THE FRACTURED NECK OF FEMUR

ASSESSMENT OF TREATMENT

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As in most orthopaedic units, the fractured neck of femur in the elderly, in Durban, has provided problems of treatment and disposal.

No accurate follow-up of the 10-year period between 1940 and 1950 has been possible since, at that stage, records were not kept by the hospital for more than 5 years. It is our impression, however, that the incidence of complications was high in cervical fracture, partly, we believe, from the use of a caliper, which caused abnormal thrusts and stresses at the fracture level, and possibly from the delay in operative treatment, since the orthopaedic department was understaffed, the theatre facilities limited, and patients often had to wait several days before surgery was attempted. With the development of an accident unit, an attempt was made to reduce the time spent in hospital by speeding up the initial treatment and convalescence, in the belief that a poor risk is improved by the early fixation of a fracture, while vascular complications might be reduced if early reduction is secured.

There was also the advantage of early ambulation in reducing the risk of medical and nursing complications, particularly in the humid summer months. Conservative treatment was, however, still necessary in a few cases where grossly comminuted fractures of the trochanteric type were not suitable for pinning. It now seems desirable to review these results and assess whether this practice has improved the bed position without jeopardizing the end result.

This review consists of 172 consecutive patients treated by operative methods over a 5-year period from December 1952 to December 1957 in the Accident and Orthopaedic Unit at Addington Hospital, Durban. The majority of the patients were dealt with primarily by the registrar staff under consultant supervision, but the complications were the responsibility of the consultants. The standard of technical skill thus varied — a state of affairs to be anticipated in most orthopaedic units.

THE SUBCAPITAL AND TRANSCERVICAL GROUP

Routine Management

Operative treatment was instituted as soon as possible after injury, often within 6 hours. The hip was manipulated under a general anaesthetic (usually 'pentothal' plus a relaxant), and fixed to a special mobile frame, made by the Stryker Orthopaedic Frame Company of America (Figs. 1 and 2). The frame consists of a light, laminated, wood platform, designed to fit any standard operating table. Since its introduction by one of us in 1948, this table has proved most valuable, especially when operating in less well-equipped hospitals and nursing homes.

The patient lies on the platform, which is hollow and allows an X-ray casette to be introduced beneath the hip. Both legs are abducted by about 45° and held in this position by adjustable leg pieces, which control both the abduction and the desired amount of rotation. The lateral X-ray is thus no problem. Counter-traction is obtained by tilting the whole table into about 15 - 20° (Trendelenberg).

The apparatus is simple and effective for all but those with the most grossly comminuted fractures, where more positive traction on an orthopaedic table is indicated. The standard trifin 'vitallium' nail was used for fixation.

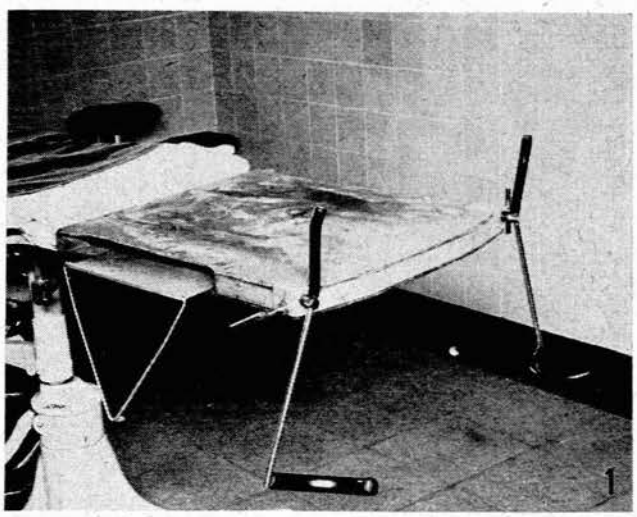

Fig. 1. Stryker orthopaedic frame, showing leg pieces and casette holder.

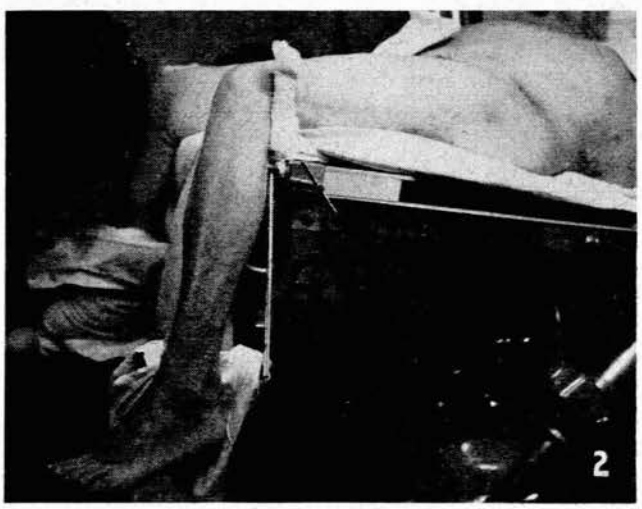

Fig. 2. Stryker orthopaedic frame, showing patient in position, and Trendelenberg tilt of table to provide countertraction.

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Postoperative Management

Early mobilization of the affected limb was encouraged, and, while in the earlier cases a shoe was used to prevent external rotation, this fell into disuse, and for the last 3 years the leg has been left free in bed. When necessary the patient is got up before the stitches are removed. With heat and humidity to contend with, most patients appreciate this freedom from restriction. Crutches were provided at about the end of the second week and, while weight bearing was officially discouraged, most of these patients bore some weight on the affected leg — this was accepted as part of the foibles of the elderly.

Thus, at discharge, most were partially weight bearing, and, providing the pinning was sound, this weight bearing appeared to have little effect on the eventual result.[1] We consider that a good valgus reduction, and the use of a long oblique pin placed low on the calcar side of the neck, is preferable to 'dead-centre' pinning, since any tendency to cut out is thus reduced to a minimum (Fig. 3).

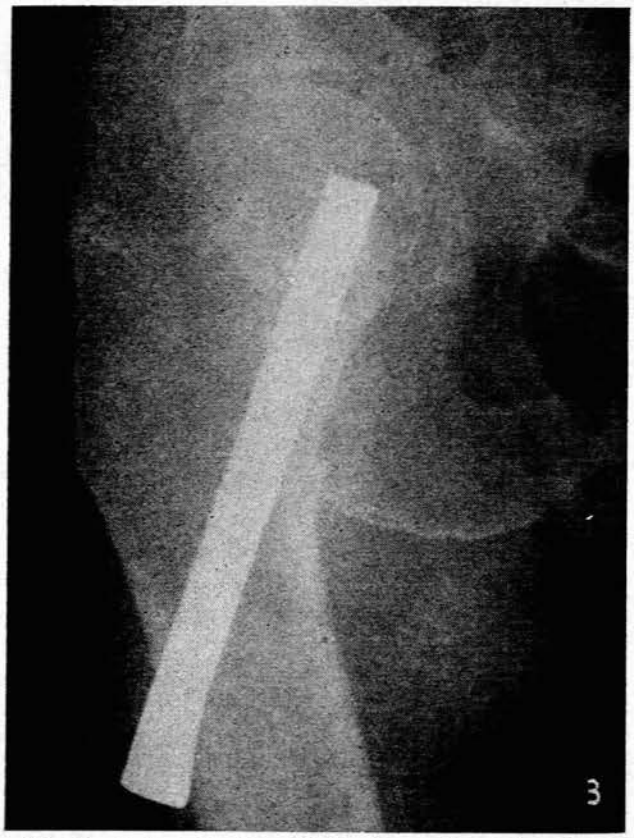

Fig. 3. A typical subcapital fracture reduced in valgus, with a long, low, oblique pin.

On the average, fractures so treated were bearing full weight (with the use of a stick on the sound side) at about 14 - 15 weeks.

Results

A detailed follow-up study has proved difficult, since many patients were resident in other areas and returned home after their initial treatment. The majority were followed-up for at least 1 year, and many for 2 - 3 years and more, but it is fair to assume that the complications listed below would be more numerous if a larger follow-up of all cases had been possible.

The local complications in 91 subcapital and transcervical fractures were as follows:

Avascular necrosis	7 cases	or	7·7%
Pin cut out early	8 „	or	8·8%
Non-union	4 „	or	4·4%
Delayed union	1 „	or	1·1%
Total	20 cases	or	22%
Immediate prosthesis	2 cases		

Clinical follow-up proved even more difficult, but 15 patients (uncomplicated cases), who had been operated upon 2 years before, were examined. Only 4 had slight pain in the affected hip, and all were walking well, with a good range of hip and knee movement.

The Angle of the Fracture

In an effort to determine whether the angle of the fracture was of any importance in judging the prognosis, Pauwels' method was used.[2,3] (This is the angle formed by a line drawn along the fracture surface of the femoral neck to intersect a horizontal line down through the anterior superior spine).

The average angle in the whole series was 62°, the least being 18° and the greatest 90°. In the 20 patients with local complications, the average angle was exactly the same, i.e. 62°, and it was consequently felt that the initial angle of the fracture was of no clinical importance. However, we have not found a more reliable method of assessing clinical union than the assumption that an unaltered angle after weight bearing is probably an indication of stability and progress towards union. Following is a summary of the types of fracture and the fracture-shaft angles.

Type of fracture	*Neck angle*		
	0° — 30°	30° — 50°	50° — 90°
Abduction	1	5	3
Adduction	3	20	54

In the abduction type of fracture the majority were treated conservatively, but in 9 patients treated by an S.P. nail, one with an angle of 42° developed avascular necrosis, and in another the pin cut out late, but the fracture united satisfactorily.

Displacement of Fracture and Reduction

In the 20 patients with postoperative complications, 10 showed marked initial external rotation of the shaft of the femur and upward displacement of the trochanter (Figs. 4 and 5).

In a study of the postoperative X-rays, 6 showed poor postoperative reduction, 7 poor position of the nail, and 3 both poor position of nail and unsatisfactory reduction. Thus in 16 out of 20, there was also faulty operative technique. As Lloyd originally remarked and Watson-Jones reaffirmed: 'the bad results of nailing are the results of bad nailing'[4] (Figs. 6 and 7).

In passing, it was noticed that the fracture with the spur in the inferior aspect of the head was more difficult to reduce, and even when well reduced, remained potentially unstable (Fig. 5).

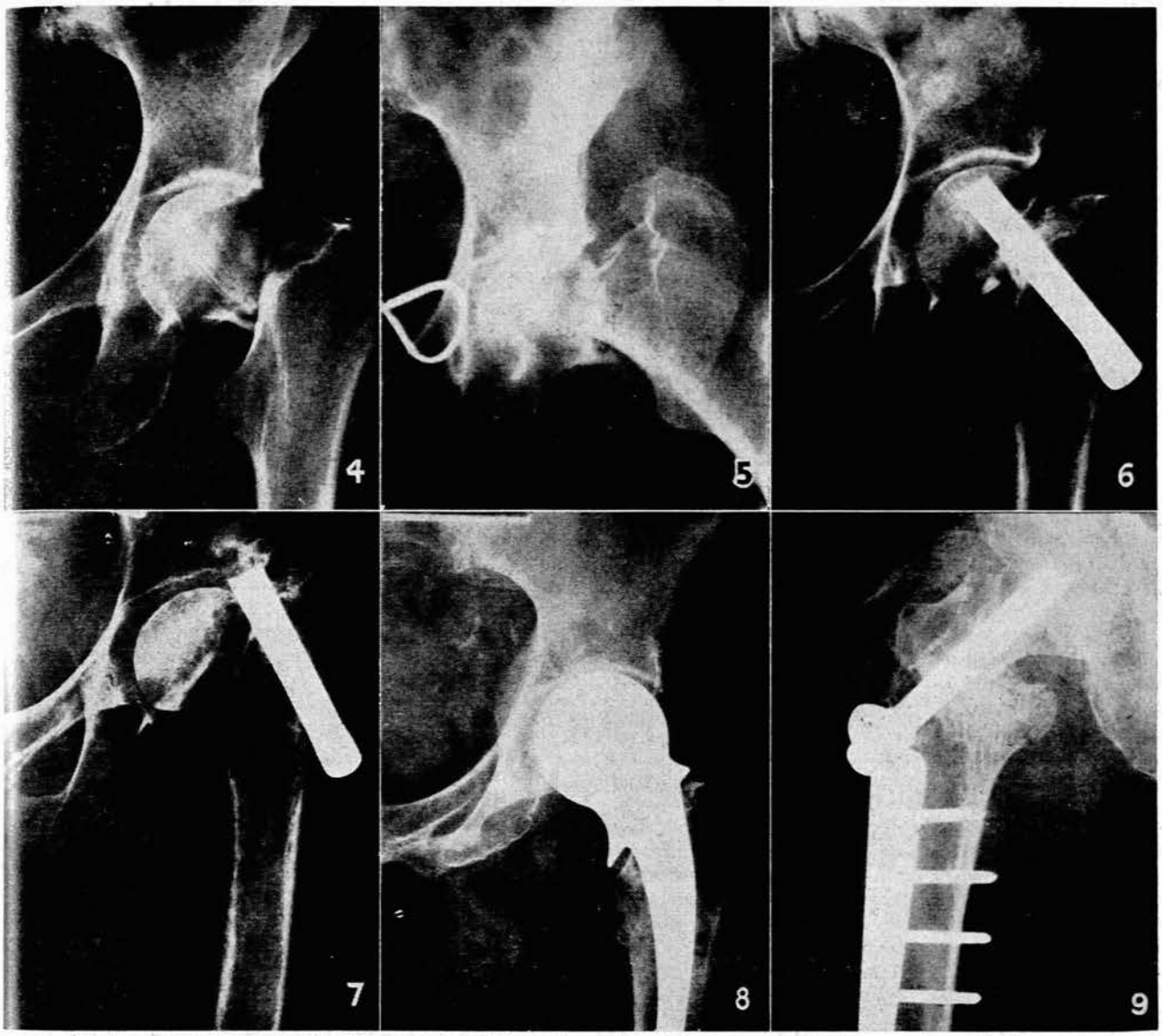

Fig. 4. A transcervical fracture with marked initial displacement of fragments, and subsequent complications.
Fig. 5. X-ray showing poor operative reduction; also demonstrating a spur on inferior aspect of head.
Fig. 6. Position at 6 weeks, showing pin tending to cut out of the head, and absorption of the neck.
Fig. 7. Five months after original injury; the inevitable picture of avascular necrosis of the head.
Fig. 8. A Thompson prosthesis has been inserted. This might well have been performed initially.
Fig. 9. A comminuted trochanteric fracture of the unstable group treated by McLaughlin nail plate allowing early mobilization of the patient.

TREATMENT OF POSTOPERATIVE COMPLICATIONS

The complications were treated as follows, as shown below:

Insertion of Thompson's prosthesis	5 cases
Insertion of Judet — metal	1 case
Insertion of Judet — acrylic	1 case
Excision of head and neck of femur	1 case
McMurray osteotomy	3 cases
Arthrodesis	1 case

PRESENT POLICY

On reviewing the results it is clear that the patients with marked initial displacement, or with poor reduction or pinning, do badly.

Eyre-Brook and Pridie[5] noted that avascular necrosis occurred only in patients with a fracture angle of more than 53°, and advised additional fibular grafting in any case with an angle of over 60°.

However, in this series 2 patients with angles of 42° and 40° respectively, developed avascular necrosis, although, as mentioned previously, the average angle for the patients with complications was 62°, being the same as the angle for the uncomplicated cases.

Moreover, as Charnley[6] points out, even if the shearing strain in steep-angle fractures is eliminated, avascular necrosis is still not prevented. There seems little doubt that the obliquity of the angle is merely an indication of the degree of displacement, and that the steep-angle fracture has a poorer prognosis, because of the greater displacement and not because of the greater shearing strain.[7,8]

In cases with marked initial displacement, it is fair to assume that the vascular supply to the femoral head is impaired, especially the lateral epiphyseal vessels, resulting in non-union of the fracture with or without a viable head, delayed union, or union of the fracture, but crumbling of the head and late osteoarthritis of the joint.[9]

Our findings are in agreement with Charnley,[10] who recently stated:

'I am forced to believe that the most important feature in the union of a fracture is the extent to which the soft parts are torn at the time of injury. From the degree of displacement, it may be possible to hazard a guess at the likelihood of an intact callus pathway existing.'

Our present policy is, therefore:.

(*a*) *In the younger age group* (i.e. under 65 - 70 years): Fixation of fracture with a trifin S.P. nail, or a compression screw (Charnley).

(*b*) *In the older age group* (i.e. over 70 years): At operation:

1. If there is marked initial displacement of the fracture — immediate replacement of head by a Thompson's prosthesis.
2. If postoperative reduction or position of S.P. nail is unsatisfactory — replacement by a Thompson's prosthesis.
3. The bed-ridden patient is best treated with a prosthesis, and, since the type of prosthesis is unimportant, provides an opportunity for using redundant stores of acrylics. The one exception is the hemiplegic patient, where interference of this kind seems to favour dislocation of the hip.

PROSTHETIC REPLACEMENT[11]

The Thompson's vitallium prosthesis was used in nearly all cases, and found quite satisfactory.[12] This has the advantage of being easy to insert, and maintains the length of the femoral neck (Fig. 8).

Either a lateral or a low-posterior approach is used, similar to that described by Moore,[13] and more recently in this country by Kaplan.[16] The gluteal muscles are preserved, but the gemelli, piriformis, and quadratus femoris are divided. The latter operation is quick (approximately 45 minutes), blood loss is minimal, and it is well tolerated by the older patients.

In the 10 patients with Thompson's prostheses, examined a year after operation, only 4 had slight pain, and all were walking well, with a good range of hip and knee movement.

Since December 1957, a further 60 prostheses have been inserted, making a total of 70.

There has only been one postoperative death, and in one patient with hemiplegia the hip dislocated postoperatively. The remainder have been very satisfactory, but they are not included in the above results because of the short time since operation.

TROCHANTERIC FRACTURES

There were 81 cases in this group. The classification of Mervyn Evans[14] has been used, the fractures being divided into stable and unstable varieties as follows:

	Stable	*Unstable*
No. of cases	56	25
Percentage	69%	31%
(Mervyn Evans' series)	72%	28%

Fractures are *stable* if there has been no displacement initially, or if after reduction and nailing the medial cortical buttress (the calcar femoralis) is intact, without displacement or overlap in both A.P. and lateral views.

Weight bearing was allowed as soon as possible after the operation, and in this series the fractures all united without any change in the angle.

The *unstable* group is that in which there is comminution of the calcar femoralis, or in which the displacement is not reduced effectively at operation (Fig. 9). Instability also occurs if the fracture line is reversed, corresponding to a McMurray osteotomy.

If satisfactory reduction cannot be obtained, it has been our practice to displace the shaft upwards and medially, and to aid this manoeuvre, it is often necessary to rotate the leg externally to obtain and maintain this position while the pin-plate is fitted. It is this type of case which requires direct traction on either a Charnley or Watson-Jones table.

Weight bearing is discouraged until the fracture has united, but the patient is allowed up early with crutches, and, as in the case of subcapital fractures, some weight bearing occurs. However, all these fractures united with good clinical results, and in only 3 was there a coxa vara of more than 10°.

The latest model McLaughlin nail plate was used in the majority of cases, and no stress fractures of the metal were observed, but in the case of the original model there were some in which the bolt unscrewed or gave way.

Over the last year, a four-flanged nail has been offered for use, but we are not impressed with the claim that this is an improvement, because it adds to the trauma at insertion.[15] The only disadvantage of the McLaughlin apparatus is that in thin subjects the pin-plate junction provides a prominence which eventually leads to local irritation and the formation of a bursa. Whereas most pin-plates are left, in these cases removal is necessary, and it is as well to advise this reasonably soon after union, since they can present a difficult removal problem after a year.

RESULTS

The results of treatment can be summarized as follows. The whole series included 172 patients (average age 71 years; oldest 102 and youngest 28). Of these, 78 had subcapital fractures and 13 transcervical fractures (average age 70 years), and 81 had trochanteric fractures (average age 72 years). The mortality (27) was 15·7, 14 and 17·4%.

for the whole series, the group with subcapital and transcervical fractures, and those with trochanteric fractures, respectively. The average age in the fatal cases was 80 years. The causes of death in the 27 patients were as follows: Cardiovascular complications 13, pulmonary embolism 3, uraemia 1, bronchopneumonia 1, oesophageal stricture 1, and unknown 8 (total 27).

The general complications can be summarized as follows: Wound sepsis 2, local haematoma 1, foot drop 1, and venous thrombosis of calf 3 (total 7).

As stated, the average mortality for the whole series was 15·7%, being slightly higher in the trochanteric fractures (17·4%) as compared with the proximal type of fracture (14%), and it was noted that the average age of the fatal cases was 80 years, as compared with 71 years for the whole group.

The time for clinical union and length of hospitalization can be summarized as follows:

	Transcervical and subcapital fractures	*Trochanteric fractures*
Time for clinical union (uncomplicated cases)	14·6 weeks	13·3 weeks
Time spent in hospital	6·5 weeks	8·5 weeks

It is interesting to note that the patients with trochanteric fractures were in hospital for a longer period, i.e. 8·5 weeks, compared with the patients with transcervical and subcapital fractures (6·5 weeks), whereas the reverse might normally be anticipated. The most probable reason for this was that the former tended to have more comminuted fractures and were older and less robust patients.

SUMMARY

1. The operative results of 172 cases of fractures of the neck of the femur are reviewed.

2. Early operative treatment is to the advantage of the patient and nursing staff, but there is no evidence to suggest that this reduces the incidence of complications involving the head of the femur.

3. Early ambulation, with partial weight bearing, likewise does not appear to aggravate the incidence of complications.

4. The subcapital and transcervical fractures in the older age groups, which show marked initial displacement, or where attempted reduction and pinning have failed, are treated with replacement by a Thompson's prosthesis. Similar conditions are probably best treated by nailing or possibly by some form of compression screw.

5. In the trochanteric group, the routine use of a McLaughlin nail plate has been very satisfactory, although it has disadvantages in thin subjects.

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