Compression Fixation Using a Condylar Plate for Subtrochanteric Fractures

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Condylar plate를 이용한 전자적하부 골절의 치험

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대퇴골 전자적골절 8례에 대하여 Condylar plate를 이용하여 관협정복 및 압박내고정술을 시행하였던 경험을 보고자 한다. 골절의 분류는 Seinsheimer의 분류를 따랐으며 숨식의 AO의 방법으로 시행하였다. 숨기상의 error로 blade와 후방돌출이 1례, 내측 안정성 성취 실패가 2례 있었고, 합병증으로 수술중 대퇴간부골절 1례, 금속판의 파로 골절 1례, 금속판사 이란 1례가 있었다. 생역학적 원리 및 숨식의 적응을 고려함으로써 재래식 내고정보다 우수한 압박고정을 얻을 수 있으므로 특히 전자적하부 골절에 시도해 볼만한 가치가 있다고 사료된다.

MATERIALS

From November 1980 to April 1988, the compression blade plate was used in the treatment of 8 fresh subtrochanteric fractures. There were 6 men and 2 women with a range of age from 29 to 76 years. There were 5 left hips and 3 right hips in this group.

The anatomical configuration of each fracture was classified according to the method of Seinsheimer. All 8 patients were evaluated for complications and for technical errors either at the time of surgery or that became apparent later. All cases were followed up for at least 4 months.

METHOD

A detailed description of this operation is not available. On the basis of our experience, we have learned that it is an exacting and technically demanding operation and we recommend the following procedure:

A pre-operative work drawing is essential and the selected plate is then drawn in with the help
of the template. The patient should be positioned for two-plane intraoperative X-rays with exposures made prior to draping to ensure proper X-ray tube placement.

A vastus lateralis splitting incision which extends proximally above the greater trochanter is used. If the fracture is comminuted, large fragments are anatomically reduced and fixed by interfragmentary compression method. The remainder of the fracture then is reduced. A guide pin placed perpendicular to the femoral shaft then is started just above most prominent lateral protrusion of the greater trochanter and inserted approximately 60mm.

In the frontal plane the tip of the guide pin should be into bottom half of the femoral head, below and as close as possible to the area of intersection between the compression and tension trabecular systems and in the sagittal plane the pin should be in the middle of the femoral neck and head. The blade starter is then inserted just below the guide pin to a depth of preoperative measured length.

A 95 degree condylar blade plate is then selected. Plate length is selected so that at least 4 screw holes extend below the fracture site. It is necessary to be certain that plate is parallel to the shaft of the femur in the frontal and sagittal plane. If a medial defect is present, cancellous bone graft should be added to the defect. The proximal screw is placed so that it crosses the calcar. A cortical compression screw is preferable. Compression then is applied to the fracture by placing tension on the plate and the remainder of the screws are inserted. The wound is closed in layers, using permanent suture to close the fascia lata. Postoperative immobilization was not performed in case of rigid fixation obtained. Partial weight bearing with crutches was permitted after early. callus or bony bridge appearance on the medial cortex comminution site.

CASE STUDIES

Case 1

A 65-year old male was injured in an automobile accident on Nov. 8 1980. He had type III-A subtrochanteric fracture of left femur. Approximately 10 days after injury, the patient was taken to open reduction and internal fixation with a condylar plate. Following intraoperative technical errors were found.

(1) Posterior protrusion of the blade portion of the plate. (2) Too short blade length and too low level of insertion point of the blade. (3) No screw fixation of the proximal fragment. So proximal fragment fixation was not secure.

One year following operation, he has full range of motion of the left hip joint, even though the blade was posteriorly protruding. The roentgenograms shown in Figure 1 reveals the status of the fracture prior to surgery and 12 months after surgery.

Case 2


Two weeks following injury, the patient was taken to surgery where open reduction and internal fixation of the subtrochanteric fracture was performed with a condylar plate. When he awake from general anesthesia, a new intraoperative fracture had developed through the last screw of the condylar plate. A compression plate was applied to the same femur with open reduction, internal fixation at the same time. At follow-up five months after operation, he had bone healing on the subtrochanteric fracture and also on the
Fig. 1. Case 1. a) A 65-year-old-man sustained Seinsheimer type III-A subtrochanteric fracture.
b) postoperative 1 year A-P film shows bony union inspite of too short blade length and inadequately proximal fragment fixation.
c) postoperative 1 year lateral film shows posterior protrusion of blade tip.
d) postoperative 1 year axial film shows solid bony union.
Fig 3. Case 3. a,b) A 68-year-old-man sustained type II-B subtrochanteric fracture.
   c) At postoperative 3 month, blade breakage occurred due to poor reduction and inadequate proximal fragment fixation.
   d) After plate removal, delayed union with coxa vara deformity ensued.

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live load the fracture site is under compression stress only. In practice, the tension-moment (Th) is smaller than the live-load moment (Pe). This is because in the proximal femur, the pre-load-moment arm (h) is approximately one-half the live-load moment (e) and to equalize the two moments, the preload (T) would have to equal twice the live load (2P). The preload (tension band) moment (Th) can be maximized by achieving medial bone contact thereby maximizing the tension-band moment arm (h). Also, the preload (tension band) moment (Th) can be maximized by good plate fixation so that the surgeon can prestress the system by applying maximum tension to plate, thereby making the preload (T) as large as possible. Live load (P) is lowered by external support.

In addition to maximizing the tension band moment, prestressing the assembly provides at least three more benefits. First, contact of the bone ends is ensured even when there is no live load, an effect considered to be beneficial for primary bone healing. Second, the compression force results in a frictional force that increases resistance to torsion. The further this resistance is acting from the plate, the greater the torsional stability of the structure, another reason for obtaining medial contact. Third, although elastic prestressing of the metal increases the average tensile stress on the metal the variation of stress between zero and full live load, such as occurs during walking, is smaller, the net result being beneficial to the fatigue of the metal. But in case of subtrochanteric fracture with medial cortex comminution or loss, prestressing is impossible, and the advantage of condylar plate fixation without prestressing technique is few.

A natural tension band exists in the proximal thigh in the form of the fascia lata. Durable fascia lata repair is desirable and approximation with interrupted permanent suture should accomplish this.

All of our suboptimal results using the compression blade plate technique can be attributed directly to technical errors. A technical error did not always lead to compromised result, however, the margin of safety must be presumed to have been diminished. The most common technical errors are in the placement of the blade, the usual malposition being posterior protrusion as in case 1: failure to gain control of the proximal fragment by not inserting the screws into the medial cortex as in case 1.3: failure to obtain the medial defect as in case 3.5: and failure to restore normal head-neck angle.

Compression fixation with a blade plate for subtrochanteric fracture is recommended primarily for those fractures confined to the subtrochanter region. These are the ones most likely to fail with conventional treatment. Currently, caution is counseled in the use of this technique for the treatment of subtrochanteric fracture. If the
Table 1. Subtrochanteric fractures

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Sex</th>
<th>Age (Yr.)</th>
<th>Fracture type</th>
<th>Technical error</th>
<th>Complications</th>
<th>Results</th>
<th>Radiologic union</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M</td>
<td>65</td>
<td>III A</td>
<td>Posterior protrusion of the blade. Short blade length</td>
<td>Healed</td>
<td>4 Months</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>30</td>
<td>III B</td>
<td>Intraoperative femoral Healed shaft fracture</td>
<td></td>
<td>5 Months</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>M</td>
<td>68</td>
<td>III B</td>
<td>Failure to obtain anatomical reduction</td>
<td>Metal fatigue fracture coxa vara</td>
<td>6 Months</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>M</td>
<td>55</td>
<td>IV A</td>
<td>Failure to obtain medial continuity</td>
<td>One screw loosening</td>
<td>Healed</td>
<td>8 Months</td>
</tr>
<tr>
<td>5</td>
<td>F</td>
<td>73</td>
<td>IV A</td>
<td>Failure to obtain medial continuity</td>
<td>Healed</td>
<td>6 Months</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>55</td>
<td>III A</td>
<td></td>
<td>Healed</td>
<td>3 Months</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>M</td>
<td>29</td>
<td>IV</td>
<td></td>
<td>Healed</td>
<td>5 Months</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>M</td>
<td>76</td>
<td>IV A</td>
<td></td>
<td>Healed</td>
<td>4 Months</td>
<td></td>
</tr>
</tbody>
</table>

fracture configuration is such that good medial contact can be obtained or if it is of the long spiral variety with minimal, if any, comminution then this procedure may be used with excellent results.

Finally, we agree with Campbell that no single operation may be applicable to all of the various subtrochanteric fracture patterns. Anatomical reduction and compression blade plate fixation is an effective method of treatment some of these fractures, especially those fresh fracture which do not extend into the trochanteric mass.

SUMMARY

Compression fixation with a blade plate was used in the treatment of fresh subtrochanteric fractures. Seven fractures united as fixed, one settled into varus with metal failure. The average Harris Hip Rating for eight patients was 85.

In each instance, technical errors accounted for suboptimal results. Compression fixation using condylar plate is designed for the treatment of the subtrochanteric fractures. Clinical details of the eight patients are summarized in table 1.

REFERENCES

9. Muller, M.E., Allgower, M., and Willeneger, H.


