



## Bilateral Total Hip Arthroplasty in Femoral Head Avascular Necrosis: Functional Outcomes and Complications

Afshin Taheriazam<sup>1\*</sup> and Amin Saeidinia<sup>2,3</sup>

<sup>1</sup>Hip Surgeon, Department of Orthopedics Surgery, Tehran Medical Sciences Branch, Islamic Azad University, Tehran, Iran

<sup>2</sup>General Practitioner, Researcher Assistant, Mashhad University of Medical Sciences, Mashhad, Iran

<sup>3</sup>Member of Young Researchers Club, Rasht Branch, Islamic Azad University, Rasht, Iran

Corresponding Email: [afshintaheriazam@yahoo.com](mailto:afshintaheriazam@yahoo.com)

### ABSTRACT

Total hip arthroplasty (THA) is one of the successful and cost-benefit surgical treatments. One-stage bilateral THA (BTHA) offers many benefits. However, there are concerns about the safety of the procedure and higher complications. We aimed to evaluate the complications and outcomes of one-stage BTHA with Hardinge approach for femoral head avascular necrosis patients. A total of 60 patients from April 2009 and May 2013, were underwent one-stage bilateral total hip arthroplasty (BTHA) in Milad and Erfan hospitals, Tehran, Iran. A prospective analysis of the functional outcomes and complications of one-stage BTHA through Hardinge approach in patients with femoral head avascular necrosis (AVN) performed. We evaluated all patients clinically and radiologically with serial follow-ups. A clinical hip score based upon the modified Harris Hip Score (MHHS) was performed preoperatively and again postoperatively. During period of study 44 men (73.3%) and 16 women (26.6%) with a mean age of  $31.40 \pm 4.08$  years (range 25 to 36 years) at the time of presentation were entered. The mean surgical time was  $2.6 \pm 0.38$  hrs. The mean hospital stay was  $3.50 \pm 0.72$  days. Hemoglobin level decreased significantly after operation ( $P = 0.046$ ). There was no reported patient with perioperative death, deep venous thrombosis, pulmonary embolism, infection, dislocation, periprosthetic fracture or heterotrophic ossification. The mean preoperative MHHS score was  $47.93 \pm 7.33$  in patients. MHHS score improved to  $95.06 \pm 3.47$  in the last follow-up ( $P = 0.0001$ ). Our results recommend the use of one-stage BTHA through Hardinge approach in femoral head avascular necrosis patients.

**Keywords:** One stage bilateral total hip arthroplasty, clinical outcome, complication, avascular necrosis

### INTRODUCTION

Total hip arthroplasty [THA] is one of the successful and cost-benefit surgical treatments which has improved and decreased the complications in patients suffer by advanced arthritis[1]. It is estimated that 15% to 25% of patients who need total hip arthroplasty [THA] require bilateral procedures[2]. In the USA and Europe, there are physicians who advocate that bilateral THA[BTHA] should be performed simultaneously[3, 4]. One-stage BTHA offers the benefits of one-session anesthetic risks, a shorter recovery period which is important to younger patients, and diminished costs[5, 6]. However, there are concerns about the safety of the procedure, since higher complications have been reported [7]. Also other studies indicated that one-stage BTHA is effective in pain alleviation and restoring the function of patients affected with bilateral hip arthritis without any significant increased risks to patients[4-6, 8-11]. Many approaches have been described for total hip arthroplasties, but there would be an attempt for safer and improved THA surgery procedures. In 1982 Hardinge described the direct lateral approach [12]; which also referred to as lateral, Hardinge's or trans-gluteal approach. Hardinge approach is a modified version of Bauer's

approach [13]. This approach can enable an easy insertion of the components of hip prosthesis, since it provides an excellent acetabular cavity and femoral proximal end exposure. Additionally, posterior hip structures are preserved, thus turning postoperative prosthesis dislocation is difficult. It can enable an easier aesthetic procedure by performing with the patient lying on his/her back or chest. The release of the anterior third of the gluteus muscle tendon on the great trochanter is its significant disadvantage, which would lead to the development of limping. Although Hardinge approach allowed a wider access to the hip, it was employed so rare, since abductor tendons' tenotomy led to gluteus muscle failure[14].

In the United States, there is a growing demand for primary THA procedures, and it has been forecasted that over half a million procedure would be done by the year 2030 [15]. There are so many limitations in THA surgery procedure's available data, since lack of detailed data of major and minor medical complications, and the long durations of the conducted studies.

As a result, there are currently very few orthopediccenters worldwide that routinely perform one stage BTHA routinely, and published literature regarding the outcome of one stage BTHA[16]. We aimed to evaluate the complications and outcomes of one-stage BTHA with Hardinge approach for femoral head avascular necrosis patients.

## MATERIALS AND METHODS

### *Patients*

A total of 60 patients from April 2009 and May 2013, were underwent one-stage bilateral total hip arthroplasty (BTHA) in Milad and Erfan hospitals, Tehran, Iran. A prospective analysis of the functional outcomes and complications of one-stage BTHA through Hardinge approach in patients with femoral head avascular necrosis (AVN) performed. Patients with grade 1 or 2 ASA (American Society of Anesthesiologist) and third (crescent sign and eventual cortical collapse) and fourth (end stage with evidence of secondary degenerative change) grade of Ficat classification were entered in the study (Figure 1). Other inclusion criteria included significant flexion contracture bilaterally, and patient willingness to have both hips replaced during one procedure.

Patients with history of hip fusion and grade 3 ASA or greater were excluded from the study. During period of study 44 men (73.3%) and 16 women (26.6%) with a mean age of  $31.40 \pm 4.08$  years (range 25 to 36 years) at the time of presentation were entered. 38 patients (63.3%) were recognized with grade 2 ASA and 22 patients (36.6%) with grade 1 ASA. 27 patients (45%) were in grade 3 Ficat and 33 patients (55%) were in grade 4 Ficat.

### *Surgical procedures and Prosthesis*

The standard direct lateral Hardinge approach was used for all of the patients. One surgical team and the same main surgeon \_senior author of the article\_ had done the hip replacements (Figure 2). General anesthesia was used for 42 patients (70%), spinal anesthesia for 14 patients (23.3%), and epidural anesthesia for 4 patients (6.6%). Pelvic radiograph was obtained, at the end of each procedure. Preoperative prophylaxis against infection was given to all patients (Cefazolin 1g intravenously before the surgery followed by 1g 3 times daily for first day). Subcutaneous low molecular weight heparin (40 mg once daily) starting on the day of surgery was given to all patients for 14 days in addition to antiembolism stockings as prophylaxis against deep vein thrombosis (DVT). Early mobilization was used both to prevent DVT and to hasten the functional recovery. Full weight-bearing was allowed from the day after surgery with walker onwards in all cases. They used walker for first three weeks and physiotherapy was performed for them outpatient in first week.

In all patients we used cementless acetabular cup and stems: in 30 patients (50%) Continuum cup (Zimmer, Warsaw, IN, USA) with ceramic head and highly crossed-link PE (Polyethylene) with M/L-Taper hip stem prosthesis (Zimmer, Warsaw, IN, USA) were used. In 18 patients (30%) we used Trident Multi hole® cup (Stryker Orthopaedics, Mahwah, NJ, USA) with highly crossed-link PE and Accolade® stem (Stryker Orthopaedics, Mahwah, NJ, USA); in 6 patients (10%) cup Trilogy (Zimmer, Warsaw, IN, USA) with ceramic head and M/L-Taper hip stem prosthesis (Zimmer, Warsaw, IN, USA); in 6 patients (10%) cup Reflection (Smith & Nephew, Memphis, TN, US) with Synergy Oxinium head (Smith & Nephew, Memphis, TN, US).

***Follow-up***

We evaluated all patients clinically and radiologically with serial follow-ups to obtain the complications. We monitored the following data such as: hospital stay length; operative time; preoperative and postoperative hemoglobin levels; vital status; and complications (such as pulmonary embolism, surgical site infection, dislocation, revision), and other intraoperative and postoperative complications. We used data forms to record the details of the procedure including estimated blood loss, duration of the procedure, and other information. Recording and analysis of perioperative medical and surgical complications were performed. All complications during the hospital stay were evaluated, and patients were followed closely for a period of  $3.67 \pm 0.54$  years.

Complications local to each joint including fracture, dislocation, superficial wound infection, deep wound infection around the prosthesis and incidence of heterotopic ossification. Systemic complications including cardiac, gastrointestinal complications, cerebrovascular accidents, phlebitis/pulmonary embolism, and urinary tract infection were also noted. Any other complications and the details of any revision procedure were also noted. Patient assessment was undertaken preoperatively and again postoperatively using a clinical hip score based upon the modified Harris Hip Score (MHHS)(17). A group of independent examiners (not the operating surgeon) conducted the clinical and functional assessment for this study. We asked the patients, whether they would go for the same surgery procedure and if they would recommend it to others. Patients' satisfaction evaluation was used as a good factor, distinguish the procedure from others.

***Statistical Analysis***

We used descriptive statistical analyses to present mean and standard deviation of quantitative variables. Paired sample T-Test, Independent T-Test and Chi Square test were used with 95% confidence limits. For all analyses, we used SPSS (SPSS 21.0 for Windows; SPSS Inc. Chicago, Illinois). P-Value less than 0.05 were considered as significant.

***Ethics***

We considered all ethical issues for patient's information and procedures based on ethical committee of Tehran branch of Azad University and ethical statements. Informed consent was obtained from each individual prior to surgery, and patients were fully informed of the potential benefits and complications.

**RESULTS*****Demographic data***

The mean surgical time was  $2.6 \pm 0.38$  hrs (range 1.5 to 3 hrs). The mean hospital stay was  $3.50 \pm 0.72$  days (ranged from 2.5 to 4 days). Hemoglobin level decreased significantly after operation, the preoperative values of  $15.2 \pm 3$  mg/dL decreased to postoperative values of  $12.2 \pm 2.7$  mg/dL ( $P= 0.046$ ). There were no significant differences between hemoglobin level and ASA grade ( $P=0.45$ ).

***Postoperative complications***

There was no reported patient with perioperative death, deep venous thrombosis, pulmonary embolism, infection, dislocation, periprosthetic fracture or heterotrophic ossification. No patient required reoperation. There was just a patient, developed unilateral, temporary peroneal nerve palsy (1.6%) which resolved after 3 months. All the complications occurred during the stay at hospital. There were no patients showed deep vein thrombosis and no pulmonary embolism.

***Clinical and Radiographic Follow-up***

The mean preoperative MHHS score was  $47.93 \pm 7.33$  in patients (ranged 38-62). MHHS score improved to  $95.06 \pm 3.47$  (ranged 91-99) in the last follow-up ( $P=0.0001$ ). There were no significant differences between MHHS score and ASA grade ( $P=0.76$ ). There was no radiographic evidence of loosening or periprosthetic dislocation in any THA studied. The mean range of flexion was improved from  $65^\circ$  (range,  $40^\circ$  to  $85^\circ$ ) to  $115^\circ$  (range,  $90^\circ$  to  $121^\circ$ ) after operation. Postoperatively, all patients (100%) reported satisfaction with the surgery, increased function and reported either no pain or a small amount of pain but no compromise in activities and all of them (100%) would recommend the surgery procedure to others with similar problems.



**Figure1.** Plain radiography; one of the bilateral femoral head avascular necrosis cases



**Figure2.** Postoperative plain radiography of the bilateral total hip replacement case; Trilogy cup and ML taper stem with ceramic head

## DISCUSSION

Our results indicated that clinical outcome of one stage BTHA is comparable to that of unilateral THA [18]. We found that there was significant difference in the functional outcome of bilateral THA, [as evaluated by the MHHS and range of movement] when compared to those of unilateral THA[18]. Our results are similar to the report by Wykman and Olsson [19] who found suboptimal gain in the range of movement and improvement in gait in patients undergoing bilateral THA. Although it has been reported that there is an increased rate of heterotopic ossification in patients who underwent one stage procedure[20], in this survey, we did not reported any such complication.

Baker and Bitounis[21], compared the Hardinge's direct THA, the Dall-modified direct THA [22] and the posterior approach. They concluded that the direct THA may lead to abductors weakening compared to posterior approach. Dall [22]proposed the modification of the lateral approach. This study found one-stage BTHA through Hardinge approach as a valid alternative to two-stage BTHA, since safety profiles of our patients were good. Despite of arguments about the pulmonary embolism rate and risk of death [7, 16, 23, 24], we didn't found any significant increase in the risk of major complications associated with the surgery procedure. We reported neither vein thrombosis nor pulmonary embolism in our study, as they are the most common complications of THA procedures in previous evaluations[25, 26]. In literature there wasn't any increase in complications associated with one-stage BTHA procedure [16], while there was a report of fewer complication rates [23]. No death was reported in our studied patients. The risk of death in one-stage BTHA isn't significantly higher than two-stage BTHA [26, 27].

We found a significant decrease in postoperative hemoglobin levels. According to recent studies, there should be significant increases in homologous blood transfusion rates [in the scale of 20 to 40%] after one-stage BTHA [25,

28]. Preoperative erythropoietin treatment and iron supplementation are the measures, keeping the homologous blood transfusion rate below 20%. Significant decrease in the need for homologous blood transfusion would be achieved by autologous blood transfusion in the immediate postoperative period [29].

Patient satisfaction is an important parameter, and all of our patients showed the willing to repeat the procedure. One-stage BTHA needs consideration in two situations, namely, incapacitating bilateral hip disease with normal hip position and with bilateral abnormalities in hip position. In patients who have incapacitating bilateral hip disease with normal hip position, one-stage BTHA can optimize the functional outcomes [19], and decrease the rehabilitation time [30] and the management cost [5].

### CONCLUSION

Despite of the small sample size and absence of a control group and cost evaluations, our results recommend the use of one-stage BTHA through Hardinge approach in femoral head avascular necrosis patients. We found that one-stage BTHA through Hardinge approach can be a good alternative to two-stage BTHA in patients with ASA stages 1 or 2 with lower complications.

### Acknowledgement

Authors thank all of nurses and personnel of Erfan and Milad hospitals for their cooperation in all stages of the study.

### REFERENCES

- [1] Ibrahim MS, Twaij H, Giebaly DE, Nizam I, Haddad FS. Enhanced recovery in total hip replacement: a clinical review. *The bone & joint journal*. 2013;95-B(12):1587-94.
- [2] Lazansky MG. A method for grading hips. *The Journal of bone and joint surgery British volume*. 1967;49(4):644-51.
- [3] Laursen JO, Husted H, Mousing NB. One-stage bilateral total hip arthroplasty a simultaneous procedure in 79 patients. *Acta orthopaedica Belgica*. 2000;66(3):265-71.
- [4] Ritter MA, Stringer EA. Bilateral total hip arthroplasty: a single procedure. *Clinical orthopaedics and related research*. 1980(149):185-90.
- [5] Lorenze M, Huo MH, Zatorski LE, Keggi KJ. A comparison of the cost effectiveness of one-stage versus two-stage bilateral total hip replacement. *Orthopedics*. 1998;21(12):1249-52.
- [6] Reuben JD, Meyers SJ, Cox DD, Elliott M, Watson M, Shim SD. Cost comparison between bilateral simultaneous, staged, and unilateral total joint arthroplasty. *The Journal of arthroplasty*. 1998;13(2):172-9.
- [7] Berend ME, Ritter MA, Harty LD, Davis KE, Keating EM, Meding JB, et al. Simultaneous bilateral versus unilateral total hip arthroplasty an outcomes analysis. *The Journal of arthroplasty*. 2005;20(4):421-6.
- [8] Agins HJ, Salvati EA, Ranawat CS, Wilson PD, Jr., Pellicci PM. The nine- to fifteen-year follow-up of one-stage bilateral total hip arthroplasty. *The Orthopedic clinics of North America*. 1988;19(3):517-30.
- [9] Alfaro-Adrian J, Bayona F, Rech JA, Murray DW. One- or two-stage bilateral total hip replacement. *The Journal of arthroplasty*. 1999;14(4):439-45.
- [10] Cammisa FP, Jr., O'Brien SJ, Salvati EA, Sculco TP, Wilson PD, Jr., Ranawat CS, et al. One-stage bilateral total hip arthroplasty. A prospective study of perioperative morbidity. *The Orthopedic clinics of North America*. 1988;19(3):657-68.
- [11] Egli S, Huckell CB, Ganz R. Bilateral total hip arthroplasty: one stage versus two stage procedure. *Clinical orthopaedics and related research*. 1996(328):108-18.
- [12] Hardinge K. The direct lateral approach to the hip. *The Journal of bone and joint surgery British volume*. 1982;64(1):17-9.
- [13] Bauer R, Kerschbaumer F, Poisel S, Oberthaler W. The transgluteal approach to the hip joint. *Archives of orthopaedic and traumatic surgery Archiv fur orthopadische und Unfall-Chirurgie*. 1979;95(1-2):47-9.
- [14] Dripps R. New classification of physical status. *Anesthesiol*. 1963;24:111.
- [15] Kurtz S, Ong K, Lau E, Mowat F, Halpern M. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. *The Journal of bone and joint surgery American volume*. 2007;89(4):780-5.
- [16] Kim YH, Kwon OR, Kim JS. Is one-stage bilateral sequential total hip replacement as safe as unilateral total hip replacement? *The Journal of bone and joint surgery British volume*. 2009;91(3):316-20.

- [17] Wamper KE, Sierevelt IN, Poolman RW, Bhandari M, Haverkamp D. The Harris hip score: Do ceiling effects limit its usefulness in orthopedics?: A systematic review. *Acta Orthopaedica*. 2010;81(6):703-7.
- [18] Sivananthan S, Arif M, Choon DS. Small stem Exeter total hip replacement: clinical and radiological follow-up over a minimum of 2.5 years. *Journal of orthopaedic surgery*. 2003;11(2):148-53.
- [19] Wykman A, Olsson E. Walking ability after total hip replacement. A comparison of gait analysis in unilateral and bilateral cases. *The Journal of bone and joint surgery British volume*. 1992;74(1):53-6.
- [20] Ritter MA, Vaughan RB. Ectopic ossification after total hip arthroplasty. Predisposing factors, frequency, and effect on results. *The Journal of bone and joint surgery American volume*. 1977;59(3):345-51.
- [21] Baker AS, Bitounis VC. Abductor function after total hip replacement. An electromyographic and clinical review. *The Journal of bone and joint surgery British volume*. 1989;71(1):47-50.
- [22] Dall D. Exposure of the hip by anterior osteotomy of the greater trochanter. A modified anterolateral approach. *The Journal of bone and joint surgery British volume*. 1986;68(3):382-6.
- [23] Saito S, Tokuhashi Y, Ishii T, Mori S, Hosaka K, Taniguchi S. One- versus two-stage bilateral total hip arthroplasty. *Orthopedics*. 2010;33(8).
- [24] Trojani C, Chaumet-Lagrange VA, Hovorka E, Carles M, Boileau P. [Simultaneous bilateral total hip arthroplasty: literature review and preliminary results]. *Revue de chirurgie orthopedique et reparatrice de l'appareil moteur*. 2006;92(8):760-7.
- [25] Babis GC, Sakellariou VI, Johnson EO, Soucacos PN. Incidence and prevention of thromboembolic events in one stage bilateral total hip arthroplasty: a systematic review. *Current vascular pharmacology*. 2011;9(1):24-32.
- [26] Tsiridis E, Pavlou G, Charity J, Tsiridis E, Gie G, West R. The safety and efficacy of bilateral simultaneous total hip replacement: an analysis of 2063 cases. *The Journal of bone and joint surgery British volume*. 2008;90(8):1005-12.
- [27] Aghayev E, Beck A, Staub LP, Dietrich D, Melloh M, Orljanski W, et al. Simultaneous bilateral hip replacement reveals superior outcome and fewer complications than two-stage procedures: a prospective study including 1819 patients and 5801 follow-ups from a total joint replacement registry. *BMC musculoskeletal disorders*. 2010;11:245.
- [28] Memtsoudis SG, Salvati EA, Go G, Ma Y, Sharrock NE. Perioperative pulmonary circulatory changes during bilateral total hip arthroplasty under regional anesthesia. *Regional anesthesia and pain medicine*. 2010;35(5):417-21.
- [29] Gee AO, Garino JP, Lee GC. Autologous blood reinfusion in patients undergoing bilateral total hip arthroplasty. *Journal of orthopaedic surgery*. 2011;19(2):181-4.
- [30] Jaffe WL, Charnley J. Bilateral Charnley low-friction arthroplasty as a single operative procedure. A report of fifty cases. *Bulletin of the Hospital for Joint Diseases*. 1971;32(2):198-214.