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Regional bone loss following femoral neck fracture: A comparison between cemented and cementless hemiarthroplasty

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ABSTRACT

The aim of this prospective, randomised study was to measure and evaluate regional bone mineral changes and clinical results following the use of cemented and cementless hemiarthroplasty (HA) for treatment of femoral neck fracture in elderly patients. The study comprised 60 patients, 30 with cemented HA (group A) and 30 with cementless HA (group B). All patients underwent osteodensitometry of the contralateral hip, lumbar spine and bilateral distal femur. Dual-energy x-ray absorptiometry (DEXA) was scheduled at 1 month, 6 months and 1 year after surgery. Harris Hip Score (HHS) was used for functional assessment. Overall mortality rate was 20.3% within 1 year after surgery. There were no significant differences in morbidity, mortality and hospital stay between the two groups of patients. The implantation of cemented prosthesis took statistically significantly longer than that of cementless prosthesis (79.03 ± 3.59 vs 68.02 ± 5.97 min; $p = 0.00$). Functional score in patients treated with cemented HA was significantly higher compared with those with cementless HA. There was a trend of less intensive reduction of bone mineral density (BMD) in regions of interest of the lumbar spine and ipsilateral distal femur in patients with cemented HA (group A), whereas bone loss was less pronounced for the contralateral hip and distal femur in patients treated with cementless HA (group B). Management of displaced femoral neck fractures in elderly patients with cemented and cementless HA provides a comparable outcome with regard to morbidity and mortality; however, functional outcome of patients treated with cementless HA tends to be lower. There is less intensive BMD reduction in lumbar spine and ipsilateral distal femur in patients treated with cemented HA, whereas BMD reduction in patients treated with cementless HA is more likely to be less intensive in contralateral hip and distal femur.

Introduction

Surgical options for the treatment of displaced femoral neck fractures include internal fixation, hemiarthroplasty (HA) and total hip arthroplasty. There is no definitive management algorithm regarding optimal treatment for displaced femoral neck fractures in elderly patients. Hemiarthroplasty is usually the standard procedure for displaced osteoporotic femoral neck fractures in elderly patients because of the simple technique, shorter operative time, reduced blood loss and lower dislocation rate compared with total hip arthroplasty. The choice between cemented or cementless HA for treatment of displaced osteoporotic femoral neck fractures continues to be debated despite the numerous studies conducted on the subject [1–5]. Many authors analysed outcome with sufficiently long-term follow-up and there appears to be no significant difference between cemented and cementless HA in terms of morbidity, mortality or length of hospital stay. Vidovic et al. recently investigated the influence of cemented and cementless HA on periprosthetic bone loss [6]; however, regional bone loss, including that of the uninjured limb, following either type of HA has not yet been published. Studies have shown that during the recovery phase of an injury, there are three factors that influence bone mineral changes: the injury itself, which can cause a catabolic effect on the bone and leads to a decrease in bone mineral quantity; operative trauma, which has an additional catabolic effect; and prolonged disuse or reduced weight-bearing,

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which is associated with decreased bone mineral quantity. The persistence of initial bone loss is significantly influenced by the severity of injury, the treatment chosen and functional recovery.

Bone loss observed after injury affects not only the injured bone, but also the uninjured bone; it can persist for a long time and increases the risk of later fractures at other sites. These observations support results reported by Karlsson and Finsen [7,8]. Hence, any significant functional impairment may considerably contribute to the development of post-traumatic osteopenia and consecutive implant failure or later fracture [9].

The first aim of this prospective, randomised clinical study was to evaluate the magnitude and course of regional bone mineral changes following femoral neck fracture treated with cemented or cementless HA in contralateral hip, lumbar spine, and bilateral distal femur. The second aim of the study was to evaluate and compare clinical factors, including functional outcome, between two groups of patients.

Material and methods

A total of 142 elderly female patients (mean age 85.2 years) with displaced femoral neck fracture (Garden 3 and 4) were enrolled in the study. Patients were divided into two groups: one group was treated with cemented HA (group A) and the other with cementless HA (group B). Patients were excluded from the study if they could not comprehend the study protocol, sustained pathological fracture, or had known local or systemic infection, hip osteoarthritis, complete pre-injury immobility, previous fracture of lower limbs, immunosuppresion or other disease that interferes with bone metabolism. Sixty-three patients were excluded from the study. The study comprised 79 patients: 38 with cemented HA in group A and 41 with cementless HA in group B. A total of 19 patients did not complete 1-year follow-up: 17 patients died within 1 year postoperatively and two were lost to follow-up. The final study population comprised 60 patients who completed all follow-up examinations, 30 in group A and 30 in group B.

Age, operative time, duration of hospital stay, morbidity and mortality were recorded. All patients underwent osteodensitometry to evaluate bone mineral density (BMD), which was measured by dual-energy x-ray absorptiometry (DEXA) at 1 month, 6 months and 1 year after surgery (Hologic® QDR 1500 dual X-ray absorptiometry system, Hologic, Waltham, MA, USA). Changes in BMD in the contralateral hip were measured in the neck, Ward triangle and trochanter; the total value of the femur was also obtained, Fig. 1. Measurement of BMD of the distal femur involved using one region of interest in the distal metaphysis and the global value according to Sievannen [10], Fig. 2. Osteodensitometry of the lumbar spine was measured in four regions of interest (from L1 to L4), see Fig. 3.

Harris Hip Score (HHS) was used to evaluate functional outcome at 3, 6 and 12 months after surgery. Institutional review board approval was obtained before initiation of the study and all patients provided informed consent for participation in the study.

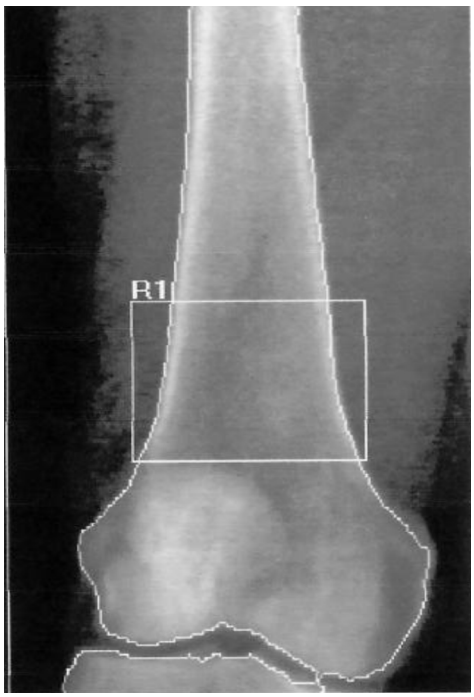

Fig. 2. Region of interest of distal femur.

Fig. 1. Region of interest dual-energy x-ray absorptiometry (DEXA) scan of the contralateral hip.

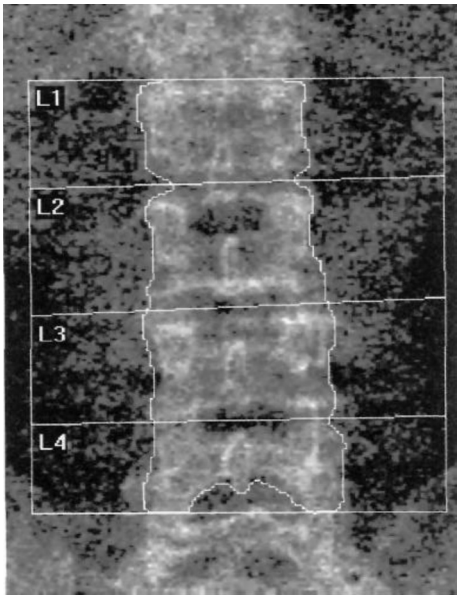

Fig. 3. Evaluation of bone mineral density (BMD) was conducted at each one of the four regions of interest in lumbar spine.