BILATERAL HIP AND KNEE REPLACEMENT FOR RHEUMATOID ARTHRITIS

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A series of 19 patients with severe rheumatoid arthritis had replacement of both hips and both knees. They are reviewed after a mean follow-up of 27 months. The preferred programme is to replace hips before knees.

Pain was relieved in all the patients and function was improved in all but two. Severe rheumatoid disease and prolonged immobilisation before the operations were not contra-indications to a successful outcome, but the presence or the development of cervical myelopathy combined with gross upper limb deformity militated against a good result.

The individual replacement of irreparably destroyed hip and knee joints is fully accepted. The gratifying results of hip arthroplasty in rheumatoid arthritis have been reported by Poss (1975), Colville and Raunio (1978) and Ritter and Stringer (1980); those of knee arthroplasty by Attenborough (1978), Riley and Hungerford (1978), Sheehan (1978) and Laskin (1981). When arthritis involves many joints, the question of multiple joint replacement arises. There are many reported series of bilateral hip arthroplasty and of bilateral knee replacement, but comparatively few on the combination of these procedures. This may reflect the fact that patients with advanced rheumatoid arthritis are regarded as poor risks for operation because of their systemic and medical problems. In this situation a definite policy on multiple procedures must be adopted before operative treatment is started.

This study presents the treatment policy adopted by the senior author (JS) and attempts to define the indications and contra-indications, the complications and the results of quadruple arthroplasty of the hips and knees.

SEQUENCE OF OPERATIONS

Although the main aims of surgery in patients with advanced rheumatoid arthritis are relief of pain and improvement of function, the correction of deformity also is important as a means of restoring normal mechanics and avoiding implant failure. Patients with advanced disease commonly present with flexion deformities of both hip and knee; adduction contracture of the hip, and valgus and lateral rotation deformities of the knee. In severely debilitated patients the policy has usually been to replace one joint at a time. We suggest that the proximal deformities should be corrected first; this is based on the following observations.

In the normal standing posture, the force of weight-bearing passes from the centre of the femoral head through the centre of the knee to the centre of the ankle. This line of leg alignment passes in a straight line through the knee. Any structural deformity which results in the three points no longer being in a straight line produces abnormal varus or valgus bending moments; the lower limb is no longer loaded as a straight column and the forces passing through the medial or the lateral compartment of the knee are increased. Various abnormalities at the hip, such as an adduction contracture, or shortening due to destruction of the head or to subluxation, cause the transfer of forces to the lateral compartment of the knee and produce a valgus deformity at that joint. The problem is compounded if there is an existing valgus deformity of the knee, and there is then a predisposition to ultimate failure of the prosthetic joint.

If both hip and knee need replacing, then hip arthroplasty should be undertaken before knee arthroplasty for the following reasons.

1. Active knee flexion and extension depend largely on free hip function.
2. Accurate knee alignment may not be possible in the presence of hip deformity.
3. Patients with arthritis of hip and knee in the same limb frequently complain of pain in the knee rather than in the hip. This pain is often referred from the hip, and after replacement and realignment of the hip the knee symptoms invariably improve, occasionally to such an extent that knee arthroplasty can be deferred indefinitely.
4. During the operation for hip arthroplasty the forces which may be applied to the knee could damage the fixation of a previously inserted knee arthroplasty.
5. If one hip is more affected than the other, then shortening causes the opposite knee to assume a flexed position; this may become fixed unless early hip arthroplasty is performed. Even severe flexion deformity of the knee frequently improves after replacement and realignment of the opposite hip.

**CLINICAL MATERIAL**

The main indication for multiple joint replacement in this series was severe restriction of activity due to pain and deformity resulting from joint destruction. Patients were assessed at a combined rheumatology and orthopaedic conference to determine their suitability for multiple operations. The proposed operations and the effort involved in rehabilitation after each operation were discussed with each patient. With severe disability it is so advantageous to have all four joints replaced, that every effort was made to persuade the patient to agree to this in advance. All patients had some involvement of the upper extremities, but even severe rheumatoid disease of the upper limbs was not considered to be a contra-indication. Individual plans for the use of walking aids were agreed.

Special attention was paid to clinical and radiological assessment of the cervical spine; significant subluxation was regarded as a relative contra-indication. Weakness of the upper limb may be due to neurological causes, to arthritis, or to both, and it may be difficult to define the precise cause when the arthritis is severe. All the patients reported were being treated with steroids, and any necessary changes in the dosage of these and other drugs were made before operation; at this time any associated medical problems also were carefully assessed. Severe medical problems which endangered survival were absolute contra-indications; these included severe vasculitis, rheumatoid involvement of the lung and cardiac decompensation.

Nineteen patients are reported. Their mean age was 53.8 years (range 27 to 67 years) and they had suffered from rheumatoid disease from 6 to 30 years with an average of 17 years. Follow-up after the fourth operation ranged from 6 months to 7 years with a mean of 29.4 months. Charnley hip prostheses and Sheehan knee prostheses were used in all cases. One patient had Still's disease and the remainder rheumatoid arthritis. Two patients had previously had synovectomy of one knee, and two others had had soft-tissue release operations around one hip before their arthroplasty. Five patients presented initially with involvement of all four major joints. Fourteen presented for their third or fourth major arthroplasty after varying intervals with progression of the disease in an unoperated hip or knee.

The planning of the operations and the rehabilitation followed the principles already outlined. Two groups of patients can be identified. The first group was of five patients with gross deformity who had all four major joints replaced in turn during their initial stay in hospital. In this group the interval between hip arthroplasties ranged from one to four weeks, depending on the medical fitness of the patient. The knee arthroplasties were separated by an average interval of six weeks (range 2 to 12 weeks). For this group the average total time to completion of all four arthroplasties was 13 weeks (range 6 to 28 weeks). In the second group, of 14 patients, the operations were staged over a longer period and over a number of admissions. The sequence of the operations was dictated by the patient's disability and deformity and by the improved functional result following one or two joint replacements.

Of the whole group 12 patients had both hips replaced before either knee arthroplasty. Three patients had both knees replaced before hip arthroplasty was undertaken; this appears to contradict the stated principles, but at the initial assessment the hips were normal. The severity of the deformities and disability is shown by the fact that all but four patients had two or more joints replaced during a single admission. A further indication of severity and of loss of independence was that pre-operatively 10 patients had been either bedridden or confined to a wheelchair for periods which ranged from 6 months to 16 years. Two other patients were unable to rise from a chair without assistance, and 14 of the patients were unable to climb stairs even by employing the most bizarre methods.

**RESULTS**

Each hip and knee arthroplasty was assessed individually, using for the hips the numerical classification of Merle d'Aubigné and Postel (1954) as modified by Charnley (1972), and for the knees the British Orthopaedic Association Research Subcommittee criteria (Aichroth et al. 1978). The status of the patients before and after operation is given in Table I.

**Hips.** One of the primary goals of surgery is to relieve pain. Pre-operatively all but five patients had Grade 1, 2 or 3 pain and were thus very disabled. After operation all but one patient had complete relief of pain. The average hip flexion before operation was 61.5°; postoperatively it averaged 98°. Before operation all 19 patients had a composite range of movement of less than 160°, whereas on review only one patient was thus restricted. Twelve of the 13 patients who had fixed flexion deformity before operation had complete restoration of normal alignment; the one patient whose flexion deformity was not corrected had been confined to a wheelchair throughout, because of continuing progression of systemic disease.

**Knees.** Pre-operatively 16 patients had persistent pain; at review nine had complete relief of pain, and eight had mild pain, mainly retropatellar, which did not interfere with daily activities and rarely required medication. Two other patients have, since the arthroplasty, had unilateral patellectomy performed for patellofemoral pain, without compromising the final result. The average arc of knee movement before and after operation was unchanged at

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Table I. Sequence of operations and clinical details of 19 patients having quadruple arthroplasty

<table>
<thead>
<tr>
<th>Case number</th>
<th>Sequence of replacements</th>
<th>Duration of disease (years)</th>
<th>Mobility before first operation</th>
<th>Follow-up (months)</th>
<th>Mobility after 4 operations</th>
<th>Activity of the arthritis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>L hip R knee L knee R hip</td>
<td>11</td>
<td>Bedridden for 6 months</td>
<td>18</td>
<td>Mobile without aids</td>
<td>Progressive in upper limbs</td>
</tr>
<tr>
<td>2</td>
<td>R knee L knee L hip R hip</td>
<td>15</td>
<td>Less than 50 yards with two sticks</td>
<td>6</td>
<td>Walks up to ½ mile with one stick</td>
<td>Active in ankles and feet</td>
</tr>
<tr>
<td>3</td>
<td>L hip R knee R hip L knee</td>
<td>13</td>
<td>Mobile indoors only with two sticks</td>
<td>57</td>
<td>Unlimited walking without sticks</td>
<td>Quiescent</td>
</tr>
<tr>
<td>4</td>
<td>L knee R hip R knee L hip</td>
<td>19</td>
<td>Bedridden for 2 years</td>
<td>24</td>
<td>Walks ½-¾ mile with crutches. Needs help getting out of chair</td>
<td>Progressive in upper limbs</td>
</tr>
<tr>
<td>5</td>
<td>R hip L hip R knee L knee</td>
<td>30</td>
<td>50 to 100 yards with two sticks</td>
<td>24</td>
<td>Walks ½ 1 mile with stick</td>
<td>Active in left ankle</td>
</tr>
<tr>
<td>6</td>
<td>L hip L knee R hip R knee</td>
<td>30</td>
<td>Bedridden for 15 years</td>
<td>84</td>
<td>Mobile with two tripods for 3 years. Now confined to wheelchair</td>
<td>Progressive cervical myelopathy</td>
</tr>
<tr>
<td>7</td>
<td>L hip R hip R knee L knee</td>
<td>14</td>
<td>Bedridden for 6 years</td>
<td>42</td>
<td>Confined to wheelchair</td>
<td>Active. Extensive destruction of all joints of upper limbs and cervical spine</td>
</tr>
<tr>
<td>8</td>
<td>R hip L hip L knee R knee</td>
<td>12</td>
<td>A few steps indoors</td>
<td>10</td>
<td>Unlimited walking with one stick</td>
<td>Quiescent</td>
</tr>
<tr>
<td>9</td>
<td>R hip L hip L knee R knee</td>
<td>25</td>
<td>A few steps with crutches</td>
<td>72</td>
<td>Can walk 50 yards with two sticks</td>
<td>Quiescent</td>
</tr>
<tr>
<td>10</td>
<td>L hip R hip R knee L knee</td>
<td>12</td>
<td>Bedridden for 30 months</td>
<td>14</td>
<td>Unlimited walking without aids</td>
<td>Active in upper limbs</td>
</tr>
<tr>
<td>11</td>
<td>L hip R hip L knee R knee</td>
<td>25</td>
<td>Bedridden for 16 years</td>
<td>11</td>
<td>Unlimited walking without aids</td>
<td>Active in upper limbs</td>
</tr>
<tr>
<td>12</td>
<td>L hip R hip R knee L knee</td>
<td>20</td>
<td>A few steps with two crutches</td>
<td>22</td>
<td>Unlimited walking without aids</td>
<td>Quiescent</td>
</tr>
<tr>
<td>13</td>
<td>R hip L hip R knee L knee</td>
<td>18</td>
<td>Bedridden for 9 months</td>
<td>6</td>
<td>Unlimited walking without aids</td>
<td>Active in upper limbs</td>
</tr>
<tr>
<td>14</td>
<td>R knee L knee R hip L hip</td>
<td>25</td>
<td>Indoors with two crutches</td>
<td>6</td>
<td>Unlimited walking with one stick</td>
<td>Quiescent</td>
</tr>
<tr>
<td>15</td>
<td>L hip R hip L knee R hip</td>
<td>10</td>
<td>Wheelchair life for 3 months</td>
<td>14</td>
<td>Unlimited walking without aids</td>
<td>Quiescent</td>
</tr>
<tr>
<td>16</td>
<td>R hip L hip R knee L knee</td>
<td>11</td>
<td>Less than 50 yards with two sticks</td>
<td>7</td>
<td>Walks more than 100 yards with two sticks</td>
<td>Active in upper limbs and cervical spine</td>
</tr>
<tr>
<td>17</td>
<td>R hip L hip R knee L knee</td>
<td>7</td>
<td>Wheelchair life</td>
<td>9</td>
<td>Walks up to ½ mile with one stick</td>
<td>Active in upper limbs and ankles</td>
</tr>
<tr>
<td>18</td>
<td>R knee L knee R hip L hip</td>
<td>23</td>
<td>A few steps indoors with a stick</td>
<td>51</td>
<td>Walks up to 100 yards with one stick</td>
<td>Quiescent</td>
</tr>
<tr>
<td>19</td>
<td>L hip R hip L knee R knee</td>
<td>12</td>
<td>Wheelchair life for 10 months</td>
<td>55</td>
<td>Walks more than 1 mile without sticks</td>
<td>Active in upper limbs</td>
</tr>
</tbody>
</table>
85. Flexion contractures ranged from 10 to 52 preoperatively with an average of 25; at follow-up this deformity ranged from 0 to 42 and averaged 14. The flexion contracture was decreased in 16 patients, remained unaltered in two and was increased in one. An increase in the arc of flexion was recorded in 16 cases, mainly due to a decrease in the flexion contracture. As far as could be judged, a significant improvement in alignment was noted in all cases. The inability to correct flexion deformity fully in a number of patients made the assessment of varus-valgus alignment impossible, since this can only be judged accurately in a fully extended joint.

**Functional results.** All but two patients were very satisfied with their hip and knee arthroplasties. The two exceptions, although they had considerable relief of pain, were disappointed because they were still confined to wheelchairs and were therefore not independent; although pain relief had fulfilled one primary goal of their treatment, the continuing disability caused them to be classified as failures. One of them, a patient with Still's disease, was, after quadruple arthroplasty, mobile for three years, using two tripods as supports, but then developed progressive cervical myelopathy with weakness of all four limbs; neurosurgical intervention was not considered advisable. The second patient had tetraparesis from subluxation of C4 on C5 as well as gross destruction of all joints of the upper limbs, typical of the mutilans variety of rheumatoid arthritis.

Walking distance was increased for all 17 patients who were mobile (Table I). The most dramatic improvement was recorded in eight of the 10 patients who had been bedridden or wheelchair-bound before their operations. At follow-up six of these eight patients no longer needed any form of aid and could walk for more than a mile; of the other two, one used a stick and the other used two crutches.

The aids required for walking were decreased for all patients. Nine patients no longer required any support, six used one stick and the remaining two required two crutches or sticks. These last two patients, although they needed assistance in rising out of a chair, enjoyed a better quality of life with some restoration of independence.

Activities such as rising from a chair independently and climbing stairs were improved for all except two of the mobile patients. These two had extensive arthritic changes and weakness in their upper limbs and were unable to propel themselves sufficiently far forward from a chair to get their centre of gravity over their feet. The combination of extensive arthritic changes and decreased ranges of movement in the legs also prevented them from climbing stairs.

**Current status of disease.** At review eight of the patients who were mobile continued with symptomatic and active rheumatoid disease mainly of the upper limbs. The activities of daily living were restricted in two of these patients, because of their total dependence on walking aids, decreased range of movement in the legs and extensive destruction of the joints of the upper limbs. The final result in the other six patients with active disease was not compromised, because they had a good range of movement in the lower limbs and consequently were not totally dependent on walking aids. In the early stages of rehabilitation upper limb involvement may delay progress but some of the many varieties of walking aids available may help to overcome this problem.

Further operations for the correction of foot and ankle deformities were undertaken in two patients, while two others benefited from unilateral excision of the radial head.

**Complications.** The prevention of progressive contraction of the knee proved a problem in four patients, after their hips had been replaced. Traction and casting did little to decrease the deformity, and operation was the ultimate solution. Early in this series two patients with severe flexion deformities of both hips and knees suffered anterior dislocation of the hip. This problem has now been overcome by the use of a split mattress which allows extension of the hip in the presence of knee flexion deformity. The remaining complications (including an oblique fracture of the femur between hip and knee prostheses sustained in a fall four years after four arthroplasties) were all amenable to surgical and medical treatment.

**DISCUSSION**

Replacing four joints in a severely disabled patient demands careful planning and assessment. To restore function to a patient with severe arthritis of many joints clearly requires several operations. Johnson (1975) reported 11 patients who had had bilateral hip and knee arthroplasties, and suggested that the hips should be replaced before the knees, though he gave no specific reasons. Arafiles and Gustilo (1979), reviewing a smaller number of patients, approved of this advice.

To achieve the best functional result requires correction of malalignment as well as equalisation of leg length. If knee replacement is undertaken in the presence of hip disease with deformity, the forces through the limb will not be correctly aligned and unequal weight will be transmitted to one or other side of the knee prosthesis. A second factor is flexion deformity of a knee, which may not be correctible in the presence of shortening of the contralateral limb due to hip disease; restoring limb length by hip replacement invariably leads to an improvement of the knee contracture.

A third factor to be considered is that the energy required to move the lower limbs is less if free hip movement is restored before replacing the knees; this may be important in debilitated patients. Moreover, if knee arthroplasty is undertaken before hip arthroplasty, there is always the danger of loosening the knee components during the hip operation. For all these reasons we prefer to operate on the hips before the knees.
The replacement of two joints under a single anaesthetic is, in our opinion, a severe procedure. While it has advantages, such as reducing hospital stay (and therefore cost) and minimising the number of anaesthetics, there is an increased incidence of pulmonary embolism, wound problems, and ectopic bone formation as reported by Gradillas and Volz (1979), Ritter and Stringer (1980) and Bracy and Wroblewski (1981) respectively. These complications make such double replacements at the one operation an unattractive option. Head and Paradies (1977) reported eight patients who had ipsilateral hip and knee replacement under one anaesthetic, five of whom eventually had four joints replaced. These authors considered that the shorter rehabilitation was of significant value in increasing the motivation of the patient towards good function. We do not dispute the merits of their procedure, but the prolonged operating time and the large volume of blood replacement, 21 units in one case, make it unacceptable to us.

Function was improved in all but two of our patients, as measured by an increase in walking distance, with less need for aids and improved performance of daily activities. All had reduction in pain. Severe rheumatoid arthritis of all four joints and prolonged immobilisation, as in 10 of our patients, are not contraindications. The main factors that determine success of quadruple arthroplasty are the neurological status of the patient and, to a lesser extent, the amount of destruction of the joints in the upper limbs. Irreversible neurological lesions cannot be compensated for, but for upper extremity involvement the provision of suitable walking aids can be made on an individual basis.

Patients with nearly normal function of the lower limbs were not dependent on walking aids, but a less than optimum result in the legs increased the dependence on aids and severely compromised the functional result when gross upper limb deformities were also present. In this context it would appear that cervical myelopathy is a definite contra-indication to multiple arthroplasty.

The results of individual operations were similar to those reported for single arthroplasty of the hip and knee. The occasional use of walking aids is, however, often necessary because of alteration in proprioception produced by multiple joint replacements.

The early and late complications in this series are higher than in other reports. The two patients who had anterior dislocation of the hip prosthesis had flexion contractures of both hips and knees, and the fact that dislocation was anterior indicates lack of control of lateral rotation under these circumstances. The use of a split mattress and bed enhances the stability of the hip, but may lead to increased contracture of the knee. Our dislocation rate, two cases in 38 hips, is higher than those reported by Beckenaugh and Ilstup (1978), Colville and Raunio (1978) and Khan, Brakenbury and Reynolds (1981). No further problems followed reduction of the dislocations and the eventual functional result was not impaired.

We feel that patients are too often allowed to slide gradually into a situation where three or four joints have to be replaced before they can begin to become mobile. Replacing four joints, one after another within a short period of time, places a considerable burden on surgeon, nursing staff and patient. It is far easier for the patient and for the surgeon if the problems can be located as they arise, and the results of the operations will be far superior.

One of the most significant factors to be considered before multiple operations are agreed is the motivation of the patient, which is very difficult to assess. The effort needed in rehabilitation is very considerable, particularly when four joints are replaced in rapid succession, and it is mandatory that each patient is fully prepared for the sustained effort that will be required.

REFERENCES


