THIGH PAIN AFTER CEMENTLESS HIP ARTHROPLASTY

ANNOYANCE OR ILL Omen

A. C. L. Campbell, C. H. Rorabeck, R. B. Bourne, D. Chess, L. Nott

From University Hospital, London, Ontario

A retrospective review of 148 consecutive porous-coated hip arthroplasties (PCA) showed an incidence of thigh pain of 13% one year after surgery, and 22% at two years. Positive correlations were made with femoral stem subsidence ( > 2 mm) and with distal periosteal and endosteal bone formation. No positive correlations were made with parameters of bone quality or component fit. Resolution of pain occurred in one-third and an anti-inflammatory agent produced partial relief in two-thirds of the patients. We conclude that thigh pain is secondary to stem instability with distal stress transfer in the absence of stable proximal fixation.

The aims of total arthroplasty of the hip are to relieve pain, to reduce disability, and to correct deformity. Cemented arthroplasties have been very successful in the short and intermediate term but the incidence of recurrence of pain and disability, usually secondary to loosening at the prosthesis-cement or cement-bone junction, has led to further developments. New techniques of cementing have given a significant improvement (Miller et al 1978; Ling 1980; Bourne, Oh and Harris 1984; Harris and McGann 1986; Russotti, Coventry and Stauffer 1988), but other investigators have cited cement as the main cause of late problems. Cementless arthroplasty has therefore become popular and the stable direct fixation of a metal prosthesis to bone has been demonstrated in the laboratory (Galante et al 1971; Pilliar, Cameron and Macnab 1975; Bobyn et al 1980; Hedley et al 1982). We have recently compared two otherwise similar populations of cemented and cementless total hip arthroplasties and found that a ‘unique’ symptom of ‘thigh pain’ was experienced only by the second group (Bourne et al 1991). Similar thigh symptoms have been described previously in association with loose cemented femoral stems, and also as an early but benign and self-limiting complication of cementless hip arthroplasty (Hedley et al 1987).

Our retrospective study therefore aimed to determine the incidence, severity and temporal distribution of this symptom in a consecutive series of cementless hip arthroplasties, and to discuss causative factors, natural history and conservative management. Our working hypothesis was that this type of thigh pain is a sign of implant instability and thus of failure of biological fixation. We recorded any discomfort perceived in the thigh, excluding other causes such as pain secondary to trochanteric bursitis or pain referred from the lumbar spine. In almost all cases this pain was of the ‘start-up’ type, related to the onset of walking, stair-climbing or getting out of a chair. It usually eased, partially or completely, after a few steps.

PATIENTS AND METHODS

We reviewed all patients who had undergone PCA hip arthroplasties (porous coated anatomic; Howmedica, Rutherford, New Jersey) over 18 months from May 1984. Two groups of patients were excluded: first, those with diagnoses that might have influenced biological integration or bone remodelling such as rheumatoid arthritis, steroid treatment, avascular necrosis, Paget's disease, osteomalacia, or ankylosing spondylitis; and secondly, those with deformity of the proximal femur that might have prevented an optimal press fit, in such conditions as congenital dislocation of the hip, previous fracture or osteotomy, or hip dysplasia.

All the arthroplasties were performed by or under the direct supervision of one of the two senior authors (CHR, RBB) in a vertical-laminar-flow operating room used exclusively for joint replacement surgery. The operating team wore body exhaust suits. Routine prophylaxis with cephalosporin or vancomycin and either enteric-coated aspirin or Warfarin was provided; subcutaneous heparin was not used.

We performed the operations in an identical manner using a direct lateral approach (Hardinge 1982). The proximal femur was prepared in accordance with the guidelines laid down by the manufacturers of the prosthesis, aiming at maximal metaphyseal fill. An adequate press fit was thought to have been achieved in
all cases. Postoperative rehabilitation was the same for all patients: walking with a frame was followed by 50% weight-bearing on crutches for six weeks, after which full weight-bearing was allowed.

All patients were reviewed after operation, for up to two years. Clinical review included an interview and examination by an orthopaedic research nurse (LN) and one of the attending surgeons (CHR or RBB). Thigh pain was assessed on a 10-point visual analogue scale and modified Harris hip scoring was completed. Radiographs, standardised for exposure, magnification and joint position, were taken at each visit and assessed by two observers blinded to the clinical result, but reaching an agreed decision. Migration was referenced to the tip of the greater trochanter and the position of the stem to the longitudinal axis of the femur. Changes in the proximal femoral bone in relation to the stem of the prosthesis were evaluated on the anteroposterior radiograph only, using the seven zones described by Amstutz et al (1976).

RESULTS

Of 148 consecutive PCA arthroplasties, 23 were excluded for the reasons discussed above regarding osteoblastic potential or anatomical variation. Another 13 patients were excluded because data were incomplete, usually missing radiographs. One patient died from unrelated causes, and one arthroplasty failed, requiring revision before the second anniversary of the primary procedure. The one-year data for this patient were included. This left 111 patients at one-year and 110 at two-year follow-up.

The mean age of these patients was 61 years (26 to 81); 44 were women and 67 were men. Left- and right-sided replacements were about equal in number.

Thigh pain. No patient complained of the typical thigh pain at six weeks, three months or six months after arthroplasty, possibly because it was masked by coexisting pain from the recent operation or muscle strain. Thirty patients (27%), however, had some thigh pain of variable severity and duration during the two-year follow-up (Table I).

Fourteen (13%) developed thigh pain between six and 12 months: 12 rated this discomfort as mild (1 to 3 on the visual analogue scale), one as moderate (4 to 6), and one patient had severe pain (7 to 10). Of these 14 patients five had complete relief by the two-year review, three had only partial amelioration, two reported no change, and in three the pain had increased in severity. One patient had a revision arthroplasty for gross aseptic loosening of the femoral stem.

At the two-year review, in addition to the eight patients from the earlier survey who were still experiencing thigh pain of variable intensity, 16 reported typical thigh pain. In these 24 patients the pain was mild in 13, moderate in nine, and severe in two. Thus, there was a trend towards more severe pain.

Treatment. Twenty-one of the 24 patients took simple oral analgesics, usually on an intermittent basis. We treated nine patients with moderate or severe pain with an anti-inflammatory drug (diclofenac 100 mg slow release) indefinitely; six of these had at least partial relief, but there was no improvement in the remaining three. The use of a cane or crutch provided only temporary and inconsistent pain relief and was not well accepted by most patients. Three patients had aspiration arthrograms: none showed obvious leakage of dye around the femoral stem and all the aspirates were sterile on bacteriological culture. The patient who had revision to a cemented femoral stem for gross loosening had an excellent early clinical result.

Subsidence. At one year, three of 13 (23%) patients showing subsidence of more than 2 mm had thigh pain while only 11 of 98 with no subsidence, or subsidence of less than 2 mm (11%), had pain. At two years this difference was even more marked: ten of 28 (36%) patients with definite subsidence had thigh pain, while only 14 of 82 (15%) patients with no subsidence or

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**Table I.** Details of 111 patients (110 after two years) having cementless PCA total hip arthroplasties

<table>
<thead>
<tr>
<th></th>
<th>At 1 year</th>
<th>At 2 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thigh pain</td>
<td>No thigh pain</td>
</tr>
<tr>
<td>Number (%)</td>
<td>14 (13)</td>
<td>97</td>
</tr>
<tr>
<td>Mean age (yr)</td>
<td>64</td>
<td>61</td>
</tr>
<tr>
<td>at operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex M/F</td>
<td>8/6</td>
<td>59/38</td>
</tr>
<tr>
<td>Pain severity*</td>
<td>Mild</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Severe</td>
<td>1</td>
</tr>
</tbody>
</table>

* see text

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**Table II.** Relationship between typical thigh pain and various radiographic features at one and at two years

<table>
<thead>
<tr>
<th></th>
<th>Thigh pain</th>
<th>No thigh pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>At one year</td>
<td>(n=14)</td>
<td>(n=97)</td>
</tr>
<tr>
<td>Subsidence &gt;2</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>&lt;2</td>
<td>11</td>
<td>87</td>
</tr>
<tr>
<td>Periosteal reaction +</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>96</td>
</tr>
<tr>
<td>Loose beads +</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>87</td>
</tr>
<tr>
<td>Tight fit +</td>
<td>8</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>34</td>
</tr>
<tr>
<td>At two years</td>
<td>(n=24)</td>
<td>(n=86)</td>
</tr>
<tr>
<td>Subsidence &gt;2</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>&lt;2</td>
<td>14</td>
<td>68</td>
</tr>
<tr>
<td>Periosteal reaction +</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>81</td>
</tr>
<tr>
<td>Loose beads +</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>73</td>
</tr>
<tr>
<td>Tight fit +</td>
<td>20</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>34</td>
</tr>
</tbody>
</table>

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THE JOURNAL OF BONE AND JOINT SURGERY
subidence of less than 2 mm experienced such pain (Table II).

**Periosteal reaction.** Three of the 14 patients (21%) with thigh pain at one year had evidence of periosteal new bone at the tip of the stem in zones 3 and 5, whereas only one of 97 patients (1%) without thigh pain at one year showed signs of new bone. The two-year review showed similar results, six of 24 (25%) and five of 86 (6%), respectively (Table II).

**Loose beads.** Beads shed from the porous-coated surfaces of the femoral stem were noted in three of the 14 patients (21%) experiencing thigh pain and in only ten (10%) of the asymptomatic group at one year. At two years eight of 24 (33%) with thigh pain and 13 (15%) of those without pain showed this radiographic feature.

**Other factors.** We found no correlation of thigh pain at one or two years with Harris hip scoring, age, sex (Table I), bone quality (Engh), calcar or diaphyseal fit (Table II), metaphyseal fill, cancellous hypertrophy in zone 4, or sclerotic lines in zones 3, 4, 5. We did not assess the association of thigh pain with patients' weight, hand dominance, or with the incidence of heterotopic ossification.

**DISCUSSION**

The incidence of thigh pain in our patients with cementless PCA hip replacements has been shown to be high and to increase with time, a pattern different from that described by other investigators. Both Hedley et al (1987), reporting an incidence of thigh pain of 8% at one year and 4% at two years, and Callaghan, Dysart and Savory (1988), giving values of 18% at one year and 16% at two years, describe a decreasing and smaller incidence of thigh pain with time, using the same hip prosthesis as in our series. The reason for this difference is not clear, although there are minor population variations in terms of primary diagnosis and age. It is unlikely that surgeon-related technical factors could account for it.

Other studies have mentioned thigh pain in an almost casual or anecdotal manner, but our results suggest that the subjective severity of symptoms appears to increase with time. We do not believe that this is a consequence of 'chronic pain intolerance', since the complainers at two years included a good proportion of patients who had developed pain between the first- and second-year reviews. There are no comparable data in the literature, but our study suggests that thigh pain may have an increasing incidence with time, rather than lasting only for a finite period. This raises some valid questions about the future of such prostheses, even when they appear to be clinically stable.

At-risk factors proved difficult to determine; again no useful comparative data are available from the literature. We were unable to identify a definitive population at risk, although there was a tendency to an increasing incidence with time of males developing pain with increasing subjective severity. This may be due to stress, activity, or be weight-related, and may lead to instability of fixation similar to that seen in failing, loose, cemented arthroplasties.

We could not relate parameters of poor bone quality to the incidence of thigh pain, despite the theoretical connection. It can only be assumed that our evaluation of these parameters was either inappropriate or too crude and insensitive to confirm the correlation. In terms of implant fit or fill, we made no significant correlations: calcar fit was not related, and somewhat paradoxically good isthmal fit correlated with thigh pain at two years only. Over two-thirds of all our patients were assessed as having a poor metaphyseal fill, and therefore no statistical significance could be attached to this factor.

We found an association of thigh pain at both one year and two years with subsidence of the femoral stem of greater than 2 mm. In addition, patients showing this degree of subsidence usually had a tendency to continued subsidence, rather than having a single episode of movement resulting in tighter wedging and stabilisation of the stem. This indicates that there is a continuing endosteal osteolysis as a cause or a result of distal migration, with instability rather than stabilisation by fibrous or bony ingrowth. It has been suggested that distal migration may result in wedging and permanent stabilisation of a collarless prosthesis, but we have doubts as to the validity of this concept in most patients.

We were able to correlate thigh pain with the formation of periosteal new bone at the level of the tip of the stem, a radiographic sign which is indicative of local stress. Other authors have associated this with a well-fixed stem and localised distal stress transfer (Lord and Bancel 1983; Engh and Bobyn 1985; Engh, Bobyn and Glassman 1987), but we believe that it may be the consequence of an end-stem-pivot situation. Both these biomechanical situations will, of course, result in an increase in localised stress at isthmal level, but only one of them can occur with stable proximally-fixed stems.

Implant-related factors are an interesting and controversial aspect of this problem. Engh et al (1987), presenting their results with the AML cementless femoral stem, report an incidence of thigh pain of 7%. It is possible that the inherent increase in stability provided by this long, straight, stiff, cobalt-chrome device and its method of insertion has resulted in a reduced incidence of thigh pain. The result of comparing proximally-coated with fully-coated stems is uncertain, although it has been anecdotally implied that only proximal coating gives an increased incidence of thigh pain (Engh 1991), probably related to better bony or fibrous fixation.

Paradoxically, the distal stress transfer that may occur after the insertion of a fully-coated biologically-fixed stem does not appear to result in significant thigh pain. Lord and Bancel (1983) describe an incidence of thigh pain of approximately 1% using the madreporic prosthesis, but no mention of this symptom is made in reports on other cementless prostheses such as the Autophor (Mittemeier 1984), Ring (Ring and Ring...
1983), and Isoelastic (Andrew et al 1986) systems. There is some anecdotal evidence of a markedly reduced incidence of thigh pain with the use of titanium alloy implants. This would implicate biomechanical causes in implant stiffness.

Engh and Bobyn (1985) described three types of thigh pain: start-up pain, end pain and fatigue-fracture pain. Our patients described a typical ‘start-up’ pain. Engh’s ‘end pain’ was associated with a stem that was well fixed proximally but with radiographic evidence of relative motion between the tip of a relatively stiff and long stem and the more flexible femoral shaft. This mechanism did not seem to be important in our patients because of the relative shortness of the PCA stem. Engh’s ‘fatigue-fracture’ pain was thought to be due to localised stress at the tip of a well-fixed stem. Localised stress may cause thigh pain, but we believe that this is usually in association with instability rather than sound fixation.

The response to conservative therapy has been variable. Unfortunately, most of the patients taking analgesics needed to take them for long periods, although some experienced spontaneous resolution of their symptoms. Non-steroidal anti-inflammatory drugs presumably acted by dampening down the osteitis associated with a loose femoral stem. However, in theory, because of their negative effects on bone formation, they could interfere with subsequent stabilisation of the stem.

We have attempted to define the natural history of thigh pain more precisely and have described a different course of events to other authors. We believe that continued follow-up, not only of this symptomatic population, but of all cementless prostheses is not only indicated but mandatory. Review at five years may produce some important data. We have not been able to prove conclusively that thigh pain is a symptom of stem instability as a consequence of failed biological fixation, but we believe that the positive correlations with stem migration, bead shedding, and evidence of localised stress at the tip of the stem strongly support our view.

**Conclusions.** We found a higher incidence of thigh pain after PCA cementless total hip arthroplasty than has previously been described. New cases continued to occur with increasing male predominance and severity of symptoms. Thigh pain correlated with femoral stem subsidence greater than 2 mm, bead shedding, and distal periosteal reaction. This suggests that stem instability is a likely cause. Our study has some weaknesses: it describes a relatively small population and, of course, follow-up is short. Long-term studies are essential.

More questions have been raised than answers given; but we consider that thigh pain associated with cementless total hip arthroplasty is a definite annoyance and may possibly be an ill omen.

We give our special thanks to Dr Robert W. Hardie for his assistance with data analysis.

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**


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