INTRODUCTION

Despite advances in techniques and instrumentation, optimal approach for treatment of disrupted spinal segments remains debatable. Choosing the most appropriate technique, requires knowledge and ability to define the extent of injury as well as appreciation of rationale of treatment methods. The goals of surgical intervention are restoration of alignment, stabilization and improvement of neurological recovery without further damage. It is difficult to decide on a single surgical technique that can manage all injuries. The selection of surgical approach (anterior, posterior or combined), type of instrumentation and modes of reconstruction (bone grafts/cages) must be planned. Analysis of fracture, patient condition, limitations of working environment and shortcomings of instrumentation, a rationale decision making process should be used to maximize benefits and diminish risks.

This report describes the surgical management of burst thoracolumbar vertebral fractures.

METHODOLOGY

All surgically managed cases of burst thoracolumbar vertebral fractures were reviewed. Patients were

RESULT

Operative management of unstable burst vertebral fractures is challenging and debatable. This study of such cases was conducted at the Aga Khan Hospital, Karachi from January 1998 to April 2003. All surgically managed spine injuries were reviewed from case notes and operative records. Clinical outcome was assessed by Hanover spine score and correction of kyphosis was measured for radiological assessment. The results were analyzed by Wilcoxon sign rank test for two related samples and p-value < 0.05 was considered significant. Ten patients were identified by inclusion criteria. There was statistically significant difference between mean pre- and postoperative Hanover spine score (p=0.008). Likewise, there was significant difference between mean immediate postoperative and final follow-up kyphosis. (p=0.006). Critical assessment of neurologic and structural extent of injury, proper pre-operative planning and surgical expertise can optimize the outcome of patients.

Key words: Vertebal fracture. Surgery. Hanover spine score. Kyphosis.
DISCUSSION

The goals of operative intervention for thoracolumbar trauma are anatomic reduction rigid fixation and stabilization and neural decompression, whenever indicated. Different operative approaches were employed to obtain these goals in this series. Although mean postoperative drop in the Hanover spine score was significant, postoperative score was fairly high in most of the cases, except a few.

Case number 9 and 2 in Table I, had similar injuries, but the postoperative Hanover scores are different (86 vs. 45). Although both patients had posterior instrumentation, the difference was short segment pedicle screws fixation, single level above and below the injured vertebra, in case 9, as compared to two levels above and below in case 2. Fixation levels need to be considered critically. Short segment fixation can attribute to loss of correction in the absence of anterior reconstruction (bone graft or cage) and high fatigue failure rates. Also, the case 9 had some residual pain in L2 dermatome, which was noted in the follow-up clinic. Pedicle screw fixation is technically demanding and has limitations and problems. One should have reasonable training and expertise before practicing this system.

Another case with low functional score was case 7 in Table I. This patient had L1 burst fracture with neurogenic bladder (Frankle grade C). He was managed by short segment pedicle screw instrumentation only (D12-L1: one level above and below the injured level). Per operative kyphosis correction achieved was from 39 to 3 degrees. He had kyphosis of 8 degrees in the final follow-up evaluation (loss of 5 degrees). This patient still has bladder problem and his postoperative score at final follow-up was 42 (base line: 98). On retrospective review, we believe that anterior surgical approach might have resulted in a better outcome. The amount of bony comminution with the primary injury was extensive and failure to support the anterior column after posterior correction is associated with higher risk of loss of kyphosis as well as instrumentation failure when compared to a combined approach or anterior approach.

Table I: Injury details, treatment and outcome of the patients.

<table>
<thead>
<tr>
<th>Case No</th>
<th>Age</th>
<th>Gender</th>
<th>Injury</th>
<th>Surgical procedure</th>
<th>Pre-operative Hanover spine score</th>
<th>Postoperative score-final follow</th>
<th>Pre-op Kyphosis</th>
<th>Immediate post-op Kyphosis</th>
<th>Final follow-up Kyphosis</th>
<th>Loss of Kyphosis</th>
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<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>F</td>
<td>L2 burst fracture, incomplete paraparesis below L3</td>
<td>Anterior decompression and instrumented fusion with iliac crest bone graft</td>
<td>98</td>
<td>85</td>
<td>30</td>
<td>-1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>34</td>
<td>F</td>
<td>L1 burst fracture, normal neurology</td>
<td>Reduction and stabilization by posterior instrumentation</td>
<td>96</td>
<td>86</td>
<td>30</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>35</td>
<td>M</td>
<td>Double burst fracture at D12 and L1, with conus medullaris syndrome</td>
<td>Posterior stabilization, anterior decompression and fusion with bone graft</td>
<td>96</td>
<td>64</td>
<td>30</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>M</td>
<td>L1 burst fracture, normal neurology</td>
<td>Posterior stabilization and anterior reconstruction with bone graft</td>
<td>96</td>
<td>86</td>
<td>30</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>24</td>
<td>F</td>
<td>L1 burst fracture with incomplete conus medullaris lesion</td>
<td>Posterior stabilization and anterior decompression and fusion with bone graft</td>
<td>96</td>
<td>88</td>
<td>35</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>48</td>
<td>M</td>
<td>L1 fracture with paraplegia</td>
<td>Posterior reduction and instrumentation D11-L3</td>
<td>97</td>
<td>64</td>
<td>45</td>
<td>4</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>26</td>
<td>M</td>
<td>L1 burst fracture with neurogenic bladder</td>
<td>Posterior reduction and instrumentation D12-L2</td>
<td>98</td>
<td>42</td>
<td>39</td>
<td>3</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>31</td>
<td>M</td>
<td>L3 burst fracture, normal neurology</td>
<td>Posterior reduction and instrumentation L2-L4</td>
<td>95</td>
<td>60</td>
<td>35</td>
<td>2</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>26</td>
<td>M</td>
<td>L1 burst fracture, normal neurology</td>
<td>Posterior reduction and instrumentation D12-L2</td>
<td>95</td>
<td>45</td>
<td>38</td>
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<td>4</td>
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<tr>
<td>10</td>
<td>16</td>
<td>M</td>
<td>L1 burst fracture, normal neurology</td>
<td>Posterior reduction and instrumentation D12-L2</td>
<td>95</td>
<td>Lost to follow-up</td>
<td>41</td>
<td>4</td>
<td>Lost to follow-up</td>
<td>-</td>
</tr>
</tbody>
</table>

Figure 1 (a): MRI (case 5) showing injury to all three columns. Patient had incomplete conus medullaris lesion.

Figure 1 (b): Anterior decompression, fibular grafting and posterior stabilization.
only for instrumentation and bone grafting.\textsuperscript{7} To address the issue, load-sharing classification was developed, which quantify the amount of comminution of the injured vertebral segment.\textsuperscript{8} This classification has been validated also in the clinical practice.\textsuperscript{9} Another reason in this case is associated neurologic injury. Motor recovery and return of bowel and bladder function is more reliable after direct anterior decompression. The ligamentotaxis effect of indirect posterior decompression is based on integrity of Sharpey, fibers or annular ligament attachments to the displaced fracture fragments.\textsuperscript{10} This technique may also be ineffective in the setting of higher canal compromise.\textsuperscript{11} Considering the degree of comminution and the significant canal compromise (70\%) in this patient, direct anterior decompression and reconstruction of the anterior column might have resulted in a better outcome. The outcome of this case can be compared with other cases in this series. Cases number 3 and 5, had better neurological outcome and therefore, higher postoperative functional scores after direct anterior decompression.

Another case to consider is case 4; this patient with normal neurology had anterior reconstruction by bone graft in addition to posterior instrumented stabilization. Anterior surgery was done for comminuted injured vertebral segment mentioned in load sharing classification. This patient had good functional score (86) postoperatively. Kyphosis is well-known criteria for the outcome assessment of spinal injuries. As it is balanced by lumbar hyperlordosis, this causes muscle strain and pain and loss of kyphosis with posterior instrumentation alone is well recognized.\textsuperscript{12}

**CONCLUSION**

The treatment of thoracolumbar fractures is still evolving. Evolution is based on the understanding of spinal mechanics and instrumentation. Although, techniques may change, but treatment should be guided by well founded principles and detailed structural and neurological assessments. Surgical intervention should be used to preserve or improve neurologic function, reduce bone deformity and stabilize the spine for early mobilization of patients.

\textbf{REFERENCES}