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PROSTHETIC REPLACEMENT IN THE TREATMENT OF SUBCAPITAL FRACTURES OF THE FEMUR

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Thanks to improved anesthesia, the surgical treatment of hip fractures has replaced conservative treatment with traction and bed rest, not least because patients must be mobilized early to prevent thromboembolic disease (Harris, Salzman & Desantis 1967, Riska 1970 b).

In which cases, then, should the primary treatment consist of endoprosthesis and what cases ought to be nailed according to earlier methods? Nicoll (1963) strongly recommends saving the femoral head by reducing the dislocated fracture and nailing. Trueta (1968) and Harrison (1953) state that many of the patients develop capital necroses before long, and Merle D'Aubigne (1958) found necroses in more than 50 per cent of his cases. Such figures suggest primary endoprosthetic surgery at least in older patients. But necrosis of the femoral head does not necessarily need to trouble the patient (Boyd & Salvatore 1964, Fielding, Wilson & Zickel 1962, Rehnberg 1965), and if it does, it can be taken care of at the secondary stage. Even a pseudarthrosis after a fracture of the femoral neck can remain symptomless (Boyd & Salvatore 1964, Rehnberg 1965), though most pseudarthroses cause pain and some compel patients to stay in bed. This may be fatal to old patients. Pseudarthroses can of course be prevented by primary endoprosthetic surgery, but an endoprosthesis that has stayed put and given no symptoms may later get loose and cause the patient great discomfort, necessitating further measures. Thus late complications after endoprosthetic surgery have compelled us to pay more attention to the choice of treatment (cf. Anderson, Hamsa & Waring 1964, Parrish & Jones 1964).

These problems in the treatment of subcapital fractures of the femur will be discussed here in the light of 122 cases of endoprosthetic

Table 1. Prosthetic replacement in the treatment of femoral neck fractures at the surgical department of Koskela Hospital in 1961–1968.

Age (years)	Moore endoprosthesis	Thompson endoprosthesis	Total patients
Under 45	–	1	1
45–49	1	–	1
50–54	1	–	1
55–59	4	–	4
60–64	2	–	2
65–69	17	4	21
70–74	17	6	23
75–79	24	6	30
80–84	16	4	20
85–89	15	–	15
90–94	4	–	4
Total	101	21	122

surgery. At the same time, a description will be given of the two methods of endoprosthetic replacement used today in our clinic.

CLINICAL MATERIAL

The material consists of 122 patients with fractures of the femur treated in 1961–68 at the Surgical Department of Koskela Hospital, Helsinki, with endoprosthetic replacement surgery. Of the patients, 11 were men and 111 women; 69 were over and 53 under 75 years of age (Table 1).

Indications for the Endoprosthetic Replacement Operation

In 107 cases, endoprosthetic replacement was performed as a primary operation. In 15 cases, it was performed in the secondary stage, in two because of the failure of conservative treatment and in 13 because of complications after nailing. Of these 13 patients, 11 had pseudarthrosis and two necrosis of the femoral head after nailing of a subcapital fracture. Of 470 patients with fractures of the hip, 158 had subcapital fractures of the Pauwels (1935) III type (Riska 1970 a), of whom 65.5 per cent were treated with endoprosthetic surgery. In nine of 26 patients with fractures of type Pauwels II (Riska 1970 a), endoprosthesis was done because of an unstable fracture (Table 2).

Table 2. Prosthetic replacement in the treatment of femoral neck fractures at the surgical department of Koskela Hospital in 1961–1968.

Type of fracture	Total number of patients	Treated with endoprosthesis
Subcapital Pauwels I	41	4
Subcapital Pauwels II	26	9
Subcapital Pauwels III	158	103
Transcervical	29	4
Trochanteric	210	1
Pathological	6	1
Total	470	122

Associated Diseases

Many of the patients had a poor general condition at the time of the accident. Even if early surgical treatment was considered essential for the prognosis in elderly patients with hip fractures, they had to be treated adequately because of associated diseases before surgical intervention. Universal arteriosclerosis in need of treatment was found in 50 patients, heart conditions motivating the administration of digitalis in 39, senile dementia in 21, diabetes mellitus in 16, chronic kidney conditions in 15, and arterial hypertension in 10 patients; 10 had a past history of cerebral apoplexy. Organic malignant tumor was recorded in four patients.

Operative Technique

The hospitalized patient was put in traction, and surgical procedures were decided on only after preoperative treatment had been given by the physician. Most patients were anesthetized through inhalation, but when this was prevented by diseases of the circulation or of the respiratory tract, spinal anesthesia was used. Moore's (1952) endoprosthesis was applied in 101 cases, and Thompson's (1954) prosthesis in 21. In 8 cases, the endoprosthesis was fixed with methylmetacrylate. A posterolateral incision was used in 96 and an anterior incision in 26 instances.

The Posterolateral Approach ("Southern Exposure")

The method was that described by Osborne in 1930, by Gibson (1950), and later by Moore (1959). If the endoprosthesis could not be

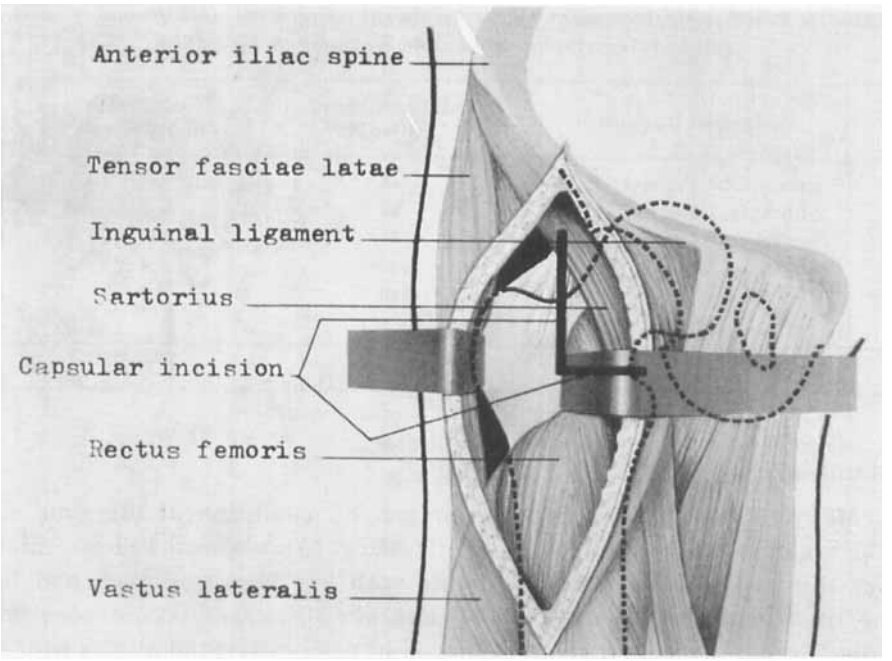

Figure 1. The anterior approach. A straight incision is made on the medial side of the tensor fasciae latae muscle. The sartorius and rectus femoris muscle are taken medially, and the capsule is opened with an incision in the shape of an L. If necessary, part of the capsule is resected.

firmly implanted into femur, it was affixed with acrylic cement (Charnley, Follacci & Hammond 1968). Patients were allowed to get up the following day, though in some instances mobilization had to wait longer because of the patient's poor general condition.

The Anterior Approach

The operation was performed with the patient on his back with the sound leg suspended from the ankle (about 30 cm). A straight incision was made into the anterior surface of the thigh in the region of the hip joint on the medial side of the tensor fasciae latae muscle. The capsule was opened with a straight incision and distally across in the shape of an L (Figure 1). The opening had to be sufficiently high and, if necessary, part of the capsule was resected. A Thompson prosthesis was preferred, but if the correct size was missing, a Moore endoprosthesis was used instead. The limb was given hyperextension by

Table 3. Complications in the treatment of 122 patients with endoprosthetic replacement.

Complications	Moore endoprosthesis 101 patients	Thompson endoprosthesis 21 patients	Total 122 patients	
	Cases	Cases	Cases	Per cent
Primary mortality died within one month	12	–	12	9.8
Postoperative infections	5	1	6	4.9
Thromboembolic disease	10	1	11	9.0
Late fracture of the femoral shaft	4		4	3.3

lowering the foot end of the operating table, while the suspension prevented the healthy leg from following. This made it easy to insert the endoprosthesis with or without acrylic cement. Patients were ambulant on the following day and were allowed to bear full weight on the operated leg.

Postoperative Complications

There were 12 primary deaths (9.8 per cent). Three patients died of pneumonia, three of pulmonary thromboembolism, two of cerebral apoplexy, one of coronary thrombosis, and one of a tumor of the adrenal gland. Two patients were not examined post mortem.

Six patients (4.9 per cent) developed postoperative infections (Table 3). Four could be treated with antibiotics without removing the endoprosthesis.

A deep thrombophlebitis appeared in 11 patients (9 per cent), of whom three died primarily of pulmonary thromboembolism. No routine treatment with anticoagulants was given prophylactically: treatment was only begun when the thrombophlebitis had been diagnosed.

Follow-up

Follow-up periods comprised 4–7 years for 14 patients, 2–4 years for 20 patients, 1–2 years for 25 patients, 6–12 months for 20 patients, and 5–6 months for 19 patients. Of the dead, 12 died within one month and 12 within five months of the operation.

Table 4. Results of treatment with endoprosthetic replacement.

Result	Moore endoprosthesis	Thompson endoprosthesis	Total patients	
	Cases	Cases	Cases	Per cent
Excellent	37	12	49	40.2
Good	23	3	26	21.3
Fair	9	2	11	9.0
Poor	3		3	2.5
Died within five months after the operation	21	3	24	
Still in bed because of associated disease	8	1	9	
Total	101	21	122	

RESULTS

Results were classified into excellent, good, fair, and poor by the following criteria:

Excellent: The patient walked almost without limp and without a stick, and the mobility of the hip joint was normal. There was no pain.

Good: The patient walked almost without limp, indoors without and outdoors with a stick. The mobility of the hip joint was good. Stress caused periodic pain in the hip joint.

Fair: The patient had to use a stick when walking because of pain in the hip joint. The ability to move about was poorer than before the accident. The mobility of the joint was reduced by at least one-third. X-rays showed that the position of the endoprosthesis was correct, but there was a resorption area around the shaft of the endoprosthesis because of its loosening.

Poor: The patient had to use two sticks or crutches when ambulant. There was pain in the hip joint both when walking and standing. The mobility of the hip joint was reduced by about half, and to judge by the resorption area in the X-rays the endoprosthesis had loosened. Changes suggesting osteoarthritis had appeared in the acetabular roof.

Results were excellent in 49 patients (40.2 per cent) and good in 26 (21.3 per cent). Thus good results were obtained in 61.5 per cent of the operated patients. Twenty-four patients died within five months of the operation, and nine stayed permanently in bed because of other simultaneous diseases (Table 4). Thus results could not be assessed for these 33 patients.

Results were fair in 11 patients, of whom 6 had loosening of the endoprosthesis. Poor results were obtained in three patients, of whom two had postoperative infections.

Late Complications

Four patients operated on through a posterolateral approach had a late fracture of the femoral shaft following a fall (3.3 per cent), but results of the endoprosthetic surgery had been good. One patient with a femoral mid-shaft fracture was treated operatively with wire loops, and was sufficiently reconditioned to be sent home. Of three patients treated conservatively with traction and bed rest, one remained bedridden, and two were reconditioned and sent home after six months in hospital.

DISCUSSION

Of 122 patients with fractures of the femoral neck treated in 1961–68 with endoprosthetic surgery, 35 were operated before 1965 and 87 after January, 1965. Thus, the primary prosthetic replacement operation has become much more common in recent years, especially as it is vital to mobilize aged patients as soon as possible after surgery to prevent the appearance of thromboembolic diseases. Such diseases were found in only 9 per cent of the operated patients, though their age was high (Table 1). The 15 patients with secondary endoprosthetic operations had long hospitalization periods, which in itself means a prolonged period of reconditioning. Nor were results as good as in patients with primary endoprosthetic operations. That two operations were performed on 13 patients also affected the final result. For these reasons, in the past three years primary endoprosthetic replacement has been done in this clinic to most geriatric patients with a Pauwels III type fracture, irrespective of the patient's age. No biological age limit could be placed on endoprosthetic surgery, as the procedure was chosen *in casu,* according to the type of fracture and the patient's other diseases. Especially patients with serious arteriosclerosis, but also those with mental disease, need rapid mobilization to avoid complications, and in such cases endoprosthetic surgery is a good treatment of subcapital fractures. The same conclusion was stated by Luncefort 1965.

Above all, postoperative complications must be avoided after endoprosthetic surgery. The appearance of thromboembolic diseases can

be largely prevented by prophylactic treatment with anticoagulants (Harris et al. 1967). Infections of the respiratory tract can also be largely avoided with effective antibiotics and physiotherapy. To prevent loosening of the endoprosthesis it can be fixed to the femur with acrylic cement, which thus helps to avoid one late complication. A hip joint with endoprosthesis can of course develop other complications, such as late hematogenous infections (Langenskiöld & Riska 1967), and they have to be encountered with sufficiently early, effective and adequate treatment with antibiotics.

After a successful endoprosthetic operation, patients are as a rule more satisfied with the results than patients nailed. Perhaps this is a consequence of the fact that after nailing, the postoperative treatment is more of a strain, full weight bearing being forbidden for periods up to four months from the operation. Moving on crutches is depressing. In any case, endoprosthetic surgery can prevent the development of pseudarthroses and necroses of the femoral head after subcapital fractures. With improvements in operative technique, late complications have also decreased after endoprosthetic surgery, which speaks strongly for this procedure.

SUMMARY

The treatment of subcapital fractures of the femur has been reviewed on the basis of 122 patients treated with endoprosthesis at the Surgical Department of Koskela Hospital, Helsinki, between 1961 and 1968. Of these 122 patients, 11 were men and 111 were women. 69 of them were over 75 years at the time of the accident, and 53 were under 75 years. 107 patients were treated primarily with endoprosthesis, 15 with an endoprosthesis as a secondary procedure.

Four patients had a subcapital Pauwels I fracture, nine patients a Pauwels II type fracture, and 103 patients a Pauwels III type fracture. Four patients had a transcervical fracture, one an intertrochanteric fracture, and one a pathological fracture.

101 patients were treated with a Moore endoprosthesis and 21 with a Thompson prosthesis. 96 patients were operated on through a posterolateral incision, 26 through an anterior incision.

The primary mortality amounted to 9.8 per cent. Postoperative infections occurred in 4.9 per cent, thromboembolic diseases in 9.0 per cent. Four patients had later fractures of the femoral shaft.

For 14 patients, the follow-up was 4–7 years, for 20 patients 2–4

years, for 25 patients 1–2 years, for 20 patients 6–12 months, and for 19 patients 5–6 months. 12 patients died within a month of the operation, and 12 patients within five months.

Results classified as excellent were obtained in 49 patients (40.2 per cent), good results in 26 patients (21.3 per cent), fair in 11 patients (9.0 per cent), and poor results in 3 patients (2.5 per cent). Twenty-four patients died within five months and their results could not be assessed, and 9 patients remained permanently bedridden mainly because of other simultaneous disease. Thus good results were obtained in 61.5 per cent altogether.

A primary endoprosthetic operation is indicated in most patients with a dislocated subcapital femoral fracture of the Pauwels III type, irrespective of the biological age of the geriatric patient, providing there is no contraindication for operation. The discussion deals with current methods of treatment and with their indications.

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