NON-EXTENSILE SURGICAL APPROACHES FOR TWO-COLUMN ACETABULAR FRACTURES

CHRISTOPHER C. SCHMIDT, GARY S. GRUEN

From the University of Pittsburgh, USA

We reviewed the outcome, at a mean follow-up of 14 months, of 21 two-column fractures of the acetabulum treated by operation through one or two non-extensile approaches. Eighteen procedures resulted in reduction of the articular surfaces to within 3 mm. The blood loss and operating time when two combined non-extensile approaches were used were similar to those reported for extended acetabular approaches. The incidence of heterotopic ossification which limited joint motion was low, and the average Harris hip score was 81 points.

The use of non-extensile approaches for acetabular fractures in which both columns are involved avoids iatrogenic injury to the abductors, and reduces the incidence of complications.

Received 3 August 1992; Accepted 24 September 1992

The functional outcome after operation for a displaced acetabular fracture is related directly to the quality of the reduction (Pennal et al 1980; Hofmann, Dahl and Wyatt 1984; Heeg, Klasen and Visser 1990). Matta, Mehne and Roffi (1986) have shown that acetabular displacement greater than 3 mm reduces the chance of a satisfactory result and Letournel (1980) noted that a good articular reduction depended on restoration of the normal anatomy of the anterior and posterior columns.

A number of different surgical techniques have been described. The Kocher-Langenbeck and the iliinguinal approaches are non-extensile: they allow visualisation of the posterior or the anterior column respectively (Letournel and Judet 1981). Both provide exposure without detachment of the abductors from the ilium or the greater trochanter from the femur. Many acetabular fractures which need an operation, however, have displacement of both anterior and posterior columns and are commonly treated through an extensile exposure such as the extended iliofemoral, modified extended iliofemoral, or the triradiate approach. These expose both columns through a single incision (Letournel and Judet 1981; Mears and Rubash 1983; Reinert et al 1988) and were developed to treat either acute or longer standing acetabular fractures. The improved exposure is said to aid the reduction of displacement of both columns and to allow curettage of the early callus seen in fractures more than 14 days old (Letournel and Judet 1981; Mears and Rubash 1983; Matta and Merritt 1988; Mayo 1990).

The extensile approaches, however, do not provide complete exposure of the anterior column (Letournel 1980; Gruen, Mears and Cooperstein 1989; Mayo 1990), and they have a high complication rate (Bosse et al 1988; Matta and Merritt 1988; Reinert et al 1988). In many cases, the anterior column medial to the ilipectineal eminence cannot be exposed or stabilised from an extensile approach because of the location of the femoral nerve and the external iliac vessels (Gruen et al 1989; Mayo 1990). The extended iliofemoral approach causes some devitalisation of the abductors, and may also lead to skin flap necrosis (Reinert et al 1988; Juliano, Edwards and Bosse 1992). Extensile approaches are also associated with a high incidence of symptomatic heterotopic ossification (Bosse et al 1988; Matta and Merritt 1988) for which prophylactic irradiation has been recommended.

Since August 1989, we have used either the Kocher-Langenbeck, or the iliinguinal or both approaches together, rather than the extended iliofemoral or triradiate exposures, to expose two-column acetabular fractures.

We believe that these incisions provide the necessary exposure, and avoid the limitations and complications associated with an extensile approach. We have evaluated our early results for acetabular fractures involving two columns, including the transverse, transverse/posterior wall, anterior column/posterior hemitransverse, T-type and both-column fractures of Judet, Judet and Letournel (1964).

PATIENTS AND METHODS

We reviewed retrospectively the management of 55 closed acetabular fractures seen consecutively at our regional trauma centre from August 1989 to June 1991.

C. C. Schmidt, MD, Research Fellow
G. S. Gruen, MD, Assistant Professor, Chief of Orthopaedic Trauma Department of Orthopaedic Surgery, University of Pittsburgh, 3471 Fifth Avenue, Suite 1010, Pittsburgh, Pennsylvania 15213, USA.

Correspondence should be sent to Dr G. S. Gruen.

©1993 British Editorial Society of Bone and Joint Surgery
0301-620X/93/4556 $2.00

THE JOURNAL OF BONE AND JOINT SURGERY
incision alone was used for transverse/posterior wall and T-type acetabular fractures with posterior displacement. The ilioinguinal approach alone was used for anterior column/posterior hemitransverse, transverse, and transverse/posterior wall fractures in which the CT scan showed no fragments in the joint and less than 40% loss of the posterior wall. The ilioinguinal approach was also used for both-column fractures with no significant comminution of the posterior column. A combined approach, using both incisions, was used for transverse/posterior wall, transverse, and both-column fractures in which there was comminution or displacement of both columns which could not be reduced through one approach.

**Assessment.** Postoperatively, an anteroposterior and two Judet oblique views were obtained. Original and residual fracture displacement was measured at the subchondral bone level (Matta et al 1986) (Fig. 2), and note was made of associated injuries, operative time, blood loss and complications. At later review, from 9 to 29 months (mean 14), follow-up radiographs were taken and the Harris hip score (Harris 1969) determined. One patient was pregnant and had no follow-up radiograph. Heterotopic ossification was classified according to Brooker et al (1973) and Matta et al (1986).

**RESULTS**

Case 13 is illustrated in Figure 3. Table I shows the age, sex, ISS, fracture type, displacement, follow-up, Brooker score, and Harris hip score for each patient. The

---

**RESULTS**

Case 18. An obturator view of the left acetabulum showing a transverse acetabular fracture, 15 days after a road-traffic accident. Fracture displacement at the subchondral level was measured as 10 mm.

**Surgical approaches** (Fig. 1). The selection of approach was based on the fracture pattern. A *Kocher-Langenbeck*
Case 13. A 24-year-old man with a both-column fracture. Figure 3a - The anteroposterior radiograph shows displacement of the articular surface (white arrow). The black arrow marks the extension of the fracture into the iliac wing. Figure 3b - A three-dimensional iliac oblique CT scan shows disruption of both anterior and posterior columns.
postoperative radiographic results demonstrated that reduction of the subchondral bone was to 3 mm or less in 18 of the 21 (86%) patients. The Harris hip score was excellent in eight patients (38%), good in four (19%), fair in four (19%) and poor in five (24%). The average score was 81 points. Four patients with satisfactory reduction had Harris hip scores of under 70 points, mainly because of persisting pain. This, despite adequate reduction, may be due to irreversible damage to the articular surface at the time of injury.

Seven patients had Brooker III or IV heterotopic ossification. Two of these patients (9% of the study population) developed more than 20% limitation of hip motion. One of these also developed avascular necrosis.
of the femoral head, after a transverse posterior wall fracture-dislocation and a Kocher-Langenbeck approach.

Table II illustrates the mean blood loss and operating times for the three types of non-extensile approaches.

**Complications.** In three patients there were urinary-tract infections, all of which resolved with antibiotics. One patient had a delayed wound infection after a Kocher-Langenbeck approach and fixation of a trochanteric fracture, eventually requiring a Girdlestone procedure. There were no postoperative neurological complications and no other wound infections.

**DISCUSSION**

The non-extensile approaches which we advocate have operating times and average blood losses which are similar to those reported by others (Matta et al 1986; Goulet and Bray 1988; Reinert et al 1988; Routt and Swiontkowski 1990; Helfet et al 1992). In this series, we had no problems with skin flap or muscle necrosis. Skin and muscle necrosis have been reported as potential complication of extensile approaches (Reinert et al 1988; Juliano et al 1992). Reduction to within 3 mm was achieved in 86% of the patients without osteotomy of the greater trochanter, as against reported rates of 81% to 94% using extensile approaches for complex fractures (Hofmann et al 1984; Goulet and Bray 1988; Matta and Merritt 1988).

Two of our patients (9%) with heterotopic bone of Brooker grade III or IV lost more than 20% of hip

---

**Table I.** Details of 21 patients with two-column acetabular fractures

<table>
<thead>
<tr>
<th>Case</th>
<th>Age (yr)</th>
<th>Sex</th>
<th>Injury severity score</th>
<th>Fracture type*</th>
<th>Approach†</th>
<th>Displacement (mm) Preoperative</th>
<th>Postoperative</th>
<th>Follow-up (mth)</th>
<th>Brooker score</th>
<th>Harris hip score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>44</td>
<td>M</td>
<td>18</td>
<td>Tv/PW</td>
<td>K</td>
<td>1</td>
<td>0</td>
<td>18</td>
<td>II</td>
<td>91</td>
</tr>
<tr>
<td>2</td>
<td>26</td>
<td>M</td>
<td>29</td>
<td>Tv/PW</td>
<td>I</td>
<td>4</td>
<td>2</td>
<td>18</td>
<td>III</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>68</td>
<td>F</td>
<td>10</td>
<td>Tv/PW</td>
<td>K</td>
<td>6</td>
<td>2</td>
<td>15</td>
<td>III</td>
<td>88</td>
</tr>
<tr>
<td>4</td>
<td>34</td>
<td>F</td>
<td>13</td>
<td>Tv/PW</td>
<td>K</td>
<td>6</td>
<td>0</td>
<td>13</td>
<td>III</td>
<td>67</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td>F</td>
<td>10</td>
<td>Tv/PW</td>
<td>K</td>
<td>3</td>
<td>2</td>
<td>13</td>
<td>†</td>
<td>96</td>
</tr>
<tr>
<td>6</td>
<td>70</td>
<td>M</td>
<td>29</td>
<td>Tv/PW</td>
<td>K</td>
<td>13</td>
<td>0</td>
<td>11</td>
<td>III</td>
<td>64</td>
</tr>
<tr>
<td>7</td>
<td>42</td>
<td>M</td>
<td>9</td>
<td>Tv/PW</td>
<td>C</td>
<td>10</td>
<td>1</td>
<td>10</td>
<td>I</td>
<td>85</td>
</tr>
<tr>
<td>8</td>
<td>46</td>
<td>F</td>
<td>17</td>
<td>Tv/PW</td>
<td>K</td>
<td>4</td>
<td>0</td>
<td>9</td>
<td>I</td>
<td>63</td>
</tr>
<tr>
<td>9</td>
<td>27</td>
<td>M</td>
<td>11</td>
<td>Tv/PW</td>
<td>K</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>O</td>
<td>84</td>
</tr>
<tr>
<td>10</td>
<td>30</td>
<td>F</td>
<td>14</td>
<td>BC</td>
<td>I</td>
<td>38</td>
<td>3</td>
<td>21</td>
<td>I</td>
<td>71</td>
</tr>
<tr>
<td>11</td>
<td>34</td>
<td>M</td>
<td>27</td>
<td>BC</td>
<td>C</td>
<td>13</td>
<td>4</td>
<td>15</td>
<td>III</td>
<td>89</td>
</tr>
<tr>
<td>12</td>
<td>26</td>
<td>F</td>
<td>22</td>
<td>BC</td>
<td>C</td>
<td>13</td>
<td>2</td>
<td>12</td>
<td>I</td>
<td>68</td>
</tr>
<tr>
<td>13</td>
<td>24</td>
<td>M</td>
<td>9</td>
<td>BC</td>
<td>C</td>
<td>12</td>
<td>2</td>
<td>11</td>
<td>II</td>
<td>79</td>
</tr>
<tr>
<td>14</td>
<td>39</td>
<td>M</td>
<td>34</td>
<td>BC</td>
<td>C</td>
<td>32</td>
<td>6</td>
<td>10</td>
<td>IV</td>
<td>73</td>
</tr>
<tr>
<td>15</td>
<td>74</td>
<td>M</td>
<td>10</td>
<td>BC</td>
<td>C</td>
<td>11</td>
<td>1</td>
<td>10</td>
<td>II</td>
<td>90</td>
</tr>
<tr>
<td>16</td>
<td>33</td>
<td>M</td>
<td>27</td>
<td>Tv</td>
<td>I</td>
<td>5</td>
<td>2</td>
<td>20</td>
<td>I</td>
<td>94</td>
</tr>
<tr>
<td>17</td>
<td>30</td>
<td>M</td>
<td>22</td>
<td>Tv</td>
<td>C</td>
<td>21</td>
<td>2</td>
<td>18</td>
<td>II</td>
<td>90</td>
</tr>
<tr>
<td>18</td>
<td>18</td>
<td>F</td>
<td>19</td>
<td>Tv</td>
<td>C</td>
<td>10</td>
<td>2</td>
<td>15</td>
<td>II</td>
<td>95</td>
</tr>
<tr>
<td>19</td>
<td>22</td>
<td>F</td>
<td>17</td>
<td>Tv</td>
<td>I</td>
<td>26</td>
<td>2</td>
<td>14</td>
<td>II</td>
<td>73</td>
</tr>
<tr>
<td>20</td>
<td>16</td>
<td>M</td>
<td>10</td>
<td>T</td>
<td>K</td>
<td>54</td>
<td>4</td>
<td>21</td>
<td>III</td>
<td>54</td>
</tr>
<tr>
<td>21</td>
<td>16</td>
<td>M</td>
<td>14</td>
<td>A/HTv</td>
<td>I</td>
<td>4</td>
<td>0</td>
<td>12</td>
<td>II</td>
<td>91</td>
</tr>
</tbody>
</table>

* Tv = transverse; PW = posterior wall; BC = both column; T = T type; A/HTv = anterior column/hemitransverse
† K = Kocher-Langenbeck; C = combined; I = ilioinguinal
‡ follow-up radiograph not taken because of pregnancy

**Table II.** Mean operating times and mean blood loss for each approach

<table>
<thead>
<tr>
<th>Approach</th>
<th>Mean blood loss (ml)</th>
<th>Mean operating time (h : m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kocher-Langenbeck</td>
<td>1341</td>
<td>3 : 49</td>
</tr>
<tr>
<td>Iliinguinal</td>
<td>960</td>
<td>4 : 01</td>
</tr>
<tr>
<td>Combined</td>
<td>2269</td>
<td>6 : 16</td>
</tr>
</tbody>
</table>
motion, much the same incidence as that found by Routt and Swiontkowski (1990), who also used combined nonextensive approaches. In neither series was routine prophylaxis employed, but the incidence in both was less than that for the extensile approaches. Bosse et al (1988) used an extended or modified extended iliolumbar approach, and reported a 50% incidence of Brooker III and IV heterotopic ossification, with 30% of these groups having ankylosis of the hip. Matta (1992), using an extended iliolumbar approach, reported a 12% incidence of disabling heterotopic ossification. Because of other variables such as head injury, soft-tissue trauma and timing of surgery, it is impossible to draw firm conclusions about the association between the approach and subsequent heterotopic ossification, but our results suggest that a non-extensile approach decreases the risk of disabling changes.

In our series the average Harris hip score was 81 points and 57% had good or excellent results. Hofmann et al (1984) using either a non-extensile or extensile approach noted an average Harris hip score of 90 points. Heeg et al (1990) and Helfet et al (1992) reported 86% and 88% good or excellent results using a single non-extensile approach. These authors, however, included single-wall or one-column fractures in their series. Heeg et al (1990) had 44% posterior wall fractures, which are usually associated with a good functional outcome (Letournel 1980). We have observed that articular cartilage injury is often more severe in two-column fractures. Despite this we have shown that good or excellent functional outcomes can be achieved by the use of non-extensile approaches for operation on these displaced fractures.

Conclusions. The use of non-extensile approaches decreases the iatrogenic trauma to skin and muscle and the amount of heterotopic ossification. We recommend the use of one or two non-extensile approaches in the treatment of acute acetabular fractures, whatever their complexity.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES


Letournel E, Judet R. Fractures of the acetabulum. Translated and edited by Elson RA. Berlin, etc: Springer Verlag, 1981.


Mayo KA. Surgical approaches to the acetabulum. Techniques in Orthopaedics 1990; 4:24-35.


