Research Article

Dynamic compression plating versus intramedullary interlocking nail technique: a prospective study in a tertiary care centre

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ABSTRACT

Background: A prospective study was performed to compare the efficacy and the outcome of the dynamic compression plating method and the interlocking nailing method for humeral shaft fractures.

Methods: 86 patients undergoing surgery for humeral shaft fractures were categorized into 2 groups of 43 each, undergoing Dynamic Compression Plating (DCP) and Intramedullary Interlocking (IMIL) technique after detailed clinical, physical and radiological history were taken. They were followed up for a total of 36 weeks or till the complete union of the bones, which ever was first.

Results: More than 60% of the patients were between 21-50 years of age. Out of the indications for surgery, 49 were fractures with unacceptable reduction and 23 of the fractures were with multiple injuries. Among the DCP group, only 14% of the patients took more than 20 weeks for the union of the fracture while in IMIL group this was further reduced to 9.3%. Union took place in <10 weeks in 48.8% of the patients in the IMIL group and 41.8% in the DCP group. The major complication that was observed in the DCP group was shoulder stiffness which was observed in 16.3% of the cases while in IMIL group, it was only 4.7%. An infection contributed to 11.6% of the complications on the IMIL group but was only 4.7% in the DCP group.

Conclusions: Though technically more demanding, our study showed that intramedullary interlocking system to be better than compression plating as it was minimally invasive with lesser blood loss.

Keywords: Dynamic compression plating, Intramedullary interlocking, Humerus shaft fracture

INTRODUCTION

Humerus shaft fractures due to a trauma are a leading cause of morbidity. It is estimated that 3% of all the fractures commonly encountered are humeral shaft fractures. With increase in vehicular traffic and accidents, this number is expected to rise further.1

The humerus fracture is quite challenging to treat for an orthopedician. If not properly understood and treated, it can lead to irreparable damages.

Classification of the fracture guides us in choosing the treatment modality. A simple oblique fracture yields good results with conservative management. A transverse fracture precludes the use of hanging arm cast due to risk of distraction and potential complications. Spiral fractures in the distal third also called as Holstein-Lewis fracture is often complicated by Radial nerve palsy either primarily or post closed reduction.2,3

The muscular attachment of the major pectoralis, deltoid, rotator cuff muscles influence the degree of displacement of the fractures. If the fracture is uncomplicated, it may be treated conservatively. Segmental fractures usually need internal fixation. Comminuted fractures are better managed by closed means. Osteopenia bones are better managed by intramedullary nailing than by plating.4
Normally most of the fractures are treated non-operatively. Conservative treatments have resulted in good results till now. However, the need for continued follow up and hospital visits, longer time of hospital stay has become increasingly difficult. Moreover, in certain cases like segmental fractures, pathological fractures, open fractures, unstable fractures (spiral/long oblique), comminuted fractures, segmental fractures, fractures with delayed union or non-union, fractures with vascular injuries or radial nerve injuries, there is a need for surgical intervention.\(^5\)\(^6\)

For such fractures, open reduction and internal fixation with plate osteosynthesis or intramedullary implant is the line of treatment. The advantages of this technique is that it results in early mobilization and comfort to the patient although it does not provide rational stability.\(^7\)

Interlocking nailing of the shaft of humerus is a recent development which not only has the advantages of the plating, but also controls rotation and maintains length of the humewral shaft.\(^8\)

We have compared the efficacy and the outcomes of the dynamic compression plate technique and the interlocking nailing in our study.

**METHODS**

This study was performed in the department of orthopedics over a period of Two years at MR Medical College. 86 patients of all age groups and both the sexes, with humerus shaft fractures that required surgery were included into the study.

Patients with compound fractures, fractures other than humerus shaft like upper and lower ends, and other pathological fractures were excluded from the study.

The indication for the operative treatment were patients with polytrauma who required early mobilizations, failure of the conservative treatment, patients who needed to return to work and where prolonged immobilizations were not possible, comminuted fractures or short oblique fractures or spiral fractures or those which were associated with neurovascular injury.

All patients were subjected to a thorough history, physical and clinical examination. Roentgenograms were taken of the arm, shoulder and elbow. Immobilization of the arm was done by using arm pouch and plaster of paris.

After explaining the procedure properly to the patients and the relatives, informed consent was taken from them. They were then divided into 2 groups, the DCP group which underwent dynamic compression plating and IMIL group, which underwent Intramedullary Interlocking technique.

For patients with upper and middle third shaft fractures, anterolateral approach was used and for the fractures in the lower one third of the shaft, posterior approach was used.

Among the plating group, appropriate surgical techniques were used to fix the compression plates depending on the fracture. Axial compression was used for transverse or short oblique fractures and interfragmentary lag screw fixations were done for oblique and spinal fractures (Figure 1A-C).

![Figure 1: X-rays of compression plating method; (A) before surgery, (B) after surgery, (C) after union.](image)

In the intramedullary interlocking technique, reamed ante grade inter locking nails were used, which are commercially available (Figure 2A-C).
Figure 2: X-rays of intermedullary interlocking technique; (A) before surgery, (B) after surgery, (C) after union.

All the patients were followed up until the completion of the union and were accordingly categorized. During follow-up, all the patients underwent complete clinical examination and radiological tests were done.

By the end of 20 weeks, the union was analysed and categorized accordingly. The fracture was categorized as non-union if after 36 weeks also there was an absence of union.

RESULTS

86 patients were treated for humerus fracture. More than 60% of the patients were between 21-50 years of age, with 22% of them being between 21-30 years (Table 1).

Table 1: Age wise distribution of patients.

<table>
<thead>
<tr>
<th>Age group (in years)</th>
<th>No. of patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-20</td>
<td>7</td>
<td>8.1%</td>
</tr>
<tr>
<td>21-30</td>
<td>19</td>
<td>22.1%</td>
</tr>
<tr>
<td>31-40</td>
<td>16</td>
<td>18.6%</td>
</tr>
<tr>
<td>41-50</td>
<td>15</td>
<td>17.5%</td>
</tr>
<tr>
<td>51-60</td>
<td>12</td>
<td>14.2%</td>
</tr>
<tr>
<td>61-70</td>
<td>8</td>
<td>9.3%</td>
</tr>
<tr>
<td>71-80</td>
<td>9</td>
<td>10.5%</td>
</tr>
<tr>
<td>Total</td>
<td>86</td>
<td>100%</td>
</tr>
</tbody>
</table>

Of the main indications which required surgery, 49 were fractures with unacceptable reduction and 23 of the fractures were with multiple injuries (Figure 3).

Figure 3: Indication for surgery.

Among the DCP group, only 14% of the patients took more than 20 weeks for the union of the fracture while in IMIL group this was further reduced to 9.3%. Union took place in <10 weeks in 48.8% of the patients in the IMIL group and 41.8% in the DCP group (Table 2).

Table 2: Time taken for the union of fractures.

<table>
<thead>
<tr>
<th>Time taken for union (in weeks)</th>
<th>No. of patients (DCP)</th>
<th>No. of patients (IMIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10 weeks</td>
<td>18 (41.8%)</td>
<td>21 (48.8%)</td>
</tr>
<tr>
<td>10-16 weeks</td>
<td>11 (25.6%)</td>
<td>10 (23.3%)</td>
</tr>
<tr>
<td>16-20 weeks</td>
<td>8 (18.6%)</td>
<td>8 (18.6%)</td>
</tr>
<tr>
<td>&gt;20 weeks</td>
<td>6 (14%)</td>
<td>4 (9.3%)</td>
</tr>
<tr>
<td>Total</td>
<td>43 (100%)</td>
<td>43 (100%)</td>
</tr>
</tbody>
</table>

The major complication that was observed in the DCP group was shoulder stiffness which was observed in 16.3% of the cases while in IMIL group, it was only 4.7%. An infection contributed to 11.6% of the complications on the IMIL group but was only 4.7% in the DCP group.
Table 3: Complications observed post-surgery.

<table>
<thead>
<tr>
<th>Complications</th>
<th>No. in nailing group</th>
<th>No in plating group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infections</td>
<td>2 (4.7%)</td>
<td>5 (11.6%)</td>
</tr>
<tr>
<td>Delayed union</td>
<td>1 (2.3%)</td>
<td>4 (9.3%)</td>
</tr>
<tr>
<td>Non union</td>
<td>0</td>
<td>2 (4.7%)</td>
</tr>
<tr>
<td>Radial nerve injury</td>
<td>0</td>
<td>3 (7%)</td>
</tr>
<tr>
<td>Shoulder nerve injury</td>
<td>7 (16.3%)</td>
<td>2 (4.7%)</td>
</tr>
<tr>
<td>Elbow stiffness</td>
<td>2 (4.7%)</td>
<td>0</td>
</tr>
<tr>
<td>Anesthesia in the regimental batch area</td>
<td>2 (4.7%)</td>
<td>0</td>
</tr>
</tbody>
</table>

DISCUSSION

Humeral fractures are reported to be more common in males, with road traffic accidents to be the common cause. The most common age group is around 30 years. The other major cause that contributed towards humerus fractures was osteoporosis in women. In our study also, road traffic accident was the major cause of this type of fracture.9

The most common indication for surgery in our study was fractures with unacceptable reduction and fractures with multiple injuries. This was true in another study by Singisetti et al, where failure to achieve acceptable reduction by closed methods and patients with multiple injuries, were the major indications for surgery.10

The mean age group in our study was 41.4±8.2. Mean age of 39.6 was reported by Lal et al, 43.8 by Rommens et al, and 39.5 by Foster et al.3,11,13

The union of bones in our study took approximately 12.2 weeks by compression plating and 9.9 weeks by the intramedullary nailing method. Vander et al, reported a union of bones of weeks and Foster et al, reported 14 weeks by compression plating, which were slightly higher than our study. Among the IMIL group, Lin et al, reported 8.6 weeks and Lal et al, reported 8.38 weeks. Lesser time was taken by the IMIL group compared it the DCP group probably due to the lesser invasive method and early mobilization.3,11,13,15

The major complication that was observed in the DCP group was shoulder stiffness which was observed in 16.3% of the cases while in IMIL group, it was only 4.7%. An infection contributed to 11.6% of the complications on the DCP group but was only 4.7% in the IMIL group.

Foster et al, found an incidence of infection to be 14% in the plating group while Robinson et al reported an incidence of 7%. 5% incidence was reported by McCormack in the nailing group, corroborating our study.13,16,17

Non-union was seen in 4.7 cases in the DCP group, while in the IMIL group, all the fractures had united. Delayed union was observed in 9.3% of the cases in DCP group and 2.3% in IMIL group. These results were in accordance with the studies performed by Vander et al, who reported a rate of delayed union to be 13.8% in the plating group while Crolla et al, reported 9% in the interlocking nailing.14,18

CONCLUSION

For a long time now, dynamic compression plating was one of the main surgical procedures for humeral shaft fractures. But Interlocking nailing procedure is found to be better minimally invasive procedure with lesser blood loss and lower rate of infection. Though we have had no cases of radial nerve injury, it is known to have lesser chances of nerve injuries. The patient satisfaction is also higher among the patients undergoing nailing procedure rather than plating method.

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REFERENCES


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