

The Orthopaedic Hospital of the Invalid Foundation, Helsinki, Finland.

EXPERIENCE WITH THE McKEE-FARRAR TOTAL HIP REPLACEMENT

A report of 143 operations

P. SALENIUS & L. E. LAURENT

Accepted 18.iv.73

Total hip replacement was first performed by Wiles in 1938 in six patients (Wiles 1958, Lowy 1968) and next by McKee who performed 3 total hip replacements in 1951 (McKee 1951, McKee & Watson-Farrar 1966). Finally in 1958 Charnley and in 1960 McKee & Farrar began to perform this operation regularly using methylmethacrylate to fix the components into the bone (Charnley 1960, 1961). All subsequent modifications of Charnley and McKee prosthesis are fixed to the bone with bone cement whereas the Ring prosthesis (Ring 1968) is applied without cement in the bone.

Total hip replacements were started at the Orthopaedic Hospital of the Invalid Foundation, Helsinki, Finland, in June 1967. Since that time until the beginning of 1973 we have performed about 450 total hip replacements of the McKee-Farrar type. The purpose of this paper is to report the results of the first 143 operations performed until the end of 1970 with an observation time from 2.5 to 5 years.

MATERIAL AND METHODS

The number of operations was 143. The number of patients was 126 of whom 17 were operated bilaterally. The distribution of the patients is indicated in Table 1.

Table 1. Number of patients and hips.

	No. of patients	No. of hips	Bilateral operation
Women	74	80	8
Men	52	63	9
Total	126	143	17

The indication for the operation was advanced osteoarthritis of the hip with considerable limitation of mobility of the hip. In such cases the result of osteotomy has been poor in previous reports (Salenius et al. 1971). In some of the youngest patients the indication for the operation was rheumatoid arthritis with grave limitation of motion in the hip joint. The pre-operative mobility of the hip joints is showed in Table 2.

Table 2. Pre-operative flexion of the hip joint.

Degree of flexion	No. of hips
0-30°	72
30-60°	44
60-90°	27
Total	143

All patients had weight-bearing pain in the hip before the operation, and in addition more than half of the patients also had pain at rest. The age distribution of the patients can be seen in Table 3.

Table 3. Age of the patients at operation.

Years	20-29	30-39	40-49	50-59	60-69	over 70
No. of hips	3	6	24	44	59	7 = 143

The youngest patient was 20 years and the oldest 76 years of age. 33 patients were younger than 50 years. These were cases with bilateral osteoarthritis and ankylosis or grave limitation of motion in both hips with pain at rest and on weight-bearing. The total hip replacement operation was then performed as an alternative to arthrodesis or Girdlestone's operation.

OPERATIVE TECHNIQUE

The operations were performed with an anterolateral approach according to the technique published by McKee & Farrar in 1966. In the beginning the larger size of acetabular cup was used. Later we changed to the smaller type of cup which is better fitted into the acetabulum. This has been regarded as an improvement to stability and seems to diminish the risk of loosening of the prosthesis. The cartilage was removed entirely from the acetabulum, but the sclerotic bone under the cartilage was left in order to increase the stability in fixation with the cement. It became obvious that if the sclerotic bone was removed and the cement was applied in the soft cancellous bone the fixation was not firm enough. Three to four holes of about 10 mm in diameter were drilled in the acetabular roof. One or two of these holes were bored through the acetabular medial and cranial wall. The acetabulum was cleansed of all soft tissue. Two types of acrylic cement have been used, Simplex and the C.M.W. cement. Of the cups 85 were of the smaller size and 58 the larger size. Suction drainage (Redivac) was applied postoperatively as a routine. Sometimes the operative wound was rinsed during the operation with a

solution of antiseptics or antibiotics or an antibiotic powder was applied in the wound. Postoperative antibiotic therapy was not used as a routine. The patients were mobilised the first day after operation, and partial weight-bearing with crutches was allowed. The duration of the post-operative hospitalization is seen in Table 4.

Table 4. Duration of post-operative hospitalization.

	No. of hips
Less than 3 weeks	71
3-6 weeks	60
More than 6 weeks	12
Total	143

COMPLICATIONS

Table 5.

Death relating to operation	2	Mortality 1.6 %
Embolism of lung	2	(1 fatal 3 weeks after op.)
Cardiac infarction	3	(1 fatal 5 weeks after op.)
Peroneal palsy	1	(heat damage to N. ischiadicus)
Infection	7 = 4.9 %	
Early (3 weeks-3 months)	3	
Late (5-18 months)	4	
Dislocation	4	
Early	1	
Late (4-12 months)	3	
Aseptic loosening of prosthesis	18 = 11.9 %	
Acetabular part	10	
Femoral part	6	
Both parts	2	

Infection

The bacteriology and the results of treatment of the infected hips appear from Tables 6 and 7.

Table 6.

Bacteriology	
Staph. aureus	3
Staph. albus	1
Pseudomonas	2
No fistulation	1

Table 7.

Treatment of infected hips	
Prosthesis removed	3
Healed temporarily with irrigation	2
Healed with antibiotics	2

Five of the patients with fistulation had irrigations with Alevaire and antibiotics (Compere et al. 1967) for a few weeks, one to four

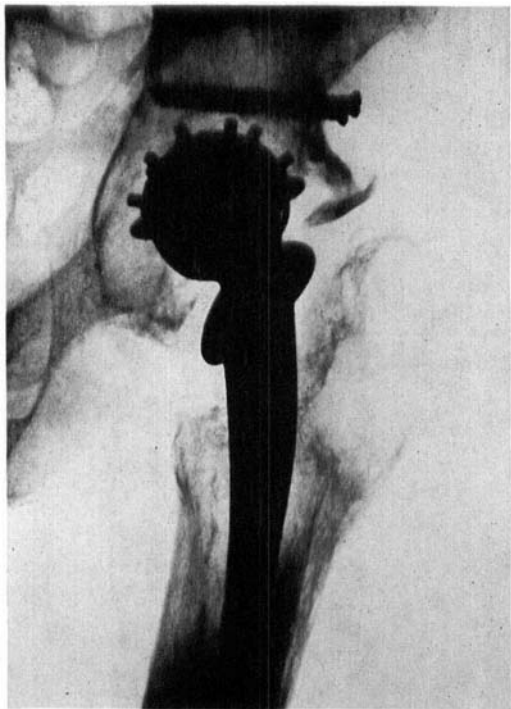


Figure 1 A. The patient was operated on in 1969. The primary result was good but the patient later had pain on weight-bearing.

times. In two of the cases the fistula temporarily closed. One of the infected cases had clear clinical signs of infection 5 months after the operation, but no fistulation, and the infection healed with antibiotic treatment. There have been no signs of infection at follow-up 4 years later. The other case had early infection and fistulation after operative reduction of prosthesis because of early dislocation. The infection healed and had not relapsed one year after the operation when the patient died of a cardiovascular disease.

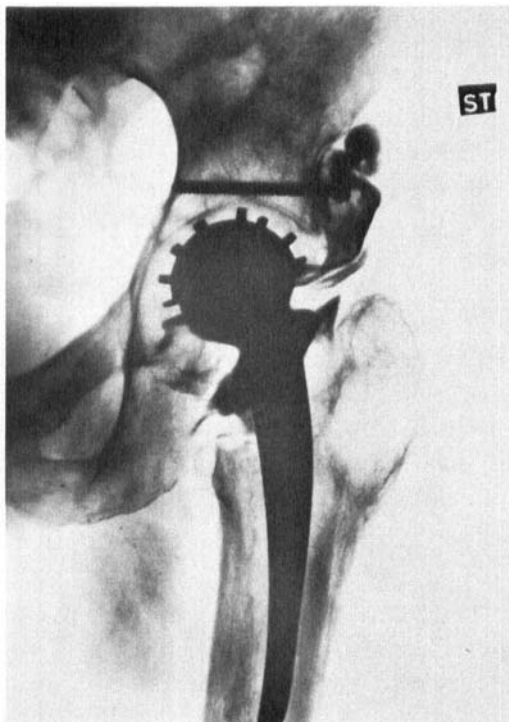
Periarticular calcification

There were only 4 cases with noteworthy postoperative calcification in these series.

Dislocation

The only patient who got an early dislocation had an operative reduction and a plaster for 3 weeks. The dislocation did not relapse. One patient got a dislocation at home one year after operation. It was

Figure 1 B. In arthrography 1972 the radio-opaque medium goes between the acrylic cement and bone in the acetabulum. The patient is waiting for reoperation.



reduced and has not relapsed. The third patient had had several operations before the total replacement (Judet arthroplasty, twice unsuccessful fusion operations). There was extensive scarring of the soft parts, which led to a habitual dislocation of the artificial joint. The prosthesis was removed. The fourth patient with late dislocation had sequelae after an acetabular fracture with dislocation of the hip. After reapplication of prosthesis a loosening occurred of the acetabular part, which was subsequently removed.

Loosening of prosthesis

This complication occurred in 18 non-infected cases. The acetabular part went loose in 10, the femoral part in 6, and both parts in 2 cases. In these series 2 screws were drilled into the roof of the acetabulum. If the screws were broken it was concluded that there was loosening of the acetabular part. In one case there was cranial dislocation of the whole artificial joint which recurred after reapplication. In some cases

cinematography and arthrography were used in the diagnosis of loosening (Figure 1 A, B).

The greater cup had been inserted in 9 of the 12 cases with loosening of the acetabular part of the prosthesis. In 7 cases the cup was situated too laterally and was not enough covered by the acetabulum.

Reapplication has so far been performed in 8 cases with good results in 5. In 2 cases the loosening recurred and in one case the joint went stiff.

Pain without loosening

In 8 cases the hips were painful at follow-up about 3 years after the operation. Loosening or infection could not be established. One of these cases was operatively explored with negative findings. In some of these cases there is probably a slight loosening which cannot be clinically diagnosed.

RESULTS

The follow-up examination was performed for the first time in 1970 and for the second time in 1972. Two patients had died during the observation period. In the follow-up examination a case in which there was no pain in the hip, where the mobility of the hip had reasonably increased compared to the mobility before the operation and where the patient could move around without crutches or stick was recorded as excellent or good (Merle d'Aubigné et al. 1954). Those in which either infection or continuous pain was present and in which the mobility of the hip had not increased after the operation were regarded as poor. If the patient had pain on strain, but the mobility of the hips was increased and if he could move around without crutches, the result was recorded as fair. The results of the follow-up can be seen in Table 8.

Table 8. Result according to patient at follow-up.

	Excellent or Good	Fair	Poor	Total
1970				
No. of hips	121 (86 %)	15 (11 %)	5 (3 %)	141
1972				
No. of hips	108 (78 %)	13 (9 %)	18 (13 %)	139

If the results were divided into excellent and good as recommended by Lubinus (1972) then 54 of the patients were regarded as excellent

and 50 good. It was observed that if the mobility of the hip was good before the operation the postoperative mobility was better. It is obvious that if the hip joint has been stiff for a very long time the soft tissues have become contracted, also; therefore, the mobility of the hip increases more slowly than in these cases. The pre- and postoperative mobility of the operated hips can be seen in Table 9.

Table 9. Flexion of the hip.

Before operation	No. of hips	At follow-up	
		0-60°	60-100°
0-30°	72	24	48
30-60°	40	10	30
60-90°	27	2	25
Total	139	36	103

It can be seen that a flexion motion of more than 60 to 100° was present post-operatively in 103 hips.

DISCUSSION

In most cases infection entirely spoils the results and leads to loosening of the prosthesis. Irrigation with Alevaire and antibiotics after revision is worthwhile to try before the prosthesis is removed. Buchholz (1972) successfully performed reapplication in infected cases under the cover of gentamycin mixed to the cement.

In this series the infection rate of 4.9 per cent is too high and only reorganisation of the hospitals operative ward is likely to decrease the infection rate. There has been a substantial decrease in infection rate in hospitals where a "green house" or an operating room with laminar air-flow has been adopted (Charnley, Lubinus, Weber). The use of local and postoperative antibiotic treatment is still controversial. There are reports of the decrease in the early infection rate with systematic treatment with antibiotics (Wilson et al. 1972).

Dislocation can obviously be avoided with proper operative technique. Patients with scarring of the muscles and soft tissues after previous operations are not very well suited for total arthroplasty. However, the actual postoperative procedure allowing the patient to get up from bed on the first postoperative day does not seem to increase the rate of dislocation. This is important since the rate of postoperative thrombosis and embolism is reduced with early mobilisation.

Loosening of the prosthesis has occurred in 18 non-infected cases (11.9 per cent). This is greater than in many other previous reports (Andersson et al. 1972). The operations were performed by 8 surgeons. Especially in the beginning the greater cup was not placed deep enough into the socket. Later the smaller cup and a head with a long stem were used in the majority of cases. The cup should be placed entirely under the roof of the socket. Later the number of holes bored in the socket was increased to 5-7, and at least two holes were penetrating the wall of the acetabulum. In contrast to Andersson et al. (1972) our opinion is that the holes increase the stability. The cement was placed into the holes using the fingers or a spoon before the rest of the cement is applied (Wilson et al. 1972).

A significant resorption of the bone was noted in some of the cases, where the prosthesis had loosened. The cement seems to have a toxic effect if the prosthesis is loose (Wilson et al. 1970).

The rate of complications in these series is rather high, and we think the total replacement of the hip should still be reserved for patients in the higher age group. In suitable cases we still prefer to perform osteotomy, which later can be converted to a total hip. In young patients cup arthroplasty or arthrodesis still have their place if osteotomy is not indicated.

After a series of 450 McKee-Farrar replacements we are now going to try the metal-polyethylen principle (the Brunswick prosthesis).

SUMMARY

In the years between June 1967 and the end of the year 1970 a total of 143 total hip replacements according to McKee-Farrar were performed at the Orthopaedic Hospital of the Invalid Foundation, Helsinki. The number of patients was 126; 17 were operated bilaterally. The indication for the operation was a stiffened, painful osteoarthritic hip. The mortality was 1.6 per cent. There were 3 early infections within 3 weeks to 3 months postoperatively and 4 late infections between 5 and 18 months postoperatively. The total number of infections was 7 cases corresponding to 4.9 per cent of the entire series. The cup loosened in 10 cases and the femoral part loosened in 6 cases and both parts loosened in 2 cases, the total number of loosening being 18 (11.9 per cent). In 8 cases reapplication was performed with a good result in 5 cases. The result of the operation at follow-up (after 2.5 to 5 years in 1972) of 139 hips was recorded as good or excellent in 108 (78 per cent) cases, fair 13 cases and poor 18.

REFERENCES

- Andersson, G. B. J., Freeman, M. A. R. & Swanson, S. A. V. (1972) Loosening of the cemented acetabular cup in total hip replacement. *J. Bone Jt Surg.* **54-B**, 590-599.
- Buchholz, H. W. & Gartmann, H.-D. (1972) Infektionsprophylax und operative Behandlung schleichenden tiefen Infektionen bei der totalen Endoprothese. *Chirurg* **43**, 446-453.
- Charnley, J. (1960) Anchorage of the femoral head prosthesis to the shaft of the femur. *J. Bone Jt Surg.* **42-B**, 28-30.
- Charnley, J. (1961) Arthroplasty of the hip. A new operation. *Lancet* **1**, 1129-1132.
- Compere, E. L., Metzger, W. I. & Mitra R. N. (1967) The treatment of pyogenic bone and joint infections by closed irrigation (circulation) with a nontoxic detergent and one or more antibiotics. *J. Bone Jt Surg.* **49-A**, 614-624.
- Lowy, M. (1968) Total hip replacement. *Proc. roy Soc. Med.* **61**, 665.
- Lubinus, H. H. & Jacobsen, U. (1972) Erfahrung mit dem totalen Hüftersatz unter Verwendung des Systems Brunswik und eines dorsolateralen Zugangs. Bericht über 852 Fälle. Mitteilungen aus der chirurgisch-orthopädischen Klinik Dr. Lubinus, Kiel.
- McKee, G. K. (1951) Artificial hip joint. (Proceeding of the East Anglian Orthopaedic Club). *J. Bone Jt Surg.* **33-B**, 465.
- McKee, G. K. & Watson-Farrar, J. (1966) Replacement of arthritic hips by the McKee-Farrar prosthesis. *J. Bone Jt Surg.* **48-B**, 245-259.
- Merle d'Aubigné, R. M. & Postel, M. (1954) Functional results of hip arthroplasty with acrylic prosthesis. *J. Bone Jt Surg.* **36-A**, 451.
- Patterson, F. P. & Selby Brown, C. (1972) The McKee-Farrar total hip replacement. *J. Bone Jt Surg.* **54-A**, 257-275.
- Ring, P. A. (1968) Complete replacement arthroplasty of the hip by the Ring prosthesis. *J. Bone Jt Surg.* **50-B**, 720-731.
- Salenius, P., Langenskiöld, A. & Österman, K. (1971) Intertrochanteric displacement osteotomy in the treatment of osteoarthritis of the hip. *Acta orthop. scand.* **42**, 63-77.
- Weber, B. G. (1970) Total hip replacement with rotation-endoprosthesis (Trunnion-bearing prosthesis). *Clin. orthop.* **72**, 79.
- Wiles, P. (1958) The Surgery of the osteo-arthritis hip. *Brit. J. Surg.* **45**, 488-497.
- Wilson, J. N. & Scales, J. T. (1970) Loosening of total hip replacement with cement fixation. *Clin. Orthop.* **72**, 145.
- Wilson, P. D., Amstutz, H. C., Czerniecki, A., Salvati, E. A. & Mendes, D. G. (1972) Total hip replacement with fixation by acrylic cement. *J. Bone Jt Surg.* **54-A**, 207-236.

Correspondence to:

The Orthopaedic Hospital of the Invalid Foundation
Tenholantie 10
00280 Helsinki 28
Finland