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Cementless total hip arthroplasty in posttraumatic osteoarthritis hip

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Abstract
Background: Total hip arthroplasty (THA) relieves pain and functional disability experienced by patients with moderate to severe osteoarthritis of the hip, and it improving their quality of life. Relieve of the pain, while maintaining both mobility and stability of the joint are the indicator of success of THA. The purpose of this study was to evaluate the results of primary cementless total hip arthroplasty in patients with posttraumatic osteoarthritis hip.
Methods: Thirty-eight patients with posttraumatic hip Osteoarthritis that were treated with cementless total hip arthroplasty were included in the study. This was a prospective study with the mean follow-up period was 54 months (range, 48 to 72 months). The pre-operative and post-operative pain and functional status was compared using Harris hip score.
Patients: Thirty-eight patients (26 males, 12 females) with mean age of 36 years (range 31 to 46 years) with 16 patients fracture neck femur, 14 patients with malunited fracture acetabulum and 8 patients with fracture head femur. From all twenty-four had avascular necrosis of the femoral head (AVN) were operated on in the period from January 2009 to May 2017. Unilateral cementless total hip arthroplasty was performed in all patients. Indications for surgery were severe pain and loss of function in the hip. Plain X-ray was used for the diagnosis in all cases, and CT scan was needed in cases of acetabular fractures.
Results: The mean Harris Hip Score was 80 that was improved from 38 (preoperatively) to 93 (3 years postoperative). Ten patients had excellent, Twenty good, Five fair, and three patients with poor score. Improvements were seen in the range of motion in all patients as compared to preoperative range.
Conclusion: The management of posttraumatic arthritis of the hip in young and active patients continues to be a difficult challenge. Results of cementless hip Arthroplasty are good and encouraging in treating this group of patients.

Keywords: Cementless, hip arthroplasty, posttraumatic, osteoarthritis

Introduction
Osteoarthritis is a disease affecting the joint cartilage and subchondral bone. The disease is considered to involve the entire joint; including ligamentous and muscular changes, as well as synovial inflammation. [1], Patients symptoms that include joint pain, stiffness, and decreased range of motion. The first line of treatment is non-surgical consisting of patient education, analgesics, weight loss, and physiotherapy. Operations for osteoarthritis can be divided into two groups [2]. First, operations that preserve the patient's own hip joint, such as excision of osteophytes and curettage of cysts, osteotomies, and, and second, operations that reconstruct the hip joint, hemiarthroplasty, resurfacing arthroplasty and total hip arthroplasty and salvage procedures as arthrodesis [3],
Among these surgical options, the ultimate contemporary surgical solution for severe Osteoarthritis of the hip is total hip arthroplasty [4, 5]. The 1994 National Institutes of Health Consensus Statement on total hip replacement concluded that THA is an option for nearly all patients with diseases of the hip with chronic discomfort and significant functional impairment [6]. The aims of THA are relief of pain and improvement in function. Further, candidates for elective THA should have radiographic picture of joint damage and moderate to severe persistent pain or disability, or both, that is not completely relieved by an extended course of nonsurgical management [7].
Total hip arthroplasty results in pain relief, functional recovery, and improved quality of life [8].

Cemented total hip arthroplasty is still more common, but cementless total hip arthroplasty is gaining in popularity [9, 10]. Potential advantages of cementless over cemented total hip arthroplasty are, shorter operating time, reduced risk of infection, significantly reduced risk of aseptic loosening and hence reduced revision rates and avoidance of cement related complications [11, 12].

The aim of this prospective study is to evaluate the clinical and radiographic results of THA in 38 patients with post-traumatic Osteoarthritis of the hip that were younger than 46 years at follow up time up to 3 years.

Patients and Methods

In a prospective study, Thirty-eight patients (26 males, 12 females) with mean age of 36 years (range 31 to 46 years) presented with post-traumatic hip arthritis (16 with fracture neck femur, 14 with malunited fracture acetabulum and 8 with traumatic avascular necrosis of the femoral head) were operated on in the period from January 2009 to May 2017. Indications for surgery were severe pain and loss of function in the hip joint. Plain X-ray was used for the diagnosis in all cases, and CT scan was needed in twelve 24 patients with fracture acetabulum.

On admission detailed history and examination including the patient's age, sex, preoperative diagnosis, level of activity, and mental status; involvement of other joints; the use of crutches or walker; medical problems. Any limb length discrepancy, range of motion changes and any deformity, if present, was recorded and hip function was assessed as per modified Harris Hip Score (HHS) [13].

Investigations including ESR and CRP to exclude presence of infection. Radiograph of the pelvis AP view with both hips and femur in addition to lateral view were done. The AP views were obtained with the patient lying supine on the table with the hips in 10° to 15° of internal rotation. Preoperative parenteral antibiotics and prophylaxis for deep vein thrombosis was used in all patients, anticoagulant injection 24 hours before operation and three weeks postoperative. In addition, these patients received oral indomethacin 25 mg once a day for 14 days postoperative for prophylaxis against heterotopic ossification.

All the patients were operated on in lateral position with epidural/spinal anesthesia in 28 cases and general anesthesia in ten. Harding lateral approach was used in all cases. Cementless acetabular cups augmented with screws were placed in all cases (Standard cup, Zimmer), with a 28 mm polyethylene bearing. The stem was proximal hydroxyapatite coated in 12 stems, and not coated in other twenty-six.

The patient was then placed in the lateral position on a standard operating room table. After scrubbing, painting, and draping, hip was approached via Harding lateral approach. The hip was then dislocated posteriorly. An osteotomy of the femoral neck was done as determined by preoperative templating, using the femoral neck-cutting guide. The acetabulum was prepared by reaming. An acetabular component that was oversized by 1-2 mm over the last reamer was used, so that it can be press-fit into position. Augmentation of fixation with postero-superior quadrant screws was done. The acetabular prosthetic shell was positioned between 15 to 25 degrees of ante version and 40 to 45 degrees of inclination, after ensuring that the patient was in the true lateral position. The femoral canal was then prepared for femoral component. A trial neck and head was fitted and the femoral component was reduced back into the acetabulum.

Assessment of stability of the hip was done. If the hip was stable, the trial components were removed. The appropriate sized femoral component was inserted. The prosthetic head of appropriate size and neck length were placed onto the stem. The hip was again reduced and moving the hip through a functional range of motion to assess stability. The wound was closed in layers, with posterior capsular repair, over a suction drain and abduction splint was applied.

Suction drain was removed on 2nd post-op day and antiseptic dressing applied which was changed after every two days. Stitches were removed on the 10th or 12th postoperative day.

On discharge, patients were advised: Not to combine two or more of the following movements: bending way over, turning toes inward, twisting body. When lying on side, making sure to have a pillow between the knees. Not to sit on a low toilet (Arabic toilet) and use an elevated toilet seat.

Post-operative follow up was done at 2, 6, 12 weeks, 6 months and final follow up at 3 year, both clinically and radio logically. Final assessment of all patients treated by total hip arthroplasty was done by Harris Hip Scoring system [3].

Fig 1

Male pt. 34 years old Presented with fracture neck femur Cannulated screw fixation, Revision with DHS, avascular necrosis. Cementless Total hip replacement.

Fig 2

Female patient 45 years old with left fracture acetabulum, AVN head femur Replaced by cementless total hip.

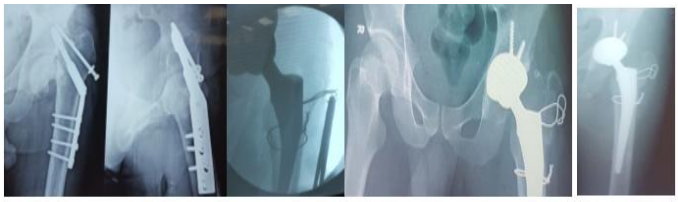

Fig 3

Male patient 47 years, with DHS of fracture neck femur, nonunion and implant failure Revision by cementless total hip.

Statistical analysis

STATA intercooled version 12.1 was used for data analysis. The quantitative data were represented as mean, median, range, and standard deviation. Student t test was used to compare means of two groups and ANOVA for the comparison of the three group's means or more. To comparing pre- and postoperative results, the paired t test was used. The qualitative data was presented as number and %and comp. the p- value was considered significant if it was <0.05.

Results

The mean follow-up period was 54 months (range, 48 to 72 months). The period of hospitalization was 14 days in the average (range 11-22days). Average operative time was 150 minutes (range 140 -210 minutes). The average blood loss was 1000 ml (range 900-1500 ml). There was no intraoperative complication in this work. Superficial wound infections were seen in three of the patients (7.89%) treated with antibiotics and repeated wound dressing. Deep vein thrombosis developed in two patients (5.26%) in one month postoperative and the patient received medical treatment. Deep infection was found in one patient in the third month treated by aggressive debridement and insertion of septocol sheets and parenteral third generation cephalosporin antibiotic according to culture sensitivity for two weeks followed by oral antibiotic for another two weeks and after 40 months the patient needed two stage revision with cementless long stem THR. Stage 1 heterotopic ossification was seen in five patients (13.15%), but no cases had stage 2 or stage 3. Table 1

Table 1: postoperative complications.

Type of complication	No /total	Percentage
Superficial infection	3/38	7.9%
Deep infection	1/38	2.6%
Deep venous thrombosis	2/38	5.26%
Heterotopic ossification	5/38	13.15%
Aseptic loosening	2/38	2.6%

Statistically, there was significant improvement of the mean Harris Hip [13] Score from 38 (preoperatively) to 82 (3 years postoperative) (p value 0.01). Ten patients had excellent, Twenty patients with good, Five fair, and three patients with poor score. Improvements were seen in the range of motion in all the patients as compared to preoperative range. Table 2

Table 2: postoperative results according to HHS.

Results	No /total	Percentage
Excellent	10 /38	26.3%
Good	20/38	52.6%
Fair	5/38	13.15%
Poor	3/38	%7.9

The mean range of flexion was improved from 60° (range 40° - 80°), to 110° (range 80°-120°) *(significant: p value 0.03)*. The internal rotation increased from 15° (10°-25°) preoperative, to 30° (25°-35°) postoperative *(significant: p value 0.04)*. External rotation increased from 25°(20°-30°) to 40°(35°-45°) (significant: p value 0.01). Abduction improved from 20° (15°-30°), to 45° (10°-25°) to 30° (25°-35°) which is significant also (p value 0.035).

Cup position measurements for all patients were within normal. The mean cup angle was 40 ° (range, 35 ° to 55°); cup height, 25 mm (range, 20 to 30 mm); and cup medialization distance, 30 mm (range, 20 to 40 mm). Stem was centralized in 26 patients, in varus position in eight, and valgus in four patients. Table 3

Table 3: radiologic stem position

Position	No /total	Percentage
Central	26 /38	68.5 %
Varus	8/38	21 %
Valgus	4/38	10.5 %

Only 6 stems (12%) with radiolucency at 2 zones (zone I&II), but not proved to be loose. There were four cases with acetabular osteolysis in zone 3, and femoral osteolysis were observed in six cases in this study in zones 3 &4 at 50 months after surgery. Two patients (8%) needed revision after 55 months of follow-up for aseptic loosening in the cups (vertical migration 6mm and loosening in three zones).

There is no difference in the outcome was found between the type of trauma either followed by AVN or only arthritis (acetabular fractures, proximal femoral fractures, or fracture head femur) as regards changes in pre-and postoperative Harris hip scores ($p > 0.05$).

In 27 (71.05%) patients we used a size 36 head. 0 was the most commonly used head offset in 22 (57.89%) patients. We used a full hemispherical, modular, porous coated metal shell with a highly cross-linked polyethylene liner. The minimum shell size used was 44 and the maximum was 60. The most commonly used shell size was 50. The liner size used corresponded to the size of the head. Size 36 was the most frequently used.

Five patients had shortening on the operated side post-operatively; two had shortening less than 1 cm. And lengthening of the operated limb in 10 patients in our study, 8 had lengthening of less than 1 cm. The mean lengthening was 0.56 cm (range: 0.2-1.5 cm). Table 4

Table 4: limb length discrepancy

Type	No /total	%
Shortening		
Less than 1cm	2/38	5.3%
More than 1cm	3/38	7.8%
Lengthening		
Less than 1cm	8/38	21%
More than 1cm	2/38	5.3%

In our study, there were complications of persistent anterior thigh pain that occurred in 3(7.8%) patients, superficial wound infection in three (7.8%) patients and heterotopic ossification occurred in 5 (13.15%) patients.

Discussion

Post-traumatic arthritis of the hip is an important cause of osteoarthritis of the hip. It commonly affects young patients and it has been associated with poor outcomes. We obtained long-term follow-up data on 38 patients mean age of 36 years (range 31 to 46 years) or younger who underwent a primary THA at our institution for a diagnosis of post-traumatic arthritis. The majority of patients were treated with standard, cementless, metal-on-plastic implants, and one patient underwent a revision THA.

Total hip arthroplasty is regarded by many to be the ultimate contemporary solution to osteoarthritis of the hip [14]. It relieves pain and functional disability experienced by patients with moderate to severe osteoarthritis of the hip, improving their quality of life. The mean age of the patients, in our study of 38 cases, 36 years (range from 31 to 46 years). The mean age of our study is comparable to other studies. In our study, male patients made up 68.42% of the study population. Our study is compatible with the study of Archibeck *et al.* [15]. And Kim *et al.* [16]. In showing a male preponderance [17-19].

Posttraumatic arthritis when complicated with avascular necrosis of the femoral head often results in the collapse of the femoral head and secondary osteoarthritis of the hip [20-23]. The main goal in young patients is to preserve the normal bone stock, but THR is indicated when pain and loss of function are severe. THR in those patients with high demands and active lifestyle carry the risk of early loosening and repeated revisions. To overcome these problems, more durable bearing materials have been developed [24].

Large diameter metal-on-metal resurfacing arthroplasty has been advocated as a bone sparing procedure for young active patients. With more than ten years follow-up there is, at the present time, insufficient evidence to determine whether modern metal-on-metal resurfacing offers advantages over standard total cementless hip arthroplasty. The occurrence of high metal ion concentrations after implantation of large diameter metal-on-metal articulations raises serious concerns for their use in women during childbearing age. There was also reported incidence of symptomatic and asymptomatic pseudo-tumors [25, 26].

Cementless fixation of prostheses in THA still has the advantages of longevity and easy revision. The early results of cementless THA are superior to cemented THA even with advances in cementing techniques. Salvati and Cornell [27] reported a failure rate of 37% after a mean follow-up period of eight years after total hip arthroplasty with cement in patients with avascular necrosis (Table 3). Stauffer [28] however, found the femoral loosening rate to be 50% after mean follow-up period of ten years. Lins *et al.* [29] reported after a mean follow-up period of 60 months that 81% of the femoral components, and 97% of the acetabular components were stable in the 37 hips with avascular necrosis they treated with cementless total hip arthroplasty. Two deep infection cases were reported in the same study, one in early, and the other in late postoperative periods. Although heterotopic ossification developed in 35% of the cases, none of them reached stages 3 or 4. Piston *et al.* [30] performed total hip arthroplasty in 35 hips of 30 patients with an average age of 32, and reported the revision rate as 6% after an average follow-up period of 7.5 years. In the study of Celebi L *et al.* [31] they reported deep infection in one case, and stage 2 heterotopic ossifications (6%) in two [32].

Our results are consistent with those of Archibeck *et al.* [15]. who reported an excellent or good result in 86% of their subjects. The mean Harris Hip [33] Score 80 that was improved from 38 (preoperatively) to 82 (3 years postoperative). Ten patients had excellent, Twenty good, Five fair, and three patients with poor score. Improvements were seen in the range of motion in all the patients as compared to preoperative range. Pain and function account for a majority of the Harris hip score [34].

The average pre-operative Harris hip score was lower in our study as compared to the other studies. This may reflect that the patients in this part of the world, report only when the disease is advanced i.e. pain is severe and functions are compromised. In our study 8 patients developed limb length discrepancy. Limb length discrepancy is a common cause of patient dissatisfaction following total hip arthroplasties [34-36]. the limb length discrepancy was considered insignificant. Anterior thigh pain has been reported to be a common complication in a cementless stem.

In our study, cementless total hip arthroplasty was performed in all cases with Ten patients had excellent, Twenty-two well, Five fair, and One patients with poor score and one revision 2.6 %). There was no intraoperative complication in this work. Superficial wound infections were seen in three of the patients (7.8%) treated with antibiotics and repeated wound dressing. Deep infection was found in one patient in the third month treated by aggressive debridement and insertion of septocol sheets and parenteral third generation cephalosporin antibiotic Deep vein thrombosis developed in two patient (5.2%) in one month postoperative and the patient received medical treatment. Stage 1 heterotopic ossification in spite of prophylactic therapy was seen in five patients (15. 6%) but without function impairment.

Kim *et al.* [37] reported that dislocations occurred in the early period in three cases out of 116 that they performed cementless total hip arthroplasty because of avascular necrosis of femoral head; and dislocation occurred in another one in 49th month postoperatively. Dislocation in the late period has been attributed by the researchers to over-abduction positioning of the acetabular component. In our study we had no early or late dislocation, and we can attribute the absence of dislocations in our study to avoidance of positioning the acetabular components in over-abduction, good component anteversion, and absence of other pathological changes that occur in non-traumatic AVN.

Archibeck *et al.* [15]. Reported an incidence of mild to severe anterior thigh pain of 9%. They found thigh pain to be related to the size of the stem. Kim *et al.* [37] in two separate studies reported the incidence of anterior thigh pain to be 10% and 11.4% respectively. 37-38 we had 2 cases (5.2%) of anterior thigh pain persisting at one year follow-up. One had a stem size 9 implanted at surgery and the other had size [11].

We found no relationship between the stem size and thigh pain. Also out of these two stems, one had been placed in a varus of 40 and the other in a neutral position. Thus, we found no association between a varus stem placement and anterior thigh pain. Our incidence of anterior thigh pain is comparable to the other studies. In all of the above-mentioned studies, no patient had anterior thigh pain two years after the operation. In our study, we had a single case of superficial wound infection. It settled with an extended antibiotic course and daily antiseptic dressings. She was painless at the last visit and her ESR and CRP were normal. Heterotopic ossification is a commonly cited complication of total hip arthroplasty.

At a minimum 12 months follow-up we noted one case with radiological evidence of heterotopic ossification (Brooker grade 1) [39] in our study. The patient was asymptomatic and no intervention was done for this. This low rate is related to the surgical approach we used (lateral approach) and possibly to some genetic factors, which need further study.

Conclusion

Primary THA is an effective treatment option for post-traumatic arthritis of the hip in patients aged 46 or younger. Patients report good long-term outcomes after surgery; however, long-term implant survival may be a major concern in these young patients. Overall, these findings have the potential to improve patient care as well as guide future research with the ultimate goal of improving patient outcomes

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