Novelty Journals

ISSN 2394-966X

International Journal of Novel Research in Life Sciences
Vol. 4, Issue 2, pp: (45-53), Month: March – April 2017, Available at: www.noveltyjournals.com

Removal of the Implanted Monosegmental Internal Fixation after 12 Months of Insertion in Patients with Traumatic Fractures of the Thoracic and Lumbar Spine: A Retrospective Evaluation and Review of the Literature

[1]Dr. Munthir Al-Zabin, [2] Dr. Mark Hofmann

[1]Corresponding author: MD, PhD, Department of Neurosurgery, Khoula Hospital, Muscat, Sultanate of Oman.
[2] Professor, Clinic for Orthopaedics and Traumatology, D-20223 Hamburg-Bergedorf, Germany

Abstract: **The Removal of the internal fixation is an elective operation after the healing process and with the option that all procedures have been performed in order to ensure that the fracture area is not further affected. In this study aimed to demonstrate that, the explantation of the internal fixation is not associated with an increased risk for the patients.**

Objective: Patients with monosegemental traumatic / unstable fractures of the thoracic and lumbar spine have been operated with an internal fixation. A retrospective evaluation of our cases between 2006 and 2011 were performed due to the clinical course and follow-up after the removal of the internal fixation after approximately 12 months.

Methods: 51 cases: 28 thoracic, 23 lumbar have been treated, whereas performed a dorsal approach and implantation of an internal fixateur have been performed. The removal of the internal fixation (second surgery) was approximately after 12 months. The mean age of the patients was 42 years. 29 patients were males and 22 females.

Results: Prior to the second surgery 9 patients had pain > 50 on VAS, Motor deficits 6 prior and 5 after surgery. 8 Patients had sensory deficits prior, but just 6 after the 2. surgery. There were no signs of instability in 49 patients, while 2 patients with fixation in the thoracic spine, a slight compression of the vertebral bodies without surgical consequence and in 2 patients re-bleeding was noted requiring surgical evacuation on the day of surgery. The recovery of these patients was unremarkable in the further clinical course. Infection was not noted.

Conclusions: The removal of the internal fixation in this patients was not associated with an increased risk for the patients.

It appears to be particularly practicable in younger age groups up to 65 years. The long term effect of this operation technique is unclear as of yet.

Keywords: **Thoraco-lumbar fracture, implantation of transpedicular spondylodesis, internal fixation / fixateur, elective operation, orthesis, removal of fixation hard-ware.**

1. INTRODUCTION

Development of transpedicular screw fixation (see figure 3) has brought short-segment instrumentation (fixation of one normal vertebra above and below an injured segment) into general clinical practice.(1) After King(2) initially reported vertebral body screw fixation through the transfacettal approach to the lumbar spine in 1944, Boucher (3) introduced the

way to place screws into the vertebral body through the pedicle in 1958. Since pedicle screw fixation became widespread, as described by Roy-Camille et al. 1963, pedicle screws have been used widely in diseases of the lumbar spine. (4-5)

The optimal management of thoracic-lumbar fractures continues to be a matter of controversy, and the impairment scale of the neurologic status can be an additional possibility for the decision making. (6-7). See Table 1 below.

Table 1: American Spine Injury Association Impairment Scale

Grade	Description
A	**Complete**: no motor or sensory function is preserved
B	incomplete: sensory but no motor function is preserved below the neurological level
C	**Incomplete:** motor function is preserved below the neurologic level, & the majority of key muscles below the neurological level have a muscle grade <3/5
D	**Incomplete:** motor function is preserved below the neurological level, & the majority of key muscles below the neurological level have a muscle grade >3/5
E	**Normal:** motor & sensory function is normal

To date, various unfavourable results have been reported with the method of pedicular screw fixation in patients with injuries / fractures of thoracolumbar spine. (8-11) These patients, who suggest temporizing treatments insisted that they could achieve satisfactory results only by treatments using postures and long-term relaxations. (11-14)

However, other surgeons, who suggested surgical treatment, the patients could be expected to become mobile early, and they performed rehabilitative remedies, overcome anatomic fractures, and improve, in most cases, nervous functions by using decompression and fixation.

The previously used management with immobilization and / or thoracolumbar orthesis is not as effective as the operative invasive management, as described in the literature. See figure 1 below. (9, 15, 37, 50-53).

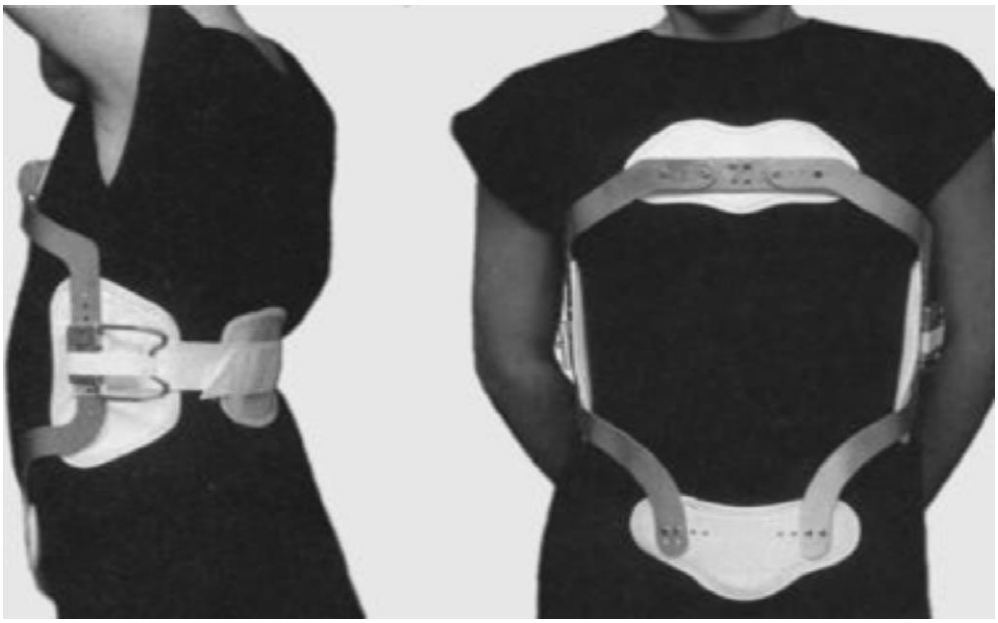


Figure 1: Immobilization and / or Thoracolumbar orthesis

Because of the increasing number of patients with surgically treated injuries of the spine (see table 2), it's important to answer the question of indication for hardware removal. (12-23, 49, 52-53).

Novelty Journals

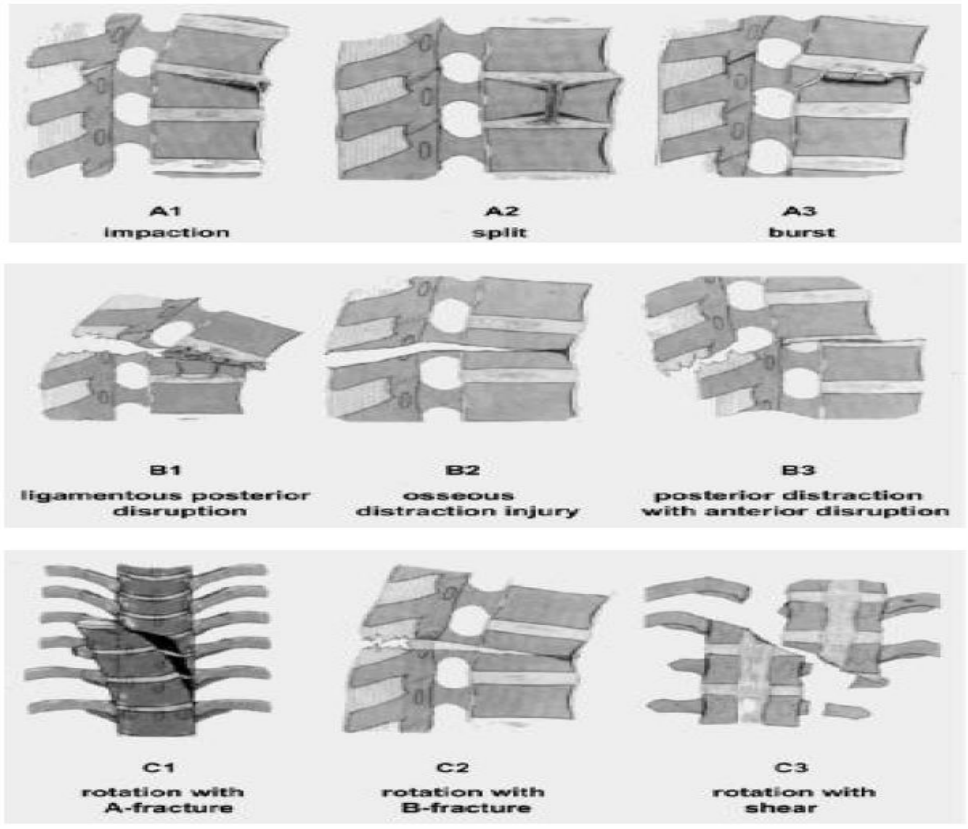
ISSN 2394-966X

International Journal of Novel Research in Life Sciences
Vol. 4, Issue 2, pp: (45-53), Month: March – April 2017, Available at: www.noveltyjournals.com

Table 2 above and figure 2 below (due to the AO-classification)

A Compression injury	A1 Impaction fracture	A1.1 Endplate impaction
		A1.2 Wedge impaction
		A1.3 Vertebral body collapse
	A2 Split fracture	A2.1 Sagittal split fracture
		A2.2 Coronal split fracture
		A2.3 Pincer fracture
	A3 Burst fracture	A3.1 Incomplete burst fracture
		A3.2 Burst-split fracture
		A3.3 Complete burst fracture
B Distraction injury	B1 Posterior ligamentary lesion	B1.1 With disc disruption
		B1.2 With type A fracture
	B2 Posterior osseous lesion	B2.1 Transverse bicolumn
		B2.2 With disc disruption
		B2.3 With type A fracture
	B3 Anterior disc rupture	B3.1 With subluxation
		B3.2 With spondylolysis
		B3.3 With posterior dislocation
C Rotation injury	C1 Type A with rotation	C1.1 Rotational wedge fracture
		C1.2 Rotational split fracture
		C1.3 Rotational burst fracture
	C2 Type B with rotation	C2.1 B1 lesion with rotation
		C2.2 B2 lesion with rotation
		C2.3 B3 lesion with rotation
	C3 Rotational shear injury	C3.1 Slice fracture
		C3.2 Oblique fracture

Comprehensive Classification, groups and subgroups



Comprehensive Classification: A type fractures (compression type), B type fractures (distraction type) and C type fractures (rotation type)

Novelty Journals

ISSN 2394-966X

International Journal of Novel Research in Life Sciences
Vol. 4, Issue 2, pp: (45-53), Month: March – April 2017, Available at: www.noveltyjournals.com

Figure 3: Dick's internal fixator with transpedicular screws and rods in model (Hofmann et al, Orthopedics)

The most injured vertebral segments in the fractures of the thoracic and lumbar spine are T12, L1, and L2. Especially L1 is the most affected segment. (Modern Aspects of Spinal Traumatology, Maglio). **See diagram 1 below.**

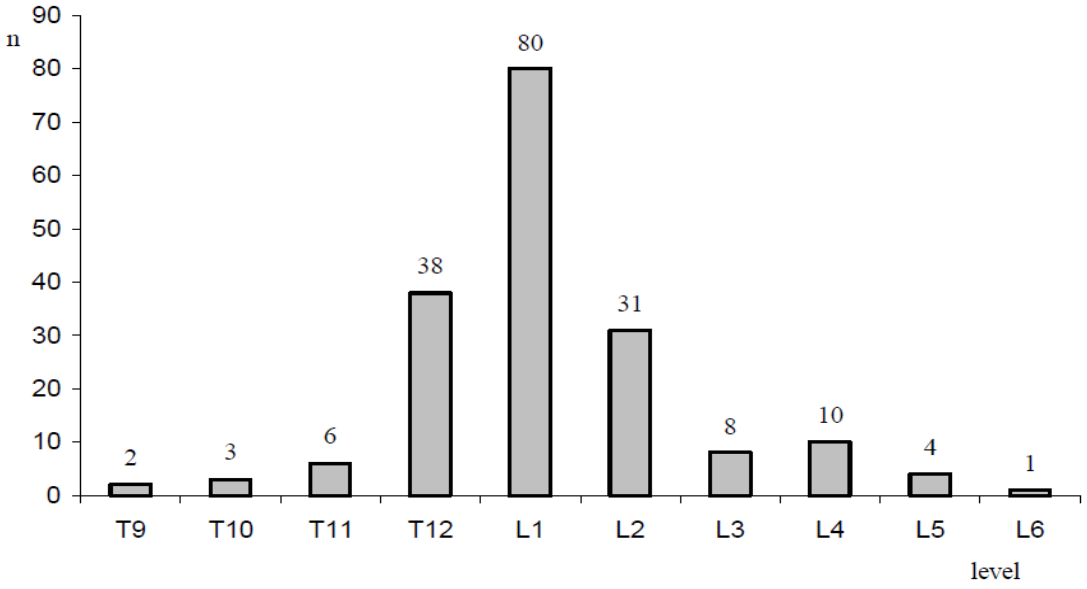


Diagram 1: Most injured vertebral segments in injuries of the thoracic and lumbar spine

The consolidation of the thoracic and lumbar fractures is achievable normally after 12 months. To avoid the possibilities of complications of foreign body, the internal fixation has been removed, when the patient was totally free from any injury related symptoms (22-34, 35, 38, 48-50, 52-53). If the consolidation of the fracture is in doubt, a preoperative CT scan is useful. This study evaluates surgical outcome from the removal of the short segment pedicle screw fixation in 51 patients with thoracic and lumbar spine fractures, whereas until now in the literature this issue hasn't been oftentimes reported (36, 37, 39, 50-53).

Novelty Journals

ISSN 2394-966X

International Journal of Novel Research in Life Sciences
Vol. 4, Issue 2, pp: (45-53), Month: March – April 2017, Available at: www.noveltyjournals.com

2. MATERIALS AND METHODS

Between 2005 and 2011, 51 cases of dorsal monosegmental fractures were reported (28 thoracic, 23 lumbar, see Table 3 below), 29 patients were males and 22 females. Age varied between 17 and 73 years. The mean age was 42 years, whereas a dorsal internal fixation with transpedicular screws and rods was performed (Hamburg, Germany).

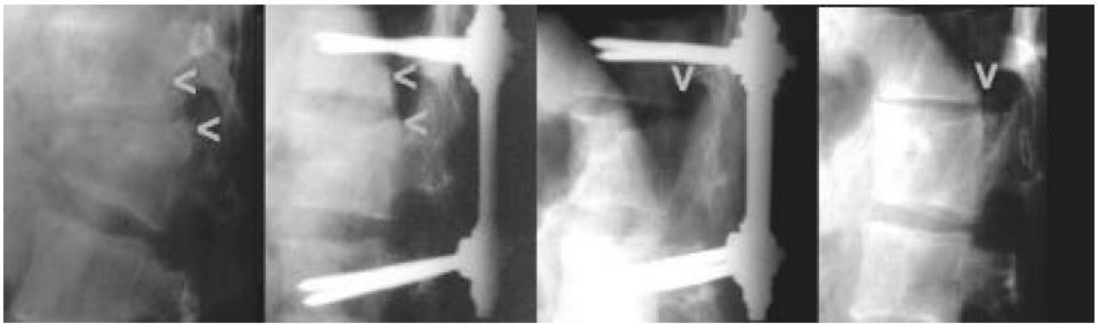
The removal of the internal fixation (second surgery) has been performed approximately after 12 months. Only patients, who have been free from symptoms related to the initial fractures in the thoracic and lumbar spine have been included to be treated with the second operation. An X-ray anterio-posterior and lateral and a CT-scan of the affected region were performed regularly after the first operation and preoperatively for the second operation. The height of the fractured vertebral body maintained postoperatively. After the second operation, patients were followed up for a period of time of 24-36 months.

Table 3: Levels of the thoracic and lumbar spinal fractures

Level	n
T 9	3
T 10	2
T 11	2
T 12	21
L 1	17
L 2	5
L 3	1
Total	**51**

In the following two cases were exemplary for the clinical course:

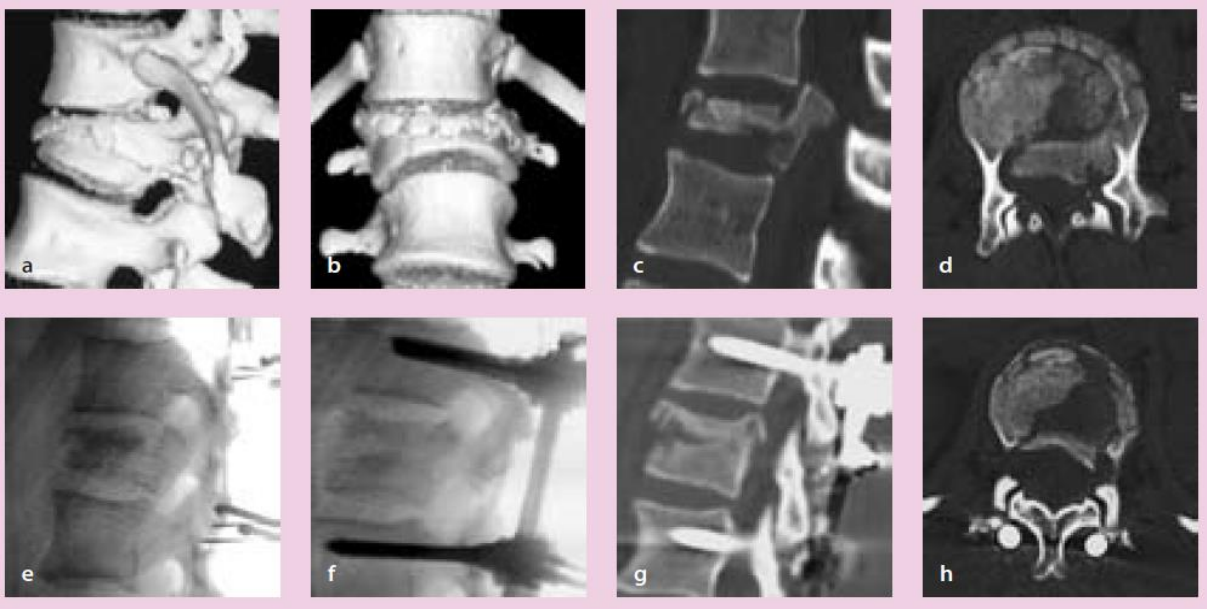
Case 1: Farmer, male, 67 years old, L1-fracture, fall from tree. Recognizable bony narrowing in plain lateral radiographs. Follow-up 24 months after initial surgery after t= 0, and removal of the internal fixation after 9 months. The patient has no sensory motor deficits in the extremities, stable walking, no limitations in the daily life activities (see X-ray after 24 months).



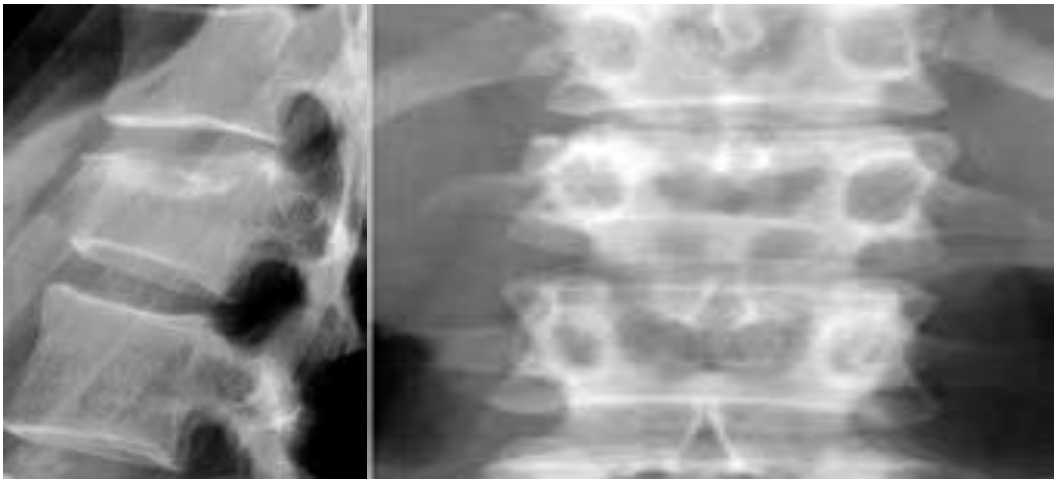
t=0 t=1 t=9 t=24

Case 2: 23-year-old female sustained a motor vehicle accident as an unrestrained passenger. Clinically, she presented with an incomplete paraplegia (ASIA C) and an incomplete conus-cauda syndrome. The initial CT (a–d) scan demonstrates an unstable complete burst fracture of L1 (Type A3.3). The 3D reconstruction (a, b) gives a good overview of the degree of comminution and the deformity; the posterior fragment is best visualized in the lateral 2D reconstruction (c) and the axial view (d). In an emergency procedure, the myelon was decompressed by laminectomy and the fracture was reduced and stabilized with an internal fixator (e–h). Interestingly, the prone position alone (e) reduced the fracture to a certain degree when compared to the CT scan taken with the patient in a supine position. With the internal fixator (RecoFix), the anatomical height and physiological alignment was

restored (f) and the posterior fragment was partially reduced (g, h). After 12 months the patient could walk with assistance, with weakness in the lower extremities of 3-4/5



After removal of the internal fixation:



3. RESULTS

Prior to the second surgery nine patients had pain > 50 on visual analogue scale (VAS) and five patients postoperatively. Motor deficits were noted in six patients prior to surgery and five patients after the surgery. Eight patients had sensory deficits prior to the surgery and 6 patients after the second surgery. With regards to the ability to work after the second surgery; 24 of them were working on full time basis, 12 part-time, seven were unable to work and seven retired from job. Thus, the back to work percent was 86%.

About 29 out of 51 patients were available for reexamination and interview after 6-36 months of the explantation of the internal fixation. 27 of the 29 (93.1%) patients were satisfied with the outcome. Radiological findings after the second surgery showed no signs of instability in about 49 patients; however in two patients with fixation in the thoracic spine slightly compression of the vertebral bodies without a surgical consequence was observed.

Complications: In two patients postoperative re-bleeding requiring surgical evacuation on the day of surgery and were uneventful further recovery. No case of infection was reported.

4. DISCUSSION

Because of the increasing number of patients with surgically treated injuries of the spine, we more often have to answer the question of indication for hardware removal. In the cervical spine and after anterior instrumentations of the thoracic and lumbar spine, hardware removal is only indicated as part of the management of postoperative complications (50-53).

Alanya, Vyas R, Shamie A et al. described the possibility for explantation of the fixateur interne in their study « Safety and efficacy of implant removal for patients with recurrent back pain after a failed degenerative lumbar spine surgery" in the Journal of Spinal Disord Tech 2007;20:271-77. According to them, the persistent pain is a strong indication for

The "Efficacy of Spinal Implant Removal After Thoracolumbar Junction Fusion" was reported by Seok Won Kim et al (53). The purpose of the study was to evaluate the efficacy of spinal implant removal and to determine the possible mechanisms of pain relief. Fourteen patients with an average of 42 years (from 22 to 67 years) were retrospectively evaluated. All patients had posterior spinal instrumentation and fusion, who later developed recurrent back pain or persistent back pain despite a solid fusion mass. Patients' clinical charts, operative notes, and preoperative x-rays were evaluated. Relief of pain was evaluated by the Visual Analog Scale (VAS) pain change after implant removal. Clinical outcome using VAS and modified Mac Nab's criteria was assessed on before implant removal, 1 month after implant removal and at the last clinical follow-up. Radiological analysis of sagittal alignment was also assessed. Average follow-up period was 18 months (from 12 to 25 months). There were 4 patients who had persistent back pain at the surgical site and 10 patients who had recurrent back pain. The median time after the first fusion operation and the recurrence of pain was 6.5 months (from 3 to 13 months). All patients except one had palpation pain at operative site. The mean blood loss was less than 100ml and there were no major complications. The mean pain score before screw removal and at final follow up was 6.4 and 2.9, respectively ($p<0.005$). Thirteen of the 14 patients were graded as excellent and good according to modified Mac Nab's criteria. Overall 5.9 degrees of sagittal correction loss was observed at final follow up, but was not statistically significant. It was concluded in this study, that for the patients with persistent or recurrent back pain after spinal instrumentation, removal of the spinal implant may be safe and an efficient procedure for carefully selected patients who have palpation pain and are unresponsive to conservative treatment.

In the patients of our study, who have been treated with the second operation, the management with explantation of the hardware has been performed successfully; so far the patients were followed up during the first 12-36 months.

For this elective procedure, only the patients with a clinical unremarkable course have been selected. Further investigations and studies concerning this management should be performed.

5. CONCLUSIONS

The explantation of the thoracic and lumbar monosegmental internal fixation in patients after thoracic and lumbar fractures was not associated with an increased risk for this group as compared to not removal of this fixation and it appeared to be particularly practicable and safe in younger age groups up to 65 years. The long term effect of this operation technique and it's indication is unclear as of yet.

REFERENCES

[1] Jeffrey WP et al: Successful Short-Segment Instrumentation and Fusion for Thoracolumbar Spine Spine 2000; 25:1157–69.

[2] King D: Internal fixation for lumbosacral fusion. Am J Surg1944; 66:357–67.

[3] Boucher HH: A method of spinal fusion. J Bone Joint Surg1959; 41:248.

[4] Roy-Camille R et al: Internal fixation of the lumbar spine with pedicle screw plating. ClinOrthop1986;203:7–17.

[5] Han IH et al: Thoracic Pedicle Screw Fixation and Fusion in Unstable Thoracic Spine Fractures. J Korean NeurosurgSoc 2002; 32:334–40.

[6] Ahmet A et al: Short-Segment Pedicle Instrumentation of Thoracolumbar Burst Fractures Does Spine 2001;26:213–7.

[7] Been HD et al: Comparison of two Types of Surgery for Thoraco-Lumbar Burst Fractures: The Netherlands ActaNeurochir (Wien) 1999; 141:349–57.

[8] Kothe R et al: Multidirectional instability of the thoracic spine due to iatrogenic pedicle injuries. Spine1997; 22:1836–42.

[9] Aebi M et al: Stabilization of the lower thoracic and lumbar spine the internal spine skeletal fixation system. 1987;12:544–51.

[10] Denis F et al: Searis K. Acute thoracolumbar burst fractures. Clin OrthopRelat Res 1984;189:142–9.

[11] Gertzbein SD et al: The neurologic outcome following surgery for spinal fractures. Spine 1988;13:641–4.

[12] Cantor JB et al: Nonoperative management of stable thoracolumbar burst fractures. Spine 1993;18:971–6.

[13] Dickson JH et al: Results of reduction and stabilization of the severely fractured thoracic and lumbar spine. J Bone Joint Surg1978;60:799–805.

[14] Jacobs RR et al: Surgical management of thoracolumbar spinal injuries. ClinOrthopRelat Res 1984; 189:22–35.

[15] Bradford DS et al: Surgical stabilization of fractures and fracture dislocation of the thoracic spine. Spine 1977;2:85–196.

[16] McCormack T et al: The load-shearing classification of spine fractures. Spine 1994; 19:1741–4.

[17] Lee YS, Sung JK. Long-term Follow-up Results of Short Segment Posterior Screw Fixation for Thoracolumbar Burst Fractures. J Korean NeurosurgSoc 2005; 37:416–21.

[18] Blauth M, TscherneM :Theraputic concept and results of operative treatment in acute trauma of the thoracic and lumbar spine : J Orthop Trauma 1987;1:240–52.

[19] Farcy JP et al: Sagittal index in management of thoracolumbar burst fractures. Spine 1990; 15:958–65.

[20] Sasso RC, CostlerHB : Posterior Instrumentation and fusion for unstable fractures and fracture-dislocations of the thoracic and lumbar spine. Spine 1993; 18:450–60.

[21] James JY et al: The Treatment of Unstable Thoracic Spine Fractures. Spine 2002; 27:2782–7.

[22] Kim KS et al: Dorsal Short-Segment Fixation for Unstable Thoracolumbar Junction Fractures. J Korean NeurosurgSoc 2006; 40:249–55.

[23] Roy-Camille R et al. Osteogenesis of thoracolumbar spine fractures with metal plates screwed through the vertebral pedicle. ReconstrSurgTraumatol 1976; 15:2–16.

[24] Dorr LD et al: Clinical review of the early stability of spine injuries. Spine 1982; 7:545–53.

[25] Frankel H et al. The value of postural reduction in the initial management of closed injuries of the spine. Paraplegia 1969; 7:179–92.

[26] Patrick T et al: Functional and radiologic outcome of thoracolumbar and burst fractures managed by closed orthopedic reduction and casting. Spine 2003; 28:2459–65.

[27] Chun SW et al. Pedicle Screw Fixation and Posterolateral Fusion for Thoracolumbar Spine Fracture. J Korean NeurosurgSoc 1999;28:644–8.

[28] Park P et al: Adjacent segment disease after lumbar ot lumbosacral fusion. Spine 2004; 29:1938–44.

[29] Hyun SJ et al: Predictable risk factors for adjacent segment degeneration after lumbar fusion. J Korean NeurosurgSoc 2007 41:88–94.

[30] Aota Y et al. Postfusion instability. J spine Disord 1995; 8:464–73.

[31] Bolesta MJ et al: Fractures and dislocationsof the thoracolumbar spine USA. Lippincott William & Wilkins 2008: 1405-65.

[32] Vaccaro AR et al: Diagnosis andmanagement of thoracolum-bar spine fractures.Instr Course Lect 2004;53:359–73.

[33] Mirza SK, Chapman JR. Principles of managementof spine injury. In: Bucholz RW, HeckmanJD. Rockwood and Green's Fractures inadults.6th edition. USA. Lippincott Williams &Wilkins 2008; 1295-1323.

[34] Butt RM et al: Epidemiology of spinal injuries. PakistanJ Neurol. 1997; 3: 20-5.

[35] Bensch FV et al: The incidence and distribution of burst fractures.EmergRadiol 2006; 12:124–9.

[36] Vaccaro AR et al: Diagnosis and management of thoracolumbar spine fractures.J Bone & Joint Surg Br 2003; 85:2456-70.

[37] Berry GE et al: Are plane radiographsof spine necessary after blunt trauma?Accuracy of screening torso computer tomographyin thoracolumbar spine fracture diagnosis. J Trauma.2005; 59: 1410-3.

[38] Karaikovic EE, Pacheco HO. Treatment optionsfor thoracolumbar spine fractures. Bosn J BasicMedSci 2005; 5: 20-6.

[39] Kervin AJ et al: The effectof early spinal fixation on non neurologicoutcome.J Trauma 2005; 58: 15-21.

[40] Krbec M, Stulik J. Treatment of thoracolumbarspinal fractures using internal fixations. ActaChirOrthop Traumatol Cech 2001; 68: 77-84.

[41] Razaq M et al: Short segment posterior instrumentation, reductionand fusion of unstable thoracolumbar burstfractures. Med J Malaysia.2000; 55: 9-13.

[42] Hiwatashi A et al : Kyphoplastyvs. vertebroplasty to increase vertebral bodyheight a cadaveric study. Radiology 2005; 237:1115-9

[43] Farcy JP et al: Sagittal index in management of thoracolumbar burst fractures. Spine 1990.

[44] Steib JP et al: Thotacolumbar fractures surgicallytreated by ''in situ'' contouring. Eur Spine J2006; 12:1823–32.

[45] Dai L-Y et al: Thoracolumbarfractures in patients with multiple injuries: diagnosisand treatment – a review of 147 cases. JTrauma 2004; 56: 348–55.

[46] Thomas KC et al: Comparison of operative and nonoperativetreatmentfor thoracolumbar burst fractures inpatients without neurological deficit: asystematic review. J Neurosurg Spine 2006;4:351–8.

[47] Khan I et al: Thoracolumbarjunction injuries and their management withpedicle screws. J Ayub Med Coll Abbottabad2007; 19:7-10

[48] Afzal S et al: Instrumentation for the surgical managementof thoracolumbar spinal fractures. JK-Practitioner 2002; 94:227-30

[49] Tezer CM et al: Surgical outcome of thoracolumbar burstfractures with flexion–distraction injury of theposterior elements. Intern Orthop 2005; 29: 347–50

[50] Helton LA, Defino, Fabiano RTC. Low thoracicand lumbar burst fractures: radiographic andfunctional outcomes Eur Spine J 2007 16:1934–1943.

[51] Starkweather A. Posterior Lumbar InterbodyFusion. An Old Concept with New Techniques.JNeurosciNurs 2006; 38: 13-30.

[52] Hardware removal after spinal instrumentation, Baron HC et al. Unfallchirurg. 2012 Apr; 115(4): 339-42.

[53] Seok Won Kim, M.D.,corresponding author Chang Il Ju, M.D., Chong Gue Kim, M.D., Seung Myung Lee, M.D., and Ho Shin, M.D. Efficacy of Spinal Implant Removal After Thoracolumbar Junction Fusion. J Korean Neurosurg Soc. 2008 Mar; 43(3): 139–142.