LATE RESULTS OF TRANSFER OF THE TIBIAL TUBERCLE FOR RECURRENT DISLOCATION OF THE PATELLA

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The authors wished to determine the late results of the Hauser operation, with special reference to the development of osteoarthritis. Predisposing factors associated with recurrent dislocation of the patella were also investigated.

Thirty-five patients with forty-four surgically treated knees attended for review, ten to twenty-five (average sixteen) years after operation. Two patients had subsequently undergone excision of the patella. Ten patients gave a family history of recurrent dislocation of the patella and seven patients showed generalised joint laxity.

Pain was present in eight knees before operation and was present in thirty-three knees (75 per cent) at the time of review. Patellar crepitus was present in thirty-seven out of forty-two knees (88 per cent) at review. Osteoarthritis was present in thirty out of forty-two knees (70 per cent). The incidence increases with time since operation and the present age of the patient.

It is concluded that the Hauser operation prevents further dislocation but does not prevent the development of osteoarthritis. It is possible that a simple soft-tissue operation which effectively prevents dislocation might achieve the same results.

Of the many operations devised for recurrent dislocation of the patella, transposition of the tibial tubercle with lateral release and medial plication (Hauser 1938) remains probably the most widely used. It is accepted by many authors that this operation is successful in preventing further dislocation, though there has been no survey based on follow-up for more than ten years. Harrison (1955) suggested, on very limited evidence, that repositioning of the patella might halt or even reverse the degenerative process, a claim that was supported by Heywood (1961), Bowker and Thompson (1964) and Hughston (1968). In contrast Macnab (1952) believed that once degenerative change had occurred only patellectomy would prevent progressive osteoarthritis.

The principal aim of this study, therefore, was to determine the late results of the operation, with special reference to the development of osteoarthritis. Predisposing factors associated with recurrent dislocation of the patella were also investigated.

CLINICAL MATERIAL

The documents were available of fifty-two patients whose clinical records clearly confirmed treatment by a Hauser operation more than ten years previously. From this total, thirty-five patients, with forty-four surgically treated knees, attended for review. The average time since operation was sixteen years, the range being from ten to twenty-five years (Fig. 1). The age at the first dislocation averaged fourteen years and varied from three to forty-three years (Fig. 2). The interval from first dislocation to operation varied from less than one year to twenty-six years, and averaged six years (Fig. 3). The age at operation ranged from twelve to forty-six years with an average of twenty-one years (Fig. 4). Table I shows that this clinical material is similar to that reviewed by previous authors.


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VOL. 57-B, No. 2, MAY 1975
METHOD OF ASSESSMENT

At interview the patients were questioned about any family history of recurrent dislocation of the patella. Their symptoms were determined, particular attention being paid to: 1) pain in the knee (apart from that associated with actual dislocation); 2) the frequency and total number of dislocations; and 3) the extent of instability or giving way without actual dislocation. The replies were graded and compared with the symptoms as recollected before operation. In most instances the latter differed little from those recorded in the hospital notes.

At the clinical examination particular note was made of retro-patellar crepitus, patellar laxity and genu valgum. The patient's ability to stand unsupported on the semi-flexed knee was checked. An assessment of generalised hypermobility involved examining the knees, thumbs, fingers, elbows and ankles, as described by Carter and Wilkinson (1964). Three abnormally mobile joints were taken as evidence of generalised joint laxity.

Radiographs were taken of both knees and included tangential views of the patello-femoral joint in 40 degrees of flexion (Macnab 1952) in order to assess patello-femoral arthritis. The findings were graded as mild, moderate or severe (Table II). Finally, downward and medial displacement of the patella was measured from the radiographs in the thirty-five cases in which a unilateral operation allowed comparison with the opposite knee (Figs. 5 and 6).

RESULTS

Predisposing factors—Ten patients gave a family history of recurrent dislocation of the patella, six of these having more than one relative affected. A strong familial

![Fig. 3](image-url)

**FIG. 3**
The time interval between onset of dislocations and operation.

![Fig. 4](image-url)

**FIG. 4**
The age distribution at time of operation.

<table>
<thead>
<tr>
<th>Author</th>
<th>Number of patients</th>
<th>Number of knees</th>
<th>Male</th>
<th>Female</th>
<th>Bilateral</th>
<th>Hyper-mobile patella</th>
<th>Generalised hypermobility</th>
<th>Number of patients with a family history</th>
<th>Age at first dislocation</th>
<th>Interval from onset to operation (years)</th>
<th>Number of knees reviewed over 10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bowker and Thompson</td>
<td>48</td>
<td>65</td>
<td>12</td>
<td>36</td>
<td>17</td>
<td>32 out of 47</td>
<td>5 out of 10</td>
<td>12 out of 25</td>
<td>3–50</td>
<td>0 to 46</td>
<td>7</td>
</tr>
<tr>
<td>Hampson and Hill</td>
<td>35</td>
<td>44</td>
<td>13</td>
<td>22</td>
<td>9</td>
<td>25 out of 42</td>
<td>7 out of 20</td>
<td>10 out of 35</td>
<td>3–43</td>
<td>0 to 26</td>
<td>44</td>
</tr>
<tr>
<td>Harrison</td>
<td>26</td>
<td>30</td>
<td>Not stated</td>
<td>14</td>
<td>Not stated</td>
<td>Not stated</td>
<td>Not stated</td>
<td>Not stated</td>
<td>3–34</td>
<td>2 to 20</td>
<td>Average 15</td>
</tr>
<tr>
<td>Heywood</td>
<td>76</td>
<td>90</td>
<td>Not stated</td>
<td>14</td>
<td>16</td>
<td>Not stated</td>
<td>Not stated</td>
<td>Not stated</td>
<td>3–36</td>
<td>Average 14</td>
<td>Not stated</td>
</tr>
<tr>
<td>Macnab</td>
<td>46</td>
<td>64</td>
<td>6</td>
<td>40</td>
<td>18</td>
<td>Not stated</td>
<td>Not stated</td>
<td>Not stated</td>
<td>3–21</td>
<td>Average 7</td>
<td>10 (Over 8 years)</td>
</tr>
</tbody>
</table>

1 Some cases reported by other authors were not treated by Hauser operations.
incidence as noted by Bowker and Thompson (1964) (Table I) is therefore confirmed. Seven patients had generalised joint laxity, confirming the findings of Heywood (1961) and of Bowker and Thompson (1964) (Table I). Only one of the patients with generalised joint laxity had a family history of recurrent dislocation of the patella.

**TABLE II**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Clinical features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil</td>
<td>Normal knee joint</td>
</tr>
<tr>
<td>Mild</td>
<td>Minor osteophyte formation and/or slight reduction in cartilage space</td>
</tr>
<tr>
<td>Moderate</td>
<td>Marked loss of cartilage space, but without collapse of subchondral bone</td>
</tr>
<tr>
<td>Severe</td>
<td>Gross osteoarthritis</td>
</tr>
</tbody>
</table>

The only examples of genu valgum were in two patients with gross osteoarthritis. The importance of this factor in the pathogenesis of recurrent dislocation of the patella may therefore have been over-emphasised. **Subjective assessment**—Pain in the knees as recollected before operation and at time of review is compared in Figure 7. It can be seen that whereas only eight knees gave mild or moderate pain before operation, thirty-three knees (75 per cent) were painful at the time of review; in two cases this pain was severe. The eight knees giving pain before operation did not show any greater incidence of osteoarthritis at review than did the other knees in this small series.

A feeling of insecurity, or episodes of giving way, as remembered before operation and again at review, are graded and compared in Figure 8. It can be seen that operation did not significantly affect these symptoms.

Dislocation had recurred in only one knee out of the forty-four. **Objective assessment**—Only forty-two knees were available for analysis at the time of this study because the patella had been subsequently excised in two patients, in one for severe pain and in the other for recurrent dislocation. Retro-patellar crepitus was present in thirty-seven knees (88 per cent), being of moderate intensity in twelve and severe in two. Kneeling was uncomfortable in seventeen of the knees operated upon (as against three of the twenty-six not operated upon). Six patients could not stand unsupported on the semi-flexed knee. **Radiological assessment**—Radiographs showed osteoarthritis in thirty out of the forty-two knees (70 per cent). There was patello-femoral arthritis in thirty knees, moderate in four and severe in two. Osteoarthritis of the tibio-femoral compartment was present in twenty knees, moderate in two and severe in one. In five knees tibio-femoral arthritis predominated, but in the remaining twenty-five knees patello-femoral arthritis was the more severe. The incidence of osteoarthritis in relation to the present age of the patient is shown in Figure 9. It can be seen that the proportion of degenerate joints increases from five out of fifteen knees under thirty years to eleven out of thirteen over the age of forty. All eight moderate or severe examples of osteoarthritis are included in the latter group.

Figure 5—A line is drawn upwards from the lateral articular margin of the tibia, perpendicular to the tibial plateau. From this reference line the medial displacement of the patella in the surgically treated knee is determined by comparison with the patellar position in the knee not operated upon. Figure 6—Downward displacement of the patella is determined by comparing the distance between the lower border of the articular surface of the patella and the tibial plateau in the knee not operated upon and that in the knee operated upon, the radiographs being taken with both knees flexed to 40 degrees.
Pain before Operation
Pain at Review

36
11
6
2
6
2

0

Grade 0 = No Pain
Grade 1 = Mild Pain
Grade 2 = Moderate Pain
Grade 3 = Severe Pain

Grade 0 = No Instability
Grade 1 = Insecurity or Occasional Giving Way (< Once/Month)
Grade 2 = Giving Way (> Once/Month)
Grade 3 = Giving Way (> Once/Week)

Number of Knees

Fig. 7
The grading of pain as recollected before operation and at time of review.

Fig. 8
The distribution of insecurity or episodes of "giving way" as recollected before operation and at time of review.

Fig. 9
The incidence of osteoarthritis compared with the patient's age at time of review.

Fig. 10
The incidence of osteoarthritis in knees reviewed less than sixteen years after operation and in those reviewed at sixteen years and later.
The incidence of osteoarthritis in relation to time since operation is shown in Figure 10. While only half of the patients seen less than sixteen years after operation had osteoarthritis, nearly all patients reviewed at sixteen years and later were affected.

Medial displacement of the patella ranged from 0·2 to 3·2 centimetres with a median distance of 1·1 centimetres. Downward displacement ranged from 0·2 to 2·8 centimetres, with a median distance of 1·0 centimetre.

DISCUSSION
The most striking finding of this long-term study is the clinical and radiological evidence of progressive degeneration of the knee joint after operation and with increasing age of the patient. We are therefore unable to support the suggestion of Harrison (1955), Heywood (1961), Bowker and Thompson (1964) and Hughston (1968) that Hauser operations prevent or slow down degeneration.

We do not consider that these authors have a sufficient number of long-term results on which to support their argument. Moreover, the limited long-term findings appear to suggest deterioration of function of the knee. Harrison (1955) stated that six out of ten knees operated on more than ten years before review gave discomfort or an ache, while Heywood (1961) reported eight out of seventeen knees with unsatisfactory results ten years and more after operation.

On the other hand, in our series, neither the frequency of dislocation before operation nor degree of patellar displacement achieved at operation appeared to influence the long-term results.

The associated generalised joint laxity might suggest that these are dysplastic joints in which patellar dislocation highlights one feature of a generalised condition. The significance of a strong familial tendency to recurrent dislocation with or without generalised joint laxity (Carter and Sweetnam 1958), needs further study.

The authors wish to thank the surgeons of Harlow Wood and Winford Orthopaedic Hospitals for permission to include their cases, and in particular Mr W. Waugh who first suggested this study to us. We are also indebted to Mr A. H. C. Ratliff for advice and encouragement during the preparation of this paper.

REFERENCES