THE MANAGEMENT OF LOCAL COMPLICATIONS OF TOTAL HIP REPLACEMENT BY THE MCKEE-FARRAR TECHNIQUE

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One thousand and forty-two McKee-Farrar prostheses of the present design inserted in Norwich from January 1965 to December 1972 have been reviewed retrospectively to determine the incidence of complications needing revision. Of prostheses implanted for more than two years, 6.6 per cent needed revision for loosening (cup 3.5 per cent; stem 2.2 per cent; both components 0.9 per cent). Of the total number, 2.3 per cent became infected and 1.9 per cent dislocated. Most dislocations needed only a single closed reduction but 0.8 per cent were revised. The outcome of revision operations was also assessed. Of revisions for loosening, 40 per cent needed no further operation but 23 per cent required excision; pelvic fracture or bone destruction around the components made success unlikely. Revisions for dislocation were disappointing. Of all revisions 17 per cent became infected. Excision arthroplasty is better than a series of failed revisions in an elderly patient.

The management of hip disorders has changed profoundly since 1966 when McKee and Watson-Farrar of Norwich introduced their artificial hip for general use, and nobody would now return willingly to the earlier methods of treatment (Bonnin 1972). Patients suffering from the local complications of total hip replacement are at present relatively few in number but they are being seen more and more frequently as prosthetic surgery gains popularity. This paper records briefly the experience in their management at the Norfolk and Norwich Hospital.

MATERIAL

The notes of all patients who had prosthetic replacement of the hip between January 1965 and December 1972 were reviewed. The patients themselves were not examined and no attempt was made to measure the improvement in symptoms or gain in function. Because this was a retrospective study we do not propose to comment on the bacteriological aspects of wound infection or on the antibiotic regimes used to prevent it. The operations were performed by nineteen different surgeons in a standard operating theatre with orthodox precautions to maintain sterility.

Technique of operation—A McKee-Farrar all-metal prosthesis was inserted in every patient through the antero-lateral approach described by McKee and Watson-Farrar in 1966. In some cases the anterior fibres of gluteus medius were divided in order to give better exposure of the femur. In the preparation of the acetabulum it is now thought undesirable to remove subchondral bone because it provides good anchorage for the cement. To provide extra fixation, at least three keying holes one centimetre or more in diameter are made through cortical bone, a pit is made in the ischium and the fovea is

vigorously cleared of all soft tissues. Screws are no longer inserted in the brim of the acetabulum and a plastic cannula is now placed in the femoral shaft before introducing the acrylic cement. The operative technique is otherwise unchanged from that described by Watson-Farrar in 1969.

The early design of femoral component which was used before 1965 impinged on the edge of the cup and many of these had to be replaced. The present design has been used continuously since 1965, but a smaller cup was introduced in 1967. Techniques of manufacture were refined over the last two years of the period of the review so that the femoral stem was stronger, the head more nearly spherical, and the joint dome-bearing. The cement used was Simplex P without barium.

Note on terminology—*First total hip replacement* implies the insertion of a prosthesis for the first time, irrespective of previous operations on the hip. *Revision operation* means any operation in which either component was removed or replaced. The term does not include cases in which the prosthesis was explored but no abnormality found. *Excision arthroplasty* means the removal of the whole prosthesis as a salvage operation, not as a Girdlestone procedure. *Needing operation* means that operation for loosening or infection was indicated but not actually performed because the patient was too old or infirm to derive the full benefit.

FINDINGS

These are divided into two sections. The first deals with the incidence of complications after replacements at this hospital in the eight-year period up to December 31, 1972, but not their management. The second section concerns operations for complications and includes a few patients who had their first arthroplasty either before 1965 or elsewhere.

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COMPLICATIONS AFTER 1,042 FIRST REPLACEMENTS PERFORMED BETWEEN 1965 AND 1972

Complications requiring operation—The incidence of operations for infection, dislocation and loosening is set out in Tables I and II. Because operations for loosening were rarely indicated within two years, the proportion operated on for that reason is expressed as a percentage of the arthroplasties done between 1965 and the end of 1970.

A total of 2.8 per cent of patients operated upon during the first six years needed operation for infection in comparison with 1.0 per cent in the last two years. The change would appear to have coincided with the opening of a new operating theatre suite.

Complications that did not require operation—Two patients had a femoral nerve palsy after operation and three had a sciatic palsy affecting the lateral part of the nerve. All five recovered within two years. The palsies were probably caused by retractors or from the preparation of keying holes in the pubis or ischium. There was no case of thermal damage to the sciatic nerve from cement extruded through a breach in the femoral cortex.

The stem had penetrated the femoral cortex of five patients, who underwent revision for loosening rather than for the posterior prominence. Another patient complained of a painful swelling at the back of the thigh which did not warrant operation. Otherwise such penetration has not been a practical problem. We do not know how often the femoral cortex was breached without causing symptoms.

OPERATIONS FOR COMPLICATIONS

Such operations are summarised in Table III. Some patients had more than one operation for loosening, and some of the cases revised for loosening became infected later.

Revision for loosening—The findings at the first revision are shown in Table IV and the eventual outcome in Table V.

Operations for infection—If an abscess or sinus forms it is standard practice to curette the walls and remove as much infected tissue as possible; Table VI sets out the results of this procedure. Of the three patients treated successfully, one had a superficial infection curetted two weeks after operation and the other two discharged pus more than two years after the first arthroplasty; both of these wounds were irrigated continuously with antibiotic

solution for several days after curettage. All three patients were apparently free of infection eighteen months later. No sinus healed if it needed curettage more than once, and all such hips eventually needed excision arthroplasty. This group included two treated by continuous irrigation.

FIG. 1

A radiograph of an elderly patient with a discharging sinus but not enough disability to warrant excision arthroplasty.

One wound discharged for the first time over four years after the first arthroplasty; the prosthesis was removed and a new one inserted eight weeks later. This patient remained free of infection for two and a half years, when the stem of the femoral component broke and excision arthroplasty was done.

Five patients who needed excision arthroplasty for infection were too old or infirm to withstand such an extensive procedure (Fig. 1). They were advised to

TABLE I
INFECTION AND DISLOCATION

	Number	Percentage
First total hip replacements	1,042	—
Number needing later operation for infection	25	2.3
Dislocations treated by closed reduction only	11	1.1
Dislocations needing open reduction or revision	8	0.76

TABLE II
LOOSENING OF COMPONENTS AFTER FIRST REPLACEMENTS
PERFORMED FROM 1965 TO 1970 INCLUSIVE

	Number	Percentage
First replacements	739	—
Number which needed operation		
—for loosening of femoral component	16	2.2
—for loosening of acetabular component	26	3.5
—for loosening of both components	7	0.9
Totals	49	6.6

TABLE III
OPERATIONS DONE ON PATIENTS WHO ALREADY HAD AN
ARTIFICIAL HIP JOINT

Nature of operation	Number of hips	Number of operations
Replacement of one or both components for loosening	73	89
Incision of abscess or curettage of sinus	23	40
Excision arthroplasty Primary excision	10	10
for loosening Secondary excision	4	4
Excision arthroplasty Primary excision	7	7
for infection Secondary excision	23	23
Closed reduction of dislocation	19	31
Open reduction of dislocation	2	2
Replacement for persistent dislocation	6	7
Excision of new bone	3	4
Exploration but no abnormality found	4	4

TABLE IV
FINDINGS AT FIRST REVISION OPERATIONS
FOR LOOSENING WITHOUT INFECTION

Component loose	Number of hips
Stem	25
Cup	44
Both components	14
Total	83

TABLE V
EVENTUAL OUTCOME IN CASES OF LOOSENING WITHOUT INFECTION

Outcome	Totals	Findings at first revision		
		Loose stem	Loose cup	Both loose
Number of joints revised for loosening	83	25	44	14
Excision arthroplasty as first revision	10	2	4	4
Components replaced at first revision	73	23	40	10
No more operations needed	29	9	14	6
Later open operation for loosening or dislocation	22	8	12	2
Later operation for infection	16	7	6	3
Lost to follow-up	10	2	8	0
Later operation not done because of age or infirmity	7	1	6	0
Eventual excision arthroplasty after revision	17	8	7	2
Number of excision arthroplasties done for loosening	27	10	11	6

TABLE VI
OUTCOME AFTER CURETTAGE OF INFECTED SINUS
OR INCISION OF WOUND ABSCESS

Outcome	Number of hips
No operation needed after one curettage	3
More than one curettage done, but excision arthroplasty not necessary	0
Excision arthroplasty done after curettage	15
Infection not relieved by curettage but excision not done because of age	5

TABLE VII
MANAGEMENT OF DISLOCATION

	Number of hips
Dislocation	19
One closed reduction and conservative treatment only	11
Open reduction	2
Replacement for recurrent dislocation	6
Eventual excision arthroplasty after revision	2
Dislocation after revision but cannot be traced	2
Dislocation after revision but further operation refused	1
Bony ankylosis after revision	1

TABLE VIII
PELVIC FRACTURES AND LOOSE ACETABULAR COMPONENTS

Number of hips with loose acetabular components	57
Radiographs lost or destroyed	19
Radiographs available for study	38
no pelvic fracture seen	27
pelvic fracture present	11
Management:	
excision	3
replacement but excision eventually needed	7
lost to follow-up	1

TABLE IX
THE INCIDENCE OF INFECTION IN FIRST REPLACEMENTS
AND SECONDARY OPEN OPERATIONS

	Number	Percentage
First arthroplasties	1,042	
—needing operation for infection	24	2.3
Secondary open operations not done for infection	105	
—but needing later operation for infection	18	17.1

tolerate some discharge and moderate pain rather than undergo an operation from which they would be unlikely to derive full benefit.

During excision arthroplasty it is often difficult to remove buds of cement from the locking holes in the pelvis and irregular deposits from the depths of the

that dislocated more than once was treated successfully by conservative means.

Six hips were revised for persistent dislocation. One dislocated again and the patient has been walking and driving with a dislocation for the last five years. Another went on to solid bony ankylosis and two needed excision

FIG. 2

FIG. 3

Figure 2—A radiograph showing satisfactory appearances three months after the first arthroplasty. Figure 3—The same case as in Figure 2 eighteen months after operation. The patient now has pain on standing and a fracture is just visible in the medial wall of the acetabulum.

FIG. 4

FIG. 5

Figure 4—The same case as in Figures 2 and 3 thirty months after operation. Figure 5—The same case after excision arthroplasty.

femoral shaft. This study showed that a discharging sinus would persist unless all foreign material was removed.

Operations for dislocation—Nineteen hips dislocated. Eleven were successfully treated by a single closed reduction and immobilisation. Reduction was often done in the ward using intravenous pethidine or diazepam; skin traction, plaster boots with anti-rotation bars, plaster spicas or abduction plasters were variously used for immobilisation. Two hips required open reduction; none

arthroplasty for loosening or infection after revision. The other two dislocated again and have not been seen at this hospital since (Table VII).

Fracture of pelvis—All the available radiographs of hips with a loose acetabular component were closely examined and a defect in the medial wall of the acetabulum was found in eleven (Figs. 2 to 5). A new prosthesis was inserted in seven, but all eventually needed excision arthroplasty (Table VIII).

Miscellaneous complications—In five cases the femoral component fractured (Fig. 6). Four hips were explored without finding any abnormality; one patient was free of pain two years later but the others developed signs of overt infection and had excision arthroplasty.

New bone was removed from the supero-lateral aspect

formed by the introducer used to position the cup. The cup was also loose and a new joint was inserted; the patient was free of pain over three years later.

The teeth of the Travers retractor damaged the femoral artery of another patient. Despite arterial repair, an above-knee amputation was needed.

FIG. 6

The stem of this prosthesis broke and was replaced by a Minneapolis prosthesis.

FIG. 7

The new bone above the greater trochanter was excised because of pain.

FIG. 8

A radiograph showing extensive bone destruction around the loose components.

FIG. 9

A radiograph of a case in which the cup was placed too far laterally and became loose. It was replaced successfully.

of four hips which had become stiff and painful (Fig. 7). Two were relieved of pain; one later showed signs of infection; and the fourth developed more bone which was excised three years later, with relief of pain.

One arthroplasty done elsewhere had an eggshell-like layer of cement between the components, presumably

DISCUSSION

Attrition of acrylic cement can produce particles similar to those found around a worn Judet prosthesis. The associated inflammatory reaction combined with mechanical trauma can lead to extensive bone destruction (Fig.

8), but a distinction must be drawn between the effects of acrylic particles and a solid cement mass firmly fixed to bone.

It is surprisingly difficult to distinguish between the effects of loosening and of infection. The inflammation already mentioned leads to the formation of a thick pus-like material similar to that found around some infected hips, and Charosky, Bullough and Wilson (1973) have commented on this. Many cases of suspected infection are treated with antibiotics and specimens of exudate and tissue from the hip are often sterile. The borderline between infection and the inflammatory reaction associated with loosening is indistinct, and this may account for the difference between the incidences of infection after first arthroplasty and after revision (Table IX).

If a loose prosthesis can cause bone destruction, it is logical to replace it as soon as the loosening is confirmed. Pain on bearing weight and "telescoping" of the hip are the earliest indications. Standard radiographic examination is not helpful in the early stages but may reveal later bone destruction. Contrast arthrography (Salvati, Freiburger and Wilson 1972) has not proved as useful as the clinical findings; the image intensifier has also been unhelpful.

Miller (1972) has described pelvic fracture after total hip replacement. Table VII shows that replacement is not rewarding with such a fracture, but we do not know whether loosening of the cup leads to fracture of the pelvis or *vice versa*. It is interesting that no pelvic fracture has been reported near a metal upon plastic joint, although Welch and Charnley (1970) and Andersson, Freeman and Swanson (1972) have reported medial migration of plastic acetabular components.

Selection of patients for revision—In this series replacement of loose components gave poor results if there was much bone erosion or a pelvic fracture, but patients with good bone and an obvious cause of loosening did better (Fig. 9). Many patients with pain on weight-bearing are relieved by using elbow crutches and restricting activities for a few weeks, but if this fails, exploration of the joint is indicated before bone destruction is advanced.

Originally it was considered important to have a tight reduction of the hip, but it is now thought that stability is attained by correct positioning of the pros-

thesis and that only the gentlest traction should be needed to reduce the hip.

It is easy to broach the postero-lateral cortex of the femur, particularly if the patient is obese, the bone soft and the hip stiff. Adequate preparation of the femoral shaft is possible with a long-handled sharp spoon, and the use of a Moore's rasp and hammer should seldom be necessary. If the cortex is accidentally broached the patient may notice a tender mass in the back of the thigh when sitting on a hard seat and there is a higher chance of loosening of the femoral component.

Dislocation—Dislocation is usually due to an error in technique, most commonly incorrect positioning of the cup. The few revision operations done in Norwich did badly and the outlook for a hip which dislocated more than once was poor.

The prostheses were all inserted through the antero-lateral approach, and all the dislocations were anterior. We believe that dislocation is less common if this route is used, even though exposure of the femoral shaft is easier through a posterior approach.

Of the six hips revised for dislocation, two dislocated more than three years after operation for no apparent reason; neither patient had suffered any trauma and the hips were completely satisfactory until dislocation occurred. In contrast, all successfully treated hips dislocated within three weeks of operation, except for one at five weeks.

Loosening of the cup—The mechanics of cup fixation have been examined by Andersson, Freeman and Swanson (1972). We feel that several broad plugs of cement passing through the stout cortical bone of the acetabular roof are likely to provide sound fixation of the cup for a longer period than if cement is applied to cancellous bone only. We do not doubt that cement applied to cancellous bone can provide excellent fixation in the cadaver without the addition of keying holes, but the thermal damage and bone resorption referred to by Andersson and his colleagues probably create a situation in the living body quite different from that in the cadaver. Until studies can show that the omission of keying holes does not lead to loosening when the cup has been walked upon for several years, it is probably advisable to continue with their use.

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