Painful nonunion after triple pelvic osteotomy

REPORT OF FIVE CASES

C. Tschauner, A. Sylkin, S. Hofmann, R. Graf
From Orthopädische Abteilung, Stolzalpe, Austria

Tönnis triple pelvic osteotomy is an accepted technique to correct acetabular dysplasia and degenerative labral pathology. A series of 409 consecutive patients who underwent a triple pelvic osteotomy between 1987 and 1999 were followed for a mean of 7.1 years (2 to 15). Five patients (1.2%), all women, developed a double nonunion and required revision, which involved excision of the pseudarthrosis, autologous bone grafting and osteosynthesis with screws or reconstruction plates. Bony healing was achieved in all after a mean of 7.8 months.

Patients and Methods

A total of 409 consecutive TPOs were undertaken between 1987 and 1999. There were 341 women and 68 men with a mean age of 25.7 years (10 to 51). There were 209 left and 200 right hips; 73 had previously undergone an intertrochanteric osteotomy and 49 underwent combined osteotomies of the femur and acetabulum. The mean follow-up was 7.1 years (2 to 15). No patient was lost to follow-up. The number of patients who smoked was not recorded.

TPO was carried out as described by Tönnis et al. This involved three separate skin incisions, ischial osteotomy from a posterior approach in the lateral position and pubic and iliac osteotomies from an anterior approach in the supine position, with iliac osteosynthesis using between three and five AO stainless steel screws. The pubic and ischial osteotomies were not fixed.

Routine postoperative mobilisation, without bracing or casting, included non-weight-bearing for eight weeks, and partial to full weight-bearing during a further eight weeks. The screws were routinely removed after remodelling of the osteotomy at about one year after operation.

Clinical evaluation before revision surgery included a record of the Harris hip score (HHS). The main symptom of nonunion was pain on walking. The pain was characteristically diffuse, affecting the pelvic and gluteal regions, and different from the groin pain, which they had experienced before the primary surgery. None had pain at rest.

Radiological assessment before revision surgery included standard anteroposterior (AP) and false profile views. Dysplasia was graded according to Lequesne and Seze and Tönnis. The five patients with symptomatic double nonunions presented with persistent iliac and pubic nonunion either with (case 1), or without (cases 3, 4 and 5; Fig. 1), a secondary stress fracture of the inferior pubic ramus or with delayed union of the osteotomies and a stress fracture of the pubic ramus which did not unite spontaneously (case 2). Additional CT scans assisted with the planning of the revision surgery.

The final decision about proceeding to revision surgery was always made after extensive evaluation, informing the
Table I. Pre- and post-revision data for the five women who underwent revision surgery for painful nonunions after TPO

<table>
<thead>
<tr>
<th>Case</th>
<th>Age at primary surgery (yrs)</th>
<th>Loss of bony contact</th>
<th>Interval between primary surgery and revision (mths)</th>
<th>Grade of dysplasia Before primary surgery</th>
<th>Grade of dysplasia Post-revision</th>
<th>Grade of osteoarthritis HHS</th>
<th>Time to bony healing (mths)</th>
<th>Follow-up (mths)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>Partial pubis</td>
<td>20</td>
<td>3</td>
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<td>1</td>
<td>39</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>No</td>
<td>30</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>58</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>31</td>
<td>Total pubis</td>
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<td>2</td>
<td>1</td>
<td>1</td>
<td>34</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
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<td>Partial pubis</td>
<td>9</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>44</td>
<td>37</td>
</tr>
<tr>
<td>5</td>
<td>36</td>
<td>No</td>
<td>14</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>53</td>
<td>6</td>
</tr>
<tr>
<td>Mean</td>
<td>27.2</td>
<td></td>
<td>19.4</td>
<td>3.2</td>
<td>1.2</td>
<td>1.2</td>
<td>45.6</td>
<td>7.8</td>
</tr>
</tbody>
</table>

Fig. 1

Radiographs of a 31-year-old woman (case 3). a) Preoperatively, showing lost bony contact at the pubic osteotomy. Postoperatively with b) the AP view and c) the false profile showing osteosynthesis of the pubic and ischial osteotomies and a screw at the site of iliac bone harvest. d) Radiograph showing healing of the osteotomies.
patient about possible neurovascular complications and obtaining carefully informed consent.

**Revision surgery and postoperative treatment.** The non-unions were exposed through the original incisions. Care was taken to avoid traction to nerves and vessels. The pseudarthrosis was excised and an autologous block of iliac bone graft interposed. The ischium was fixed with a long cannulated lag screw and the pubis with a reconstruction plate and screws (cases 1, 2, 4 and 5) or a long axial screw (case 3), depending on the individual case (Fig. 1).

Patients remained on bed rest until the wounds healed. They were then mobilised non-weight-bearing for eight weeks. Weight-bearing was then gradually increased to full by six months postoperatively, when there was radiological evidence of bony union. Radiographs were routinely taken at eight, 16 and 24 weeks postoperatively.

**Results**

**Clinical and radiological outcome.** The clinical and radiological results after a mean of 31.6 months (24 to 41) are summarised in Table I. All nonunions healed and there was radiological evidence of healing at a mean of 7.8 months (6 to 12) after operation. The HHS at follow-up was excellent or good in four patients, but, despite bony healing, poor (6 to 12) after operation. The HHS at follow-up was excellent or good in four patients, but, despite bony healing, poor (6 to 12) after operation. The HHS at follow-up was excellent or good in four patients, but, despite bony healing, poor (6 to 12) after operation.

Based on our study of 409 TPOs, five (1.2%) of which developed double nonunion and required revision, we would make the following recommendations.

First, adequate bony contact should be ensured at all three osteotomy sites even when extensive rotational corrections are undertaken. Secondly, two or three cannulated titanium screws should be used to stabilise the iliac osteotomy. Thirdly, a long mediolateral screw should be used to stabilise the pubic osteotomy until bony union, particularly when there is poor bony contact. Finally, patients should not sit on the ipsilateral ischial tuberosity for six weeks postoperatively, and they should be informed that smoking is a risk factor and might compromise bony healing. In our view, TPO is a reliable procedure with a low revision rate.

**Discussion**

There is little information about the incidence of symptomatic nonunion after Tönnis TPO. There is functional anatomical evidence to suggest that load is vertically transferred in a sitting person from the ischial tuberosity to the sacroiliac joint and that the vertical compressive forces from the ischial tuberosity act as shear forces at the oblique ischial osteotomy, which in TPO is not routinely fixed. Additionally, during the postoperative period, the forces which are transmitted across the symphysis deform the inferior pubic ramus. This combination of a shearing force at the ischial osteotomy and a deforming force at the inferior pubic ramus increases micromovement at the sites of the ischial and pubic osteotomies which may lead to nonunion or stress fractures. This mechanism of increased movement as a potential cause of double nonunion could, theoretically, be avoided by leaving the posterior column intact, such as in the Bernese periacetabular osteotomy.

There is some evidence that smoking might be a factor for delayed union, as reported by Kalchschmidt (personal communication, 2001). Moller et al have recently described the importance of smoking as a risk factor for the development of complications after elective orthopaedic surgery.