain. Additional, deformation and inflammation of the spine in the thoracic area T12-T13 bent was registered.

The dog was subjected for x-ray and Magnetic Resonance Imaging (MRI) investigations.

RESULTS AND DISCUSSIONS

The radiological examination highlighted the T12 thoracic vertebral fracture of the caudal joint facet (Figure 2).



Figure 2. X-Ray of a the showing T12 vertebral fracture

MRI examination was performed at the Faculty of Veterinary Medicine of Bucharest on November 14, 2019 for the certainty of diagnosis of medullary compression.

It revealed the fracture of thoracic vertebrae T12 of the caudal articular facet, with the ventral displacement of the caudal portion of the interrupted spine and a compression on the spinal cord in the T12-T13 intervertebral space, without intervertebral disc herniation and intervertebral disc extrusion, and without major spinal cord injuries (Figure 3.1-3.4). MRI diagnostic: T12 fracture and the vertebral column displacement.

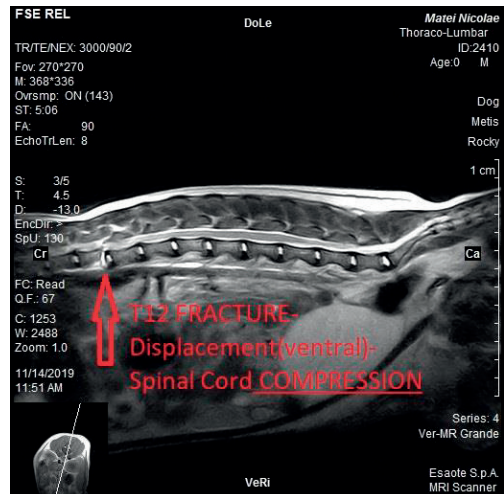


Figure 3. Magnetic Resonance Imaging of a dog with spine T12 fracture and spinal cord compression

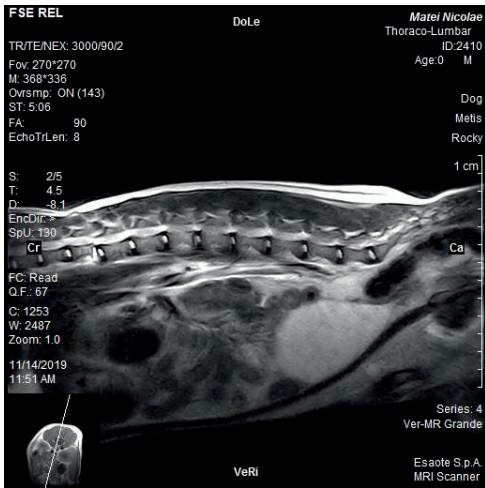


Figure 3.1. MRI in a dog with Spine T12 fracture

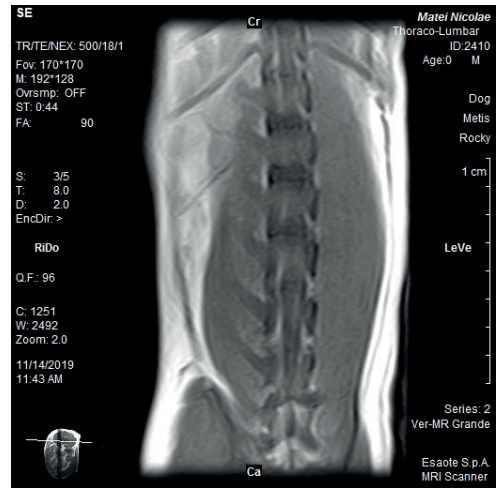


Figure 3.3. MRI in a dog - Spine-vertebral column

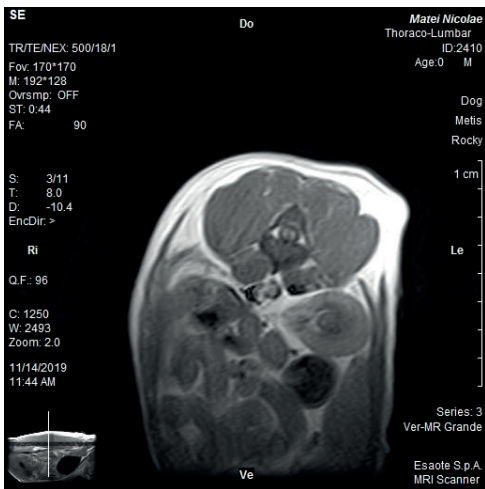


Figure 3.2. MRI in a dog with Spine T12 fracture

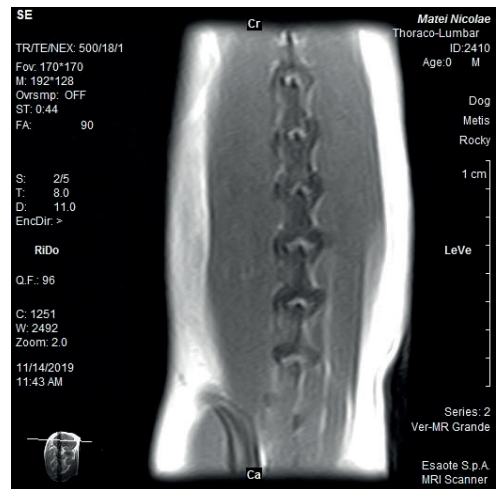


Figure 3.4. MRI in a dog with Spine T12 fracture

The dog was subjected for surgery, that was performed 5 days after the car accident, to decompress the spinal cord at the level of the T12-T13 intervertebral space and the reposition in anatomic way and stabilization of the fractured spine at the T12 level, which has a slight ventral displacement of the interrupted caudal portion as seen in the Figure 3. Preoperative: 24 hours before surgery, analgesic, antibiotic, and anti-inflammatory therapy were administered along with performing blood testing for biochemical and hemathological parameters. For anesthesia, an inhalation type with isoflurane gas was used.

Osteosynthesis materials used: we choose to use for a good stabilization of the fractured spine and reduce its displacement a reconstruction plate (length 40 mm and thickness 2.2 mm) with 3 holes and 3 screws (3.5 mm) adapted and modified especially for the dimensions of the "Rocky" patient vertebra to be fixed in 3 vertebrae: T12, T13 and L1 through the 3 screws each screw fixed on the spinous processes base of each vertebra. This plate specially adapted and modified for the described surgery is derived from a metal plate of reconstruction type "Y" with a length of 80 mm and thickness of 2.2 mm-the model (Figure 4.1) and the dimensions measured of the part used in the surgery (Figures 4.2, 4.3).

It has been cut and adjusted with making rounded edges that do not damage the vertebral periosteum and serve our surgery perfectly.



Figure 4.1. Metallic stainless steel reconstruction plate Y model - picture and brand "Sky surgicals"



Figure 4.2. Length of the plate part 40 mm before preparing for use in the surgery



Figure 4.3. The thickness of the plate 2.2 mm

One of the important advantages using this part of the Y plate is that we performed 3 different such of vertebral surgeries for 3 different similar dogs (with a 4.5-9 kg body weight) with vertebral column fractures using only 1 Y plate divided and adapted as we need.

The application of this plate was performed in the anatomically existing spaces between the

vertebral articular processes (cranial and caudal) and the base of the vertebral spinous processes so that the neck between the plate mesh sits to fit on the lateral surface of the vertebra to the articular processes.

Therefore, it will not allow the movement of the plate forwards or backwards, nor lateral or medially, also offering a strengthened by the fixing screws located at the base of the spinous processes, harmonizing very well with the movements of the spine while at the same time contributing to the reduced thickness of the plate (Figures 5-7).

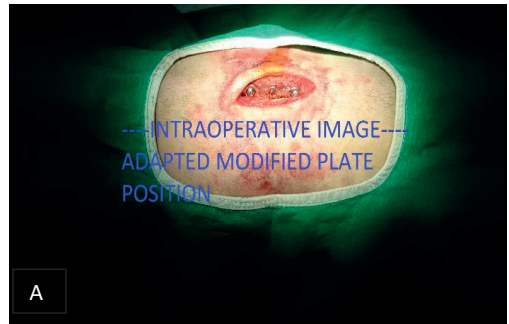


Figure 5 (A-B). Dog intra-surgery aspects showing fitting the plate on the regional anatomy

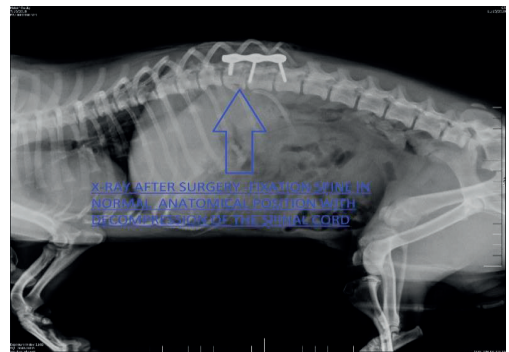


Figure 6. Postoperative radiography - plate and screws

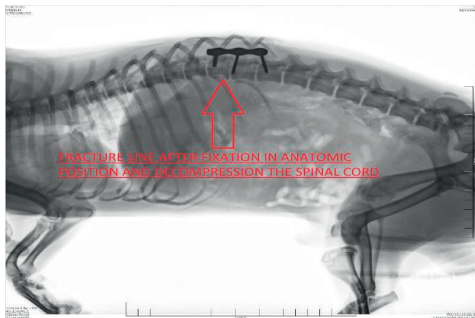


Figure 7. Postoperative X-ray (negative view) after fixation of the spine with decompression of the spinal cord

Post-surgery, analgesics, anti-inflammatories, antibiotics, neurostimulant medications were administered (as vitamin B12, B1-B6, Myodine) with very good results and fast recovery of the nervous system and muscle mass (Gârjoabă and Săvescu, 2019).

Sensory and motor neurological functions visibly greatly improved immediately after the surgery. The reaction to pain on the hind limbs was very good with the immediate withdrawal of the tested limb with very good response (Figure 8).



Figure 8. The dog immediately after surgery - sensitivity test

At 4 days post-surgery, the dog started to get up and walk easily helped and trained of the clinic team to exercise walking under careful supervise and monitoring (Figures 9, 10).

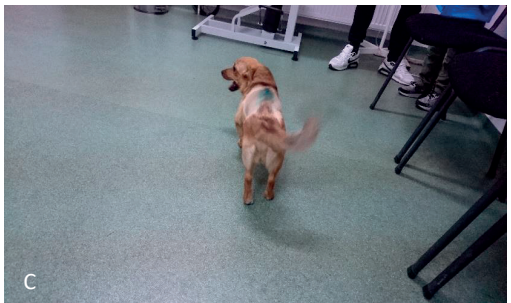


Figure 9 (A-C).The dog at four days after surgery: walking



Figure 10. The dog during of recovery exercise training

At 7 days post-surgery, the dog displayed a normal clinical behavior with very small imbalances when running back or running (Figure 11, A-C).



Fig. 11 (A-C). The dog seven days post-surgery, displaying normal status

At 3 weeks post-surgery the dog run, jump into bed as it can be seen in the following: <https://youtu.be/XGM2K7EQETk>
Similarly, at 3-4 months post-surgery, the dog run very well, being very agile and living normally as before the car accident (as it can be seen in the following link <https://youtu.be/5SqV8Psr2oc>).

DISCUSSIONS

The success of the surgery of this case report was confirmed by the very fast restoration of the nervous system with the complete recovery

the functions of the spinal cord and the functions of the vertebral column physiology, in only 7 days. Early surgical intervention is the best treatment option available in veterinary medicine for compressive or unstable lesions. Early decompression has been shown to enhance neurologic recovery in several animal studies (Kube and Olby, 2008; Merck, Manual of Veterinary Medicine 10th edition, 2014).

A good effect in the post-surgery treatment in this case was registered with the neurostimulant medications like vitamin B12, B1-B6, combined with pain killers and Myodine to improve fast the recovery of muscle mass lost in the days of paralysis and convalescence and recover the complete neuron's functions.

The position, place and location of this modified plate with screws in the described area creates a better long-term stability than a simple classic plate, because it fits very well on the shape of the lateral thoracic vertebral anatomy.

Use of a small amount of osteosynthesis metallic materials provides good results over time with a minimum biological impact comparatively with the double plate fixations on the both sides on the vertebral column (Welch, 2018; Shores and Brisson, 2017).

Another positive aspect is supported by a better acceptance from the animals (dogs in this case) of the internal on single plate versus the external fixators systems with many pins and screws in the body and other metallic systems outside the body which can be easily damaged of the dogs moving; also, external fixation systems can be easily hooked by any objects found around the dogs with high risks for compromising the surgery.

Additionally, this method doesn't cause deformation of the vertebral column and allow all the natural biomechanical movings as it is showed also in the video link performed after surgery.

We mention also other positive aspects such as, the shorter duration of the surgery with a reduced incision on only one side of the vertebral column; less chance of the body rejecting osteosynthesis material over time.

Moreover, no signs of the body reaction to the stainless steel plate implant during the time of the study 4 months were registered.

By this original method of placing the modified metallic Y plate, an economic efficiency of the

existing osteosynthesis materials was provided, without other special additional costs; it is known that the osteosynthesis materials used in spine surgery are usually very expensive. Therefore, this can be an economical option for clinics with limited possibilities and especially for social cases, unmanaged dogs, shelter dog, or zoo parks where funds are extremely limited. It could be also a very useful method for isolated areas clinics where supplies come usually 1 time every 2-3 months, for emergency situations (like, quarantine affected countries) to adapt one implant from another existent in the clinic and solve such cases of surgeries.

CONCLUSIONS

By this case we report the possibility of achieving a good stabilization of the fractured spine by this original method of placing the modified metallic Y plate. Metallic plate was adapted for fixing and stabilizing the spine, in a very short time, using another plate existing in the clinic stock. Other benefits consists in shorter surgery time, less anesthetics quantity

used, less surgical materials used, and less costs because only one side incision method.

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