Original Article

Efficacy of Different Posterior Capsulotomies on Dislocations in Hip Hemiarthroplasty: T-Shaped Capsulotomy versus Longitudinal Capsulotomy

Ahmet Yilmaz

Department of Orthopedics and Traumatology, Adana Numune Training and Research Hospital, University of Health Sciences, Adana, Turkey

Abstract

Background: Dislocation following hip hemiarthroplasty is one of the leading reasons necessitating a resurgery. Many studies suggested that the type of the surgical approach is the main cause for dislocation. However, no consensus has been reached yet regarding the type of the surgical approach. In this prospective clinical study, we aimed to compare the efficacy of two different capsulotomy techniques on dislocations, applied during hip hemiarthroplasties performed through the posterior approach. **Materials and Methods:** We investigated the dislocation rates in 287 patients (aged 65 and above) who underwent cemented bipolar hemiarthroplasty for displaced femoral neck fractures through the posterior capsular approach using two different capsulotomy techniques between 2009 and 2016. Patients were followed up for 12 months after hemiarthroplasty. Patients were evaluated in two groups; on whom hemiarthroplasty was performed as longitudinal (146 patients) and as T-shaped capsulotomy (141 patients). **Results:** Posterior dislocations occurred in seven (5%) patients who underwent hemiarthroplasty with T-shaped capsulotomy. No dislocation was observed in 146 patients who underwent hip hemiarthroplasty through posterior longitudinal capsulotomy. The difference between the two study groups was statistically significant ($P < 0.007$). **Conclusion:** Capsule integrity can be achieved through a strong capsule repair which is possible through hemiarthroplasty with longitudinal capsulotomy. Longitudinal capsulotomy is an effective technique in preventing dislocations following hip hemiarthroplasty.

Keywords: *Dislocation, femoral neck fractures, hemiarthroplasty, posterior approach*

Introduction

Hemiarthroplasty is a commonly performed surgery with satisfactory results in the treatment of displaced femoral neck fractures in the elderly.[1,2] Dislocation of the prosthesis, infection, and periprosthetic fractures are the main reasons for resurgery after hip arthroplasty and result in high rates of morbidity and mortality. Dislocation of the prosthesis is the leading cause for resurgery.[3-7]

Anterior and posterior are the most preferred approaches in interventions to the hip during hemiarthroplasty. Numerous studies have reported about the impact of the type of the surgical approach on dislocation. However, there is still no consensus among authors regarding the most secure type of surgical approach for the hip. Despite several studies revealing higher incidences of dislocation in the posterior capsular approach in hip hemiarthroplasty versus the anterior approach,[4,8-14] other studies suggested that the main stabilizer in hemiarthroplasty through the posterior approach is the soft tissue rather than the articular surface, and reported either significant decrease in dislocation rates[15,16] or no dislocation at all[17] following modifications performed after posterior soft-tissue repair or with posterior repair. In this study, we evaluated the efficacy of longitudinal and T-shaped capsulotomy techniques on dislocations, applied during hip hemiarthroplasties performed through the posterior approach. Our hypothesis was that capsular integrity would be preserved in longitudinal capsulotomy and effective in preventing dislocation.

Materials and Methods

Following approval of the Local Scientific Ethics Committee, a total of 479 patients, aged above 65, were included in this prospective study held in our tertiary

How to cite this article: Yilmaz A. Efficacy of different posterior capsulotomies on dislocations in hip hemiarthroplasty: T-shaped capsulotomy versus longitudinal capsulotomy. Indian J Orthop 2019;53:402-6.

Address for correspondence:
Dr. Ahmet Yilmaz, Department of Orthopedics and Traumatology, Adana Numune Training and Research Hospital, University of Health Sciences, Adana, Turkey.
E-mail: ahmetyilmaz-dr@hotmail.com

Access this article online

Website: www.ijoonline.com

DOI: 10.4103/ortho.IJOrtho_255_18

Quick Response Code:

research and training clinic between July 2009 and December 2016. Patients with displaced femoral neck fractures and had no contraindication to anesthesia and were to undergo cemented bipolar hemiarthroplasty were assigned into two groups sequentially in order of admittance. During hemiarthroplasty, a longitudinal capsulotomy was performed in one group (Group 1) and T-shaped capsulotomy in the other group (Group 2). Patients who had another fracture other than the femoral neck fracture (n = 8), osteoarthritis of the hip (n = 1), pathological femoral neck fractures (n = 2), hip dysplasia with Wiberg's Center-Edge (CE) angle of lower than 25°[18] (n = 1), an offset difference of more than 10%[9] (n = 1), and a leg-length discrepancy over 10 mm[19] (n = 1) when compared with the contralateral hip in postoperative radiological evaluations, mental impairment (n = 14), rheumatoid arthritis (n = 1) or those who could not be mobilized with the use of a walker, and partial weight-bearing during the postoperative first 5 days (n = 16) were excluded from the study. Of the remaining 434 patients, 19 (4.4%) patients died within the 1st postoperative month. The overall number of patients died within the 3 and 12 months following the operation were 101 (23.3%) and 123 (28.3%), respectively. Twelve patients were followed <1 year. Nine patients did not come to the control, and three patients could not be reached. Sixty three (51.2%) and 60 (48.8%) of the patients died had longitudinal and T-shaped capsulotomy, respectively. With the addition of these patients, a total of 192 patients were excluded from the study. In the statistical analyzes, the rate of dislocation was evaluated in 287 patients followed throughout the 12-month period. All hemiarthroplasties were performed by two experienced surgeons. Hemiarthroplasty was performed with longitudinal capsulotomy in 146 patients (41 males, 105 females; 50.9%) and with T-shaped capsulotomy in 141 patients (38 males and 103 females; 49.1%). The mean age of the patients, who underwent longitudinal capsulotomy, was 77.3 (range 65–97) years, whereas, for T-shaped capsulotomy, it was 77.2 (range 65–98) years. The difference between the prevalences of prosthetic dislocations after hemiarthroplasty through longitudinal and T-shaped capsulotomies and the difference between the two patient groups regarding age and sex were compared using the Chi-squared test ($P < 0.05$).

Written informed consent was obtained from each patient before the surgery. All patients received thromboprophylaxis with low-molecular-weight heparin. Surgeries were carried out under spinal or general anesthesia and with the patient in the lateral position. Gluteus maximus muscle fibers were entered through the posterolateral surgical approach. The piriformis tendon and the conjoint tendons of the gemellus and obturator internus muscles were sling sutured. Tendons were dissected at their insertion point with the femur and retracted. The hip joint capsule was fully exposed at the superior, posterior, and inferior. The incision was started from the labrum, continued through the long axis of the femoral neck, and ended at the intertrochanteric line in the middle of the femoral neck in patients who were decided to undergo longitudinal capsulotomy. The capsule was hooked with sling sutures, and two equal capsular flaps were obtained. The intraarticular hip was fully exposed [Figure 1]. For the patients who were planned to undergo T-shaped capsulotomy, a parallel incision on the intertrochanteric line was added to the longitudinal incision on the distal [Figure 2a and b]. Cemented collarless bipolar hip prosthesis (troy cemented polished femoral stem) was placed in the femoral canal in all patients. Capsule repair was achieved by rotating the hip internally 30° in patients undergoing longitudinal capsulotomy. Four sutures with no. 1 vicryl were placed on the capsule separate from the short external rotators. Then, the hip was rotated externally, and each suture was tied and the capsule was almost completely closed [Figure 3]. The short external rotators were sutured to their previous positions and repaired anatomically. In the hemiarthroplasty with T-shaped capsulotomy, capsulorrhaphy was realized with an inferior defect on the aspect of the capsule parallel to the intertrochanteric line [Figure 4]. The short external rotators were sutured to their attachments.

The same postoperative treatment protocol was applied to all patients. The prosthesis was located by radiography. On the postoperative 2nd day, the drain was removed, and the patients were mobilized to the possible extent with the support of a walker and under the supervision of a physiotherapist. The patients were recommended to place a pillow between their legs while resting and sleeping for 3 weeks, in an attempt to avoid adduction or extreme internal rotation of their hips. Patients were asked to attend followups at week 3 and 6 and month 3 and 6, and at 6-month intervals following the 6th month.

Results

In this study, no statistically significant difference was found between the longitudinal capsulotomy and T-shaped

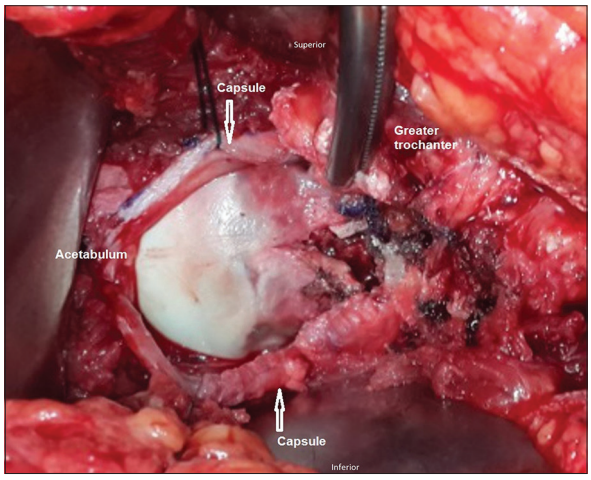

Figure 1: Appearance of the hip joint after longitudinal capsulotomy. The hip joint is internally rotated

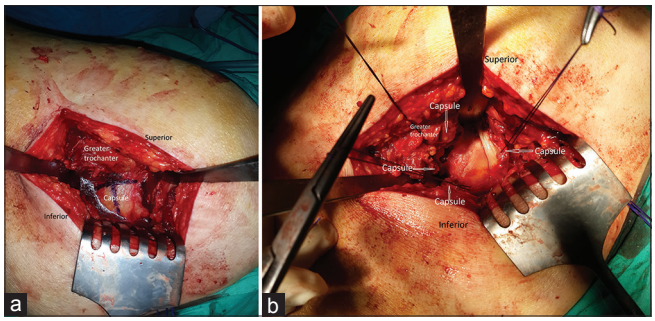

Figure 2: (a) The incision line of the T-shaped capsulotomy on the capsule. (b) Intraarticular appearance of the hip joint during internal rotation after T-shaped capsulotomy. The limbs of the capsulotomy, parallel to the intertrochanteric line, are distinctly separated toward the superior and inferior

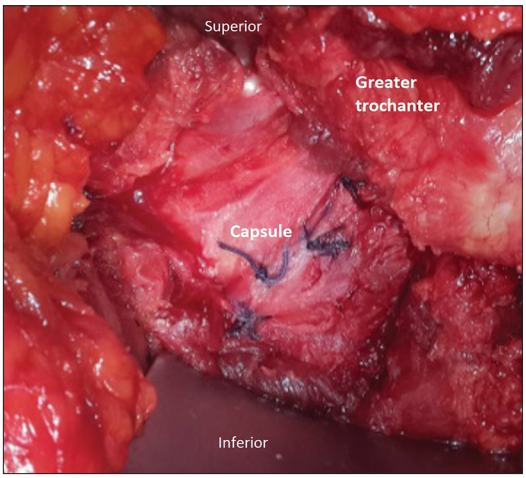

Figure 3: Capsular integrity is achieved following capsulography performed during hemiarthroplasty applied through longitudinal capsulotomy

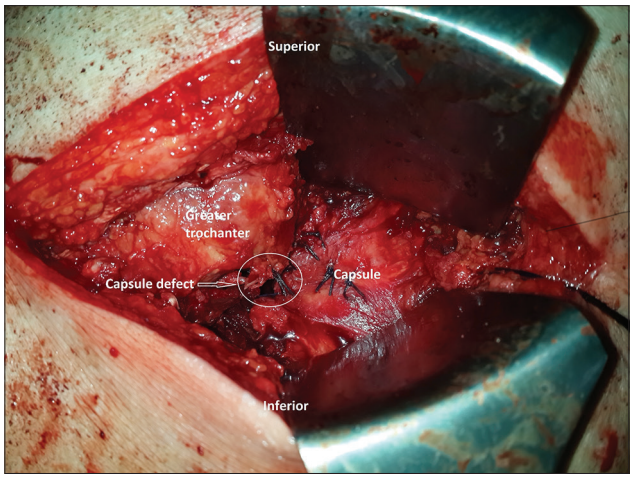

Figure 4: Appearance of the hip after capsulography performed through T-shaped capsulotomy. Inadequate closure of the inferior limb of the T-shaped capsulotomy

capsulotomy patient groups regarding age (χ^2 = 0.03; P = 0.8625) and sex (χ^2 = 0.046; P = 0.8305) distribution. There was no significant difference between death rates determined during 1 year between the groups (χ^2 = 0.146; P = 0.702). The mortality between in the first 3 months and in the 1st year was found significantly different (χ^2 = 24.16; P < 0.001). Posterior dislocations were observed in 7 of 141 (5%) patients who underwent hemiarthroplasty with T-shaped capsulotomy. All dislocations occurred within the first 3 weeks. The mechanism of prosthetic dislocation in these patients was atraumatic. Closed reduction was performed on six and open reduction on one prosthetic dislocation. No dislocation was observed in 146 patients who underwent hip hemiarthroplasty through posterior longitudinal capsulotomy. The difference between Group 1 and Group 2 was statistically significant (χ^2 = 7.074; P < 0.007).

Discussion

Main complications associated with the implant in hip hemiarthroplasty are dislocation of the prosthesis, dissociation of the bipolar prosthesis, loosening of the prosthesis, breakage of the implant, fracture around or below the implant, and cardiopulmonary problems encountered during the application of the cement.[20] Prosthetic dislocation mostly develops within 6–8 weeks following surgery when the healing of the capsule and surrounding soft tissues is still incomplete.[3,8-10,21] In different publications, it is reported that age and sex of the patient, type of arthroplasty, and experience of the surgeon do not have an impact on dislocation;[9,10,12,22] and there is no relationship between prosthetic dislocation and implementation of the prosthesis with or without cement.[23,24] Cemented prosthesis applications allow for a stable fixation and mobilization in the earlier term,[25] thus decreasing the use of cementless implants.[26] When compared to the contralateral hip, detection of a decreased femoral offset and smaller Wiberg's CE angle on the operated hip in postoperative radiographic evaluations have been suggested as predisposing factors for the development of a dislocation.[21] The relationship between dislocation and leg-length discrepancy decreased femoral offset, or a smaller Wiberg's angle could not be established in patients with single dislocation, in a study investigating cases with recurrent dislocations.[27] Postoperative radiological measurements demonstrated the significant correlation between dislocation and an offset difference of more than 10% when compared with the contralateral hip.[9] Leg-length discrepancy <10 mm following arthroplasty was found considerably reliable, and the surgery was well tolerated by the patients.[19] While some reports could not establish a relationship between cognitive impairment and hemiarthroplasty dislocations,[12,21] others have asserted cognitive impairment as a risk factor for dislocation.[3,4,10] In a recent study, a relationship was found between increased risk of dislocation and cognitive dysfunction and femoral offset. The authors of this study, where the capsular excision was performed with the anterior approach, suggested that capsular reconstruction may prove useful in avoiding dislocations in patients with cognitive dysfunction

and pointed out to the necessity of further studies to prove their hypothesis.[28]

Although hemiarthroplasty has been effectively applied to increase patient satisfaction in the treatment of displaced femoral neck fractures in elderly patients, death rates in the first postoperative year were reported to be 16%–29% in many studies.[14,29-31] The mortality rate in our study was in agreement with the literature in the 1st year after surgery. The difference in mortality rates between the two groups was not found significant regarding dislocation rate. Our results were noteworthy that the vast majority of the deaths (101/123) occurred in the first 3 months.

To determine the safest approach, early-term dislocations following hemiarthroplasty with the anterior or posterior capsular approach have been reviewed in numerous comparative studies. Chan and Hoskinson[8] reported prosthetic dislocation in one of 107 (0.9%) patients treated with hemiarthroplasty through the anterior approach and in 19 of 136 (14%) patients treated with hemiarthroplasty through the posterior approach, along with a total dislocation rate of 8.2%. Enocson *et al*.[10] found the dislocation rates as follows: 3% through the anterior capsular approach, 8.5% with posterior repair through the posterior approach, and 13% without posterior repair through the posterior approach. These studies suggested the anterior approach as a safe method and that the posterior approach was the main cause of dislocation in hemiarthroplasty.

Posterior prosthetic dislocation in the posterior approach is mainly associated with inadequate soft-tissue coverage.[32] Williams *et al*.[15] performed hemiarthroplasty by peripherally incising the capsule in the distal of the fracture line, preserving the piriformis and labrum to achieve a stable posterior approach in hip hemiarthroplasty. The authors observed dislocation in two of 150 (1.3%) patients and stated that preserving the labrum helped increase the stability. Ko *et al*.[17] reported that the defect in the capsule caused herniation of the prosthesis and performed T-shaped capsulotomy in hemiarthroplasties with posterior capsule and external rotator repairs and realized the capsule repair by hooking the transverse leg of the capsulotomy on the greater trochanter with locking-loop stitches. The researchers applied the same method to attach the piriformis, conjoint tendons, and upper part of the quadratus femoris muscle to their insertion points and reported no dislocation in 205 cases treated.

All hemiarthroplasty dislocations, in our study, had occurred within the same time range for dislocation development reported in the literature. Patients with an offset difference of more than 10%, a Wiberg's CE angle lower than 25°, and shortness more than 10 mm compared to the unoperated side were excluded from our study. By eliminating the predisposing effects of the femoral offset, leg-length discrepancy, and hip dysplasia on dislocations, we aimed to make a refined assessment of the longitudinal and T-shaped capsular methods on dislocations. Hemiarthroplasty procedures performed with longitudinal capsulotomy provided adequate exposure of the hip joint. We did not encounter any challenges related to the capsulotomy technique when removing the damaged femoral head and neck. None of our patients required a conversion from longitudinal capsulotomy to T-shaped or L-shaped capsulotomy. The capsule was repaired without problems. Considering that the capsule was repaired along a straight line and almost with no defect following longitudinal capsulotomy, it can be said that the capsulorrhaphy resulted in a robust recovery. The legs of the T-shaped capsulotomy, parallel to the intertrochanteric line may lead to poor recovery in the capsule, which in turn, might pave the way for prosthetic dislocation in the early postoperative period. None of the patients who underwent hip hemiarthroplasty with longitudinal capsulotomy developed dislocations. Dislocation rate in patients who underwent T-shaped capsulotomy was 5%, a relatively high percentage. The weakness of our study was the lack of assessing the efficacy of the capsulotomy techniques on patients with mental dysfunction, an offset difference of 10% or more in comparison to the contralateral hip and on patients who could not be mobilized or mobilized in the late period. We assume that the possibility of anteversion difference of the femoral component in prosthetic implantation between the surgeons was a drawback in our study.

Conclusion

We believe that the most important stabilizer in hip arthroplasty through the posterior approach is the capsule. Longitudinal capsulotomy is an effective technique in preventing dislocation in hip hemiarthroplasty performed with posterior soft-tissue repair through the posterior approach.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Leighton RK, Schmidt AH, Collier P, Trask K. Advances in the treatment of intracapsular hip fractures in the elderly. Injury 2007;38 Suppl 3:S24-34.
2. Jia Z, Ding F, Wu Y, Li W, Li H, Wang D, *et al.* Unipolar versus

bipolar hemiarthroplasty for displaced femoral neck fractures: A systematic review and meta-analysis of randomized controlled trials. J Orthop Surg Res 2015;10:8.
3. Ninh CC, Sethi A, Hatahet M, Les C, Morandi M, Vaidya R, *et al.* Hip dislocation after modular unipolar hemiarthroplasty. J Arthroplasty 2009;24:768-74.
4. Rogmark C, Fenstad AM, Leonardsson O, Engesæter LB, Kärrholm J, Furnes O, *et al.* Posterior approach and uncemented stems increases the risk of reoperation after hemiarthroplasties in elderly hip fracture patients. Acta Orthop 2014;85:18-25.
5. Petersen MB, Jørgensen HL, Hansen K, Duus BR. Factors affecting postoperative mortality of patients with displaced femoral neck fracture. Injury 2006;37:705-11.
6. van den Bekerom MP, Sierevelt IN, Bonke H, Raaymakers EL. The natural history of the hemiarthroplasty for displaced intracapsular femoral neck fractures. Acta Orthop 2013;84:555-60.
7. Maini PS, Talwar N, Nijhawan VK, Dhawan M. Results of cemented bipolar hemiarthroplasty for fracture of the femoral neck – 10 year study. Indian J Orthop 2006;40:154-6.
8. Chan RN, Hoskinson J. Thompson prosthesis for fractured neck of femur. A comparison of surgical approaches. J Bone Joint Surg Br 1975;57:437-43.
9. Pajarinen J, Savolainen V, Tulikoura I, Lindahl J, Hirvensalo E. Factors predisposing to dislocation of the thompson hemiarthroplasty: 22 dislocations in 338 patients. Acta Orthop Scand 2003;74:45-8.
10. Enocson A, Tidermark J, Tornkvist H, Lapidus LJ. Dislocation of hemiarthroplasty after femoral neck fracture: Better outcome after the anterolateral approach in a prospective cohort study on 739 consecutive hips. Acta Orthop 2008;79:211-7.
11. Varley J, Parker MJ. Stability of hip hemiarthroplasties. Int Orthop 2004;28:274-7.
12. Sköldenberg O, Ekman A, Salemyr M, Bodén H. Reduced dislocation rate after hip arthroplasty for femoral neck fractures when changing from posterolateral to anterolateral approach. Acta Orthop 2010;81:583-7.
13. Biber R, Brem M, Singler K, Moellers M, Sieber C, Bail HJ, *et al.* Dorsal versus transgluteal approach for hip hemiarthroplasty: An analysis of early complications in seven hundred and four consecutive cases. Int Orthop 2012;36:2219-23.
14. Abram SG, Murray JB. Outcomes of 807 Thompson hip hemiarthroplasty procedures and the effect of surgical approach on dislocation rates. Injury 2015;46:1013-7.
15. Williams CR, Kernohan JG, Sherry PG. A more stable posterior approach for hemiarthroplasty of the hip. Injury 1997;28:279-81.
16. Martińez AA, Herrera A, Cuenca J, Panisello JJ, Tabuenca A. Comparison of two different posterior approachs for hemiarthroplasty of the hip. Arch Orthop Trauma Surg 2002;122:51-2.
17. Ko CK, Law SW, Chiu KH. Enhanced soft tissue repair using locking loop stitch after posterior approach for hip hemiarthroplasty. J Arthroplasty 2001;16:207-11.
18. Byrd JW, Jones KS. Hip arthroscopy in the presence of dysplasia. Arthroscopy 2003;19:1055-60.
19. Harkess JW, Crockarell JR. Arthroplasty of the hip. In: Canale ST, Beaty JH, editors. Campbell's Operative Orthopaedics. 11th ed. Philadelphia, Pennsylvania: Mosby, Elsevier; 2007. p. 314-64.
20. Parker MJ, Gurusamy KS, Azegami S. Arthroplasties (with and without bone cement) for proximal femoral fractures in adults. Cochrane Database Syst Rev 2010;6:CD001706.
21. Madanat R, Mäkinen TJ, Ovaska MT, Soiva M, Vahlberg T, Haapala J, *et al.* Dislocation of hip hemiarthroplasty following posterolateral surgical approach: A nested case-control study. Int Orthop 2012;36:935-40.
22. Yang B, Lin X, Yin XM, Wen XZ. Bipolar versus unipolar hemiarthroplasty for displaced femoral neck fractures in the elder patient: A systematic review and meta-analysis of randomized trials. Eur J Orthop Surg Traumatol 2015;25:425-33.
23. Luo X, He S, Li Z, Huang D. Systematic review of cemented versus uncemented hemiarthroplasty for displaced femoral neck fractures in older patients. Arch Orthop Trauma Surg 2012;132:455-63.
24. Grosso MJ, Danoff JR, Murtaugh TS, Trofa DP, Sawires AN, Macaulay WB. Hemiarthroplasty for displaced femoral neck fractures in the elderly has a low conversion rate. J Arthroplasty 2017;32:150-4.
25. Deangelis JP, Ademi A, Staff I, Lewis CG. Cemented versus uncemented hemiarthroplasty for displaced femoral neck fractures: A prospective randomized trial with early followup. J Orthop Trauma 2012;26:135-40.
26. Leonardsson O, Garellick G, Kärrholm J, Akesson K, Rogmark C. Changes in implant choice and surgical technique for hemiarthroplasty 21,346 procedures from the swedish hip arthroplasty register 2005-2009. Acta Orthop 2012;83:7-13.
27. Mukka S, Lindqvist J, Peyda S, Brodén C, Mahmood S, Hassany H, *et al.* Dislocation of bipolar hip hemiarthroplasty through a postero-lateral approach for femoral neck fractures: A cohort study. Int Orthop 2015;39:1277-82.
28. Li L, Ren J, Liu J, Wang H, Sang Q, Liu Z, *et al.* What are the risk factors for dislocation of hip bipolar hemiarthroplasty through the anterolateral approach? A Nested case-control study. Clin Orthop Relat Res 2016;474:2622-9.
29. Gregory JJ, Kostakopoulou K, Cool WP, Ford DJ. One-year outcome for elderly patients with displaced intracapsular fractures of the femoral neck managed nonoperatively. Injury 2010;41:1273-6.
30. Kanto K, Sihvonen R, Eskelinen A, Laitinen M. Uni- and bipolar hemiarthroplasty with a modern cemented femoral component provides elderly patients with displaced femoral neck fractures with equal functional outcome and survivorship at medium-term followup. Arch Orthop Trauma Surg 2014;134:1251-9.
31. Hongisto MT, Nuotio MS, Luukkaala T, Väistö O, Pihlajamäki HK. Lateral and posterior approaches in hemiarthroplasty. Scand J Surg 2018;107:260-8.
32. Unwin AJ, Thomas M. Dislocation after hemiarthroplasty of the hip: A comparison of the dislocation rate after posterior and lateral approaches to the hip. Ann R Coll Surg Engl 1994;76:327-9.