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DISLOCATED FEMORAL NECK FRACTURES

A Follow-up Study of 98 Cases Treated by Multiple AO (ASIF) Cancellous Bone Screws

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A series of 98 dislocated femoral neck fractures were treated by closed reduction and osteosynthesis with multiple AO (ASIF) cancellous bone screws. The patients were followed up for 2 years (or until death).

The degree of dislocation did not have a statistically significant influence on the failure rate, which was, however, significantly correlated with poor reduction. Thirty-nine per cent of the fractures were complicated by non-union or late segmental collapse.

Forty-three of the patients participated in the 2 year follow-up examination. Of these patients, 38 had achieved excellent or good hip function.

It was concluded that the reduction was the most important single factor in the treatment of these fractures.

Key words: femoral head necrosis; femoral neck fractures; fracture fixation; fracture reduction; non-union

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There is still a great deal of controversy regarding the treatment of dislocated femoral neck fractures. Many different methods of osteosynthesis and arthroplasty have been used. The choice between osteosynthesis and arthroplasty is often based on the age and the general medical condition of the patient, and on the degree of dislocation. In osteosynthesis the reduction is considered important regardless of the method employed (Barnes et al. 1976, Frandsen 1979).

This investigation deals with the results of osteosynthesis with multiple AO (ASIF) cancellous bone screws. In a consecutive series of dislocated femoral neck fractures the results are related to the primary dislocation and the exactness of the reduction.

PATIENTS AND METHODS

From January 1975 until September 1978, 98 patients with dislocated fractures of the femoral neck were treated by closed reduction and osteosynthesis using 4 or 5 AO (ASIF) cancellous bone screws.

Of the 98 fractures 53 were classified as Garden stage 3 and 45 as Garden stage 4. The series was consecutive as far as the operation method was concerned. Six of the fractures had dislocated after having been originally classified as stage 1 and 2 fractures.

The mean age was 72 years (range 41–93 years). There were 76 females and 22 males. There were quite a number of patients younger than 70, because all patients younger than 70 were included in this series, whereas patients older than 70 were allocated equally, without any selection, to treatment by osteosynthesis or by Moore prosthesis. The patients were operated on 1 or 2 days after admission.

The reduction of the fracture on the traction table was monitored by a two-plane image intensifier.

Four or five screws were inserted parallel, and as far apart as possible, in the femoral neck. The ends of the screws were placed in the subchondral bone. The threads should pass beyond the fracture line to allow compression and telescoping of the screws (Figure 1).

All the patients were mobilized with partial weight-bearing after the first week postoperatively. Clinical and radiological follow-up examinations were performed for 2 years after the operation.

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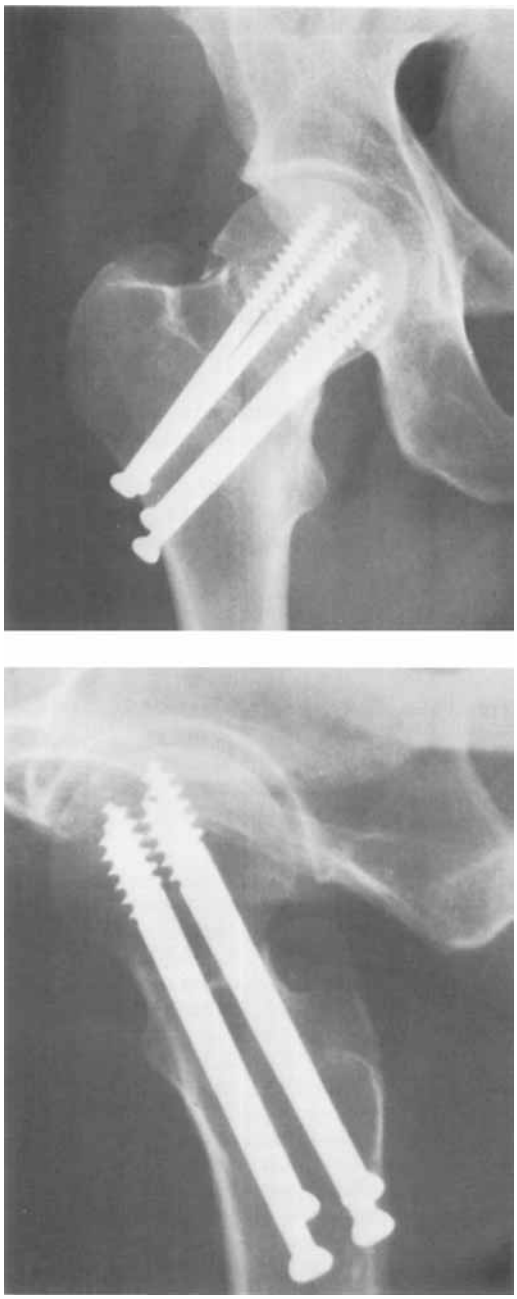

Figure 1. Frontal and lateral views of a femoral neck fracture osteosynthesized with 4 AO (ASIF) cancellous bone screws.

The quality of the reduction was evaluated retrospectively using Garden's alignment index (Garden 1971). The reduction was considered to be poor if the head-neck angle was not within 155–180 degrees in the frontal as well as in the lateral plane.

Without taking other factors into consideration the osteosynthesis was regarded as stable if 1 or 2 of the screws were supported by the femoral calcar, if at least two screws reached the subchondral area of the head, and if the screws were distributed in both the superior and inferior part of the femoral neck and head.

A radiologic diagnosis of necrosis of the femoral head was made when a deformity of the joint surface of the head with a limited depression appeared, usually accompanied by variations in bone density in the head.

At the clinical follow-up the surviving patients and those who had not been reoperated on were assessed according to Stinchfield et al. (1957). This system considers pain, hip movement and walking ability. In this assessment the movements of the contralateral hip before the operation were used as a reference. The other factors were registered on admission.

The patients' ability to take care of themselves and their situation regarding accommodation were compared with the preoperative status. Normal social function means that the patients were able to maintain their own households and to dress, bath and feed themselves.

The chi square test and Fisher's exact test were used for statistical analysis.

RESULTS

Five operations failed primarily. Three of these patients were re-operated on: two patients had a hemiarthroplasty and one patient had a Girdlestone operation. Two patients could not be re-operated on because of their general condition, and they died within 6 months.

Of the remaining 93 patients, 19 (20 per cent) developed non-union. Re-operation was indicated in all these cases, but was not possible in 6 cases because of age and other ailments.

In patients with healing of the fracture, late segmental collapse appeared in 14 cases. Ten of these patients had complaints, and subsequently re-operations were indicated, but two of the patients were not suitable for surgery because of their poor general condition.

As shown in Table 1, there were 33 failures. If the five primary technical failures are included, then the total failure rate is 39 per cent. With increasing dislocation the prognosis deteriorated, but the difference between the failure rates in stage 3 and stage 4 fractures was not statistically significant.

Table 1. Non-union and late segmental collapse in stage 3 and 4 fractures (Garden 1961)

	Stage 3 $n=49$	Stage 4 $n=44$	Total $n=93$
Non-union	8	11	19
Late segmental collapse	6	8	14
Total	14(29%)	19(43%)	33(35%)

$\chi^2 = 2.16$ $0.1 < P < 0.2$.

Table 3. Occurrence of non-union and late segmental collapse related to stable and unstable osteosynthesis

	Stable $n=64$	Unstable $n=29$	Total $n=93$
Non-union	12	7	19
Late segmental collapse	7	7	14
Total	19(30%)	14(48%)	33(35%)

$\chi^2 = 3.02$. $0.05 < P < 0.1$.

Table 2. Occurrence of non-union and late segmental collapse related to the exactness of the reduction evaluated according to Garden's alignment index (Garden 1971)

	Reduction		
	Good $n=69$	Poor $n=24$	Total $n=93$
Non-union	8	11	19
Late segmental collapse	7	7	14
Total	15(22%)	18(75%)	33(35%)

$\chi^2 = 22.1$. $P < 0.001$.

Table 2 demonstrates the importance of the reduction. The risk of failure was significantly higher after a poor reduction compared with a successful reduction.

No significant difference in failure rate could be demonstrated between the stable and unstable osteosyntheses (Table 3).

In order to evaluate the relative importance of the primary dislocation and the reduction, these two factors were related to the total failure rate (Table 4). The stage 4 fractures with good alignment achieved a significantly better result than the stage 3 fractures with poor alignment (Fisher's exact test: $P<0.05$).

Eight patients died within the first 6 months after the operation, and 29 patients (30 per cent) died within 2 years. Of the 69 surviving patients, 21 were treated with arthroplasty within 2 years and therefore have not been considered in this follow-up study. Forty-three of the 48 remaining patients agreed to participate in the follow-up study. Four of these patients had late segmental collapse, and two had non-union at the time of the follow-up. The mean age of the patients at the follow-up was 75 years (range 55–97 years).

Thirty-eight of the 43 patients had achieved an excellent or good hip status (Table 5).

The situation concerning social function and accommodation before the intracapsular fracture, and at the 2-year follow-up study is shown in Tables 6 and 7. Most patients were able to be rehabilitated to their prefracture status.

Table 4. Failure rate in relation to Garden's stages and alignment index

	Non-union	Late segmental collapse	Total
Stage 3 + good alignment ($n=37$)	1	3	4
Stage 3 + poor alignment ($n=12$)	7	3	10
Stage 4 + good alignment ($n=32$)	7	4	11
Stage 4 + poor alignment ($n=12$)	4	4	8
Total	19	14	33(35%)

Table 5. Hip function before and 2 years after the fracture evaluated according to Stinchfield's hip assessment chart

	Before	After
Excellent	39	26
Good	3	12
Fair	1	3
Poor	0	2
	43	43

Table 6. Social function before and 2 years after the fracture

	Before	After
Normal social function	27	23
Manages activities of daily living but not household chores	9	12
Manages neither activities of daily living nor household chores	7	8
	43	43

Table 7. Residence before and 2 years after the fracture

	Before	After
Own home	31	26
Nursing home	8	13
Hospital	4	4
	43	43

DISCUSSION

Fractures of the femoral neck are often complicated by non-union or late segmental collapse, mainly because of impaired blood supply to the femoral head. This risk is much smaller after non-dislocated fractures (Bentley 1968, Asser Hansen & Solgård 1978). Unlike Brown & Abrami (1964) this series did not demonstrate a significant difference in failure rate between stage 3 and stage 4 fractures.

Osteosynthesis with AO screws is a comparatively easy procedure. Contrary to Söreide et al. (1977), who used von Bahr screws, we could not demonstrate that the quality of the osteosynthesis was of significant importance.

Our failure rate is in accordance with other series dealing with other operation methods (Metz et al. 1970, Arnold et al. 1974, Fielding et al. 1962, Chapman et al. 1975, Frandsen & Jørgensen 1977 and Riska et al. 1977).

In agreement with other series (Johnson & Crothers 1975, Arnoldi & Lemperg 1977, Söreide et al. 1977, Frandsen 1979 and Kofoed & Alberts 1980) it was demonstrated that the reduction is the most important single factor in the treatment of femoral neck fractures, and that the disadvantage of a more dislocated fracture could be compensated for by a good reduction (Table 4). Therefore, every possible step should be taken to obtain an exact reduction.

The mortality rate for patients with femoral neck fractures is above average, especially during the first 3 months. This is more pronounced in men, and in the highest age groups (Jensen & Tøndevold 1979). We found a mortality rate of 30 per cent during the first 2 years, which agrees with the figures given in the series of Jensen & Tøndevold.

After osteosynthesis a significant number of patients have to be re-operated on; usually arthroplasty is the method of choice. It is therefore quite common to use arthroplasty primarily (Hinchey & Day 1964, Salvati & Wilson 1973, Johnson & Crothers 1975, Lindholm et al. 1976 and Tillberg 1976). However, in a prospective and comparative study of patients more than 70 years old, it was found that patients treated with AO osteosynthesis did much better than those treated with Moore arthroplasty (Jensen et al., submitted for publication). Söreide et al. (1979) found the same mortality after osteosynthesis and after cemented Christiansen prosthesis.

CONCLUSIONS

In osteosynthesis of femoral neck fractures with multiple AO screws the most significant factor in reducing the number of non-unions and pre-

venting late segmental collapse is exact reduction. Surviving patients, who do not need re-operation, will return to their preoperative status in most cases.

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