We describe a method of internal fixation for femoral neck fractures which has been newly developed to reduce the frequency of early complications. Two cannulated screws are inserted in the axis of the femoral neck to reach into the subchondral bone of the femoral head. The screws are inserted over guide pins and the tip of the screw is self-tapping and designed to provide good anchorage in the femoral head.

We used this method in 44 consecutive patients in a prospective study with no exclusions, followed for a minimum of 24 months. All fractures healed within 12 months, and there were no cases of early loosening or nonunion. In four cases, late segmental collapse had developed during the mean follow-up period of 30 months.

Early loosening, defined as redisplacement within eight weeks of operation, is estimated to occur in about 10% of displaced femoral neck fractures treated by internal fixation (Garden 1964; von Bahr, Syk and Walheim 1974; Thorling 1980; Frandsen and Andersen 1981; Zetterberg and Andersson 1982; Arnold 1984). Although the complication of early loosening is quite distinct from that of nonunion, these two features have not been clearly distinguished in the past; the result has been that the presentation and interpretation of treatment outcomes have been unsatisfactory.

One contributory factor in early loosening is the defective engagement of screws or nails in the osteoporotic cancellous bone of the femoral head (Søreide et al. 1978; Høgh, Jensen and Lauritzen 1982; Frandsen et al. 1984; Svenningsen et al. 1984; Nordkild, Sonne-Holm and Jensen 1985; Skinner and Powles 1986; Madsen et al. 1987). We have developed a new method of internal fixation in an attempt to reduce the frequency of early loosening. Two parallel screws are placed in the longitudinal axis of the femoral neck to reach right into the subchondral bone of the femoral head (Figs 1 and 2).

The screws are cannulated and are inserted over guide pins to gain precision and reduce the tendency to wobble during insertion. The core and thread diameters of the screws are 6 and 8 mm respectively, and they have cutting tips (Fig. 3).

We report the results of the first two years of experience with this new method of internal fixation.

PATIENTS AND METHODS

We made a prospective study of 44 consecutive patients, 29 female and 15 male, with a mean age of 82 ± 8 years, with 43 displaced and one undisplaced fracture. All fractures during the course of the study were treated by internal fixation: and none by arthroplasty. This series of patients is completely separate from the 41 described in the preceding article.

Treatment. Patients were operated on within 24 hours of admission, those with displaced fractures being put in traction with 2 to 3 kg while awaiting operation. The same surgeon (LR) operated on all 44 fractures, using spinal anaesthesia, a traction table and fluoroscopy. Light traction is employed to reduce the fractures and they are then compressed manually in the longitudinal axis of the femoral neck under reduced traction.

The lateral femoral cortex is exposed by reflecting vastus lateralis anteriorly, and the entry hole for the first screw is made at the level of the lower aspect of the lesser trochanter. The distal screw is placed parallel to the femoral neck, resting against the femoral calcar and the proximal screw parallel to it and just within the cortical bone of the femoral neck. In the lateral projection, the screws are parallel and central within the femoral head. Patients were mobilised with unlimited weight-bearing from the first postoperative day.

Follow-up. Patients were reviewed at four months and 12
months with clinical and radiological examination and again at two to three years. Complications were assessed and recorded as they occurred. Follow-up was for a mean period of 30 months (range 24 to 36 months).

RESULTS

All the displaced fractures were satisfactorily reduced according to Garden’s criteria (1971), that is to angles of 160° to 175° in the anteroposterior projection and 180° ± 15° in the lateral projection, with no sideways displacement. Ten patients (22%) died during the follow-up period, but the 34 remaining patients were all kept under review.

Thirty-three patients had no pain at rest or during weight-bearing and 31 had returned to the same living conditions as before their injury. Three had moved from old peoples homes or serviced houses to chronic care hospitals. By the criterion of an invisible fracture line bridged by bony trabeculae all fractures had healed radiologically within 12 months. In four cases, late segmental collapse developed later in the follow-up period.

The screws had retained their position in the subchondral bone of the femoral head in all 34 cases. In the four cases of late segmental collapse the cranial screw had displaced in a varus direction, but in the other 30 cases the screws had remained parallel and in their original orientation. In one of the patients with late segmental collapse and pain, an 81-year-old woman with a Garden IV fracture, re-operation for total hip replacement was required two years after injury.

DISCUSSION

In the literature, a failure rate of 40 to 70% has been reported for osteosynthesis of femoral neck fractures (Banks 1962; Frandsen 1979; Thorling 1980; Høgh et al. 1982; Skinner and Powles 1986; Elmerson et al. 1987; Holmberg, Kalén and Thorngren 1987), but there are exceptions to these depressing figures: Strömqvist et al. (1987), for example, reported a 25% failure rate in a series of 300 hip fractures operated on with hook-pin fixation, only 11% requiring re-operation and hip arthroplasty.

We have demonstrated experimentally that insufficient stability of reduction increases the risk of nonunion (Rehnberg and Olerud 1988 and the preceding paper). Other authors have given a similar opinion based on their clinical observations (Barnes et al. 1976; Arnoldi and Lempert 1977; Frandsen 1979; Deyerle 1980; Keller and Laros 1980; Kofod and Alberts 1980; Thorling 1980; Høgh et al. 1982). Fracture stability is in its turn dependent upon the mechanical qualities of the bone, the quality of reduction and the type and positioning of the fixation material (Garden 1971; Brümmer 1984; Ceder, Ström qvist and Hansson 1987; Elmerson et al. 1987; Strömqvist et al. 1987).

Review of our series has shown very few mechanical complications; several factors may explain this. Firstly, we achieved favourable reduction of all fractures (Garden 1971). Secondly, as discussed by Strömqvist et al. (1984), there is a better prognosis when operations are performed by a limited group of experienced surgeons. All of our patients were operated on by one of the authors (L.R.). Thirdly, the method of osteosynthesis employed here has probably played a large part. The use of a guide
pin increases the precision with which screws are positioned; its position can be changed without risk of
damage to the cancellous bone of the femoral head. It
also facilitates the reaming of the channel in the lateral
cortex so that it is exactly parallel and concentric to the
screw axis: this probably leads to a more stable
anchorage. The guide pin also helps to reduce wobbling
during the insertion of the screw. The screw tip is self-
tapping; this causes less damage to the cancellous bone
of the femoral head, and it allows subchondral anchorage,
where bone quality is best.

Some reports imply that the insertion of large screws
into truly subchondral bone causes deformation of the
articular surface of the femoral head. We therefore
analysed joint congruence in 20 of our patients, using
combined arthrography and tomography, and examined
autopsy material from 20 patients. In no case have we
seen any evidence of cartilage protrusion.

The early results obtained with the new subchondral
screw fixation are superior to those of the earlier
methods, reported in our preceding paper in this issue of
the Journal, especially with respect to early complica-
tions. This has encouraged us to start a prospective
randomised study comparing the two methods.

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