

# **Stabilization of Vertebral Fracture - Luxations with Polymethylmethacrylate (PMMA) and Stainless Steel Wire In Cats**

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**Abstract:** *The purpose of this retrospective study is to investigate PMMA and stainless steel wire in the stabilization of vertebral fracture and luxations. The material of the study consisted of 11 cats diagnosed with spinal fracture or luxations as a result of orthopedic and radiological examination brought to The Animal Hospital of Firat University with the complaint of paralysis. Cats were positioned in sternal recumbency. The skin incision was made in sufficient length to reach 5-6 vertebrae on the midline. Muscles were separated from spinous processes, lamina and articular facets. Then, dislocated or fractured vertebrae's were returned to normal state. Articular facets and spinous process were drilled with a 0.1 mm drill. These vertebrae's were stabilized by passing stainless steel wire through the drilled holes. Then PMMA was applied this area. So that stabilization was strengthened. The stainless steel wire and PMMA stabilization technique used for vertebral column stabilization in this retrospective study. It was concluded that this method could be applied for stabilization in cases where decompression is not necessary.*

**Keywords -** *Cat, Fracture, Luxation, Polymethylmethacrylate, Spine, Wire.*

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## **I. INTRODUCTION**

Trauma of the spinal cord and spine is one of the most usual neurological diseases in small animal clinics<sup>1</sup>. Spinal cord trauma may be formed in high-rise syndrome. Magnetic resonance imaging and myelography are important diagnostic methods in the diagnosis of spinal cord trauma when no fracture or subluxation is detected on radiographs or computed tomography<sup>2,3</sup>.

Physiologically, flexion, extension, torsion, compression and traction forces are applied on the columna vertebralis<sup>4</sup>, thus causing ataxia, paresis, or paralysis in animals<sup>1</sup>. Diagnostic approach in patients with spinal lesions must be neurological examination, determination of localization of the lesion, list of differential diagnosis, additional diagnostic testing<sup>5</sup>.

Minimal compression and contusion could be healed by conservative treatment, if there is no further neurological damage. Stabilization in spinal trauma is the protection of the function of neural tissue that is not damaged. Surgical decompression and stabilization are needed to prevent damage to the injured spinal cord and to remove the existing compression<sup>4</sup>. Many techniques have been described for the stabilization of columna vertebralis<sup>4</sup>. Applied techniques include spinous process plating<sup>6</sup>, laminar plating<sup>7</sup>, vertebral body plating<sup>8</sup>, pin penetration of the canal<sup>9</sup>, polymethylmethacrylate (PMMA) and pin or screw application<sup>10-12</sup>, external fixators<sup>13</sup>, pin-cerclage applications<sup>14</sup>, pedicle screw-rod technique<sup>15</sup>.

The purpose of this retrospective study is to report the results of PMMA and stainless steel wire in the stabilization of vertebral fracture and luxations.

## **II. MATERIAL AND METHODS**

The study material consisted of 11 paralyzed cats brought to the Surgery Clinic of Firat University Animal Hospital. It was learned fallen from height of 5 cases, traffic accidents on 4 cases and cause unknown of two cases clinical signs included depression, anorexia, dehydration, urinary incontinence or urinary retention and paralysis. In all cases; deep pain sensation and anal reflex were evaluated. In all cases were taken laterolateral and ventrodorsal radiographs.

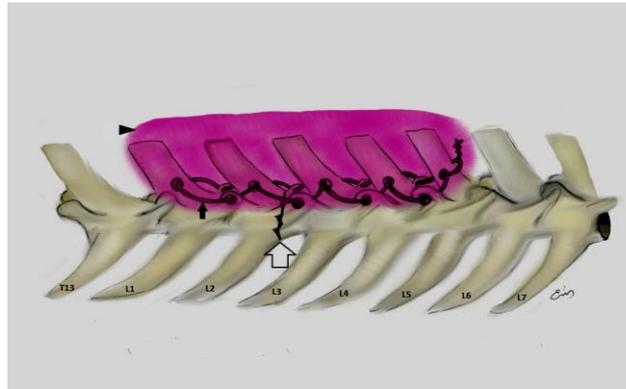
It was applied a painful stimulus to the phalanx using fingers or haemostatic for assessment of nociception (deep pain sensation).

Corticosteroid administration was initiated in all cases with deep pain sensation and no deep pain sensation. For this purpose, the firstly dose was done methylprednisolone (Depo-Medrol, 40 mg/ml, Pfizer) I.M. 30 mg/kg. Dose reduced to half every 12 hours, and 2 mg/kg after 48 hours. Followed at the next days by 2

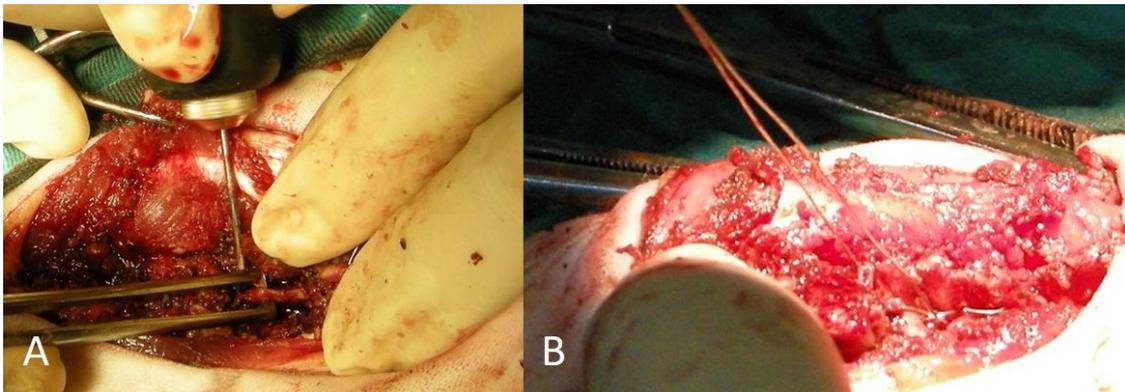
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mg/kg. Preoperative Caprofen 4 mg/kg S.C. (Rimadyl, Pfizer) and preoperative and postoperative antibiotics and Vit B<sub>1</sub> and B<sub>6</sub> applications were made.

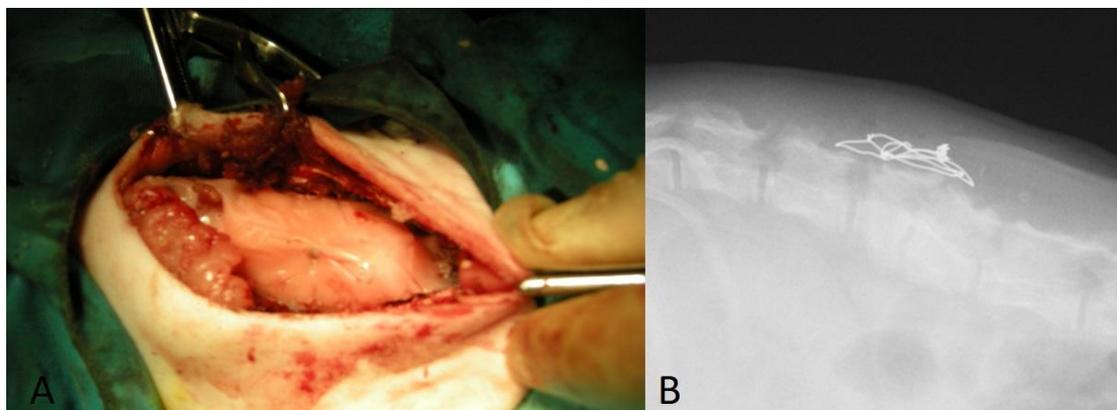
Surgical procedure: Cats were positioned in sternal recumbency. The skin incision was made in sufficient length to reach 5-6 vertebrae on the midline. Electrocauter was used in order to inhibit hemorrhage. Muscles were separated from spinous processes, lamina and articular facets. Then, dislocated or fractured vertebrae's were returned to normal state. Articular facets and spinous processes were drilled with a 0.1 mm drill. These vertebrae's were stabilized by passing stainless steel wire through the drilled holes (Fig 1,2). Then PMMA was applied this area. So that stabilization was strengthened (Fig. 3). Manual bladder assessment was performed three times daily until the female cats was able to voluntarily urinate. Bladder of male cats were evacuated by applying a catheter three times a day. Cats were discharged after ten day the operation. Eight weeks later, a full orthopedic and neurosurgical examination was performed.



**Figure 1.** Stabilization of vertebral fractures between L2 and L3 with PMMA and stainless steel wire. PMMA (black arrowhead), stainless steel wire (black arrow) and fracture line (white arrow).



**Figure 2:** Drilling of articular facet and spinous processes (A). Stage of application of stainless steel wire for fixing (B).



**Figure 3.** The application of PMMA on stabilized vertebrae with stainless steel wire (A). Postoperative radiographic appearance (B).

### III. RESULTS AND DISCUSSION

The symptoms and clinical data are listed in Table 1.

**Table 1:** Information about cats with vertebral fracture-luxations.

Case	Age (Month)	Gender	Cause	Fracture	Luxation	Location	Preoperative Neurological Findings	Postoperative Neurological Findings	Stabilization
1	2	F	TA		+	L3-L4	PP, UR, DPS(-)	PP	+
2	12	M	TA		+	T12-T13	DPS(+),DPR,	Walking	+
3	14	F	FH	+		T10-T11	DPS(+)	Leery walking	+
4	24	F	FH	+		L1-L2	PP, UI And FI, DPS(-)	PP, UI.	+
5	9	M	FH	+		L3-L4	PP, UI, DPR, DPP(+)	Leery walking	+
6	12	M	TA		+	T13-L1	Paresis, DPS(+)	Walk is good, Not shaky	+
7	11	F	TA		+	L1-L2	DPS(-),DPR, UI	DPS(-),DPR,UI	+
8	17	F	FH	+		L2-L3	DPS(+)	Walking	+
9	15	F	NA	+		L3-L4	UR,DPR,DPS(-)	UR,DPR,DPS(-)	+
10	10	F	FH	+		L4-L5	PP, DPS(+)	PP	+
11	8	M	NA	+		L3-L4	DPS(-),DPR,UI	DPS(-),DPR,UI	+

**M:** Male, **F:** Female, **TA:**Traffic accident, **FH:** Fall from a hight, **NA:** Unknown, **UI:** Urinary incontinence, **UR:** Urinary retention, **FI:** Fecal incontinence, **PP:** Paraplegia, **DPR:** Decreased perineal reflex, **DPS:** Deep Pain sentation.

It was reported that corticosteroids remain controversial in acute spinal injury<sup>3,16</sup>. The principal benefits of corticosteroids in acute spinal injury are the free-radical scavenging properties, anti-inflammatory effects, and preservation of spinal cord blood flow<sup>3</sup>. Methylprednisolone, the glucocorticoid steroid has been shown to be effective in enhancing neurological recovery in acute spinal cord injury and the effects of secondary injury<sup>17,18</sup>. High doses of methylprednisolone preserves the cord ultrastructure through a reduction of injury-induced, free radical catalyzed lipid peroxidation, when given within eight hours after injury<sup>18</sup>. Early corticosteroids, decompression and stabilization the most effective treatment for spinal cord injury<sup>18,19</sup>. In this retrospective study, methylprednisolone has been contributed significantly to nerve regeneration at acute spinal cord injury and chronic patients.

It has been reported that deep pain sensation in affected limbs is important prognostic determiner following spinal trauma<sup>20</sup>. In this retrospective study, deep pain sensation was present in 6 cases while in the other 2 cases, deep pain sensation was obtained 2 days after methylprednisolone administration. Deep pain sensation could not be obtained 3 cases.

Schiff-Sherrington Phenomenon may be observed in animals having a fracture/dislocation in the caudal thoracic to cranial lumbar region<sup>21</sup>. In this retrospective study, The Schiff-Sherrington Phenomenon was not observed in fractures and dislocations in the region caudal thoracic to cranial lumbar.

Spinous process plating, tension band / modified segmental spinal fixation and laminar plating are the main methods applied in dorsal stabilization<sup>4,6,8</sup>. It has been reported that difficult to stabilization of plates using screws, especially in small-sized animals, due to the size of the screw and the size of the corpus vertebrae<sup>4</sup>. In such cases, spinous process plating technique (PMMA and pin, supra plate) is preferred. Plastic plates are easy to use in internal fixation of vertebral fractures and dislocations<sup>6,22</sup>. Plastic plates are applied to the spinous processes in two plates and using 5-6 screws. They are attached by compression applied by screws placed through the plates between the spinous processes<sup>6,22</sup>. In this retrospective study, the stainless steel wire and PMMA were very fast to apply.

The adverse effects of neurological diseases on urinary bladder and functions, it have been evaluated to be urinary retention and urinary incontinence under two main headings<sup>10</sup>. It is reported that medical intervention are important as well as physical therapy and rehabilitation in patients with spinal cord injury<sup>23,24</sup>. In this retrospective study has been a significant contributor to the positive outcomes of animal owners' interest in their patients.

### IV. CONCLUSION

Positive results in spinal surgery can be depend on the general condition of the animal, the prevent secondary injury, early treatment and the surgical methods applied, whether or not to urinate, the animal owner's patience in the long recovery process.

The stainless steel wire and PMMA stabilization technique used for vertebral column stabilization in this retrospective study. This technique was applied easily and quickly in the stabilization of vertebral column.

It was concluded that this method could be applied for stabilization in cases where decompression is not necessary. Further, it would make a significant contribution to small animal practice.

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