A review of 100 consecutive Richard's total knee replacements

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SUMMARY
One hundred consecutive Richard's Maximum Contact (RMC) knee replacements were performed in Belfast between 1978 and 1982. Most of the 100 knees (86 patients) involved had been in severe pain, had marked stiffness or gross knee deformity, or were chairbound because of the knee. They were reviewed between five and eight and a half years (mean five years and eleven months) after operation. Thirteen patients (13 knees) died before review leaving eighty seven knees in 73 patients available for study. Using a modification of the British Orthopaedic Association knee function assessment chart, 26 knees (30%) were graded as excellent, 22 (25%) as good, 19 (22%) as fair and nine (10%) as poor. There were five implant failures, four the result of deep infection, one due to loosening. Six patients were chairbound at review and were also graded as failures. These results support the view that total knee replacement approaches the predictability and success of arthroplasty of the hip.

INTRODUCTION
The great success of total hip arthroplasty in the treatment of both degenerative and rheumatoid arthritis has led surgeons to seek, and patients to expect, similar results from replacement of the knee joint. It has been widely perceived that, compared with hip arthroplasty, knee replacement is less successful, and less predictable in its end result. Although some workers claim that knee arthroplasty is approaching that of the hip in terms of its reliability,1 it may be some time yet before this becomes the generally accepted view.

The knee is a much more complex joint and there are a huge number of different implants in general use.2 In 1972, Freeman and Swanson3 introduced the concept of the total condylar knee which remains the most common implant design in current use.4 5 A total condylar knee of the Richard's Maximum Contact (RMC) type6 was first used in Belfast in 1978 and early experience was very encouraging.7 To obtain a more valid and accurate assessment of this knee, we have retrospectively reviewed our first 100 arthroplasties.
MATERIALS AND METHODS

Between November 1978 and April 1982, 100 Richard's RMC total knee replacements (Fig 1) were performed on 86 patients. There were 66 females and 20 males; the mean age at operation was 61 years (range 26–76). Fifty four patients had rheumatoid arthritis (30 having been treated with systemic steroids) and 32 patients had osteoarthritis. Twenty four knees had been subject to previous surgery — synovectomy, previous arthroplasty or meniscectomy. Three patients had undergone more than one previous operative procedure.

Fig 1. The Richard's Maximum Contact (RMC) knee prosthesis with cruciate sacrificing (left) and cruciate sparing (right) tibial components. The patellar component is not shown.

Of the 86 patients undergoing total knee replacements, 23 had had a contralateral knee replacement, nine had one total hip replacement and seven had bilateral total hip replacements. Four patients had already had three weight-bearing joints replaced at the time of operation. Severe pain was the primary indication for operation in 90% of cases. Stiffness, deformity and instability were other significant complaints, many patients having more than one symptom. Thirty one knees had a pre-operative flexion deformity of more than 20 degrees. In nine the pre-operative valgus deformity was in excess of 30 degrees, and in six knees there was a varus deformity greater than 20 degrees. Seventeen patients were chairbound prior to operation and a further 15 were confined indoors.

All operations were performed by a small number of surgeons of consultant grade. A curved medial parapatellar approach was utilised. The patellar articular surface was not routinely replaced. All wounds were closed with suction drainage and pressure dressings were applied. Initially mobilisation was not permitted until
the wound was soundly healed but with experience mobilisation was commenced from the third post-operative day after removal of the suction drains.

Seventy three patients (87 knees) were assessed at review by two of the authors (PJG, GFMcC) using a modification of the British Orthopaedic Association knee function assessment chart. Anteroposterior (taken standing) and lateral radiographs were taken at review except in those who could not attend hospital; they were visited and assessed in their own homes. A full assessment was made of pain, walking distance and use of a walking aid, gait, flexion deformity and range, valgus or varus deformity and ability to get up from a chair or to climb stairs, and a score was allocated to each modality. Pain was scored as four when severe, three when moderate, two when slight or occasional and one when absent. Thus the better the result the lower the pain score. The overall result was graded from one to five by the reviewing authors together, corresponding to excellent, good, fair, poor and failure.

A result was graded as excellent when the operation had achieved complete or almost complete relief of pain, ability to flex the knee to a right angle, correction of deformity and considerable improvement in mobility, especially in terms of walking distance. In addition, for a result to be graded as excellent, the radiographs had to show both implants correctly positioned and absence of a lucent line at the bone-cement interface (Fig 2).

A good result denoted mild residual pain, incomplete correction of deformity, or failure significantly to improve pre-operative flexion and walking range. In knees in which two of these features were present at review, or where one was present to a moderate degree, a fair grading was awarded. An implant was deemed to have failed if it had to be removed, or if it had become so loose as to be functionally unstable. The medical condition of a number of patients was such that after an initial improvement, their walking deteriorated to the extent that they eventually had no useful mobility. These patients were assessed as being functional failures and graded accordingly. Finally, the patients themselves were also asked to grade their operation and to comment on whether they would, if indicated, have a further knee replacement.

RESULTS

Thirteen patients (13 knees) had died prior to review, three of these never having been discharged from hospital following operation. One of these patients

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died 15 days post-operatively from adrenal failure and must be considered a peri-operative death, the only one in the series. The two others developed medical complications in the rehabilitation period which prevented their discharge from hospital; they died seven months, and two years and four months respectively, after operation. According to information supplied by their family doctors, death in the other ten cases was not related to surgery and, so far as could be determined, there had been a satisfactory result from knee replacement. The four prostheses which had to be removed were not reviewed, but were automatically graded as failures. Thus, in total, 87 knees were graded.

The most significant improvement reported by patients was pain relief (Fig 3). Ninety percent of patients had had severe knee pain pre-operatively. At post-operative assessment, 34 knees (41% of those reviewed) had no pain whatsoever, while a further 35 knees (42%) admitted to only mild pain or occasional discomfort. In 13 of the 35 cases with mild pain, symptoms were confined to the patella. Five of the 11 patients (11 knees) who continued to complain of moderate pain had symptoms confined to the patella, a feature also noted in two of the three knees with severe pain post-operatively. Four knees had been surgically revised and were therefore not included in this pain assessment.

Assessment of improvement in mobility, especially walking distance (Fig 4), proved rather more difficult. Many subjects had symptoms in other weight-
bearing joints, especially in the ankle and foot, but improvement in mobility was reported by the majority. Only three patients had been able to walk an unlimited distance pre-operatively but 15 reported no limitation of walking ability at post-operative assessment, and a further 11 could walk up to one kilometre outdoors.

![Ability to walk](image)

Fig 4. Bar chart showing maximum walking distance for each patient per knee replacement pre-operatively and post-operatively. There was a shift towards a greater walking distance post-operatively.

Improvement in the flexion range was reported by most patients at review (Fig 5). Thirty eight knees (46% of those reviewed) had flexion to above 80 degrees pre-operatively, which rose to 48 knees (58%) at review. Flexion deformity was generally improved by operation (Fig 6). Pre-operatively 32 knees (38%) had a flexion deformity in excess of 20 degrees; at post-operative assessment only 5 knees (6%) had this degree of deformity.

Based on the grading system previously described, 26 knees (30%) were graded as excellent, 22 (25%) as good, 19 (22%) as fair and nine (10%) as poor. There were 11 failures. Knees were graded as fair, generally on the basis of continued moderate pain, or limited — though improved — flexion and extension. Of the nine knees graded as poor three had continuing severe pain, four recurrence of the original deformity (two varus, two valgus) and two failed to regain the pre-operative flexion/extension range.

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Fig 5. Bar chart showing the maximum flexion of each knee before and after replacement. Most patients reported an increase in flexion ability though the improvement in this parameter was not as obvious as in others.

Fig 6. Bar chart showing the flexion deformity of each knee before and after replacement. There was considerable reduction in deformity after surgery.

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There were five implant failures (6%), four the result of deep infection, the fifth due to loss of fixation as a result of a fall (Fig 7). In three of the infected implants, the pre-operative diagnosis was osteoarthritis. The interval to failure in these cases was seven, 49, 66, 69 and 78 months. Two of the four infected implants were successfully arthrodesed and two were exchanged. One of the exchanges was performed within the period of the survey and the end result was good. Mobility deteriorated in six patients (6 knees) following an initial improvement post-operatively for a variety of medical reasons such that, at review, they were chairbound and unable to walk. In these patients, the operation was considered to be a functional failure and graded accordingly. Three of these patients had suffered a cerebrovascular accident in the interim and had regained no useful mobility thereafter. In one patient with aggressive rheumatoid disease, the knee had become virtually ankylosed and the patient chairbound. A further patient had had a below knee amputation as a result of peripheral vascular disease, while the sixth patient never walked independently post-operatively due to a combination of gross obesity and poor motivation.

Fig 7. Failure of fixation as a result of a fall 78 months from arthroplasty. The patient was independently mobile using a knee brace and declined further surgery.

Post-operative complications were relatively few. Nine knees required manipulation under anaesthetic, two requiring more than one manipulation. There were three proven cases of deep venous thrombosis. In four knees there was a considerable delay in wound healing, while another required wound resuture. None of these cases subsequently became infected. One patient had persistent patellar subluxation and had a realignment procedure performed at two years.

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later. A further patient suffered a foot drop, but this had recovered six months after operation.

Patients' assessment of the operation was generally more favourable than that recorded by the clinical observers. On average, patients assessed their result one grade better than the authors. Thus, 42 knees (48% of the knees graded) considered their result to be excellent and a further 28 (32%) considered their result to be good. Eighty two percent of patients reviewed stated that, given similar symptoms, they would consider further knee arthroplasty.

**DISCUSSION**

In assessing the results of total knee arthroplasty, unfair comparison is often made with total hip replacement, especially in the mind of patients undergoing operation. Nevertheless, sufficient evidence now exists to propose total knee arthroplasty as a relatively safe and reliable form of treatment for rheumatoid and degenerative diseases of the knee.\(^1\)\(^5\)\(^9\)\(^10\) Our own experience with these first 100 Richard's knee replacements, and with more than 500 arthroplasties of the same type which have been performed subsequently, would support this view.

Analysis of the medium term results of our first 100 Richard's knees have led to some modifications in terms of patient selection and our operative and post-operative management. Careful patient selection is most important. The grossly overweight patient, aggressive rheumatoid disease and poor motivation are factors which mitigate against a good outcome from knee arthroplasty.\(^5\) Pre-operative compliance with dietary restriction and physiotherapy is a good indicator of motivation.

We had initially reserved total knee replacement for those in the older age groups with advanced disease, in accordance with the caution urged by Waugh.\(^2\) Thus in the first 100 cases there was a high proportion of patients who were either chairbound, or who had marked stiffness and gross deformity. Set against this, our results, with 55% excellent or good and 22% fair (improved) on a more than five year follow-up, are very encouraging. Our practice now is to operate earlier, before the onset of significant fixed deformity, with the expectation of better post-operative stability and mobility.

As an operation directed in large part towards the relief of pain, total knee replacement must be considered a success. In our series, 82% of patients reviewed had no pain, or only slight, occasional discomfort post-operatively. In more than one third of those with slight pain, symptoms were confined to the patella. In those with more significant post-operative pain, patellar symptoms were predominant. Some of those patients with more severe symptoms undoubtedly had some degree of patellar maltracking. Similar patellar symptoms following total knee replacement have been reported by others especially in relation to knees with a valgus deformity.\(^11\)\(^12\) More serious patellar problems, such as subluxation and dislocation, or fracture after prosthetic replacement, are reported to be relatively uncommon.\(^13\) In our series only one knee required post-operative realignment of the patella, and there were no cases of patellar dislocation or fracture. We now perform a lateral release in a significant percentage of knee replacements, and patellar problems have become less frequent.
In five knees there was either significant delay in wound healing or wound breakdown. Fortunately none of the cases with wound problems subsequently became infected. Great care should be taken in the handling of soft tissues around the knee as healing properties are often impaired. As a result of wound problems, we now prefer to use a median or straight parapatellar incision rather than the curved medial incision formerly used. Analysis of the four knees which became infected revealed no common or underlying factor. Rather surprisingly, three of the four infections occurred in knees in which the pre-operative diagnosis was osteoarthritis. Certainly with rheumatoid patients on systemic steroids there is a high index of suspicion of underlying asymptomatic infection. Swabs sent for culture at the time of operation have occasionally been reported as positive for staphylococci, and it is now our policy to send swabs routinely in every case. Where the culture is reported as positive, the prophylactic antibiotic regime is extended to a therapeutic course.

When judged against the excellent results which we achieved in pain relief, the flexion/extension range observed at review was somewhat disappointing. Although the majority of cases were improved, the average post-operative range of movement was less than that reported by others.\(^5\)\(^{14}\) This was undoubtedly due, in large part, to our initial conservatism in not permitting knee bending until the wound was soundly healed. Thus flexion was not permitted for two to three weeks after operation. We now routinely permit mobilisation from the third post-operative day and — depending on availability — patients are often placed on a continuous passive motion machine in the recovery room immediately after surgery. The use of such machines following knee replacement is gaining widespread acceptance.\(^15\)

Total replacement of the knee is now established as the treatment of choice in advanced degenerative and rheumatoid disease. The risks of surgery are no greater than those for hip replacement, and the outcome is almost as predictable. The growing numbers of patients requesting arthroplasty of the knee is testimony to its increasing acceptability and success.

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