A Five Year Follow Up of Cementless Modular Revision Hip Prostheses for Complicated Hemiarthroplasty

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Citation: Mohamed Nabil (2017) A Five Year Follow Up of Cementless Modular Revision Hip Prostheses for Complicated Hemiarthroplasty. J Orthop Skeletal Med 1(1): 104

Received: June 26, 2017; Published: September 20, 2017

Abstract

Introduction: Hip hemiarthroplasty for fracture neck of femur is a common procedure in our community. Unfortunately, we find a lot of complications following this procedure including loosening, periprosthetic fractures, malpositioning of the prosthesis, and fracture at the neck of the prosthesis itself.

Objective: To assess the results of modular prostheses revision hip arthroplasty for complicated hemiarthroplasty.

Methods: In the period from September 2010 to July 2012 I have done 23 cases of revision hip arthroplasty for complicated hip hemiarthroplasty using cementless modular long stems in all cases and cementless cups in 19 case and cemented cups in 4 cases. I used wagner osteotomy to remove cement from the femoral medulla in 17 cases while 6 cases had no need for osteotomy.

Results: I used the Harris Hip Score for assessment of the results which showed 56.5% excellent results and 43.5% good results after 5 year follow up postoperatively.

Conclusions: It could be concluded that revision hip cementless modular prosthesis is very successful in treating complicated cases of hemiarthroplasty.

Keywords: Revision hip arthroplasty; Modular cementless prosthesis; Complicated hemiarthroplasty

Introduction

Hemiarthroplasty using Thompson prosthesis of the hip is a commonly performed procedure in elderly patients with intracapsular displaced fractures of the neck of the femur with good short-term results with regard to pain relief, return to activity, morbidity and mortality [1-3]. Although Thompson hemiarthroplasty has been advocated by some for treatment of various conditions of the hip joint the results have not been very gratifying and it has largely been given up in favor of total hip arthroplasty (THA) [4]. Long-term problems associated with hemiarthroplasty include progressive acetabular cartilage degeneration and concomitant groin pain, protrusio, stem loosening and subsidence; and very poor results have been reported in active patients.

Bipolar arthroplasty was considered to improve the long-term outcome of hemiarthroplasty as a result of less wear of the metal-cartilage interface by providing another interface (metal-polyethylene) inside the bipolar head. However, recent studies comparing bipolar to unipolar hemiarthroplasty show little difference between the two with regard to morbidity, mortality, or functional outcome [5]. Current evidence is emerging that THA may be a better choice for patients of intracapsular fractures of the neck of the femur in elderly age group (60-75 years) who are mentally competent, relatively healthy, active, capable of living independently and have a long life expectancy [6,7].

The indications for conversion of hemiarthroplasty to THA include acetabular erosions and protrusio causing groin pain, femoral loosening and subsidence causing thigh pain and the typical “start-up” pain, dislocation, breakage of implant leading to loss of function, peri-prosthetic fracture and infection. Conversion of hemiarthroplasty is associated with high complication rates and loosening rates as against primary total hip arthroplasty [8-11]. The purpose of the
present study was to evaluate the functional outcome, survivorship at mid-term follow-up, and complication rates of conversion of hemiarthroplasty to THA

Patients and Methods

This prospective study was conducted at Suez Canal University Hospitals, Ismailia general hospital, and Ismailia health insurance hospital in the period from September 2010 to July 2012. I have done 23 cases of revision hip arthroplasty for complicated Thompson prostheses using cementless modular long stems in all cases and cementless cups in 19 cases and cemented cups in 4 cases. I used Wagner osteotomy to remove cement from the femoral medulla in 17 cases while 6 cases had no need for osteotomy.

There were 9 males and 14 females. The average age of the patients at the time of the operation was 58 years (range 51-74). The average weight of the patients was 82kg (range 76-91).

A detailed history was taken including the indication for the primary surgery and duration of symptoms. The indication for primary surgery was a displaced femoral neck fracture in all cases. The average time since primary surgery was 36 months (range 11 months to 72 months). Nine patients (39.1%) had groin pain as the presenting symptom, eight (34.8%) had thigh pain, four (17.4%) had both groin and thigh pain and two patients (8.7%) presented with loss of function. The average preoperative Harris Hip Score was 36 (range 23-65). The average preoperative shortening was 21mm (range 0-43 mm). Anteroposterior radiographs of the pelvis, anteroposterior and lateral radiographs of the involved hip with thigh were obtained. All patients were admitted two days prior to surgery after getting the preanesthetic clearance. I have used Revit an revision porous coated stems of Zimmer in eleven cases and used Reef hydroxapatite coated stems of Depuy in eleven cases while Hipocrats porous coated stem was used in one case. In nineteen patients I used cementless cups for the acetabulum (11 dual porous and hydroxiiapatite coated, and 8 mesh coated) and I used cemented cups in four patients.

The indications for hip revision in my series were as follows:
I. Aseptic loosening in fourteen cases (60.9%).
II. Peri-prosthetic femoral fractures in six cases (26.1%).

Fracture at neck of Thompson prosthesis in three cases (13%). Peri-prosthetic femoral fractures, which have been considered as a special type of bone deficiency, were classified in my work according to Vancouver Classification. They included the following subtypes:
I. Vancouver type B2, was found in five cases (21.7%).
II. Vancouver type C, was found in one case (4.3%).

Pre-operative templating was essential in all cases of my study. The general goals were to restore as nearly as possible the anatomic or premorbid center of rotation and femoral offset, while equalizing limb length. I placed the femoral overlay templates on the film and selected the size that most precisely matches the contour of the proximal canal and fills it most completely by the metaphyseal part. Next, if limb length discrepancy is present I selected the appropriate neck length to restore limb length and femoral offset, and I matched the center of the head with the previously marked center of the acetabulum. For modular diaphyseal stems, the fixation must be obtained distally, so a tight fit in the isthmus was planned. A well contact of the stem medially and laterally with the endosteal diaphyseal side walls over several centimeters was also planned.

Approaches

Soft tissue approach: A Modified Lateral Hip Approach was used in all cases as a soft tissue approach to expose the hip joint. This approach avoids injury or traction injury of the superior gluteal nerve in revision hip surgeries. It allows safe extension of the exposure superiorly and posteriorly along the hip bone with easy application of heavy armentarium around the acetabulum in hip revisions. The patient in lateral position and every effort was made to utilize the previous incision whenever possible. All procedures were done under combined spinal epidural anesthesia. All procedures were performed according to a standard technique with minor variations when required.

Bony approach: Wagner trans-femoral osteotomy (Extended proximal femoral osteotomy) was done in 17 cases (73.9%) to help complete removal of the intramedullary cement and the cement plug after femoral stem removal and to avoid intraoperative fractures and femoral perforation as it allows direct access to the distal canal of the femur for removal of distal cement, efficient preparation of the fixation area for the new prosthesis, also it gives possibility to adjust abductor laxity by moving the trochanter. The stem has to be adapted exactly to the diameter of the femoral
medullary canal and fixed distal 6 cm at least to the defect zone. All osteotomies were reduced and fixed by circulage wire and all united within 4-6 months. No osteotomy was required in 6 cases (26.1%) (Figures 1, 2, 3).

Figure 1A: Preoperative x-ray of 58 y female with broken neck of a Thompson prosthesis

Figure 1B: Removal of the broken prosthesis

Figure 1C: Intraoperative photo of application of Reef revision prosthesis and cup after Wagner osteotomy
Figure 1D: Postoperative x-ray showing the cementless long stem Reef prosthesis with circulage of Wagner osteotomy and cementless cup

Figure 2A: Preoperative x-ray of a 61 y female showing loosening of Thompson prosthesis with acetabular erosion

Figure 2B: Removal of the loose prosthesis and cement
**Figure 2C:** Intraoperative photo with application of cementless cup and modular cementless long stem

**Figure 2D:** Postoperative follow up x-ray

**Figure 3A:** Preoperative x-ray of a 73 y female showing loosening of Thompson prosthesis
Figure 3B: Intraoperative photo showing the Thompson prosthesis after removal

Figure 3C: Intraoperative photo showing removal of cement

Figure 3D: Postoperative follow up x-ray showing the cemented acetabular cup and modular uncemented long stem
Types of Graft Used

Artificial bone graft in the form of paste, powder, granules and blocks were used in 11 cases (47.8%) Antithrombotic prophylaxis with subcutaneous low molecular weight heparin was used for all patients. The LMWH was started in the first day after the operation and continued for 3 weeks post operative. Third generation antibiotics were given for one week for all patients, Suction drains was used for all patients and were removed after 48h. The patients were allowed partial weight-bearing with two crutches or walker for 12 weeks after the operation. The average hospital stay was 8 days. The average follow-up time for all 23 patients was 5 years. The patients were evaluated clinically and radiologically. The Harris Hip Score was measured postoperative at 1 year and 5 years. The patients' satisfaction with the outcome of the operation, functional capability, and the presence of thigh pain were noted.

Clinical Evaluation

Harris Hip Score was used as a guide for pre and postoperative clinical evaluation of the patients. Every patient was assessed preoperatively and at 1 and 5 years postoperatively. No lost cases in follow up.

Radiographic Evaluation

I evaluated the postoperative radiographs obtained at day one and at six months, 1 year and 5 years postoperatively. The parameters recorded were cup abduction angle and alignment of the stem. Stem alignment was measured as the angle between the femoral stem and the long axis of the femur on anteroposterior radiographs and was classified as varus, neutral or valgus. On the lateral radiograph, the stem alignment was classified as anterior, neutral or posterior. Limb-length discrepancy was also recorded by measuring the distance of the upper margin of the lesser trochanter from the inter-teardrop line. Follow-up radiographs were evaluated for stem subsidence, appearance/progression of radiolucent lines, osteolysis, stress-shielding of proximal femur, loosening and bony in growth according to the criteria described by Engh et al. [12]. Incidence of heterotopic ossification at any point during follow-up was recorded and classified as described by Brooker [13].

Results

Clinical Results

After five years of follow up, the Harris Hip Score (HHS) ranged from 81 to 94 with a mean value of 90.5 compared with preoperative HHS which ranged from 23 to 65 with a mean value of 36.

The hips were graded as follows:

I. Thirteen hips (56.5%) had excellent results (90 to 100 points)
II. Ten hips (43.5%) had good results (80 to 89 points).
III. There was no pain in 19 hips (82.6%), slight pain in 4 hips (17.4%).
IV. No patient was limited to bed or chair or indoor activities.
V. Five patients (21.7%) used a cane only for long walks, while two patients (8.7%) used a cane most of the time.
Restoration of leg length to within 10 mm of equality was accomplished in all patients.

Radiological Results

After five years of follow up; all cases showed spontaneous refill with remodeling of the proximal femur. Transfemoral osteotomies showed signs of healing in all cases after five years of follow up. In two cases (8.7%) lines or lucencies have been detected which were non progressive and less than 2 mm. Three cases (13%) developed pedestal when the stem end was unfixed. No particle shedding was seen.

Early Postoperative Complications

Superficial wound infection occurred in two hips and responded to local wound care and antibiotics. None of these patients had preoperative suspicion of infection. One case developed dislocation 3 weeks postoperative and responded well to closed reduction under anesthesia and abduction hip brace for 6 weeks.

One case developed fracture of shaft of femur distal to the stem on transferring from the operative table and had superficial wound infection thereafter which responded to antibiotics (tienam for one week according to culture and sensitivity test) and wound care. I decided to treat fracture of femur conservatively by skin traction over pulley in bed at home with continuation of oral anticoagulant. After four months there was good clinical and radiological union and patient started walking and weight bearing with aid of a walker in the next one month then used a cane after.
Systemic complications included chest infection in two cases (8.7%), urinary tract infection in one case (4.3%). No recorded cases of deep venous thrombosis in the series. No death was encountered in my study group that could be directly attributed to the surgery or its complications.

Discussion

Thompson hemiarthroplasty of the hip is a commonly performed procedure for the treatment of displaced intra-articular fractures of the neck of the femur in the elderly. The goal of treatment of displaced fractures of the neck of the femur is to return the patients to their pre-injury mobility status as early as possible and to minimize the risk of further operation [14,15]. Thompson prostheses have fulfilled these criteria for decades but have been associated with a poor quality of life in the long term with a very high incidence of groin and thigh pain in physically active elderly patients, largely a consequence of acetabular cartilage degeneration and stem loosening respectively [6,16,17].

Pain following hemiarthroplasty is usually due to one of the following pathological processes: articular cartilage degeneration in the acetabulum, loosening of the prosthesis, periprosthetic fracture or fracture of the prosthesis itself commonly at the junction of the head and stem. These pathological processes are exacerbated by many factors including incongruence between the femoral head and the acetabulum, impaction at the time of injury, cementation of the prosthesis, physiologically young active patients and shear forces between the prosthesis and the cartilage [16,18,19]. In view of these observations current evidence is emerging that favors THA over hemiarthroplasty for treatment of displaced fractures of the neck of the femur in patients who are elderly but have an active physical life [6,9]. The treatment of symptomatic hemiarthroplasty involves removal of the prosthesis and conversion to a total hip replacement and Cossey and Goodwin noted that conversion to THA would give satisfactory results [20]. Other investigators, however, have reported that conversion of hemiarthroplasty to THA is associated with high complication and loosening rates as against primary total hip arthroplasty [8-11,21].

Groin pain, which has been cited as the most common reason for conversion, does not seem to be relieved completely in every patient after conversion to THA. Sharkey, et al. while reporting the results of conversion of hemiarthroplasty to THA in 45 patients observed that 20% of the patients continued to have groin or buttck pain after THA and they could not identify a factor that would predict an unsuccessful result [11]. In the current study group 15 out of 18 (83%) patients who had isolated groin pain preoperatively experienced no pain postoperatively while three patients (17%) reported only partial improvement. Thigh pain, however, was relieved in all patients. Five patients who had both groin and thigh pain were relieved of both postoperatively. Sharkey, et al. suggested that patients should be warned of this contingency before the surgery, that they could experience some groin pain postoperatively.

One of the earliest studies on conversion arthroplasty, by Amstutz and Smith, noted very high incidence of intra as well as postoperative complications [21]. They reported results of 41 patients with conversion arthroplasty. They had five intraoperative proximal femoral fractures, two perforations of the medial cortex with stem protrusion, two cases with instability, two cases with infection, three patients with deep venous thrombosis and six patients (14.6%) with progressive loosening. Three patients had required revision by the end of follow-up (mean of 36 months). Sierra and Cabanela in a larger series of 132 hemiarthroplasties that were converted to THA reported a 10% rate of loosening after a mean follow-up of 7.1 years and major complications in 45%, including 12 intraoperative femoral fractures (9%) and 13 dislocations (9.8%) [8]. They concluded that conversion of endoprostheses to THAs after femoral neck fractures is fraught with high complication and loosening rates and careful selection of patients for each type of arthroplasty (hemiarthroplasty versus THA) may help ameliorate the outcome of arthroplasty for this group of patients. In the current series there were few intra-operative complications with iatrogenic fracture of the femur in one patient and fracture of the acetabular floor in two hips although none of these complications resulted in a poor long-term outcome. The incidence loosening in the current series was nil after a mean follow-up of five years. Hammad and Abdel-Aal reported no loosening in their series of conversion arthroplasty in 47 patients after an average follow-up of 44 months [9]. The reason for lower loosening rate in their series as against earlier studies as stated by them may have been as a result of better cementing technique and stem design [8,21]. In addition, failure on the femoral side may be due to extensive resorption of the endosteal bone while the stem of the hemiarthroplasty was loose, or due to damage of the endosteal bone during revision [22].

Furthermore, toggling of the stem may produce a thick fibrous membrane that is adherent and might not be completely removed at revision, with its remnants compromising the subsequent cemented fixation. Also, it had been suggested that fragments of such a fibrous membrane are metabolically very active, producing Prostaglandin E2, collagenase and Interleukin1β, all of which may contribute to resorption of adjacent bone [23,24]. The current series differs from
those studies in one respect i.e. most acetabular components and all of femoral components used in the current series were uncemented and this was probably the reason for lower loosening rates.

The incidence of dislocation after conversion arthroplasty has been reported as varying from 0 to 50% in different series [9,25]. The current series reported one dislocation in the early postoperative period which was treated by closed reduction and abduction hip brace and I believe that the occurrence of postoperative instability is technique-related.

Conversion of painful hemiarthroplasty gives good results with regard to the pain relief and functional scores [9]. The functional results of the current study were very encouraging with an average HHS of 86 at final follow-up.

Conclusion

It could be concluded that conversion of symptomatic hemiarthroplasty to THA using modular uncemented long stem is a safe option that gives good functional results, with marginally lower rates of intra-operative complications; and patients should be warned of the possibility of incomplete relief of groin pain postoperatively.

References