INTRA-ARTICULAR LOCAL ANAESTHESIA FOR PAIN AFTER HIP ARTHROPLASTY

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We investigated 15 patients with painful hip arthroplasties using intra-articular injection of bupivicaine. Fourteen had pain relief and 13 of them were subsequently found to have loosening of one or both components. The relief of pain after total hip arthroplasty by intra-articular injection of bupivicaine indicates that a satisfactory result is probable after revision surgery with refixation of the components.

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The cause of pain in the buttock, groin, thigh or leg after total hip arthroplasty can usually be established from a careful history, clinical examination and serial plain radiographs. Persistent pain soon after hip arthroplasty suggests either that the preoperative pain did not arise in the hip, that there is infection, or, less commonly, that ectopic bone formation is developing. The recurrence of pain after a painfree period suggests the possible onset of loosening. In some patients, however, the cause remains in doubt.

Such pain may be referred from the spine, or be due to bursitis, stress fracture or pelvic causes. That associated with loosening of the acetabular component may be "vague and tolerable", and apparently well-fixed femoral components, particularly uncemented, may also be associated with pain. By contrast, implants which are clearly loose may not be painful, especially on the acetabular side. Even when there is migration the surgeon must be sure that the hip is the source of the pain.

Plain radiographs are probably the most important means of diagnosis of implant loosening. The signs of loosening have been well described although all of them cannot be applied to all implants. This is especially so since the introduction of more precise methods of measuring implant migration. Many authors have reported the problems of assessment from plain radiographs and discussed the use of other radiological techniques including radio-isotope scanning, and subtraction arthrography. These investigations are expensive and often unhelpful.

We report the results of the use of intra-articular local anaesthesia to clarify the source of pain after total hip arthroplasty. The method is straightforward, economical and thus far has proved remarkably effective. We have used it for some years.

PATIENTS AND METHODS

Over a three-year period, we investigated 15 patients with painful hip arthroplasties using an intra-articular injection of bupivicaine. In all, the history, clinical examination and serial radiographs were inconclusive. There were nine women and six men with an age range of 46 to 89 years. Twelve of them had been investigated for pain at other centres. Of these, six had been told that their implants were well fixed and were not the source of the pain. Three had been referred by their surgeon to our centre for a second opinion and three had been referred by general practitioners after being discharged from other units.

In the operating theatre and under sterile conditions, the skin and subcutaneous tissues were infiltrated with 5 to 10 ml of 2% Lignocaine. Using an anterior or anterolateral portal, an 18-G spinal needle was inserted through the hip pseudocapsule into the artificial hip cavity under fluoroscopic control. The position of the needle was confirmed, when necessary, by the injection of a few millilitres of a radio-opaque dye. If fluid was obtained it was sent for culture. If a dry tap was obtained, 5 ml of Hartmann's solution were injected and reaspirated before being sent for culture. After aspiration, 10 ml of 0.5% bupivicaine were injected into the joint space and the needle was withdrawn.
All the injections were done on an outpatient basis, with no general anaesthesia or sedation, to allow the patient to be fully mobile immediately after the procedure and able to report any change in their symptoms.

On discharge, the patients walked from the day-surgery ward and were asked to keep a diary recording pain over the following 24 hours. They were encouraged to be as active as possible and perform the particular activities that had previously precipitated their symptoms. A subsequent interview was arranged to discuss the findings and to decide on further management. All patients who later had surgery had components revised to a cemented total hip replacement.

Follow-up varied from three months to three years. Our aim was to establish the findings at surgery and the patients’ early response to surgery; we did not address the long-term outcome.

RESULTS

There were no complications from the intra-articular injections, apart from minor discomfort from the placement of the needle in some patients.

The results are summarised in Table I. Fourteen of the 15 patients had pain relief after the injection. Of these, 13 subsequently had revision surgery and 12 were found to have loosening of one or both components. Two patients had painful hemiarthroplasties; one a non-cemented Austin-Moore (case 11) and the other a cemented Thompson (case 15). At operation, the latter was found to be firmly fixed but there was severe damage to the articular cartilage of the acetabulum. Of the 11 patients with total hip arthroplasty, six had a loose acetabular component, two had a loose femoral component and the remaining three had definite loosening of both components. A variety of types of prosthesis was removed: eight had been cemented, two non-cemented and one had a cemented cup and an uncemented femoral component.

The quality of early pain relief after injection was independent of which component was loose, and of its uncemented or cemented fixation. All patients described their pain relief as considerable. We did not use pain scores to assess pain, but simply asked the patient whether, if an operation could offer pain relief equivalent to that produced by the injection, he or she would wish to have a revision arthroplasty. The eventual revision operation produced satisfactory pain relief in all of the patients in whom it was performed.

One patient (case 5) appeared to have pain at the level at which the tip of his stem abutted the femoral cortex. This patient had no pain relief from his first injection, and no fluid was obtained on aspiration. We concluded that the needle had probably not been intra-articular and the injection was repeated. On this occasion we aspirated a large collection of fluid from around the prosthesis. There was good but incomplete pain relief, but persisting localised pain in the lateral mid-thigh. A second patient (case 1) had an apparently well-fixed, non-cemented fully-porous-coated femoral component (AML). She had complete relief of her groin pain and lost her thigh pain for one hour while lying still. When mobilising, her thigh pain returned although it was less than the preinjection level.

One elderly patient (case 14) had pain relief from injection, and the aspirate grew coagulase-negative staphylococci. She remained unwell due to unrelated medical problems and declined a revision operation. Recent radiographs have confirmed loosening, as was predicted from the outcome of the injection.

The only patient (case 6) who had no relief from the injection had persisting pain after a fall 13 months after total hip arthroplasty. Her periprosthetic pain continued and it was suggested that it might be functional in origin. Repeated aspiration and intra-articular anaesthetic injection produced no change in symptoms; the cultures were negative for infection. Eighteen months later the symptoms relating to her hip replacement had completely settled and serial radiographs confirmed good fixation of both components.

Seven of the 15 patients had had previous technetium bone scans. In five these showed no sign of loosening or infection. One patient (case 10) showed increased activity at the tip of the femoral component but no increase related to the cup. Both components were loose at revision. One patient with a painful Thompson hemiarthroplasty (case 15) had slightly increased activity around the tip of the stem, consistent with loosening, but at re-exploration the stem was found to be soundly fixed with very severe acetabular cartilage erosion.

We performed arthrography on two patients. In one (case 12) this was performed at the time of injection and suggested loosening of the femoral component, which was confirmed by the relief produced by the injection of bupivacaine. The second patient (case 8) had negative results from arthrography elsewhere, but good relief from bupivacaine injection. Subsequent surgery showed definite loosening.

DISCUSSION

The use of an intra-articular injection of local anaesthetic for diagnostic purposes after hip arthroplasty has received little attention. Braunstein et al reviews 12 patients who had intra-articular injection of bupivacaine and subsequent revision hip arthroplasty. They found that complete pain relief after injection correctly identified an intracapsular source of pain in ten patients, with one false-positive and one false-negative result. This gave a sensitivity of 91% in surgically proven cases. Berquist et al combined the injection of 0.25% bupivacaine with subtraction hip arthrography to evaluate bursae and communicating cavities around painful hip arthroplasties. They found that injection of local anaesthetic was of value in the diagnosis and treatment of bursitis, but there was no specific correla-
Table I. Details of 15 patients who had intra-articular injection of bupivacaine

<table>
<thead>
<tr>
<th>Case</th>
<th>Gender</th>
<th>Age (yr)</th>
<th>History</th>
<th>Radiological findings</th>
<th>Other investigations</th>
<th>Findings at operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>60</td>
<td>1° AML 1990: cup revision 92: no relief of pain</td>
<td>Stem subsidence 3-4 mm: cup incomplete RLL without definite evidence of loosening</td>
<td>Tc scan negative</td>
<td>Loose cup: well-fixed stem</td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>69</td>
<td>1° cemented Exeter matt stem 1979 Increasing buttock pain limiting walking to short distances</td>
<td>Complete socket RLL &lt;2 mm Localised lysis zone 7 in the femur</td>
<td>Tc scan negative</td>
<td>Loose cup: well-fixed stem</td>
</tr>
<tr>
<td>3</td>
<td>M</td>
<td>61</td>
<td>1° cemented Exeter matt stem 1981: increasing and disabling thigh, groin and knee pain</td>
<td>Localised endosteal bone lysis but no other sign of loosening</td>
<td></td>
<td>Well-fixed cup: loose stem</td>
</tr>
<tr>
<td>4</td>
<td>M</td>
<td>56</td>
<td>1° cemented Exeter matt stem 1980: progressively limiting groin pain</td>
<td>RLL 1-2 mm zones 1 &amp; 2 socket Stem well fixed</td>
<td>Tc scan negative</td>
<td>Loose cup: well-fixed stem</td>
</tr>
<tr>
<td>5</td>
<td>M</td>
<td>66</td>
<td>Bilat matt cemented Exeter THRs 1980 Increasing pain radiating into R thigh, with limiting walking ability</td>
<td>Incomplete RLL R socket Localised osteolysis at stem tip close to cortex Stem subsidence 6 mm</td>
<td>Tc scan negative</td>
<td>Both components loose</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>80</td>
<td>Exeter THR. 13/12 post-op fell and developed increasing hip pain. Some suggestion of functional pain</td>
<td>Well-fixed components</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>M</td>
<td>66</td>
<td>1° Charnley THR 1979 Revision to long-stem Charnley 1990 Continued groin pain</td>
<td>Circumferential socket RLL &lt;2 mm</td>
<td></td>
<td>Loose cup</td>
</tr>
<tr>
<td>8</td>
<td>F</td>
<td>47</td>
<td>Cemented Howse prosthesis 1984 for CDH Continued pain. Exploration 1986 but both components well fixed and not revised. Pain persisted</td>
<td>RLL zone 1 and 2 in socket - 1-2 mm No migration Stem well fixed</td>
<td>Bone scan positive 1986 before 1st exploration Arthrogram 1990 - no evidence of loosening</td>
<td>Loose cup. Stem well fixed</td>
</tr>
<tr>
<td>9</td>
<td>F</td>
<td>65</td>
<td>1° THR 1988 with Exeter polished stem and metal-backed cup</td>
<td>Stem well fixed. Socket RLL 1-2 mm zone 3 and &lt;1 mm zone 1</td>
<td>Tc scan showed increased uptake at stem tip, but not round the cup</td>
<td>Loose cup. Stem fixed</td>
</tr>
<tr>
<td>10</td>
<td>M</td>
<td>58</td>
<td>Non-cemented isoelastic THR 1988. Painful postop. Revisited to larger, longer isoelastic stem 12/12 later with no benefit</td>
<td>Socket satisfactory Possible stem loosening</td>
<td></td>
<td>Both components loose</td>
</tr>
<tr>
<td>11</td>
<td>F</td>
<td>78</td>
<td>Austin Moore 1993. Persistent pain limiting mobility</td>
<td>Few mm subsidence</td>
<td></td>
<td>Loose Austin Moore</td>
</tr>
<tr>
<td>12</td>
<td>M</td>
<td>77</td>
<td>Uncemented PCA THR 1989 6-year history of severe pain preventing walking without support</td>
<td>3 mm femoral component subsidence RLL zone 3 of the socket</td>
<td>Arthrogram suggested femoral component loosening</td>
<td>Socket well fixed: stem loose</td>
</tr>
<tr>
<td>13</td>
<td>F</td>
<td>71</td>
<td>Zimmer Müller dual-lock type stem 1987 Mainly buttock pain and ‘stiffness’ with occasional groin pain Associated spinal pathology</td>
<td>Socket lucency 1-2 mm zone 3 Femoral RLL zone 7 but no other evidence of loosening</td>
<td></td>
<td>Both components loose</td>
</tr>
<tr>
<td>14</td>
<td>F</td>
<td>87</td>
<td>Cemented Exeter stem with Müller cup 1983 Cup revised 1992. Continued pain in groin disturbing sleep and limiting mobility</td>
<td></td>
<td>Aspiration grew coagulase-neg staphylococcus</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>F</td>
<td>76</td>
<td>Cemented Thompson. 3 years of pain Investigated at another centre where told that there was ‘nothing to be done’</td>
<td>No radiological evidence of loosening</td>
<td>Tc scan: slight increased activity around stem tip</td>
<td>Prosthesis well fixed: complete erosion of articular cartilage in socket</td>
</tr>
</tbody>
</table>
tion between pain relief and component loosening.

To relieve pain caused by a loose hip arthroplasty, local anaesthetic must gain access to the nerve endings for pain within the acetabulum, femur or capsule. Our findings show that the capsule is rarely a source of such pain after hip arthroplasty. Miller and Kasahara\(^7\) and Sherman\(^8\) have shown that endosteal and periosteal innervation can provide sufficient afferent pathways to subserve pain, and Pacinian corpuscles are known to be present in marrow and cortical bone.\(^9\) These are probably involved in the perception of intramedullary pressure and may have a proprioceptive function. Pain may be caused by changes in intramedullary pressure\(^10\) and stimulation of the periosteum.\(^11\) Recently, Ahmed and Gillespie (personal communication) using monoclonal antibody techniques, have shown the presence of unmyelinated nerve fibres in the membrane found between loose implants and bone. Their function is unknown, although they may subserve pain. The mechanism of pain production in a loose arthroplasty component is uncertain, and may differ in the femur and the acetabulum.\(^5\) The concept of the ‘effective joint space’\(^12\) explains how the bupivacaine can reach the appropriate nerve endings.

In our series, the history suggested loosening, but this was not supported by clear radiological findings. Loosening could not be excluded, and injection with local anaesthetic was indicated. The interpretation of plain radiographs shows high intra- and interobserver errors,\(^16,18\) but after a bupivacaine injection the patient reports the findings rather than the surgeon. This is especially useful in patients with dual pathology in whom the relative contribution of the arthroplasty to the symptoms is uncertain. The experience of temporary pain relief also helps the patient to understand the potential benefits of revision surgery.

We acknowledge a number of possible criticisms of the method. Our study was retrospective and not blinded. A placebo effect is possible; the patients may have wished to report a favourable response. This seems unlikely since they understood that positive results suggested the need for a revision operation and our relatively elderly group was unlikely to wish to undergo more surgery. The reliability which we found in identifying loose components and the good response to surgical revision argue against a placebo effect. It is also possible, to validate the study, that surgeons over-reported loose components at operation, but the good clinical response to surgery suggests that this was not the case.

Our small series indicates that useful information can be obtained from a positive response to injection, but we had only one patient with a negative response which was taken to exclude the hip replacement as the cause of pain. Such a negative response requires continued follow-up, and its proof depends on either the eventual demonstration of another source of pain, or complete resolution of the symptoms, as in our case 6.

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REFERENCES


