

no contribution towards its revascularization from a segment of viable bone in the neighbourhood of the fovea. In these circumstances, the load-bearing segment of the head of the femur often collapses before revascularization from across the fracture line is complete.

I would now like to consider the mechanical factors which may be responsible for failure. It is not always realized how large is the load borne by the hip joint in normal walking. Studies made by Dr Paul of the Bio-engineering Department of the University of Strathclyde indicate that this may vary from twice to as much as six times body weight according to the speed of walking (Table 2).

Table 2

Hip-joint force:
Values in terms of body weight (Paul 1967, 16 subjects)

Walking speed		Heel strike	
		Right	Left
Normal	(average)	3.29	3.88
Energetic	(maximum)	5.8	6.4
Slow	(minimum)	2.3	-

(female)

This load imposes a considerable shearing stress on the fracture, unless it has natural stability, as in the so-called impacted abduction fracture. For this reason a Smith-Petersen nail is not a satisfactory method of fixation for fully displaced fractures: it has a poor grip on the distal fragment and the capital fragment tends to drift into a varus position, especially when there is severe osteoporosis. In a Grade 3 or Grade 4 fracture it is essential to use a more secure method of fixation, such as a nail-plate or cross screws.

However, it has not proved possible to eliminate failure by improved methods of fixation. Fixation is only as good as the quality of the bone in which the appliance is placed. As we have seen, the failure rate in femoral neck fractures rises sharply with age, much more so in women than in men. This, incidentally, is why a discussion of the results of nailing is futile unless the age and sex of the patients are clearly stated. It is doubtful if we shall ever find a completely satisfactory method of fixation for fully displaced fractures when there is severe osteoporosis and comminution of the posterior cortex of the neck of the femur.

Unfortunately, primary prosthetic replacement has not proved any more satisfactory in the treatment of this group of fractures, and it is still, therefore, advisable to nail these fractures to assist nursing.

It is not proposed to say much about the accuracy of reduction and nailing except that bad technique usually – but not invariably – gets what it deserves. Not only must the fracture be accurately reduced, but the nail should be placed in the strongest part of the head, which is its middle.

Perhaps I should now answer the question posed earlier. I still believe Senn's dictum that the only cause for non-union in femoral neck fractures is to be found in our inability to maintain coaptation and immobilization of the fragments during the time required for bony union to take place, but I am less sanguine than James Dickson was in 1953 of our ability to find a wholly satisfactory method of fixation for this fracture in a patient who has severe osteoporosis.

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**A New Method of Treatment of
Petrochanteric Fractures**

At the meeting of the Austrian Society of Traumatology held in Salzburg in October 1969 the problems of treatment of the per- and subtrochanteric fractures of the femur were very fully discussed. The following two opinions were expressed by the meeting: First, that a high percentage of union can be obtained in these fractures and that the mortality rate in both conservative and operative treatment was very similar. As most of the patients are elderly, those treated conservatively die from prolonged confinement to bed, whereas, although those treated by operation can usually be ambulant within a few days, they die from post-operative shock, loss of blood, &c. Secondly, that the duration of the operation has a profound influence on the mortality rate in the elderly. Eberwahn (1970) expressed the opinion that most patients with a petrochanteric fracture die when the operation lasts more than

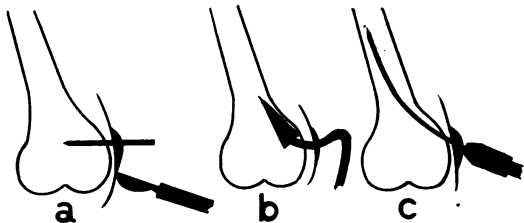


Fig 1 *Introduction of the guide pin*

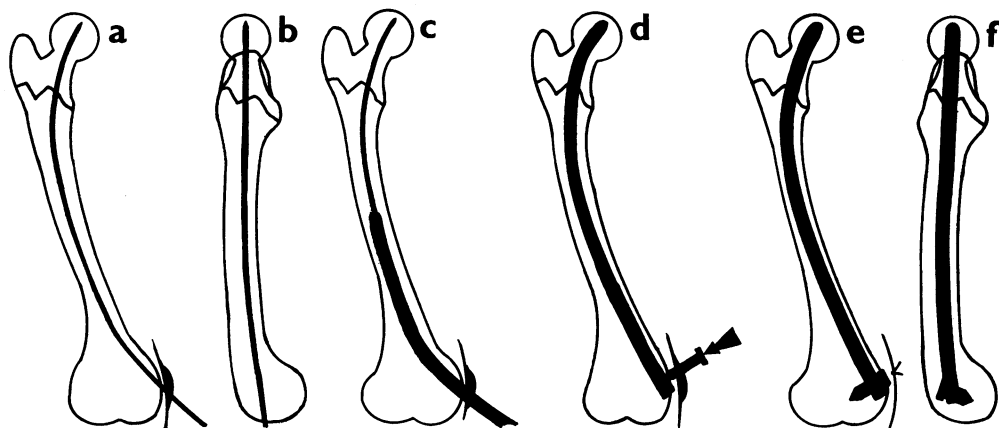


Fig 2 Introduction of the nail

one hour and that this occurs on the 3rd or 4th day. On the other hand, it is important that these elderly patients should become ambulant early and return home to their usual surroundings as soon as possible.

In 1964 I developed a new method of nailing and thus fixing these fractures (Küntscher 1966 *a,b*, 1970 *a,b,c*). The method fulfils the criteria of correction and firm fixation in an operation of short duration, and enables the patient to become ambulant in 24–48 hours with early return home.

The method is unusual as the nail is inserted at the medial femoral condyle and passes through the whole length of the femoral shaft across the fracture into the head of the femur. The fracture is reduced under general anaesthesia by the usual method of manipulation by extension, abduction and internal rotation. A small incision is made over the medial condyle (Fig 1A) and the medullary canal opened by a special reamer (Fig 1B). The correct position is determined on an X-ray television screen which is essential to this operation. Through the incision a sharp pointed curved guide pin of 4 mm diameter and 82 cm length is inserted, to which is attached a self-locking Jacob's chuck as a handle (Fig 1C).

Under television control the pin is pushed up to the fracture line when, if necessary, the proximal fragment can be manipulated by it into further correction; the guide pin is then pushed across the fracture to a distance of 1–2 cm from the joint surface (Figs 2A, B).

The length of guide pin outside the femur is then measured, from which can be calculated the exact length of nail required. This nail is of clover leaf cross-section and usually of 10 mm diameter. The nail is then passed up the medullary canal (Fig 2C) using a hammer until its apex has reached the point of the pin which is then cautiously removed. If the nail has impinged on the pin, a

special instrument with a powerful extraction screw is used. For all these manoeuvres an X-ray television screen is essential. Finally a small flat pin is inserted into a distal hole in the nail to prevent its extrusion (Figs 2D, E, F).

The patient is weight bearing on the same or next day. At first he uses crutches but soon discards these for sticks. He returns home within a few days.

Wolfers has had excellent results with this method (1967, 1970); Maurer (1970) has reported 80 cases without mortality and at the Madrid Congress in January 1970 Grau of Barcelona showed the results of 26 cases.

Summary

- (1) The operation is easy and rapidly carried out.
- (2) As the incision is remote from the site of fracture, the television X-ray apparatus does not impede the surgeon.
- (3) The nail is fixed by the whole length of the femoral shaft.
- (4) As there is no hole in the cortex near the fracture, subsequent fatigue fracture in the petrochanteric region cannot occur.
- (5) Early walking and weight bearing is possible.

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