FIXATION OF DISPLACED SUBCAPITAL FEMORAL FRACTURES

COMPRESSION SCREW FIXATION VERSUS DOUBLE DIVERGENT PINS

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One hundred and twenty-seven consecutive patients with displaced subcapital fractures of the femoral neck (Garden Grade III or IV) all under 80 years of age and independently mobile, were randomly allocated to fixation with either double divergent pins or a single sliding screw-plate device. The incidence of non-union and infection in the sliding screw-plate group was significantly higher, and we believe that when internal fixation is considered appropriate multiple pinning should be used. Mobility after treatment was disappointing in about half of the patients, and we feel that internal fixation can only be justified in patients who are physiologically well preserved and who maintain a high level of activity.

There is no doubt that some younger and fitter patients with displaced fractures of the femoral neck should be allowed to conserve their normal hip and merit treatment by fixation rather than by replacement of the femoral head. Just what constitutes a younger patient, however, and which method of fixation should be used, continue to generate controversy. Since the original report in 1878 by von Langenbeck of internal fixation of a femoral neck fracture, many and varied devices have been introduced for this difficult injury (Tronzo 1974). In general terms there are now two accepted methods of fixation in use: (a) a lateral plate with an integral sliding pin or screw, and (b) multiple pins or screws. There are already a number of excellent papers which present prospective studies comparing nail-plate and sliding nail or screw fixation (Barnes et al. 1976; Frandsen and Andersen 1981; Svenningsen et al. 1984) or which compare single with multiple pinning techniques (Strömqvist et al. 1984; Barnes et al. 1976) but the majority are limited to comparing one device with the reports of others (Brown and Abrami 1964; Ort and LaMont 1984; Skinner and Powles 1986).

We present the results of a prospective randomised trial of compression screw fixation versus double

divergent pin fixation for displaced Garden Grade III or IV (Garden 1961) subcapital fractures of the femur (Figs 1 to 4).

Fig. 1

Fig. 2

Compression nail fixation.

Fig. 3

Fig. 4

Double pin fixation.

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PATIENTS AND METHODS

The study comprised 127 consecutive patients under 80 years of age with displaced subcapital fractures of the neck of the femur which were all Garden Grade III or IV and could be adequately reduced according to Garden's criteria (Garden 1961). These patients were randomly allocated to one of two treatment groups: (a) sliding screw fixation (Clawson 1964) or (b) double divergent pin fixation (McQuillan, Abernethy and Guy 1973). All were able to walk independently before their fracture which was not pathological other than as a result of osteoporosis.

Blood levels of haemoglobin, calcium, phosphate, alkaline phosphatase and electrolytes were measured on admission, and pelvic and chest radiographs were taken. Surgery was performed under general or spinal anaesthesia, where possible within 24 hours of admission. Patients were then mobilised fully weight-bearing and reviewed at regular intervals thereafter. Pre-operative radiographs were assessed for Garden grouping, lateral angle and the complex anteroposterior angle measurement of the Western Infirmary, Glasgow (WIG angle) (Barnes et al. 1976). Only eight patients were lost to review; all the others were either reviewed personally by the senior author (JC) or radiographs and history were available. All these patients were followed to an outcome, either death, revision surgery or review. The mean time to final review was 33 months, including those patients who died or were lost to review. Results were recorded on a computer and analysed using Spearman correlation coefficients and cross-tabulation using the chi-square test.

RESULTS

Thirty patients died during the period of the study (23.6%), 21 within the first year (16.5%). Six patients developed deep infection (4.7%).

Table 1. Age distribution of the two groups

Age (years)	Fixation		Total	
	Sliding screw	Double pin	Number	Per cent
26-65	24	16	40	31.5
66-74	18	26	44	34.6
75-80	19	24	43	33.9

Table II. Incidence of non-union in the two groups

	Sliding screw		Double pin		Total
	Number	Per cent	Number	Per cent	
Non-union	22	40	13	22.8	35
Union	33	60	44	77.2	77

χ^2 , $p = 0.05$

There were 61 patients who had sliding screw fixation and 66 had double pinning. These groups were equally matched on all parameters measured except age (Table I). There was a broad spectrum of age, ranging from 26 to 80 years with a mean of 69 years, but there was no statistical correlation between age and non-union or avascular necrosis.

There was no correlation between blood calcium, phosphate or haemoglobin on the one hand and non-union or avascular necrosis on the other.

Avascular necrosis. Overall 15.7% had developed avascular necrosis by 21 months but only 4.8% required revision for this. There was no significant difference between the group treated by sliding screw (9 cases) and those treated by double pin (11 cases).

Union occurred in 77 patients (60.6%). There were 35 established non-unions (27.6%). In 15 patients the status of healing was not available due to early death or loss to follow-up. The incidence of non-union was significantly higher in the sliding screw group (Table II). There was no

Table III. Mobility in the two groups

Aids	Sliding screw	Double pin
None	23	26
One stick	17	16
Two sticks	2	4
Frame	12	11
Chair	0	1

statistical correlation between the quality of reduction and non-union. There was no significant difference in the quality of reduction between the two groups as indeed by Garden grouping, WIG and lateral angles.

Mobility. Only 49 patients (39.5) were independently mobile without sticks (Table III). This did not appear to be an age-related phenomenon. There was no statistical difference between double pinning and sliding screw fixation.

Revision surgery. Thirty-eight patients underwent revision surgery (29.9%), including the six patients with deep infection. Twenty-four of 61 patients fixed with the sliding screw device underwent revision surgery (39.3%), whereas it was only 14 out of 66 (21.2%) in the double pinning group; these figures exclude procedures for removal of the device in both groups. This difference was significant at the $p = 0.02$ level.

DISCUSSION

In comparing the two different methods of fixation, we have shown a significant statistical and clinical advantage to double pinning in relation to the rate of union and the rate of revision surgery. In attempting to explain this advantage we would suggest that two divergent pins within the femoral head offer increased resistance to posterior collapse as well as to rotation of the head

around the axis of the neck (Rau, Manoli and Morawa 1982). Garden suggested that lateral rotation at the fracture site and collapse of the posterior femoral cortex are the main causes of failure of fixation.

The dynamic compression hip screw relies not only upon the grip of the screw in the femoral head but also upon transient and intermittent compression. In elderly patients the hold obtained by the screw within the femoral head has been shown to be reduced and it has been suggested (Frandsen and Madsen 1983) that this is even further reduced after a fracture. The theoretical advantage of the sliding screw plate is that it achieves compression at the time of surgery, though this has not been shown to have clinical advantage (Frandsen et al. 1984). The double pinning technique places one pin anteriorly in the head and another posteriorly, so that rotation of the head and posterior collapse is prevented by the pins locking one on the other as well as by their grip within the femoral head. This benefit is unlikely to apply to techniques where multiple pins or screws are placed in parallel in the same coronal plane (Quinby, Ions and Stevens 1986). Our results suggest that a fixation technique using two pins which diverge and lie in different coronal planes offers enhanced fixation.

Overall only 39.5% of patients were mobile without aids after surgery and 29.9% underwent revision surgery. These results are similar to those of previous studies (Sikorski and Barrington 1981) and are poor in a group of mobile, though not necessarily active, patients under the age of 80 years. We therefore support the view that hemiarthroplasty or total hip replacement is more appropriate for displaced subcapital fracture of the femur in the elderly and less mobile patient (Sikorski and Barrington 1981), and that pinning should be reserved for those patients who are younger and more active. It is difficult to identify a precise distinction between these two groups, but in general terms older and less mobile patients tend to be confined to the house or to short walking distances only, and will make limited use of the hip. Those younger patients, who still play golf or continue to be otherwise fairly active, should be considered for hip pinning. We will in future restrict our indications for pinning to these younger patients and will

prefer a multiple divergent pinning technique. Patients who are elderly, physiologically well preserved and remain relatively active may be better served by hip replacement than by hemiarthroplasty.

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