

## SUBCAPITAL FRACTURES OF THE FEMUR TREATED WITH TWO THIN SMITH-PETERSEN NAILS

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The results of treatment of 71 patients with subcapital fractures of the femur, fixed with two thin Smith-Petersen nails, are presented, after a follow-up time of between 2 and 4 years. Excellent results of treatment were achieved in 39 out of 60 cases and good results in 11 cases. Six cases of ischemic necrosis of the femoral head were recorded, and there were four cases with pseudarthrosis of the femoral neck, one developed because of postoperative infection and three were attributed to an imperfect operative technique. The method is recommended for subcapital femoral neck fractures amenable to closed reduction and internal fixation. Pseudarthrosis may be prevented by good reduction of the fracture and a careful nailing technique.

*Key words:* femoral neck fractures; fracture fixation; internal fixation

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In the treatment of subcapital fractures of the femur, primary endoprosthesis has been advocated because of the high incidence of late capital necrosis (Trueta 1968). Other surgeons have preferred nailing, claiming that retention of the patient's own femoral head is better than an endoprosthesis (Barnes 1967, Bentley 1968, Garden 1964, Massie 1973, Nicoll 1963). This has focused attention on the methods of nailing, which in turn has resulted in new procedures of fixation (Barnes 1967, Garden 1961, Massie 1964, 1973, Smyth et al. 1964). A good surgical technique is most important (Garden 1964). Therefore, the method of nailing should be technically simple, but at the same time a good fixation should be achieved. The method presented in this

paper—fixation with two thin Smith-Petersen nails—seems to fulfill these demands.

### MATERIAL

The material includes the first 71 consecutive cases of subcapital fractures of the femur fixed with two thin Smith-Petersen nails made of Vitallium. These nails were originally intended for fixation of femoral neck fractures in children. In the belief that two nails could prevent the appearance of pseudarthrosis, which was often seen following fixation of the fracture with one ordinary Smith-Petersen nail, this fixation technique was adopted in our clinic in 1970 (Riska & Lyytikäinen 1973).

The follow-up period was insufficient in nine patients who died within 2 years of the operation, and in two patients who emigrated. These 11 patients were excluded from the series. Of the remaining 60 patients, 22 were males and 38

*Table 1. Age distribution and type of fracture.*

Age (years)	Total number	Male	Female	Type of fracture		
				Pauwels I	Pauwels II	Pauwels III
10-39	6	6			2	4
40-65	21	6	15	8	7	6
over 65	33	10	23	5	20	8
Total	60	22	38	13	29	18

females; mean ages 53 (range 15 to 85) and 68 (range 40 to 88) years, respectively (Table 1). The fractures were classified according to Pauwels (1935). Stable fractures belonging to Pauwels' group I were displaced or wedged into a valgus position (13 patients), and unstable ones belonging to Pauwels' group III were displaced into varus (18 patients). Pauwels' group II (29 patients) contained both stable and unstable fractures in a neutral or anatomical position.

#### *Preoperative treatment*

All patients were treated with traction before the operation in order to preserve the circulation and the vascular supply to the hip joint and also to alleviate the pain. Preoperative treatment was given to patients with congestive heart disease, hypertension or infections of the respiratory tract.

#### *Operative technique*

The fracture was reduced on the operating table under general anesthesia with the aid of an X-ray television screen. Through a small incision in the trochanteric region two thin Smith-Petersen nails were introduced along guide pins, hammered into the correct position and the guide pins were removed. The correct placement of the nails is demonstrated in Figure 1 A-D.

#### *Aftertreatment*

Fifty-six patients were mobilized on the day after the operation. In 15 cases mobilization was delayed because of poor general health or concomitant diseases. Weight-bearing on the operated extremity was allowed within a few days, in 56 cases on the day after the operation.

#### *Complications*

One patient died 7 days after the operation of a heart infarction, and eight patients died within

2 years of the operation from other causes. These patients were excluded from the series. Two cases of postoperative infection were registered, and in four cases the operative technique was considered to be imperfect.

#### *Follow-up*

Thirty-three patients were hospitalized for less than 3 weeks, and 22 between 3 and 4 weeks (Table 2). All of the patients were followed up for more than 2 years. The follow-up period was 2-3 years in 30 cases, 3-4 years in 27 cases and more than 4 years in 3 cases (Table 3).

*Table 2. Duration of hospital treatment.*

Duration (weeks)	Total no. of patients	Patients in different age groups		
		10-39 years	40-65 years	over 65 years
1	3		3	
2	31	2	12	17
3	17	1	4	12
4	5	2		3
6-7	4	1	2	1
Total	60	6	21	33

*Table 3. Follow-up period.*

Follow-up (months)	No. of patients
24-35	30
36-47	27
over 48	3
Total	60

*Figure 1.*  
*Radiographs of a*  
*59-year-old man*  
*with a Pauwels'*  
*group II type*  
*fracture of the*  
*femoral neck*  
*treated by two thin*  
*Smith-Petersen*  
*nails. A, B. Before*  
*operation. C, D.*  
*Two years and*  
*three months after*  
*the operation.*

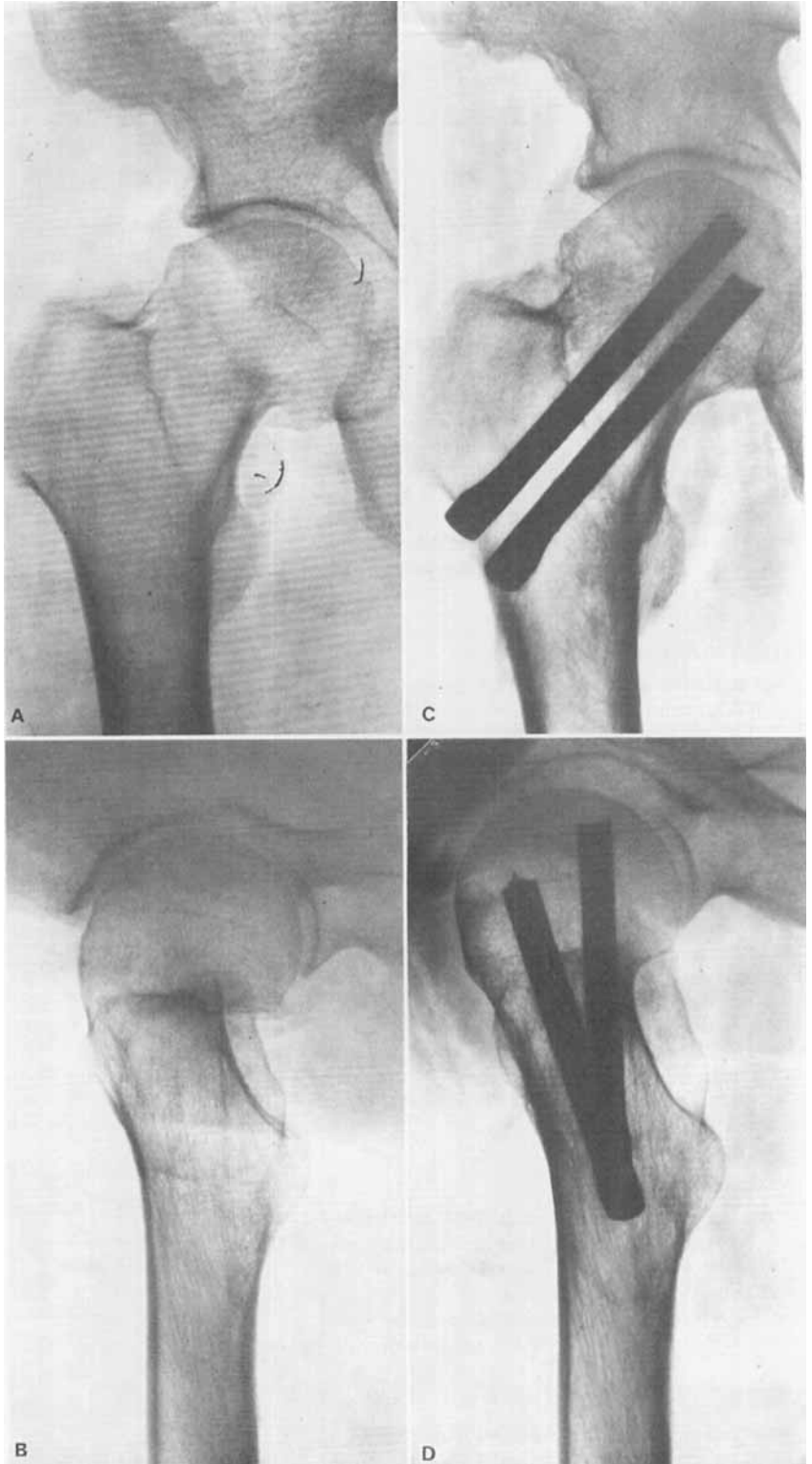


Table 4. Results of treatment.

Result	Total no. of patients	Patients in different age groups			Type of fracture		
		10-39 years	40-65 years	over 65 years	Pauwels I	Pauwels II	Pauwels III
Excellent	39	5	14	20	9	21	9
Good	11	1	3	7	2	5	4
Fair	3		2	1	1	1	1
Poor	7		3	4	1	2	4
Total	60	6	22	32	13	29	18

## RESULTS

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

*Excellent:* The patient walked without a limp, and there was no pain. The union of the fracture was good without signs of ischemic necrosis of the femoral head.

*Good:* The hip joint was pain-free but the patient had to use a stick when walking outdoors, and had a very slight limp. The fracture was well united without signs of ischemic necrosis of the femoral head.

*Fair:* The patient had to use a stick when walking because of pain in the hip joint. The mobility of the joint was reduced. X-rays showed delayed union of the fracture, or early signs of ischemic necrosis of the femoral head.

*Poor:* The patient used a stick when walking and there was pain in the hip joint both when walking and standing. The mobility of the hip joint was reduced. X-rays showed development of a pseudarthrosis or ischemic necrosis of the femoral head. The operative technique was imperfect.

An excellent result of treatment was recorded in 39 cases with good union of the fracture without signs of ischemic necrosis of the femoral head (Table 4). In 11 cases the result was classified as good. In one of these, a man of 39 with a Pauwels' group III fracture, slight pain

in the hip joint was present at the last follow-up examination 2 years and 8 months after the operation because of incipient ischemic necrosis of the femoral head, verified by tomography. Postoperative infection in one case resulted in the development of a pseudarthrosis and the result of treatment was classified as poor (Table 4). An imperfect operative technique in one case resulted in delayed union of the fracture with a painful hip joint. The result was classified as fair. Pseudarthrosis of the femoral neck developed in three additional cases giving a poor result, in one case because of poor reduction of the fracture, and in two cases because of an imperfect nailing procedure. Ischemic necrosis of the femoral head was registered in altogether five cases. The result of treatment was classified as fair in two cases and as poor in three cases. All four cases with pseudarthrosis and the three cases with ischemic necrosis of the femoral head were later treated with endoprosthetic surgery.

## DISCUSSION

Meticulous attention to surgical technique and good postoperative care are required in the treatment of subcapital fractures. In our clinic, Nyström nails were previously used for internal fixa-

tion of subcapital fractures (Nyström 1954) but these were inserted into the femoral neck without guide pins and were therefore replaced by two thin Smith-Petersen nails. The results of treatment using this nailing technique were excellent or good in 50 out of 60 patients and good union of the fracture was seen in 56. Six cases of incipient aseptic necrosis of the femoral head were recorded after a follow-up of 2-4 years. However, it may not be possible to avoid, in some cases, the development of late capital necrosis years after the fracture, because this is dependent on the type of fracture and maybe on subsequent overstrain of the hip joint (cf. Massie 1973).

In three cases an imperfect operative technique resulted in the development of pseudarthrosis, but this can be avoided by good operative technique. Weight-bearing on the operated limb was allowed on the day after the operation and the hospital stay was less than 3 weeks in 51 cases. In addition, the general condition of the patients was not affected by the nailing procedure, which can easily be carried out, under local anesthesia, if necessary. Thus, if a subcapital fracture of the femoral neck is amenable to closed reduction and internal fixation, this method with two thin Smith-Petersen nails may well be a reasonable choice.

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