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Original research

Uncemented fully hydroxyapatite-coated hip stem for intracapsular femoral neck fractures in osteoporotic elderly patients: a multicenter study

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ABSTRACT

There is still debate over the limits of age and bone stock quality of patients on whom to use an uncemented straight stem coated with hydroxyapatite (HA). We studied a group of 244 patients with a displaced intracapsular fracture of the femoral neck who underwent cementless hemiarthroplasty or total hip arthroplasty. 143 patients were reviewed at the two-year follow up. A fully HA-coated stem for intracapsular hip fracture results in a satisfactory return to pre-injury mobility and a low complications rate. The advantage reported in the literature of a low mortality rate with use of an un-cemented implant in elderly patients was shown to be greater still on finding an immediate primary stability and rapid osteointegration of the implant.

Introduction

The concept of full coating to fixate a prosthetic stem whose geometry affords a reduction in proximal-distal rigidity was introduced 25 years ago [1,2]. Despite good results documented in the literature however, the ideal type of coating and prosthetic design are still under discussion. The problem is even more evident if the host bone has osteoporotic characteristics.

The critical issues are primary fixation and osteointegration. The stability of the primary fixation depends on the prosthesis design and coating material. Radiostereometric analysis (RSA) studies of stem migration have shown precocious and definitive stability of fully coated implants and better results compared to porous metal-coated implants of similar geometry [3,4]. Osteointegration is enabled by the interaction of the bone stock and the inert material coating of the prosthesis [5]. This phenomenon is not transitory but is seen throughout the entire duration of the arthroprosthesis in a process of periprosthetic remodeling. The quality of the bone is therefore vitally important for the short- and long-term survival of the implant. The use of an uncemented straight stem coated with hydroxyapatite (HA) in young, active patients with good bone quality is an indication endorsed in the literature [6–8]. There is still debate, on the other hand, over the limits of age and bone stock quality of patients on whom to use this type of prosthetic solution.

In light of this, we studied a group of patients having intracapsular hip fractures treated with a collarless fully HA-coated stem as a prosthetic solution and analyzed their clinical and X-ray results over a 2-year follow-up.

Material and methods

We retrospectively reviewed a group of 244 patients with a displaced intracapsular fracture of the femoral neck who underwent cementless hemiarthroplasty or total hip arthroplasty with a collarless fully HA-coated right stem. Our group of study consisted of all patients admitted with a diagnosis of intracapsular hip fracture between April 2011 and July 2012. The exclusion criteria for

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our study were: patients with arthritic changes involving the acetabulum and pathological fractures. Informed written consent from all patients was obtained prior to any intervention. Degree of Osteoporosis was evaluated measuring Cortical Thickness Index (CTI) according to Dorr [9]. CTI was assessed by examination of opposite femur on routine pelvis radiograph for preoperative planning. All surgical operations were done under spinal or epidural anesthesia at the discretion of the anesthetist. A lateral approach to the hip was used in 186 patients and a posterior approach was used in 58 patients, according to the surgeon's preference. Ultra short-term antibiotic prophylaxis was performed in all patients. Prophylaxis against heterotopic ossifications was done by administration of nonsteroidal anti-inflammatory drugs. All patients received a collarless fully HA-coated Korus stem (Gruppo Bioimpianti, Peschiera Borromeo, MI, Italy) (Fig. 1). The Korus stem, made of a titanium-substrate, has a triple-tapered design, being tapered in the anterior-posterior (AP) dimension and from lateral to medial. The stem features both horizontal and vertical grooves to increase both rotational and axial stability after implantation. Both the 135° and 125° CCD angle neck stems are coated with a layer of Osprovit hydroxyapatite (HA) of approximately 150 μm thickness. The combination of the macrostructure tapering, horizontal and vertical grooves and the HA coating was devised to promote implant stability. The Korus stem should be implanted with either a collarless or collared stem, depending on the surgeon's preference and estimations of bone quality. In 181 cases patients received a bipolar cup (Janus cup, Gruppo Bioimpianti, Peschiera Borromeo, MI, Italy), in 14 cases a traditional cup (Fin II cup, Gruppo Bioimpianti, Peschiera Borromeo, MI, Italy) (Figs. 2 and 3), and in 49 cases a dual mobility cup (Dualis cup, Gruppo Bioimpianti, Peschiera Borromeo, MI, Italy). Pre-operative indication of the use of coupling with a different type of acetabular component was as follows: a traditional cup in patients under 80 not showing co-morbidity with pre-fracture unaided walking; a bipolar cup for patients over 80 or in those under 80 but with low capacity to walk unaided; use of a dual mobility cup in patients with neuromuscular disorders or cognitive dysfunction, and for patients under 75 if at risk of falls and early dislocation. To calculate fall risk status we used the Morse Fall Scale (MSF) [10] upon patient admission. MFS > 45 was indicative of high risk.

Information collected included the patient's age, gender, pre-fracture mobility status and co-morbidity. Surgical parameters recorded were operative time, intra-operative complications and postoperative complications. Complications included fracture of the proximal femur, infection, hematoma and dislocation. Regular clinical and radiological follow up of all cases was done at 6 weeks, 3 months, 6 months, 12 months and two years. At each follow up, patients were evaluated clinically using the Harris Hip Score (HHS) [11] and radiologically to detect any loosening, heterotopic ossification, subsidence of the prosthesis, acetabular erosion or protrusion acetabuli.

Results

244 patients were treated with a collarless Korus uncemented fully HA-coated stem for a fractured femur neck. 156 patients (59%) were women. 30 patients had an opposite hip arthroplasty for a previous hip fracture. 3 pre-operative pelvis radiographs was lost at time of our study. 211 pre-operative pelvis radiographs was available to calculate CTI. Mean CTI was 0.49 (SD = 0.03; range = 0.39–0.54), supporting a poor quality of bone of patients treated [12]. In 49 cases the MFS score was 45 or more and a dual mobility cup was implanted due to high risk of fall or dislocation. 41 patients died during the first year follow up period. 87 patients died and 14 were lost to final follow up. 143 patients were reviewed at the two-year follow up. At surgery time, mean age was 83.7 years (SD = 6.66; range = 66–100). 201 (82.3%) patients had at least one systemic disease, the commonest being hypertension (172 patients, 70.4%). One-year mortality rate was 16.8% (41 patients).

There were four cases of intraoperative trochanteric fractures managed by trochanteric cable fixation. Postoperatively, shortening of >15 mm was observed in five patients. Superficial infection in the form of a wound dehiscence was seen in three patients, one of whom was a diabetic. Two patients were managed by debridement and appropriate intravenous antibiotics. One case was managed with intravenous antibiotics. The infection resolved without any sequelae in all cases. Four patients had a deep vein thrombosis post-operatively. We observed two cases of dislocations. The first one was due to instability and the second to early loosening of the stem. In the second case, an undersized stem compared to the one chosen in pre-operative planning was implanted. Two patients were managed, respectively, with acetabular revision with a dual mobility cup and stem revision with an uncemented oversized stem. The rate of peri-operative complications was 7.3% (18 patients). One patient sustained a peri-prosthetic Vancouver B1 fracture after a fall six months after surgery which was successfully fixed internally with a plate and cabling.

The average HHS at 6 weeks after surgery was 52.16 (43.33–68.65), at 3 months 69.45 (49.62–81.28), and at 6 months 79.12 (54.55–87.81). At one year, the average score rose to 79.64 (55.80–88.96) and at the final two year follow up it was 81.14 (56.21–94.32). In 4 cases (1.6%) a subsidence of >3 mm was observed at the at the 6 week and 3 month follow-ups. In none of these cases

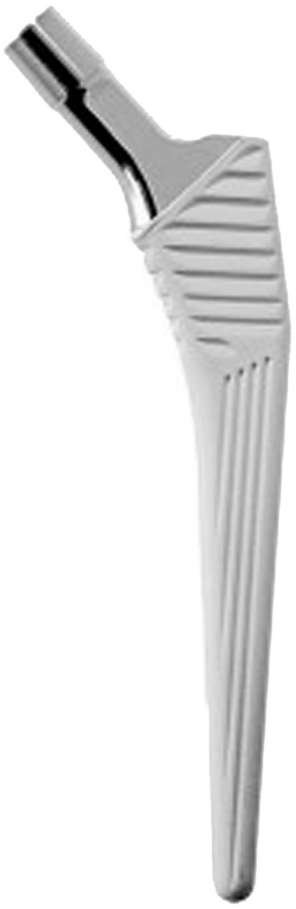

Figure 1. Photograph of an uncemented fully coated Korus stem (Gruppo Bioimpianti, Peschiera Borromeo, MI, Italy).