

TOTAL HIP REPLACEMENT BY THE BRUNSWIK PROSTHESIS

A Preliminary Report of 189 Operations

T. VISURI, P. SALENIUS & L. E. LAURENT

Orthopaedic Hospital of the Invalid Foundation, Helsinki, Finland.

The results of 189 Brunswik total hip replacements, performed at the Orthopaedic Hospital of the Invalid Foundation, Helsinki, Finland, and followed up for 2-3 years, are presented. According to the modified system of Merle D'Aubigne & Postel excellent results were achieved in 11.1 per cent (21/189), good in 56.6 per cent (107/189) and fair in 27.5 per cent (52/189). The failure rate was 4.8 per cent (9/189) and consisted of four deep infections, four cases of aseptic loosening and one case of allergic loosening. Local complications occurred after primary operations in 7.5 per cent (12/159) and after revision operations in 26.7 per cent (8/30) and the difference was statistically significant ($P < 0.01$). Among the complications, deep infections were encountered in 2.6 per cent (5/189), aseptic loosening in 2.1 per cent (4/189). Other local complications were: ectopic ossification in 1.6 per cent (3/189), nerve injuries in 1.6 per cent (3/189), dislocations in 1.1 per cent (2/189), and peroperative fractures in 1.1 per cent (2/189). General complications were observed in 8.9 per cent (17/189). Thromboembolic complications were only seen in 2.6 per cent (5/189). A possible explanation for this low figure was the early ambulation of the patients on the first postoperative day. No deaths related to the operation occurred.

Key words: total hip replacement; metal-to-metal prosthesis; metal-to-plastic prosthesis

Accepted 2.i.77

Total hip replacement was first performed at the Orthopaedic Hospital of the Invalid Foundation in 1967 with the McKee-Farrar prosthesis, and this prosthesis has been used in a total of 555 hips. Two reports have been published of the results (Langenskiöld & Salenius 1970, Salenius & Laurent 1973). After an increasing number of aseptic loosening of this prosthesis, we changed from the metal-to-metal prosthesis to the metal-to-plastic prosthesis in December 1972 preferring the Brunswik prosthesis.

The design and size of the Brunswik prosthesis has been described by Lubinus (Lubinus & Jacobsen 1973).

The purpose of this paper is to present the results of the first 189 applications and to analyse the complications of this procedure.

PATIENTS AND METHODS

The patients were operated on between December 1972 and March 1974. The minimum follow-up time was 2 years varying from 2.0 to 3.0

Table 1. Sex and age distribution at operation.

Years	20-29	30-39	40-49	50-59	60-69	70-79	80-85	Total
Women	2	0	12	28	68	23	1	134
Men	1	0	5	15	16	9	0	46
Total	3	0	17	43	84	32	1	180

years. The series consisted of 183 patients, but two of them died from causes unrelated to the hip operation and one schizophrenic patient refused to come for follow-up examination. Thus the series consists of 180 patients and 189 hips, nine patients being operated on bilaterally. The age and sex distribution of the patients are given in Table 1. The mean age was 61.9 years. The youngest patient was 25 and the oldest 84 years old. The preoperative diagnoses are listed in Table 2. In 30 patients some kind of hip operation had been performed prior to the arthroplasty (Table 3). This group is called the revision group.

Because of the rather big acetabular component of the Brunswik prosthesis which proved to be too large for many female hips, we have used a smaller metal-to-plastic prosthesis, the French Lagrange-Letournel model in such cases (Lagrange & Letournel 1974).

Table 2. Preoperative diagnosis.

Primary osteoarthritis	142
Rheumatoid arthritis	11
Posttraumatic arthritis	11
Congenital hip dislocation	6
Old osteomyelitis	4
Legg-Perthes' disease	3
Old tuberculous coxitis	1
Slipped epiphysis	1
Post-radiation necrosis	1
Total	180

Table 3. Previous operations.

Intertrochanteric osteotomy	17
Thompson-Austin-Moore arthroplasty	4
McKee-Farrar arthroplasty	4
Nailing of fracture of the neck of the femur	3
Vitallium cup arthroplasty	1
Skin arthroplasty	1
Total	30

Operation and postoperative care

All patients were operated through an antero-lateral approach according to the technique published by McKee & Farrar in 1966. A postoperative antibiotic prophylaxis started on the first postoperative day was administered to all but 28 patients for 8 days. (Three of the five deep infections occurred among the patients who did not receive antibiotic prophylaxis.) Ampicillin was used in most cases. Prophylactic anticoagulants were not used; only established thromboembolism was treated. The patients were mobilized on the first postoperative day allowing immediate weight-bearing. The operations were performed in conventional operating theatres. No air-conditioning or laminar air flow system was available. In high risk patients, a preoperative examination by a specialist in internal medicine was carried out. High risk patients were often operated on under hemispinal anaesthesia. Statistics concerning operation time, blood loss and anaesthesia are given in Table 4.

RESULTS

The results were evaluated according to a modified system of Merle D'Aubigne & Postel (1954) with six gradations for pain, motion and walking ability.

Pain (Figure 1). 76.7 per cent (138/180) of the patients suffered continuous or intermittent pain at rest before the operation. The relief of pain was marked and 67.7 per cent (122/180) were pain-free after operation. 2.8 per cent (5/180) of the patients still had restrictive pain; in four cases this was due to deep infection and in one case to aseptic loosening. In three other cases of aseptic loosening the pain was tolerable. The average score for pain was 2.36 be-

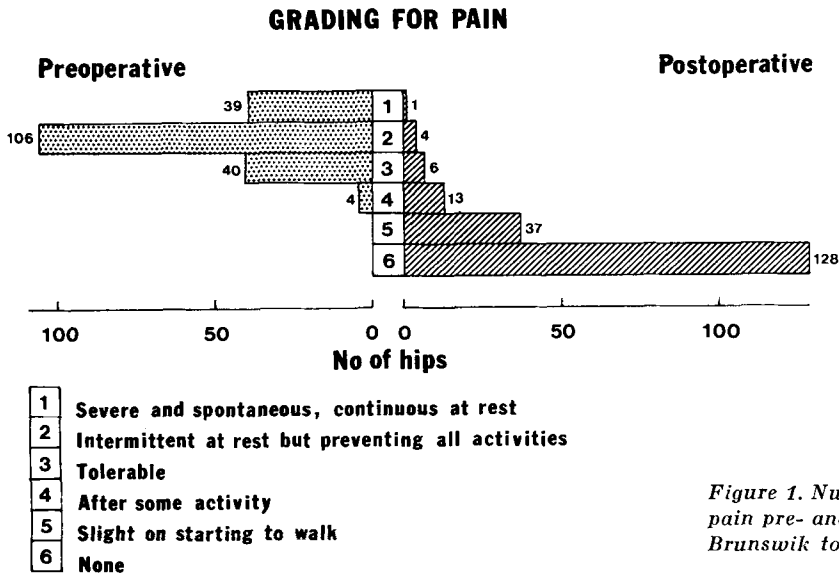


Figure 1. Numerical grading for pain pre- and postoperatively in 189 Brunswick total hip replacements.

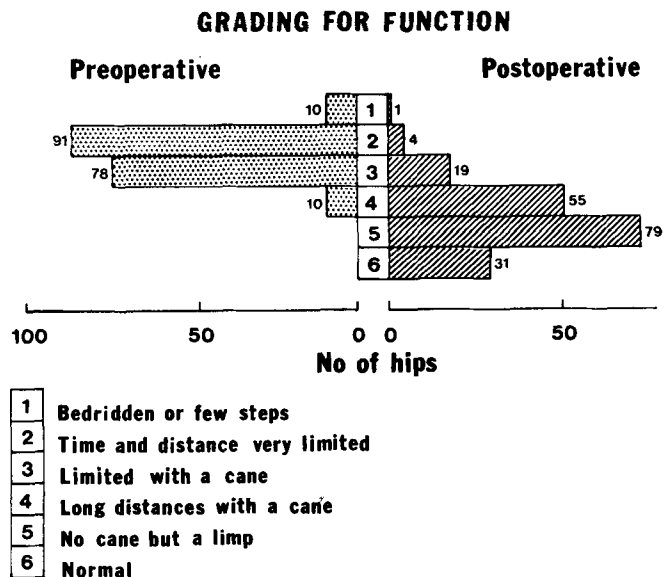


Figure 2. Numerical grading for function pre- and postoperatively in 189 Brunswick total hip replacements.

fore and 5.40 after the operation with an improvement of 3.04 points.

Function (Figure 2). Normal gait was achieved by 17.2 per cent (31/180) of the patients. 70.0 per cent (126/180) of the patients had a slight limp or used a cane but could walk long distances. In 12.8 per cent (23/180) the function was limited. The recovery of function was

less marked than the improvement in pain. The improvement rate was on average 2.13 points.

Mobility (Figure 3). The recovery of mobility was very similar to that of function with an improvement of 2.24 points. A flexion contracture was present in 30.2 per cent (57/189) of the hips before the operation: 5–10° in 23 cases, 10–20° in

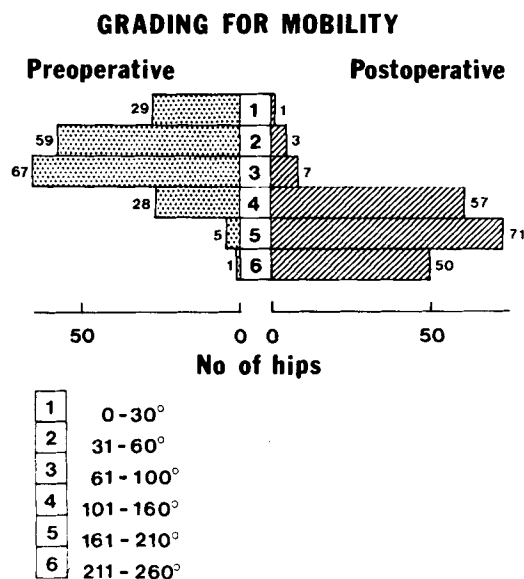


Figure 3. Numerical grading for mobility pre- and postoperatively in 189 Brunswik total hip replacements.

11 and 30-40° in 23 cases. Correction of this contracture was obtained in all but four patients. In three of these patients flexion contracture was caused by a massive myositis ossificans and in one a 10° contracture remained.

Overall results (Table 5)

11.1 per cent (21/189) of the hips were classified as excellent: there was no pain, normal gait was achieved and the range of movement of the hip was over 210°.

In 56.6 per cent (107/189) the result was good: i.e., there was no pain, but there was a limp or a cane was needed for long distances. 27.5 per cent (52/189) were classified as fair. The patients had slight or moderate pain and the walking distance was limited. The failure rate was 4.8 per cent (9/189). This group consisted of four cases of deep infection, four cases of aseptic loosening and one case of allergic loosening. The results according to the preoperative diagnosis are given in Table 5.

Complications

General complications. These are listed in Table 6. There were very few general complications in this series. No death related to the operation occurred. Deep venous thrombosis developed in four patients postoperatively and pulmonary embolism in one patient 3 weeks after the operation. The diagnosis of thrombosis was based on clinical observation only. The thrombosis was treated by heparin and oral anticoagulants. No late sequelae following thrombosis were observed at the follow-up examination. Cardiac ischaemia was diagnosed in two cases. There were also three cases of postoperative pneumonia. All general infections responded to antibiotic treatment.

Local complications. Local complications occurred in 20 patients. Local com-

Table 4. Operation statistics.

Surgeons	11
General anaesthesia	146
Hemispinal anaesthesia	43
Blood loss in primary operation	1360 ml average
Blood loss in revision operation	1430 ml average
Blood loss in hemispinal anaesthesia	1370 ml average
Blood loss in general anaesthesia	1360 ml average
Blood loss in all operations	1370 ml average
Blood loss from drains	575 ml average
Transfusion, total	4.7 units, average
Operation time	110 min, average

Table 5. Results according to the system of Merle D'Aubigne.

	Primary osteoarthritis	Secondary osteoarthritis	Rheumatoid arthritis	Revision arthroplasty	All hips
Excellent (grading 6-6-6)	19	—	2	—	21 (11 %)
Good (minimal grading 6-4-3)	79	9	7	13	107 (57 %)
Fair (minimal grading 3-3-2)	29	8	3	12	52 (27 %)
Poor (grading under 3-3-2)	2	2	—	5	9 (5 %)
Total	129	19	12	30	189 (100 %)

Table 6. Complications.

	Primary operation (159 hips)		Revision operation (30 hips)		All	
	No.	Per cent	No.	Per cent	No.	Per cent
<i>A. General</i>						
Deep venous thrombosis	3	1.9	1	3.3	4	2.1
Pulmonary embolism	1	0.6	—	—	1	0.5
Cardiac ischaemia	2	1.3	—	—	2	1.1
Pneumonia, atelectasis	3	1.9	1	3.3	4	2.1
Urinary infection	4	2.5	1	3.3	5	2.6
Cholecystitis	1	0.6	—	—	1	0.5
Total	14	8.8	3	10.0	17	8.9
<i>B. Local and technical</i>						
Deep infection	2	1.3	3	10.0	5	2.6
Aseptic loosening	1	0.6	3	10.0	4	2.1
Myositis ossificans	3	1.9	—	—	3	1.6
Nerve damage	3	1.9	—	—	3	1.6
Dislocations	2	1.3	—	—	2	1.1
Peroperative fractures	—	—	2	6.7	2	1.1
Loose cement bodies	1	0.6	—	—	1	0.5
Total	12	7.5	8	26.7	20	10.6

plications were seen in 12 patients after primary operation and in 8 patients after revision operation. This difference is statistically significant ($P < 0.01$).

There were five deep infections in this series. The course and treatment, and

the bacteria of the infected hips, are given in Table 7.

Three of the four aseptic loosening were caused by malpositioning of the prosthesis. One case of allergic loosening, proved by a skin sensitivity test, was

Table 7. The course

Patient	Previous operation	Prophylactic antibiotic	Bacterium
AR	None	None	Staphylococcus aureus
VM	Displacement osteotomy	None	Pseudomonas
FP	Displacement osteotomy	Ampicillin	Staphylococcus aureus
IS	None	None	Staphylococcus epidermidis
AH	McKee-Farrar total hip prosthesis	Cloxacillin	Staphylococcus aureus

seen after reapplication of a loosened McKee-Farrar prosthesis. Two peroperative fractures occurred. In three cases a massive heterotopic ossification developed causing stiffness of the hip. Three cases of peroperative nerve damage occurred. There were two injuries to the femoral nerve; one recovered completely, the other seems to be permanent. There was one sciatic nerve injury, which was due to a posterior dislocation of the femoral part of the prosthesis. This palsy has partly disappeared. Dislocations occurred in two patients. One was caused by a fall. The other was due to a too vertical insertion of the acetabular part.

DISCUSSION

We have encountered some difficulties with both the acetabular and the femoral parts of the Brunswik prosthesis. Because of its large size the Brunswik socket is easily inserted in a too vertical position. It fits the acetabulum best in a vertical position. Two complications resulted from this vertical insertion of the socket; one dislocation and one loosening of the cup. On the other hand, the big socket has proved very suitable in cases of deep acetabular protrusion, as is often seen in rheumatoid arthritis.

We have also encountered difficulties in the positioning of the standard femoral parts in femora osteotomized earlier. Three local complications (2 loosening

and 1 fracture) accompanied these difficulties. It is evident that a specially designed straight stem is necessary in such cases.

If one compares the local complications of our McKee-Farrar series after 3 years observation (Salenius & Laurent 1973) with those of the Brunswik operations, there are two differences. One is a decrease in the rate of deep infections from 4.8 per cent to 2.6 per cent. This difference may be explained by the use of systemic antibiotic prophylaxis, because the other conditions remained the same. The most marked difference between the operations is, however, a decrease in aseptic loosening. The incidence of aseptic loosening in the McKee-Farrar series was 12.5 per cent (18/143) six times higher than that in the Brunswik series (2.1 per cent). After 6-7 years follow-up this figure has doubled. We do not expect such a high incidence of aseptic loosening in our Brunswik series. This difference justified the change from an all-cobalt chrome prosthesis to a metal-to-plastic prosthesis.

The frequency of general complications in large series of hip arthroplasties has been reported to be 13-25 per cent (Ilstrup et al. 1973, Coventry et al. 1975). Lubinus reports a frequency of 15 per cent (Lubinus & Jacobsen 1973). In our series the frequency was 8.9 per cent with no death related to the operation. The most important factor preventing

of infections.

Time of infection	Appearance of infection	Treatment	Final result
Early	Sinus	Debridement, irrigation	Good
Early	Sinus, loosening of femoral part	Debridement, irrigation, reapplication of femoral part, removal of prosthesis	Girdlestone
Early	Loosening of femoral part	Reapplication of femoral part	Good
Late, 4 months	Loosening of both parts	Removal of prosthesis	Girdlestone
Late, 5 months	Sinus, loosening of both parts	Debridement, irrigation, removal of prosthesis	Girdlestone

postoperative complications, particularly thromboembolism, is early mobilization of the patient. The rate of thromboembolic complications in our series was 2.6 per cent, without the use of anticoagulants. This low figure is comparable to the incidence of thromboembolic complications in patients treated prophylactically with dextran 40 or sodium warfarin (Evarts 1974, Beckenbaugh et al. 1974).

It is difficult to compare the results of total hip replacement reported by different authors because the systems of evaluation vary. It is more reliable to compare the number of failures. In our series the local failure rate was 4.8 per cent and in Lubinus' series 3.7 per cent (Lubinus 1973). The results of Brunswik operations are highly satisfactory and we intend to continue using the Brunswik prosthesis.

ACKNOWLEDGEMENT

This study was supported by a grant from Instrumentarium, the Scientific Foundation.

REFERENCES

- Beckenbaugh, R. D., Coventry, M. B. & Nolan, D. R. (1974) Prophylactic anticoagulation with sodium warfarin in total hip arthroplasty. In: *Proceedings of the Second Open Scientific Meeting of the Hip Society*. pp. 190-194. C. V. Mosby Company, St. Louis.
- Coventry, M. B., Beckenbaugh, R. D., Nolan, D. R. & Ilstrup, M. S. (1975) 2012 total hip arthroplasties: A study of postoperative course and early complications. *J. Bone Jt Surg.* **56-A**, 273-284.
- D'Aubigne, R. M. & Postel, M. (1954) Functional results of hip arthroplasty with acrylic prosthesis. *J. Bone Jt Surg.* **36-A**, 451-475.
- Evarts, C. M. (1974) Prevention of thromboembolism by use of low molecular weight dextran. In: *Proceedings of the Second Open Scientific Meeting of the Hip Society*. pp. 182-190. The C. V. Mosby Company, St. Louis.
- Ilstrup, D. M., Nolan, D. R., Beckenbaugh, R. D. & Vernon-Roberts, B. (1973) Factors influencing the results in 2012 total hip arthroplasties. *Clin. Orthop.* **95**, 250-262.
- Lagrange, J. & Latourneil, E. (1975) The "L. L." total hip prosthesis. *Int. Surg.* **60**, 21-24.
- Langenskiöld, A. & Salenius, P. (1970) Total replacement of the hip by McKee-Farrar prosthesis. A preliminary report of 81 cases. *Clin. Orthop.* **72**, 104-105.
- Lubinus, H. (1973) Total hip replacement using "Brunswik"-system. *Clin. Orthop.* **95**, 211-212.
- Lubinus, H. & Jacobsen, U. (1973) Erfahrungen mit dem totalen Hüftersatz unter Verwendung des systems Brunswik und eines dorso-lateralen Zugang. In: *Der Total Hüftgelenkersatz*. pp. 92-102. Ed. Cotta, H. & Schulitz, K.-P. Georg Thieme Verlag, Stuttgart.
- McKee, G. K. & Watson-Farrar, J. (1966) Replacement of arthritic hips by the McKee-Farrar prosthesis. *J. Bone Jt Surg.* **48-B**, 245-259.
- Salenius, P. & Laurent, L. E. (1973) Experience with the McKee-Farrar total hip replacement. *Acta orthop. scand.* **44**, 451-459.

Correspondence to: T. Visuri, M.D., Jorvi Hospital, 02740 Espoo 74, Finland.