



Review

## **EFFICACY OF CAPSULAR REPAIR IN PARTIAL HIP HEMIARTHROPLASTIES: OUTCOME OF 100 CONSECUTIVE CASES**

A. Carlet, C. Buono\*, L. Scaramuzzi, M. Amendolagine, B. Moretti and G. Solarino

University of Bari “Aldo Moro”- AOU Policlinico Consorziiale, Orthopaedic &Trauma Unit

*\*Corresponding author:*

Claudio Buono, MD  
School of Medicine,  
University of Bari “Aldo Moro”- AOU Policlinico Consorziiale,  
Department of Translational biomedicine and neuroscience,  
Orthopaedic &Trauma Unit Policlinico,  
Piazza Giulio Cesare 11,  
Bari 70124, Italy  
e-mail: claudio.buono91@gmail.com

### **ABSTRACT**

In the last years, bipolar hemiarthroplasty has become the gold standard for the treatment of femoral neck fractures in elderly. The role of joint capsule as a passive stabilator of the hip and the importance of its reconstruction after hip replacement is known in the postero-lateral access as one of the key points for the success of the surgery procedure, due to its role as a protection factor from post operative dislocations. The lateral direct approach is burden of less episodes of hip dislocation, nevertheless there is no evidence of the possibility of capsular reconstruction after this procedure. The aim of this study is to compare the incidence of post-operative hip dislocations in patients underwent to bipolar hemiarthroplasty procedure with lateral direct approach with or without capsular reconstruction.

We retrospectively analysed all patients underwent to hemiarthroplasty for a femoral neck fracture in our institute from July 2021. Inclusion criteria were bipolar hemiarthroplasty intervention, lateral direct approach to the hip, minimum follow up was 1 year. Incidence of post operative dislocation and the necessity of reintervention have also been calculated.

100 hip hemiarthroplasty with lateral direct approach were performed in patients with medial femoral neck fracture (64 women and 36 men). The mean age is 82.4 years (65-96). The mean duration of the operation was 79 min (20-150). In 50 cases the capsule was preserved (Group B: capsulotomy + capsulorrhaphy), while in the other 50 cases (Group A) only selective capsulectomy was performed. The groups are homogenous in terms of age, sex, duration of surgery and type of implant (monobloc vs modular stem, neck, biarticular cup, cementation ant head size). During the study period under analysis, there were 1 cases of post-operative dislocation, in the group of patients in which capsulorrhaphy was

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not performed and it was equipped with a modular stem. The dislocation occurs in 75 days; in this case a reduction manoeuvre of the new implant was performed which proved unsuccessful, since the residual instability of the implant made it necessary to undergo partial revision with a dual mobility cup, but leaving the stem and neck in situ. Articular capsule plays a fundamental role in hip hemiarthroplasty performed also with lateral direct access, resulting in a further protective factor against post-operative dislocations.

**KEYWORDS:** *Hemiarthroplasty, Capsular repair, Capsulorrhaphy.*

## INTRODUCTION

In the last years, bipolar hemiarthroplasty has become the gold standard for the treatment of femoral neck fractures in elderly. This population has been increased since the end of the XX Century and is estimated that its number will even further increase in the next years (1).

The goal of the treatment is to restore the articular function, to reach the pre injury activity level in the early post operative period and to reduce complications due to prolonged bed-rest and the consequent mortality rate (1).

According to NICE guidelines there is no clinical evidence in the choice between total hip arthroplasty and hemiarthroplasty (HA) in displaced femoral neck fractures (Types III and IV according to Garden classification) in elderly (2). In fact, although some studies showed that total hip arthroplasty has better clinical results measured using Harris Hip Score than HA beyond 2 years, clinical knowledges and experiences demonstrate that the long-term outcomes considered in the health economic model were similar to HA (3).

Hemiarthroplasty is usually recommended for patients > 80 years or those who have a limited predicted life expectancy due to lower peri-operative blood loss and lower dislocation rates during the first year after surgery (linked to the use of larger bipolar cups that allows an increased jump (4). Despite the low incidence, HA dislocation is the most frequent complication and consequently the main concern (5). It is showed by literature that this risk is independent from the surgical approaches but it has been demonstrated that joint capsule plays a key role in the prevention of dislocations (6).

In fact its role as a passive stabilator of the hip and the importance of its reconstruction after hip replacement is known in the postero-lateral access as one of the key points for the success of the surgery procedure. On the other hand the lateral direct approach is burden of less episodes of hip dislocation, nevertheless there is no evidence of the possibility of capsular reconstruction after this procedure.

The aim of this study is to compare the incidence of post-operative hip dislocations in patients underwent to bipolar hemiarthroplasty procedure with lateral direct approach with or without capsular reconstruction.

## MATERIAL AND METHODS

We retrospectively analysed all patients underwent to hemiarthroplasty for a femoral neck fracture in our institute from July 2021 to December 2021. Inclusion criteria were bipolar hemiarthroplasty intervention, lateral direct approach to the hip, minimum follow up was 1 year. Incidence of post operative dislocation and the necessity of reintervention have also been calculated.

All patients were operated by skilled orthopaedic surgeons. Duration of surgery, size of the components, age and sex of the patients were noted. We further determined incidence of post operative dislocation and the subsequent treatment (closed reduction vs open revision).

## RESULTS

The study cohort consisted of 100 patients (64 women and 36 men) who underwent hip hemiarthroplasty using the lateral direct approach for medial femoral neck fracture. The average age of the participants was 82.4 years, ranging from 65 to 96. The average duration of the operation was 79 minutes, with a range of 20 to 150 minutes. Among the participants, the capsule was preserved in 50 cases (Group B: capsulotomy + capsulorrhaphy), while in the remaining

50 cases (Group A), only a selective capsulectomy was performed. Thus, the study encompassed two distinct groups: Group A, which underwent selective capsulectomy, and Group B, which underwent capsular preservation (capsulorrhaphy) (Table I).

Among 100 cases, a monobloc stem was utilized in 43 cases, with 20 cases in Group A and 23 cases in Group B. Conversely, the remaining 57 cases employed a modular stem, with cases in Group A 30 and 27 cases in Group B. As described by Solarino et al. in previous literature, in the hybrid implants, a distal cement restrictor was used, the medullary canal was cleaned with saline lavage and an injection gun was employed, together with digital pressurization of the cement (4).

Among the cases with a modular stem, 53 had a short straight neck (27 in Group A and 26 in Group B), 25 had a long straight neck (13 in Group A and 12 in Group B), 18 had a long retroverted neck (8 in Group A and 10 in Group B), and 4 had a short retroverted neck (2 in Group A and 2 in Group B).

All the heads used in the study were made of alumina material. Among the cases, 77 utilized heads with dimensions of “28” (37 in Group A and 40 in Group B), 20 cases used heads with dimensions of “22” (10 in Group A and 10 in Group B), 2 cases used heads with dimensions of “32” (all in Group A), and 1 cases used heads with dimensions of “36” (in Group A). Additionally, the stem was cemented in 87 cases, with 67 cases in Group A and 20 cases in Group B.

The average dimensions of the biarticular cup were 46 mm, ranging between 42 and 57 (Table I). In the years taken into analysis, 1 cases of post-operative dislocations were registered, occurring in group A and it was equipped with a modular stem. This case occurred 75 days after surgery to a lady of 87 y.o. who referred an atraumatic event, while she was trying to sit on her sofa. The size of the components were: a cemented modular stem, a long retrograde (8°) neck, head of 28mm short and a bipolar cup of 44 mm (Table II).

**DISCUSSION**

Hip fractures are a significant health issue in the elderly population, with a high rate of morbidity and mortality (7). Hemiarthroplasty is a commonly used surgical option for the treatment of femoral neck fractures in the elderly population, and the use of a bipolar cup turned out to be an effective addition in the improvement of clinical outcomes (8-10).

Despite its effectiveness, post-operative dislocations can occur, leading to revision surgery and additional related complications. There are many variables that may contribute to an increased risk of post-operative dislocation; these include components type and size of the stem, the neck and the bipolar cup, along with the use of cement and repair of the capsule.

**Table I. Intraoperative factors.**

Intraoperative factors	Group A (n=50)	Group B (n=50)
<b>Surgical approach</b>	Direct lateral	Direct lateral
<b>Sex (n)</b>		
	Male	19
	Female	31
<b>Age</b>	82,7 (58-101)	81,92 (55-100)
<b>Mean duration of surgery</b>	78	80
<b>Type of stem</b>		
	Monobloc	23
	Modular	27
<b>Neck</b>		
	Short straight	26
	Long straight	12
	Short retroverted 8°	2
	Long retroverted 8°	10
<b>Head</b>		
	Short (- 2,5mm)	26
	Standard (+0mm)	26
	Long (+2,5mm)	8
<b>Biarticular Cup</b>	46 (42-57)	46 (42-57)

**Table II. Features of dislocated implant and data of the patient.**

Group	Patient A
<b>Surgical approach</b>	Direct lateral
<b>Sex (n)</b>	F
<b>Age</b>	87
<b>Duration of surgery</b>	60min
<b>Type of stem</b>	Modular cemented
<b>Neck</b>	Long retrograde 8°
<b>Head (mm)</b>	28; -2.5
<b>Biarticular Cup (mm)</b>	44
<b>Time of dislocation (days after surgery)</b>	25
<b>Reducible by closed manouvres</b>	yes
<b>Stable after reduction manoeuvre</b>	no

It is described by one of our authors that modular stems are frequently used by young surgeons and residents to make an easier learning curve (8).

This study aimed to compare the incidence of post-operative hip dislocations in patients who underwent bipolar hemiarthroplasty procedures with a direct lateral approach.

Nowadays, the role of surgical approach that could lead to a major or minor risk of dislocation is debated. In the literature, lateral and posterior surgical approach are the most used for HA and BHA and between them posterior approach has showed better clinical and functional outcomes (2). But on the other side lateral approach has been characterized by lower dislocation rates (9). A cohort study by Joborya et al. in 2021 confirmed that direct lateral approach is already considered a safer option for reducing the risk of post-operative dislocations compared to the posterior approach, with a dislocation rate of 2.7% compared to 7.2% of the latter (10).

On the other hand, Gaurlich et al in their study observed no differences between the two approaches in terms of dislocation rates (5, 6).

Talking about capsular preservation, there is a lack of studies that investigate the impact of capsular repair during hemiarthroplasty using the direct lateral approach.

The importance of capsular repair is showed in a review of the literature published by Miranda et al. in 2021(11). In their study, the authors showed that the dislocation rate after capsular repair in THA is lower dislocation than the one after capsulotomy (11). In addition, these data changed over different approaches: in the anterior approach the dislocation rate in case of capsular repair was 0.69% against 3.7% in capsulotomy group, in the lateral approach was 0.64% against 3.89% and in the posterior approach was 0.64% and 2.4% respectively (11).

Notably, this study marks the first in vivo investigation about capsular preservation in HA using lateral direct approach. In literature this aim as primarily been studied through cadaveric studies.

In 2015, researchers have measured the mean peak torque required to dislocate hip joints that underwent hemiarthroplasty through a direct lateral approach with capsular repair and compared it to hip joints also treated with HA via direct lateral approach but only undergoing capsulectomy. The “capsule repaired” group presented a mean peak torque at dislocation of 22.96 Nm at a mean angle of 94.9°. In the “capsule not repaired” group the mean torque at dislocation was merely 5.6 Nm at a mean angle of 57.5°. Both the evaluated parameters, mean torque applied at dislocation and mean angle, display statistical significance and support the proposition that surgical repair of the capsule provides a significant increase in the mean peak torsional forces, responsible for anterior dislocation of the hip (12).

The study yields valuable information that we couldn't otherwise obtain from an in vivo study. However, although insightful, it is important to acknowledge the limitations associated with cadaveric studies. The results should be interpreted with caution due to the inherent biomechanical disparities between live tissues and cadaveric specimens.

Our study holds significant importance as it seeks to address a critical gap in the existing literature by attempting to overcome the lack of in vivo studies on the subject matter, with the goal of minimizing the morbidity and complications commonly associated with hip fractures and their surgical interventions.

The study at hand comprised a cohort of 100 patients who underwent bipolar hemiarthroplasty using the lateral direct approach to treat medial (intracapsular) femoral neck fractures. The patients were divided into two groups: Group A, which underwent selective capsulectomy, and Group B, which underwent capsular preservation (capsulorrhaphy).

The study results indicated that, over a five-year period, 1 case of post-operative dislocations was reported, occurred in Group A, the group that did not receive capsular preservation, and it was equipped with a modular stem. The timing of dislocation was 75 days, and the age of the patients was 88 year. In this case, a reduction maneuver of the new implant was performed, which proved unsuccessful, necessitating partial revision with a dual mobility cup, leaving the stem and neck in situ. There is still concern about the management of HA dislocation, because there are no guidelines in literature.

While in our experience, the only case of dislocation demonstrated a failure in closed reduction, the studies published by Gill et al. (13) and Falsetto et al. (3) showed that revision surgery was needed only in 50% of dislocations.

The statistical analyses of the study showed no statistically significant differences between the two groups with respect to age, sex, duration of intervention, cement use, and dimension of the head.

The limits of our study include the small sample and consequently the short period of follow up. In addition, it may

be matter of discussion the fact that while in group A HA were performed by different skilled surgeon, only one senior surgeon was the author of the HA in group B.

## CONCLUSIONS

Capsular restoration in bipolar hemiarthroplasty for femoral neck fractures is an additional stabilization to the hip joint and it may be considered a crucial factor in reducing the incidence of post-operative dislocations.

Despite the small sample size and significant variability in implant type, our study highlights the importance of exploring the feasibility of repairing the capsule during hemiarthroplasty procedures using a direct lateral approach. Further researches with larger cohorts and longer follow-up periods should be conducted to verify our findings. Ultimately, such knowledge could lead to improved outcomes for patients undergoing hip hemiarthroplasty.

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