FIXATION OF FRACTURED LEVEL IN SHORT SEGMENT THORACOLUMBAR FRACTURE

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ABSTRACT:

Short segment posterior fixation is the preferred technique in thoracolumbar fractures. In case of significant disruption of the anterior column, the simple short segment construct does not ensure adequate stability. In this study, we tried to evaluate the effect of involved fractured vertebra in short segment fixation of thoracolumbar fractures. In a prospective study, thirty patients with thoracolumbar fractures treated just with posterior pedicular fixation were divided into two groups receiving either the one level above and one level below excluding the fracture level (group A) or including the fracture level (group B). Different clinical and radiological parameters were recorded and followed. A sum of 30 patients (16patients in group A and 14 patients in group were involved high rate of instrumentation failure in the group A. The group A showed a mean worsening in where as the group improved significantly by a mean of The significant effect of the group B technique on the reduction of kyphotic deformity was most prominent in type C fractures. In conclusion, inclusion of the fracture level into the construct offers a better kyphosis correction, in addition to fewer instrument failures, without additional complications, We recommend insertion of screws into pedicles of the fractured thoracolumbar vertebra when consider short segment posterior fixation, especially in Magerl type C fractures.

KEY WORDS:

Fixation thoracolumbar fractured level

INTRODUCTION:

Acute fracture of the thoracolumbar spine is a major cause of disability in adult population. Posterior transpedicular fixation has been the preferred method for stabilizing acute unstable thoracolumbar fractures[1, 2].

Short segment fixation of the fracture level has replaced the traditional long segment instrumentation to decrease the number of motion segments sacrificed in the fusion process[2–5]. However, when there is significant disruption of the load-sharing anterior column, the simple one level above and one level below short segment fixation does not ensure adequate stability, resulting in poor reduction in the kyphotic deformity and occurrence of instrument failure[6]. This necessitates more extensive approaches, such as anterior reconstruction via an anterior approach or posteriorly using balloon-assisted vertebroplasty[7].

A few studies have shown that by inserting screws at the fracture level, the construct will be stronger[8]; which in turn may omit the need for further anterior reconstruction. Only two studies[8,9] have considered the inclusion of the fracture level in short segment fixation. In this study, we have tried to compare the one level

above and one level below excluding the fracture level, and the one level above and one level below including the fracture level. For more precise evaluation, the fracture classification system proposed by Magerl et al.[10] .Different parameters important in outcome will be evaluated and discussed.

Methods

Between April 2009 and May 2011, 30 patients with fractures occurring between T12 and L2 who were treated just with posterior fusion and instrumentation were involved in this prospective study. Surgical indications included more than 50% loss of vertebral body height, kyphosis progressing 20% or more, or more than 50% of canal involvement. The neurological status of the patient was recorded based. Plain spinal X-rays,and magnetic resonance imaging were used to evaluate the fracture.

Patients were organized into two groups and received either the one level above and one level below excluding the fracture level (group A) or the one level above and one level below including the fracture level (group B)

All fractures were classified based on the radiographic identify-cation of the mechanism of injury into three groups as classified by Magerl et al.[10]: compression injury force (A); distraction injury force (B); or multidirectional with translational injury force (C). A fracture could have occurred due to one, two or all three injury forces in a single patient.

All operations were performed utilizing the same instrumentation system, with screw size chosen accor-dant to the size of vertebra (6.5 × 45-mm screws and 5-mm rods at most of the time). In group B, fracture level screws were inserted at the same time with the other screws prior to compression/distraction, and were included into the lordosing-distracting maneuver. Laminectomy and decom-pression were performed when indicated by the presence of comp-ression over neural tissue in MRI. Fusion was performed in all patients using either autologous bone. Mean follow-up time was 16 month months (range6-24 months).

Pre-operative and follow-up radiographs at sixth month were done. Different measurements were used to compare the two groups, including the duration of operation, amount of blood loss, length of hospital stay; compli-cations including instrument failure and infections. (kyphotic angle) was calculated in all radiographs using the Cobb's method by radiologist. The difference between pre-operative and follow-up kyphotic angles and the percentage of correction, as calculated by the difference divided by the pre-operative kyphotic angle, were also taken into consideration. During the whole follow-up time, further radio-graphs were taken if there were any new complaints or problems to the patients.

Student's *t* test was used for statistical analysis of kyphotic angle parameters. Any value of *P* smaller than 0.05 was considered statistically significant.

RESULTS:

A sum of 30 patients (16 patients in group a and 14 patients in group b) were involvedin the study. Mean age at the time of operation was 34.5 (range 18–75). There were 13 male and 7 female patients, with a male to female ratio of 2.64. The majority of fractures resulted due to

fall (60.0%), the remaining cases resulted from car accidents (40.0%).

There were no significant differences between groups regarding age, fracture level, neurological deficit, and mechanism of injury (Table1) Regarding fusion with either bone and whether decompressive laminectomy had been performed, there were also no significant differences ($P > 0.05$)

Table 1: Summary clinical data distribution in both groups

Characteristics	Group 1	Group 2	*P* value
Mean age (years)	34.9	34.0	0.778
Mechanism of injury			
Falls	10	8	0.433
Accidents	7	5	
Fracture level			
T12	8	6	0.085
L1	7	5	
L2	2	1	
Magerltype[a]			
A (compressive)	7	6	0.211
B (distractive)	6	4	
C (rotational)	4	3	

Table 2: Detailed description of fracture types based on Magerl classification

Magerl type	Group 1	Group 2
A	7	6
B	6	4
C	4	3
Total	17	13

Table 3: Summary of operation and outcome values

	Group 1	Group 2	*P* value
Mean operation time (min)	120	125	0.950
Mean hospitalization (day)	5	6	0.269
Mean blood loss (mL)	500 ±	450 ±	0.368
Post-op infections	4	2	0.691

Table 4: Types of implant failure

Type	Group 1	Group 2
Screw breakage	1	1
Rod displacement/breakage	4	1
Screw head dislodgement	1	0

Table 5: Kyphotic angle parameters in two groups

Mean	Group 1	Group 2	P value
Pre-op kyphotic angle (°)	22	18	0.613
Follow-up kyphotic angle (°)	18 ±	14	0.008
Difference (°)	1	6	0.094
Percentage of correction	−26%	6%	0.040

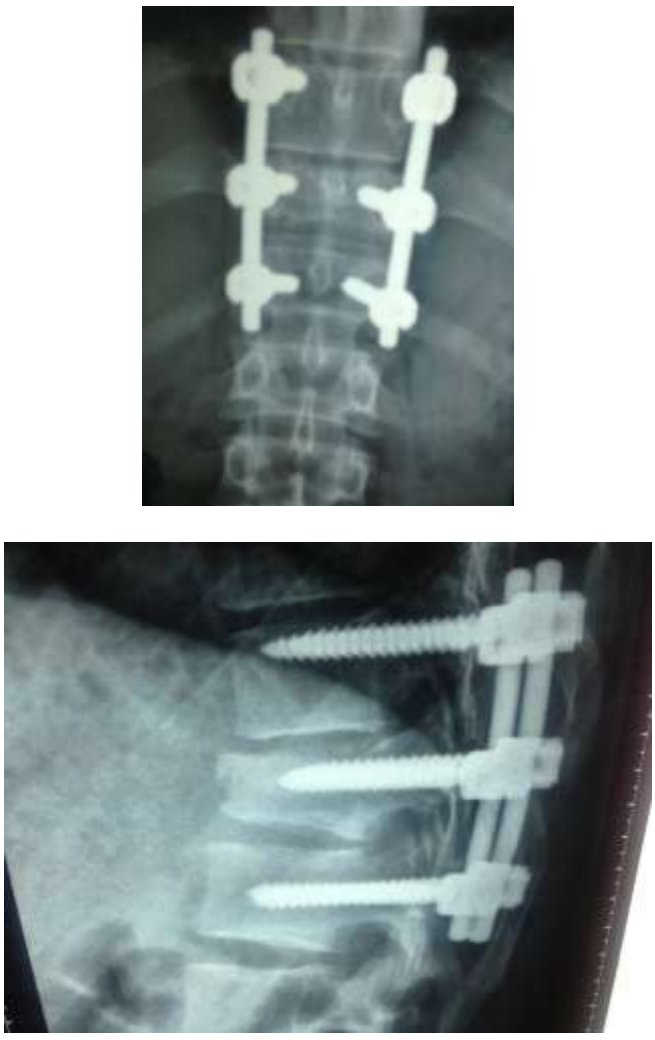

Figure 1: Shows an example ofpost operative fixation of the fructued level (Type B)

Figure 2: Shows an example of post operative fixation of the fractured level (Type A)

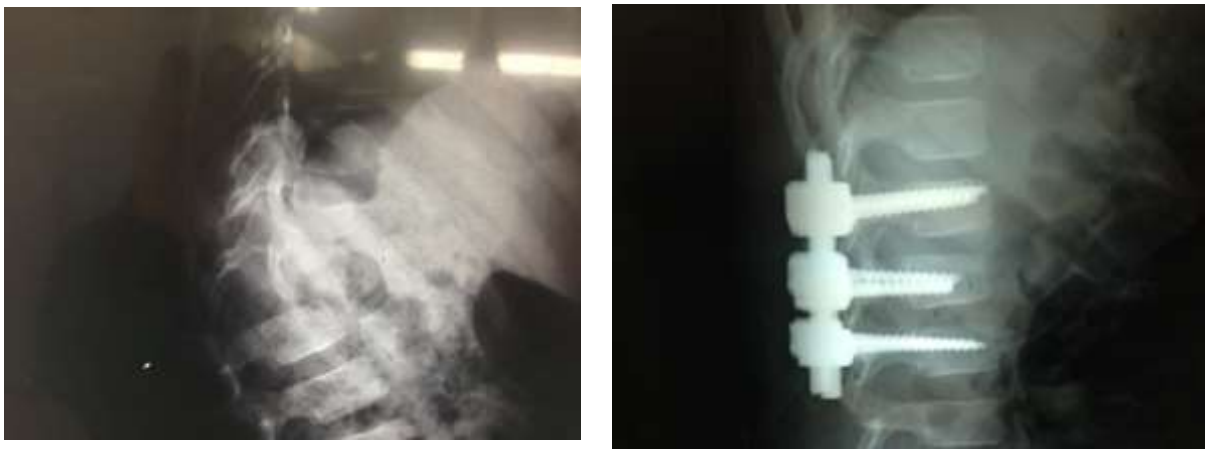

Figure 3: Shows an example of post-operative fixation of the fractured level (Type B) showing the correction of kyphosis

DISCUSSION:

Almost great similarity between the two groups Inclusion of the fracture level in the construct did not lengthen the operation or hospitalization, nor did it increase the amount of blood loss or post-operative infections. The patients in the group B also showed insignificant reductions in limitation of motion, and a similar functional quality of life in comparison to the other group.

Although the insertion of additional two screws in group B the difference between operation times has not been statistically significant. This may be due to the fact that other parts of the operation (e.g. posterolateral exposure, laminectomy-decompression, fusion, etc.) have taken relatively equal time in both groups; therefore, the smaller contribution of additional screw placement has not shown statistical significance.

The correction of kyphosis, as measured by Cobb angles at pre-op and 6-month post-operative radiographs, favor the second group completely.

Group A showed a mean worsening (30%) in kyphosis where as the group B improved significantly by a mean of 7%. It is possible that the involvement of the fracture level in the second group has led to a stronger 3-point posterior support (instead of a 2-point fixation in group A). The high rate of instrumentation failure in the group A (21.4%) when compared with the group (5.3%) favors the above explanation.

There is certainly no need to emphasize that fractures with load-sharing scores of 7 or more will need an anterior-only approach, or a staged anterior reconstruction or augmentation following a Anterior procedures offer good visualization of the fracture and allow a more direct visualization of the defect[12,13]; however, they take longer time in causing more blood loss and morbidity[12], and are unfamiliar and demanding to many surgeons.

In a similar study conducted by Guven et al.[9], the authors studied the inclusion of the fracture level in both short and long segment fixation. They observed that fracture level fixation had lowered the rates of correction failure which was most significant on short segment constructs. They concluded that fracture level screw combination can achieve and maintain kyphosis correction. In addition, in a cadaveric biomechanical study, Mahar et al.[8] showed that insertion of the screws at the fracture level improved biome-chanical stability by providing additional fixation points which may aid in fracture reduction and kyphosis correction. They also concluded that segmental fixation with additional screws at the level of the fracture increases construct stiffness and shields the fractured vertebral body from anterior loads[8]. Even in the case of a burst and completely disconnected pedicle, insertion of the screw into the pedicle will probably stiffen the rod through additional screw linkage and also by vertebral body fixation.

The superiority of the technique could not of course be extended to the other regions of the vertebral column. In fact in another study, Carl et al.[13] reported that in thoracolumbar region where compressive forces act more anteriorly, inclusion of two further levels above the fracture is necessary to achieve a stable fusion; whereas in the more lordotic middle and lower lumbar spine where the compressive forces act more posteriorly, no implant failure occurred while using a short segment two-level fixation construct.

The significant effect of the technique on the reduction of kyphotic deformity was most prominent in type C fractures ($P = 0.018$). This is because the more severe type C rotational fracture with uni- or multi-directional translation is the least stable and does better when fused by the stronger 3-point fixation construct in group A technique. It is therefore recommended that inclusion of the fracture level be performed at least in all type C fractures.

In conclusion, inclusion of the fracture level into the construct has offered a better kyphosis correction, in addition to fewer instrument failures, without additional complications, and with a comparable -if not better- clinical and functional outcome. We recommend insertion of screws into pedicles of the fractured thoracolumbar vertebra when considering a short segment posterior fixation, especially in Magerl type C fractures.

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