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FEMORAL FRACTURES AFTER MOORE ARTHROPLASTY

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The Moore Arthroplasty has for some years been accepted as a reliable procedure in the treatment of fractures of the femoral neck in geriatric patients. It is well known that fractures of the femur can result from rough manoeuvering during the operation but little attention has been given to late fractures around or below the intramedullary prosthesis. In 1964 Parrish & Jones reported nine cases and Knud Jansen discussed the problems involved in dealing with these fractures in a paper read at a meeting of the Danish Surgical Association in 1965. The choice of treatment of these fractures seems to be wide open and is seldom discussed in reports of complications after arthroplasties. The present study has concentrated mainly on the operative treatment of fractures secondary to an arthroplasty.

MATERIAL

The basis of this report is twenty-five patients, all of whom have been treated in Department M, Bispebjerg Hospital, Copenhagen, for a late femoral fracture (Table 1). The condition for which the arthroplasty was performed was a femoral neck fracture in all cases. The operative procedure followed the instructions given by Austin Moore in 1957. Acrylic cement was not used.

Table 1.

Age distribution

70–79	13
80–89	11
90–	1
	25 (23 females, 2 males)

As a rule the late femoral fracture had a spiral or an oblique form winding around the shaft of the femur or below the level of the prosthesis. In five cases the fractures were placed around the stem of the prosthesis (Table 2). Fourteen fractures were localised at the level of or below the shaft of the prosthesis—all

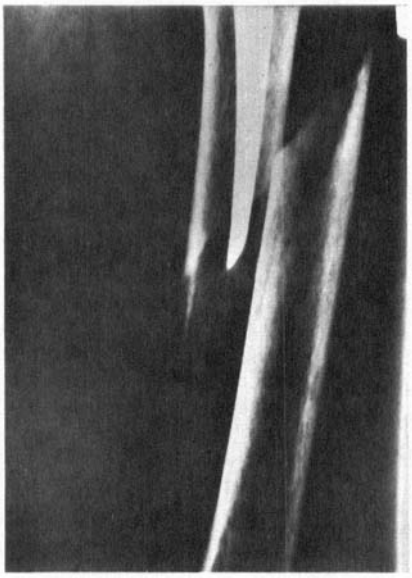

Figure 1. Typical fracture around tip of prosthesis.

oblique fractures with considerable instability (Figure 1). In the distal part of the femoral shaft three fractures were seen without direct relation to the Moore prosthesis. In the condyle area three small undislocated fractures occurred. These are only mentioned to complete the picture.

Table 2.
Site of fracture

Proximal	5
Around the tip	14
Distal	3
Supracondylar	1
Condylar	2
	25

Table 3.
Time between arthroplasty and fracture (in years)

0–½	8
½–1	0
1–2	3
2–5	8
5–10	2
10–	3
	24 (one case unknown)

In Table 3 the fractures have been divided according to the length of time between the arthroplasty and the occurrence of the fracture. The fractures are classified into two groups. A minority group of the patients sustained the fracture during the first months of the postoperative physical training. The majority of the fractures occurred after at least one year when training was completed. The longest interval has so far been twelve years.

METHODS

The choice of treatment depended on the grade of dislocation (Table 4). Proximal fractures were all treated conservatively, some with traction and some with a restricted bed-regime. Walking exercises started after four to six weeks. In the first years a few dislocated fractures were treated with traction, but later on internal fixation was preferred. Until 1967 circumferential wiring was used, but since then plate fixation has been considered the most convenient method of dealing with unstable fractures.

Table 4.
Forms of treatment

Type	Conservative	Wire	Plate	
Proximal	5	0	0	
Around the tip	2	3	9	
Distal	1	0	2	
Supracondylar	1	0	0	
Condylar	2	0	0	
	11	3	11	25

Usually an eight-hole plate of cobolt-chrome-molybdenum alloy was adapted to the outline of the trochanteric and cortical area and fixed with eight screws (Figure 2). When the plate was situated on a level with the stem of the prosthesis a special drilling technique was used. When the drill contacted the prosthesis it was retracted a few millimeters and set to a new angle tangentially to the stem, which then could be passed without difficulties. The patients were confined to bed for four to six weeks. After discharge they were seen in the outpatients' department.

Few postoperative complications were encountered. One patient died twenty-eight days after the operation with a deep infection and a pulmonary embolus. One patient died after twenty-nine days in a psychiatric department. The cause of death was unknown. In all surviving patients the fractures healed without complications.

DISCUSSION

Three conditions seem to be of decisive importance in the pathogenesis of femoral fractures after a Moore arthroplasty: Alterations in the

Figure 2. Fracture in Figure 1 treated by plate and screws.

biomechanical factors in the femur, severe osteoporosis and gait impairment.

Insertion of an uncemented metallic prosthesis and the following biological integration of the prosthesis in the bone involves changes in the transmission of forces from the acetabulum to the femoral shaft. As shown by Charnley (1964, 1965) the forces will be concentrated in the calcar and the femoral cortex laterally to the lower pole of the prosthesis, thus creating an area of high stress concentration. The result can be a resorption of the remnant of the femoral neck and this will cause a loosening of the prosthesis and permit the tip to press on the endosteal part of the lateral cortex. In some cases a significant augmentation of the thickness of lateral cortex will occur on the periosteal aspect. In Figure 3 these tendencies are illustrated.

Femoral neck fractures in elderly patients are considered by some authors to be an indirect result of senile osteoporosis (Nigst 1964). After insertion of a metallic prosthesis the osteoporosis will accelerate further and provoke a fracture at the point of highest stress concentration. The trauma is always minimal. In the presented material all patients except one sustained the fracture indoors from a small trauma. In no case was a high energy impact involved.

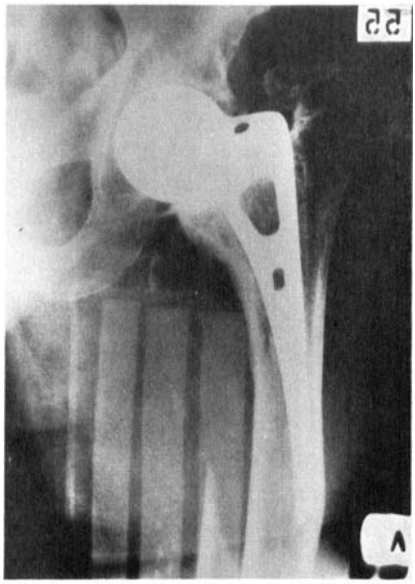

Figure 3. Loose prosthesis. Note resorption of neck and lateral cortical hypertrophy.

It is rather difficult to get an impression of the frequency of these fractures. Only a few studies mention a percentage. In many reports concerning the late result of femoral arthroplasties this complication is not referred to. Riska (1971) found late femoral fractures in 3.3 per cent of patients followed-up, in contrast to another Scandinavian study (Andersson & Nielsen 1972) who did not find late femoral fractures at all. In a paper read at a meeting of the Danish Surgical Association Knud Jansen and Ruben Hansen found two fractures in a total of thirty-three patients (1965). The presented material does not allow any conclusion of the frequency because the patients were derived from different surgical departments in Copenhagen. The precise number of arthroplasties in the decade 1963–1972 could not be found.

In spite of the great operative risk in these geriatric patients there seems to be a tendency to consider internal fixation as the best solution in unstable femoral fractures (Parrish & Jones 1964, Huggler 1968, Müller & Boitzy 1968). Parrish suggested medullary nailing alongside the stem of the prosthesis, supplemented with wiring. Huggler and Müller both recommended stabilization with an AO-plate. Riska has used circumferential wiring as we did in our first operations. Unfortunately this method does not provide a high order of stability and in addition requires a secondary operative procedure for removing the wires. From a theoretical point of view the exchange of the prosthesis

for a long-stemmed one may stabilise the fracture like an ordinary medullary nailing, but this procedure has disadvantages because of difficulty in removing the prosthesis and it offers only a moderate stability to the fracture. By comparison the lateral plating can be regarded as a minor procedure.

In 1964 Charnley recommended cementing with acrylic cement to prevent loosening of the prosthesis. This may be a realistic way to hinder some of the late femoral fractures by lowering the stress concentration in calcar and especially in the lateral cortical area. Should a fracture occur in relation to a cemented prosthesis it can be treated with a lateral plate exactly as described. In the drilling process the acrylic cement can be handled just like bone and gives sufficient hold to the screws.

Fractures without dislocation should be treated conservatively with a restricted bed-regime for four to six weeks. Thereafter graduated walking exercises can be started. This fracture type is located at the stem of the prosthesis and seems to have an inborn stability caused by the prosthetic hold on the femur.

Unstable shaft fractures should be treated by operation as early as possible with an internal fixation by an eight-hole plate. The patient can be allowed to sit out of bed a few days after the operation. Walking exercises may begin gradually three to four weeks later. Antithrombotic prophylaxis should be initiated.

SUMMARY

The insertion of an intramedullary prosthesis changes the biomechanical factors in the femur and induces stress concentrations, especially in the lateral cortex on a level with the lower pole of the prosthesis, and may result in a late femoral fracture. This complication does not seem to be frequent but gives rise to problems of treatment.

Twenty-five patients with a Moore prosthesis sustained a late femoral fracture. Fourteen were operatively stabilised, three with circumferential wiring and eleven with plates. Eleven were treated conservatively. Two of the patients died after four weeks. In all other cases the fracture healed without complications. The internal fixation with an eight-hole plate is recommended as the most convenient method, when the fracture is unstable. Otherwise conservative measures are preferred.

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