Original Article

Uncemented total hip arthroplasty in osteoarthritis of hip secondary to low and high dislocated hips: A mid-term follow-up study

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Abstract

Background: Performing successful total hip replacement (THR) in dysplastic, subluxed, and dislocated hip is a challenging task. Here, we assessed midterm clinical and radiological outcomes of uncemented total hip arthroplasty in osteoarthritis (OA) of hip secondary to Hartofilakidis low and high-dislocated hips with a mean follow-up of 8.8 years. **Materials and Methods:** A retrospective study of prospectively collected data was designed involving all consecutive patients who underwent uncemented THR for OA of hip secondary to developmental dysplasia of the hip and Grade II or Grade III Hartofilakidis classification. **Results:** Thirty-two patients underwent 45 THR, with 23 Grade II (low dislocation) and 22 Grade III (high-dislocation) of Hartofilakidis classification. Thirteen patients had bilateral hip replacements, 19 patients had unilateral THR. There was highly statistically significant difference between preoperative and postoperative HHS and SF-36v2™ at each follow-up. Survivorship of original implant was 98.88% at a mean follow-up of 8.8 years. The mean improvement in leg length in this series was 3.6 cm (1.8-4.5, 95% confidence interval). No sciatic nerve or femoral nerve palsies were observed. **Conclusions:** Uncemented THR provides better function and quality of life. However, longer follow-up studies are needed to assess survivorship of uncemented THR in Hartofilakidis low and high-dislocations.

Key words: Developmental dysplasia of hip, high-dislocation, secondary osteoarthritis, uncemented prosthesis, uncemented total hip replacement

INTRODUCTION

Osteoarthritis (OA) which is a major cause of disability among elderly population is a major cause of a burden on the health system in the western world, and its incidence and prevalence continues to rise with a rapidly increasing aging population.[1] OA occurs due to an interaction between certain systemic and local factors, which are unique for each joint.[2,3] In the context of OA of the hip, causation may be attributed to incongruency in the hip joint due to various reasons such as congenital or developmental malformation.[2,3] Hip OA can be classified as idiopathic and secondary.[4-6] Developmental dysplasia of the hip (DDH) is one of the leading causes of secondary hip OA.[6-8] Incidence of DDH varies hugely based on region and ethnicity. Symptoms of DDH in the absence of degenerative changes are usually treated with pelvic osteotomy and/or femoral osteotomy.[7]

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However in advanced stages of OA secondary to DDH total hip replacement (THR) is the treatment option of choice.[9] Successful THR is often challenging in dysplastic, subluxed and dislocated hip-related surgery and that the task of performing successful THR may only be achieved by fully appreciating the severity of the preoperative deformity.[10,11] In this regards, Hartofilakidis *et al.*[10] noted that early attempts to treat OA of hip secondary to DDH with THR yielded poor results due to lack of knowledge of the local abnormal anatomy of these dysplastic hips. The rate of failure of the acetabular component is reported to be directly proportional to the increasing severity of developmental dysplasia based on the classifications developed by both Hartofilakidis and Crowe and the main cause of failure is an aseptic loosening of the acetabulum.[12]

In high-dislocation, to position the acetabular component in the true acetabulum and to reduce the hip, shortening of the femur is required.[13-15] Shortening of femur makes the reduction of hip easier to perform and also lowers the risk of excessive stretching of the neurovascular structures. Most of the patients who developed OA secondary to DDH are quite active and young, and hence cemented components in these young people failed due to various reasons[16] including aseptic loosening of the acetabular component.[17-19] To overcome the high failure rates of cemented arthroplasty in the younger population with high-dislocation, Sener *et al.*[20] carried out a series of uncemented total hip arthroplasty in high-dislocated hips with femoral shortening with a very good short-term clinical results. However uncemented THR in DDH is technically difficult and hence many different approaches are used to overcome these difficulties.[11,21-23] Several studies have evaluated the short and intermediate term follow-up results of uncemented THR in OA secondary to DDH.[21-25] However, there are only few studies until date, which have evaluated the long-term results of uncemented THR in OA secondary to sever grades of DDH. Hence, the purpose of this retrospective study was to assess the mid-term clinical and radiological outcomes of uncemented total hip arthroplasty in OA of hip secondary to Hartofilakidis low and high-dislocated hips with mean follow-up of 8.8 years (range 2-13 years, 95% confidence interval [CI]).

MATERIALS AND METHODS

All consecutive patients who underwent uncemented THR for OA of hip secondary to DDH and Hartofilakidis classification Grade II or Grade III[26] were included in this retrospective study of prospectively collected data. A fellowship trained arthroplasty surgeon performed all of these surgical procedures. These THRs were carried out from June 1999 to August 2010 over a period of 11 years.

Following inclusion criteria were used

1. Uncemented THR,
2. OA secondary to Hartofilakidis Grade II or Grade III dislocated hip,
3. Written consent of patients to use their data that was stored in the hospital database.

Following exclusion criteria were used

1. Cemented THR,
2. Hybrid THR,
3. OA secondary to Hartofilakidis Grade I dysplastic hips,
4. Other secondary causes of OA-like slipped upper femoral epiphysis, Legg-Calve-Perthe's disease,
5. Patients refuse to give consent,
6. Incomplete data,
7. Minimum follow-up of 2 years.

There were 32 patients who had 45 uncemented THR. Of 45 hips, there were 23 Grade II (low dislocation) and 22 Grade III (high-dislocation) of Hartofilakidis classification. Out of 45 uncemented THR, 31 hip replacements were carried out using direct lateral approach described by Hardinge[27] and 14 hip replacements were carried out using transtrochanteric approach described by Charnley.[28]

All patients had preoperative planning and all hips were templated for implant size and requirement for osteotomy.

Patients were followed up postoperatively in the joint replacement clinic at intervals of 3 months, 1 year, 2 years, 5 years, 10 years, and subsequently every 5 years. During these reviews, clinical outcome measures (Harris hip score [HHS], SF-36v2™ and limp) were collected prospectively. Secondary outcome measures (patient's demographic data, operative details, complications, re-operation) were retrospectively collected from the hospital hip database and patient charts. The radiological outcome measures (stability of femoral component, fixation of the acetabular component, heterotopic ossification) were assessed by two independent reviewers with the help of radiographs of antero-posterior view of the pelvis and lateral views of the hip taken at each follow-up visit. Stability of femoral component was graded into three groups, according to stability and fixation score.[29]

Fixation of the acetabular component was assessed using DeLee and Charnley method.[30] Heterotopic ossification around THR was assessed using Brooker *et al.*[31] classification.

Approval from Hospital Research and Development Department was obtained through a formal application process. All data were exported into IBM® SPSS® 20 software (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.). Descriptive statistics of age, operative time, the length of hospital stay, and length of follow-up were calculated. Frequencies of patients' sex and Hartofilakidis grading of the hip were also calculated. Statistical significance of the mean difference of HHS and SF-36v2™ were calculated using paired *t*-test. $P < 0.05$ was considered to be statistically significant.

RESULTS

There were 32 patients who underwent 45 THR for OA of hip secondary to Hartofilakidis Type II and Type III dysplastic hips. Thirteen of these patients had bilateral hip replacements, and 19 patients had unilateral THR [Figure 1]. Twenty-three hips out of 45 hips were classified as Hartofilakidis Type II (low dislocated hips). The remaining 22 hips were classified as Hartofilakidis Type III (high-dislocated hips) [Figure 2]. Of 32 patients, there were seven (21.9%) males and 25 (78.1%) females [Figure 3]. The mean age of patients was 43.91 years (range 21-69, with 95% CI) and mean operative time of surgery was 140 min (90-170, with 95% CI). The mean length of hospital stay was 6 days (4-9 days, 95% CI), while mean length of follow-up was 8.8 years (range 2-13, 95% CI) [Table 1].

Harris hip score

Mean HHS of patients preoperatively was 52.71 (range 33-73). The mean difference of the HHS at each follow-up was calculated using the formula: HHS follow-up — HHS preoperative, with 95% CI. The mean HHS at 3 months, 2, 5, and 10 years was 86.11 (range 59-100), 93.89 (range 58-100), 96.62 (range 82-100) and 97.46 (range 90-100), respectively. The mean difference of HHS at 3 months, 2, 5, and 10 years follow-up was 33.40 (range 22.99-36.80), 41.17 (range 24.44-37.78), 44.20 (range 41.19-47.22), and 45.57 (range 42.46-48.68), respectively. The mean difference values were statistically significant ($P < 0.001$) [Figure 4].

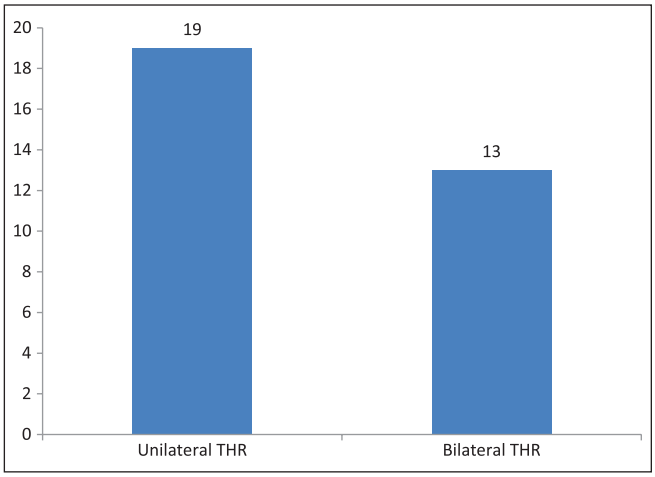

Figure 1: Distribution of total hip replacement

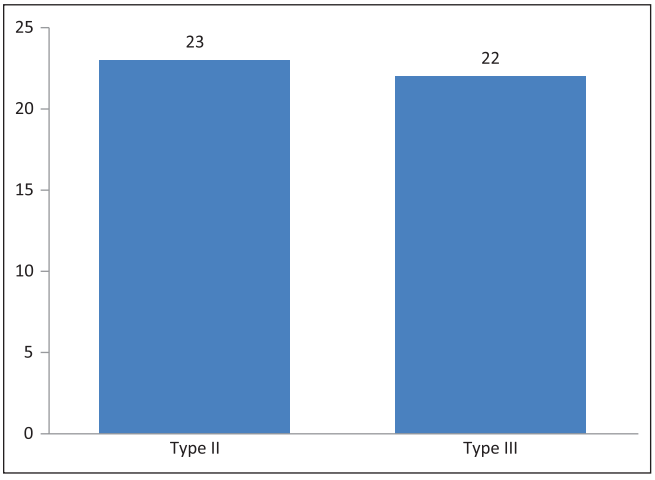

Figure 2: Hartofilakidis classification

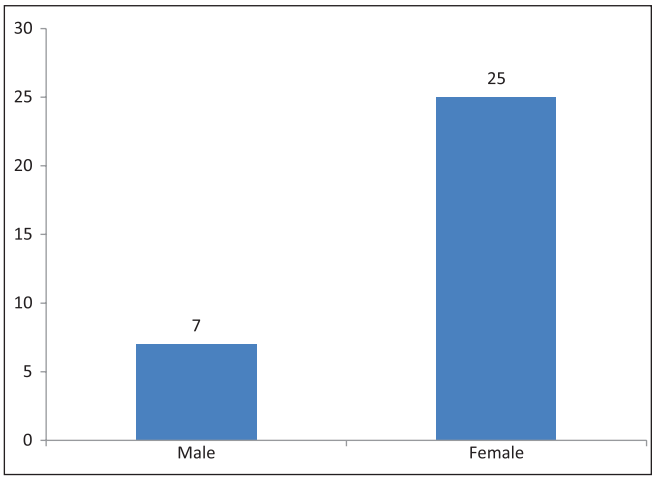

Figure 3: Gender distribution

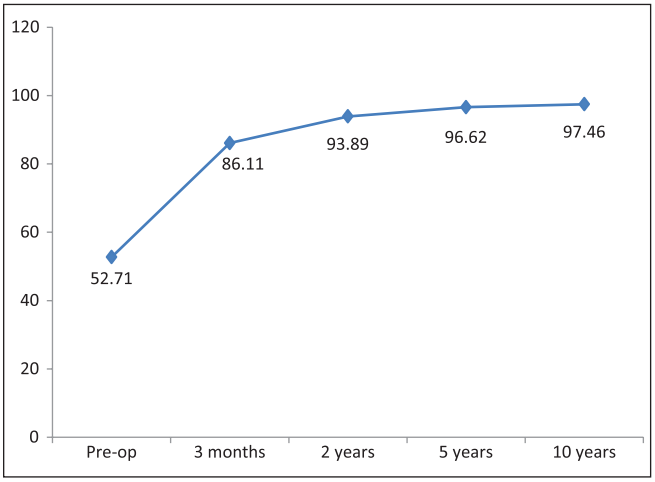

Figure 4: Mean Harris hip score

SF-36v2™ physical and mental component scores

The mean SF-36v2™ physical and mental component scores preoperatively were 38.46 (range 32-44, with 95% CI) and 36.84 (range 30-42, with 95% CI), respectively. The mean difference of SF-36v2™ physical and mental component scores at 2 years follow-up was calculated using the formula: SF-36v2™ 2 years - SF-36v2™ preoperative, with 95% CI. The mean and mean difference of SF-36v2™ physical component score at 2 years follow-up was 65 (range 61-67, with 95% CI) and 26.54 (range 23.50-29.44) respectively, which was statistically significant ($P < 0.001$). The mean and mean difference of SF-36v2™ mental component score at 2 years follow-up was 53.26 (range 45-59, with 95% CI) and 16.42 (range 15.28-17.16), respectively. This difference was statistically significant ($P < 0.001$) [Figure 5].

Limp

Out of 32 patients at final follow-up, 13 patients had no limp, 11 patients had a slight limp that was detectable only by a trained observer, six patients had moderate limp that was detectable by patients, and two patients had severe limp. All patients had improvement in leg length discrepancy with a mean of 3.6cm (range 1.8-4.5, with 95% CI) [Figure 6].

Radiological outcomes

The stability of femoral component was assessed using the criteria described by Engh *et al.*[29] Of 45 stems, 35 stems had bone ingrowth fixation, the remaining ten stems were classified as stable fibrous fixation, and none of the stems were unstable. Fixation of the acetabular component was assessed using DeLee and Charnley[30] method. There was no uncemented cup that was classified as loose according to this classification. All the acetabular components were well fixed. The incidence of heterotopic ossification was assessed using the method described by Brooker *et al.*[31] Ten hips had Class I heterotopic ossification, three hips had Class II heterotopic ossification. Figures 7-10 show pre- and post-operative radiographs of antero-posterior views of the pelvis.

Table 1: Demographic and surgical data

Parameter	Mean value	Range (95% confidence interval)
Age (years)	43.91	21-69
Operative time (min)	140	90-170
Hospital stay (length) (days)	6	4-9
Follow-up (length) (years)	8.8	2-13

Complications

No sciatic nerve or femoral nerve palsy was observed. One patient had nonunion of trochanteric osteotomy 9 months post the index procedure that was treated with autogenous bone grafting. One patient had trochanteric bursitis secondary to fracture of Doll-Miles cable, which did not resolve by conservative management. So, a second procedure was performed for removal of trochanteric claw device and Doll-Miles cable. One patient dislocated a hip 6 weeks postoperatively. It was then reduced closely and treated with abduction brace. However, the same hip again dislocated at 6 months postoperatively. At second dislocation, the patient had the hip revised, and the only cup was revised. The patient made an uneventful recovery.

DISCUSSION

Patients with OA of hip secondary to severe dysplasia, dislocated hip are often severely disabled.[21] The aim of THR in these patients is to reconstruct the hip joint in order to restore function as close to normal as possible.[21] The reconstruction of the acetabulum during THR for congenital hip dislocation and use of cementless components placed at the level of true acetabulum are recommended in several studies.[13,32-34] Many studies have adopted various techniques to overcome anteverted shallow

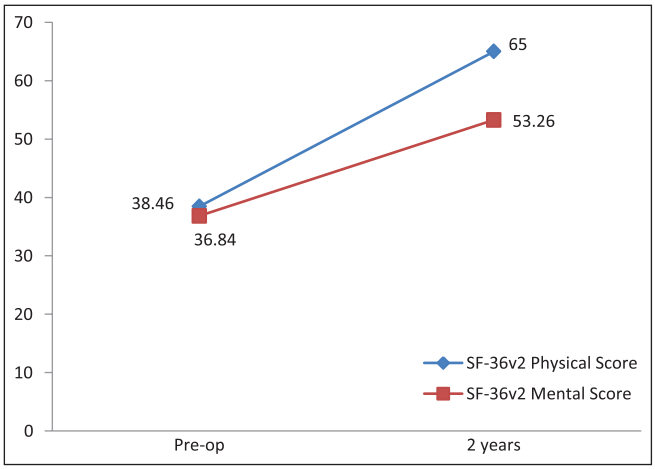

Figure 5: SF-36v2 physical and mental component scores

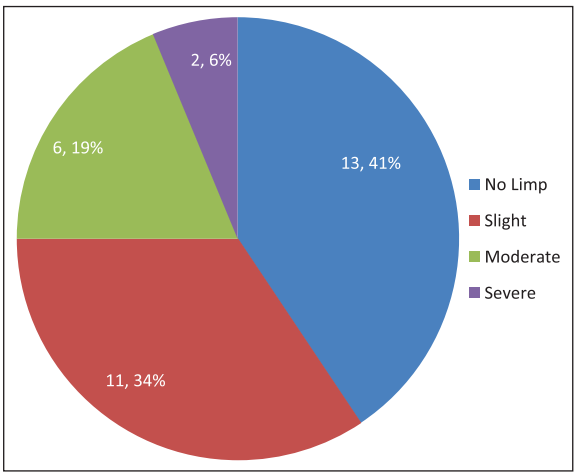

Figure 6: Distribution of limp

Figure 7: Preoperative antero-posterior radiograph of pelvis showing low dislocation on the right side and high-dislocation on the left side

Figure 8: Postoperative antero-posterior radiograph of pelvis showing bilateral uncemented total hip replacements

Figure 9: Preoperative antero-posterior radiograph of pelvis showing bilateral high-dislocation

Figure 10: Postoperative antero-posterior radiograph of pelvis showing bilateral uncemented total hip replacements

acetabulum, and most of the dysplastic hips have superior and/or anterior wall deficiencies and/or poor bone stock in the acetabulum.[35] Procedures such as the use of a femoral head autograft to augment the acetabulum are also described.[15,16,36,37] In addition, protrusion technique to overcome acetabular deficiencies[38] or technique of medial protrusion without using cement in acetabular dysplasia is also described.[39] The technique of cotyloplasty in which a controlled comminuted fracture of the medial wall of the acetabulum was created using Charnley reamer.[10,15] Reamer was struck lightly with a hammer until the entire floor of the acetabulum fractured. After this, morselized femoral head autograft was placed in the floor of the acetabulum and then bone graft was impacted. The acetabular component was then placed. Interestingly placing the acetabular component in the true acetabulum without bone grafting by medial displacement of acetabulum or cotyloplasty is shown to decrease rates of loosening and polyethylene wear.[40] In the current study, operating surgeon preferred to deepen the acetabulum in medial and posterior direction with the help of a reamer. The size of the acetabular component was chosen carefully so that there was at least 70% coverage of bone around the acetabular component. When the acetabular component did not have the perfect press-fit, it was fixed with two screws into the Illium. Medialization of the cup could cause impingement of femoral head and neck on the posterior acetabular wall. Hence, the posterior osteophyte was excised to prevent impingement.[20]

Femoral head structural autograft to increase the coverage of uncemented cup were used in four hips. Femoral head structured autograft was fixed to the superior defect of the cup with two screws. All these bone grafts healed well. Several studies have described procedures for dealing with the anatomical difficulties on the femoral side.[13,15,41,42] In this study, the surgeon used the technique described by Paavilainen *et al.*[13] in which trochanter was spilt from proximal femur and then another transverse osteotomy at the level of lesser trochanter was carried out, medial

segment with femoral head was discarded. A straight uncemented either congenitally dislocated hip stem or S-ROM was inserted. Lateral cortex of proximal femur was roughened so that trochanter was advanced down with gluteus medius. Trochanteric fragment was fixed with screw or hook and Doll-Miles cable device to get stable fixation. Only in four cases subtrochanteric osteotomies were performed to reduce the hip and reduce undue tension on sciatic nerve. Out of four subtrochanteric osteotomies, one did not heal and needed additional autogenous bone grafting. In cases where the reduction was difficult in spite of trochanteric advancement or subtrochanteric osteotomy, flexors and abductors were released.[43]

The mean improvement in leg length was 3.6 cm (1.8-4.5, 95% CI). No sciatic nerve or femoral nerve palsies were noted, which is consistent with previous reports indicating negligible neuropathy incidence with these procedures.[20,24,41,44] In patients where femur had to be brought down more than 4 cm hips were forcefully reduced and hips were left in extended position and knee was flexed to reduce the tension on the sciatic nerve.[45] The knee was allowed to extend gradually with gravity when patient was mobilising gradually over four to 6 weeks. The patients' hip commonly had fixed abduction as well because of abductor tightness consequence to trochanteric advancement, which gradually stretched over few days to weeks postoperatively. Survivorship of original implants was 98.88% of at mean follow-up of 8.8 years and improved functional outcome were observed at each postoperative interval in our study, which is consistent with previous reports.[14,46,47]

Complications and study limitations

In this study there were three complications, out of 45 THR with a complication rate of 6.67%. However, this complication rate is lower compared to previous reports.[14,20,46,47] All reviews were performed by a single trained specialist arthroplasty nurse, which may have introduced assessor bias into the study. Some of the minor complications might not be documented in the patients' records, leading to under representation of complication rate.

CONCLUSIONS

In this mid-term follow-up study of uncemented THR for hip OA secondary to congenital low and high-dislocated hips are very encouraging. Uncemented THR provides better function and quality of life compared to hip arthrodesis or excisional arthroplasty. Nevertheless longer follow-up studies are needed to assess the survivorship of uncemented THR in Hartofilakidis low and high-dislocations.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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