Research Article

Comparison between short and long segment posterior spinal fixation in thoracolumbar burst fractures

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Abstract

Background: thoracolumbar area of the spine is the most common site for injuries and the surgical treatment of fixation for treatment of unstable burst fracture remain controversy.
Objectives: to compare the effect of long and short segment posterior pedicular fixation on vertebral burst fracture without neurological deficit since the subject is controversy.
Methods: 14 patients had been taken and divided into two categories A and B, each category consists of 7 patient (5 males and 2 females) whom undergo burst fracture at thoracolumbar region (D12, L1 or L2) which is type B according to "Dennis classification" and all the patient were intact neurologically but had local kyphosis angle more than 15 degree according to Cobb method of measuring. Category A was operated by short segment posterior fixation while category B was operated by long segment posterior fixation. The result was based on the correction of kyphosis angle (immediately and at 18-24 months period follow up), operation's time, the amount of blood loss and instrumental failure.
Result: the long segment fixation was significantly ($p<0.05$) better than short segment in correction of the angle of kyphosis in long follow up period (more than 18 months) rather than immediate post-operative period. The short segment fixation had instrumental complications (fracture of screws and dislodgement) while there was no instrumental failure in long segment fixation. According to the blood loss and operation time there was also significant differences.
Conclusion: the long segment fixation had better result in long term follow up on the angle of kyphosis; there was no instrumental complication (fractures of screws or dislodgment) due to distribution of the weight load on more levels in spite of increase in the time of operation and blood loss which are significant.

Key words: Burst fracture, Kyphosis angle, Short segment and long segment fixation

INTRODUCTION

Thoracolumbar area is highly susceptible to high energy trauma like road traffic accident or fall from height.[11] fracture in this area is the most common type, accounting more than 50%.[15] The aim of treatment of burst fracture in thoracolumbar area of the spine is to restore the angle of kyphosis and remove the compression of spinal canal; nevertheless, there were controversy in using short segment or long segment posterior fixation. Since the introduction of "fixateur interne" of short segment pedicular screw by "Dick et al"[1] till now the controversy still exist.[16] surgical method of treatment provide early mobilization and correction of kyphotic angle.[18]The aim of this research is to know whether the short segment (SS) pedicular fixation is the best choice in treating burst fracture of thoracolumbar spine by comparing it with long segment (LS) pedicular fixation.

In this study we depend on Dennis classification[2] of Burst fracture in which the type of fracture depends on the morphology by X-ray (figure 1)

- **Type A**: Fracture of both end-plates. *The bone is retropulsed into the canal.*

- **Type B**: Fracture of the superior end-plate. It is common and occurs due to a combination of axial load with flexion.
- **Type C**: Fracture of the inferior end-plate.
- **Type D**: Burst rotation. This fracture could be misdiagnosed as a fracture-dislocation. The he mechanism of this injury is a combination of axial load and rotation.
- **Type E**: Burst lateral flexion. This type of fracture differs from the lateral compression fracture in that it presents an increase of the interpediculate distance on anteroposterior roentgenogram.

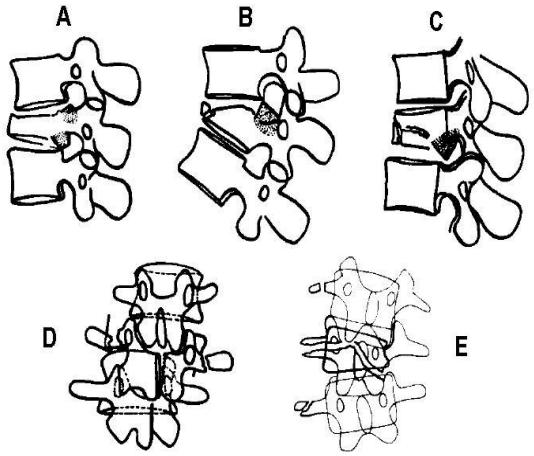


Figure 1. Dennis classification of Burst fracture

There are many classification methods for thoraco-lumbar burst fracture. We depend on Denis classification (taking in consideration to include only neurologically intact patient). Denis

Also The kyphosis angle was measured by using lateral thoracolumbar plain x ray and Cobb method by drawing line parallel to the upper border of the normal vertebra above the burst fracture and line parallel to the lower border of the normal vertebra below the burst fracture from these lines a perpendicular two lines were crossed to make the angle.[3] (figure 2A,B)

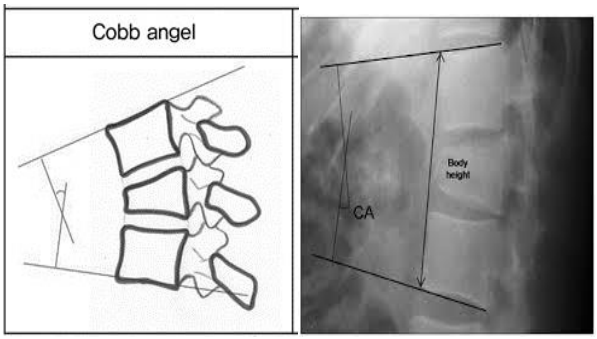


Figure 2 (A) Cobb method of measuring the kyphosis angle. (B) x-ray pre-op. Cobbs angle-

PATIENTS AND METHODS

Fourteen patients were included in this study; all of them had thoracolumbar burst fracture. The inclusion criteria were limited to neurologically intact patients; the angle of kyphosis more than 15 degrees; the fracture vertebra either D12 or L1 or L2 and the burst fracture type B according to Dennis classification.[2]The study included 10 males and 4 female, the mean of age 34.2 years (16-60). The levels of facture were L1 in 8 patients, D12 in 4 patients and L2 in 2 patients. The causes of fractures were road traffic accidents in 8 patients and fall from height in 6 patientsThe patients were divided into two categories according to the way of treatments. Category A (7patients) were treated by short segments fixation and category B (7patients) were treated by long segment fixation.

All of the patients were operated in Red Crescent Hospital in Baghdad, after 1-2 months of injury.

In category A the fixation was one level above and one level below the fracture site while in category B two levels above and two levels below the fracture sites. The instruments used were titanium pedicular screws and titanium rod to connect between the screws above and below vertically in each side.

The kyphosis angle was measured by using lateral thoracolumbar plain x ray and Cobb method.

The angle of kyphosis was measured pre-operatively, immediate post-operatively and after 18 months follow up. The failure in correction of kyphosis angle was determined by its increment equal or more than 10 degrees. The time of operation and the blood loss were measured.

Statistical comparison between 2 categories was done by MedCalc software (*t* and *U* test). The significant P value was < 0.05.

RESULT

The time of operation in short segment (SS) fixation was (120-180) minutes while in long segment (LS) fixation (160-250) minutes, the amount of blood loss in SS fixation was (200-500) milliliters while in LS fixation was (400-750) milliliters. In both categories comparison of (operation time and blood loss) was statistically significant.

The pre-operative, immediate post-operative and follow up post-operative (>18 months) of the kyphosis angle was measured and there was significant statistical

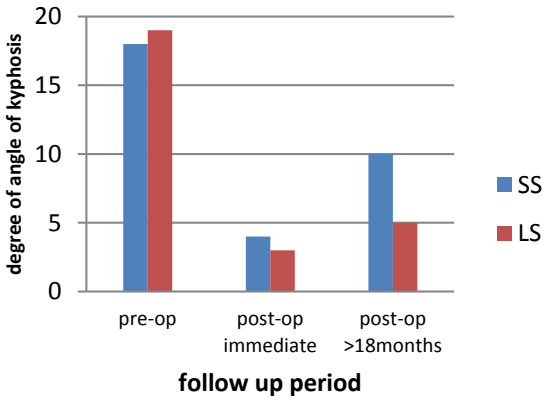
difference between two categories in follow up post-operative only (as shown in table 1).

Table 1. the results of comparison between short and long segment fixations

	Category A (SS)	Category B (LS)	P value
Age	32 +/- 11(16-55)	35+/-12 (18-60)	0.80
Time of follow up	22-27 months	24-26	0.76
Angle of kyphosis pre-op	18 +/- 2	19 +/- 1	0.20
Angle of kyphosis post-op immediately	4 +/- 1	3 +/- 1	0.25
Angle of kyphosis post-op >18 months	10 +/- 1	5 +/- 1	<0.05
Operation time	120-180 minutes	160-250 minutes	<0.05
Blood loss	200-500 ml	400-750 ml	<0.05

Four out of seven patients from (SS) category had correction loss of angle of kyphosis > 10 degrees (all in long post-operative period >18 months) with a failures rate 57%, while there was no correction loss in (LS) category. One patient had fracture and dislodgment in (SS) category. The difference between two categories was statistically significant. "Figure 3"

Figure 3: angle of kyphosis measurement showing no significant differences according to pre and immediate post-operative periods in both categories, whereas there was significant difference according to pre and long post-operative periods between two categories.



DISCUSSION

Depending on their experience, the surgeon choose their surgical approaches.[19] some doctors recommended conservative treatment like bed rest, physical therapy and braces ; however, this will not treat the kyphotic angulation and restore the original shape.[20]

Before "Dick et al"[1] whom invented what was called "fixateur interne" in 1985, there were two great surgeons who used pedicular screws, Boucher [7] at 1959 and Roy-Camille et al [8] at 1963. At that time (SS) method was considered the best way for the treatment of burst fracture.[1, 4-6] Some studies showed that (LS) fixations were superior to (SS) one.[7-9] Yu et al [10] founded that (SS) fixations had a failure rate in thoracolumbar region. Moon et al[12] founded that (LS) fixation was more effective than (SS) method. Korovessis et al[13] reported that claw figuration on two levels above and below the site of fracture was the best way in creating hard fixation. Katonis et al[15] reported that fixation two levels above the burst fracture associated with low instrumental complications. The advantage that makes (SS) method reliable are preserving the spinal motion segments, less blood loss and operative time is shorter.[17]

In this study with the comparison of (SS) and (LS) the failure in correction of kyphosis angle occurred in 4 patients all of them in (SS) category in a long period follow up result (statistically significant) demonstrated that it was not the best way in treatment of burst fracture in thoracolumbar region in spite of the significant long time and significant blood loss between the two categories. The failure rate in (SS) category was 57 % and there were also complication of screw fracture and dislodgment in one of (SS) category patient.

Conclusion

Long segment (LS) fixation occurred to be more successful than short segment (SS) one in treatment of thoracolumbar burst fractures.

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