Internal fixation versus hemiarthroplasty for displaced femoral neck fractures in the elderly

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Introduction
Femoral neck fractures are among the most common orthopaedic injuries in patients older than 60 years. To date, there is no clear consensus about which patients are best treated by internal fixation and which by some form of arthroplasty.
Patients and methods
We conducted a prospective, randomized clinical study to compare the results of bipolar hemiarthroplasty with those of internal fixation for displaced intracapsular femoral neck fractures in elderly patients. Forty patients were included. Twenty patients were operated upon using bipolar hemiarthroplasty. Another 20 patients were operated upon using closed reduction and internal fixation using three cancellous screws. Their ages ranged from 50 to 70 years. The follow-up period ranged from 17 to 30 months, with a mean duration of 23 months. Patients were evaluated clinically by means of self-reported Harris Hip Scores.
Results
The mean postoperative self-reported Harris Hip Score for the hemiarthroplasty group was higher than that for the internal fixation group. The difference was statistically significant. In the hemiarthroplasty group, reoperation rate was 15% (three patients), with no cases of prosthetic dislocation. In the internal fixation group, one patient was lost to follow-up and five patients developed avascular necrosis (AVN) (26.3%). Four patients (21%) developed nonunion.
The reoperation rate was 52.6% (10 patients). The amount of transfused blood units was greater and the operative time was significantly increased in the hemiarthroplasty group.
Conclusion
In conclusion, hemiarthroplsty after displaced femoral neck fractures in the elderly is better in terms of functional outcome, pain relief and revision rates, compared with internal fixation. However, hemiarthroplasty may be associated with an increased trend towards postoperative infection.

Keywords:
hemiarthroplasty, internal fixation, neck femoral

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Introduction

Femoral neck fractures are a very common form of orthopaedic injury and the incidence is steadily increasing. This is because of changing population demographics with an increasing proportion of the adult population reaching the age when hip fractures are common. This places an increasing demand on healthcare resources [1].

Femoral neck fractures are among the most common orthopaedic injuries in patients older than 60 years. The incidence of fractures increases after the fifth decade of life and continues to rise with increasing age; women are more frequently affected [2].

These fractures are 'unsolved fractures' because they are frequently complicated by avascular necrosis (AVN) or nonunion and associated with increased mortality and high hospitalization costs [3–5].

The treatment of femoral neck fractures aims for the restoration of the patient's function to the same level as before the fracture and avoidance of possible complications arising from the fracture [1].

The treatment of femoral neck fractures in elderly patients continues to be a challenge as these patients are often physiologically compromised and must be immediately mobilized. To date, surgical treatment of femoral neck fracture in the elderly population is still a subject of controversy [3].

Operative alternatives for displaced femoral neck fractures differ greatly throughout the world but mainly include prosthetic replacement and internal fixation (IF). Options for arthroplasty include unipolar hemiarthroplasty (HA), bipolar HA and total hip arthroplasty. Options for IF include multiple screws, a compression screw and side plate or an intramedullary hip screw device. However, whether arthroplasty or IF is more appropriate for displaced femoral neck fractures in elderly patients is still being debated [6–8].

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IF preserves the femoral head. In addition, it involves shorter operative time, less blood loss and operative trauma, whereas arthroplasty might increase operative mortality. However, some authors favour arthroplasty because the replacement of the femoral neck can decrease the rate of revision surgery and the complications related to healing of the fracture [6–8].

The prognosis for functional recovery following femoral neck fractures depends on the patient's preexisting health status. These fractures have a good prognosis only if the patient had been able to walk well before the fracture, if his or her social support system is strong enough to achieve good functional rehabilitation and the patient is free of other pathological or psychiatric conditions [9].

The purpose of this study was to compare the clinical and radiologic results of bipolar HA with those of IF in the treatment of displaced intracapsular femoral neck fractures in elderly patients.

Patients and methods

This is a prospective, randomized clinical study comparing the results of bipolar HA with those of IF for treatment of displaced intracapsular femoral neck fractures in elderly patients. The study was conducted between March 2008 and December 2009. Follow-up ranged from 17 to 30 months with a mean of 23 months.

The patient population comprised 40 patients (40 hips) of the elderly age group suffering from intracapsular displaced fractures of the femoral neck. Twenty patients were operated upon using bipolar HA, whereas another 20 were operated upon using closed reduction and IF using three cancellous screws. Patient demographics are demonstrated in Table 1.

Patient selection

Patients were randomized by dividing them manually into two groups: the first patient was placed in the HA group and the second one in the IF group.

Inclusion criteria

(1) Age from 50 to 70 years.
(2) Intracapsular femoral neck fractures.
(3) Displaced femoral neck fractures (Garden's III and IV).
(4) Patients with a fracture of the femoral neck that occurred less than 72 h earlier.
(5) Patients with independent living status, and preinjury independent walking capability without aids.

Exclusion criteria

(1) Patients with cognitive impairment.
(2) Patients with neuromuscular disorders such as epilepsy.
(3) Patients with American Society of Anesthesiologists score 3 or more [10].
(4) Patients with previous hip fractures.
(5) Patients with pathological fractures.

Table 1 Patient demographics

	HA	IF
Age (years)	63 ± 5.6	59.2 ± 6.2
Sex	10 males, 10 females	9 males, 10 females

HA, hemiarthroplasty; IF, internal fixation.

(6) Patients with multiple fractures.
(7) Corticosteroid-dependent patients.
(8) Morbidly obese patients.

Patient evaluation

Patients were evaluated clinically at 3-, 6 months, 1-and 2 years by self-reported Harris Hip Scores [11]. Patients were evaluated radiologically immediately after surgery and 3-, 6 months, 1-and 2 years using serial anteroposterior and lateral radiographs of the pelvis and both hips.

Surgical procedures

Fixation was achieved by three cannulated screws positioned in a triangular pattern. The type of bipolar hemiarthriolasty was chosen according to the Dorry classification [12]. Patients with a very small canal diameter and thick cortices (Dorr type A bone) are good candidates for uncemented implants. Patients with typical canal geometry (Dorr type B bone) are good candidates for either a cemented or an uncemented implant. Patients with a very large canal diameter and thin cortices (Dorr type C bone) are often good candidates for cemented fixation. HA was performed through the posterior approach (Moore) with posterior dislocation of the hip [13].

Statistical analysis

Data were collected and entered into a personal computer. Statistical analysis was carried out using the statistical package for social sciences (version 17) software.

Arithmetic mean and SD were calculated. For categorized parameters, the χ^2-test was used. For numerical data, the *t*-test was used to compare two groups. The level of significance was *P*-value less than 0.05.

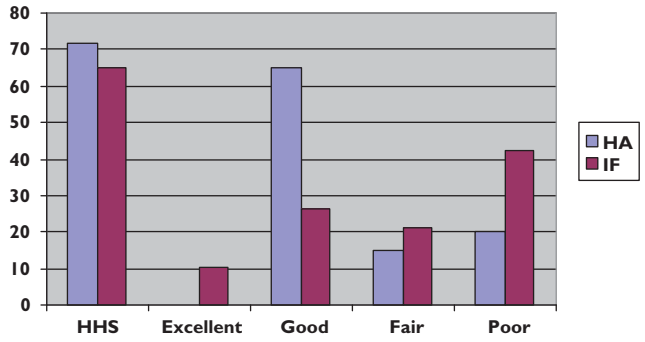
Results

The mean postoperative self-reported Harris Hip Score for the HA group was higher than that of the IF group, which was statistically significant (Fig. 1; Table 2).

In the HA group, one patient (5%) died 1½ years postoperatively. One patient (5%) developed primary deep infection that necessitated extraction of the prosthesis. One patient (5%) developed superficial wound infection that needed superficial drainage and antibiotic treatment. One patient (5%) developed protrusio acetabuli. The reoperation rate in this group was 15% (three patients). No cases of prosthetic dislocation were encountered.

In the IF group, one patient was lost to follow-up and was excluded from the study. Five patients developed AVN (26.3%) (Fig. 2). Four patients (21%) developed nonunion and one patient (5.2%) developed greater

Figure 1



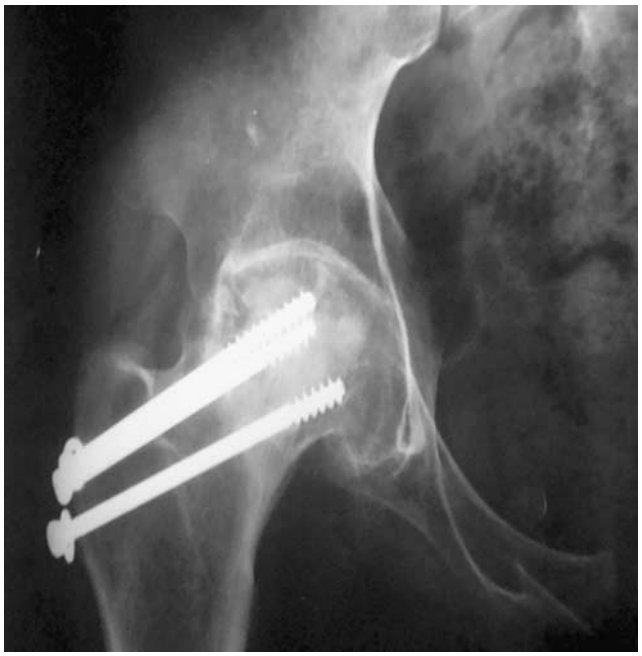
Clinical outcome at the last follow-up visit. HA, hemiarthroplasty; HHS, Harris Hip Score; IF, internal fixation.

Table 2 Results of self-reported Harris Hip Score at the final follow-up visit for the hemiarthroplasty and internal fixation groups

	HA	IF	*P*-value
Mean (SD)	72 ± 6.4	65.1 ± 11.5	<0.05 (0.002)
Range	57–78	49–82	

HA, hemiarthroplasty; IF, internal fixation.

Figure 2



A united femoral neck fracture with secondary AVN at 2 years postoperatively. AVN, avascular necrosis.

trochanteric bursitis after 1 year because of protrusion of screws. The clinical symptoms improved after removal of screws. The reoperation rate in this group was 52.6% (10 patients).

The amount of transfused blood units was greater in the HA group. The mean difference in operative time (min) was 41.6 (range 23.4–57.8) in favour of the IF group ($P < 0.05$).

Discussion

The management of femoral neck fractures in the elderly is controversial. Treatment options include HA, total hip arthroplasty and IF [14].

Bhandari *et al.* [15] conducted a meta-analysis of 14 clinical studies, which included a total of 1933 patients to determine the effect of arthroplasty, compared with that of IF on revision rates among other variables. According to their meta-analysis, reoperation rates ranged from 0 to 24% in the arthroplasty group and from 10 to 48.8% in the IF group. In this study the reoperation rate in the arthroplasty group was 15%, which falls within the range. In addition, the reoperation rate in the IF group was 52.6%, which is very close to the upper limit of the range. The statistically significant increase in reoperation rates following IF compared with arthroplasty has been reported in another meta-analysis by Wang *et al.* [9].

Bhandari *et al.* [15] in the same meta-analysis reported that reoperations following IF in the literature were often due to nonunion (range 5–28%) and AVN (range 5–18%). In the current study, nine out of 10 patients required reoperation because of nonunion and AVN. The rate of nonunion reported in this study falls within the range, and the rate of AVN is close to the range.

Although no nonunions and AVN occurred after arthroplasty, the literature reports that dislocations did occur after all types of arthroplasties (range 0–22%, mean 0.82%) [15]. In the current study no dislocations were encountered.

Bhandari *et al.* [15] and Wang *et al.* [9] reported a trend towards increased mortality in the early postoperative months after arthroplasty compared with that after IF. In the current study the only postoperative mortality encountered belonged to the arthroplasty group at 1½. However, the sample size limitations of the current study do not allow for concrete conclusions on mortality rates.

Bhandari *et al.* [15] analysed 14 studies that reported on pain relief and function following arthroplasty and IF in femoral neck fractures. They concluded that arthroplasty and IF do not differ with regard to their impact on pain relief and function. In addition, Wang *et al.* [9] in a meta-analysis of five studies with 750 patients reported no statistically significant difference between arthroplasty and IF with regard to pain relief at 1 year postoperatively.

In contrast, this study reported statistically significant differences between arthroplasty and IF with regard to pain relief and function in favour of arthroplasty. In this study the significantly higher rates of postoperative pain and function retardation following IF is attributed to AVN (26.3%), nonunion (21%) and hardware-related problems (5.2%). The association of significantly better functional outcome with arthroplasty compared with IF has been reported previously [4,14,16,17].

Nevertheless, Mouzopoulos *et al.* [3] compared HA, total hip arthroplasty and IF for displaced intracapsular femoral neck fractures. Mouzopoulos *et al.* [3] concluded that total hip arthroplasty offered better functional results and less pain compared with HA and IF. In the current study, only HA was carried out. The author of the current study suggests that the true incidence of postoperative pain following HA may not be detected in short-term follow-up studies as it may be related to acetabular cartilage degeneration.

Two large meta-analyses reported that the risk of infection associated with arthroplasty is significantly higher than that associated with IF [9,15]. This conforms to the results of our study, in which the only two reported cases of infection were in the arthroplasty group. Infection necessitated reoperation in both cases with prosthetic removal in one case.

The literature reports that patients who underwent arthroplasty had significantly greater blood loss and longer operative times compared with those who underwent IF [9,15]. This study reported similar findings. The author of the current study believes that blood loss and operative time may be critical factors, especially for patients aged 70 years or more and/or with associated comorbidities.

Conclusion

HA after displaced femoral neck fractures in the elderly is better in terms of functional outcome, pain relief and revision rates, compared with IF. However, these short-term advantages of arthroplasty were eroded by a significantly increased blood loss and operative time. HA may be associated with an increased trend towards postoperative infection.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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