

Dual mobility total hip arthroplasty in the treatment of femoral neck fractures: a retrospective evaluation at mid-term follow-up

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Summary. *Background and aim of the work:* Partial or total hip replacement is the method of choice for displaced femoral neck fractures (FNF) treatment. Dislocation is a major complication, accounting for about 3.8% of cases for hemiarthroplasty (HA) and 10% for total hip arthroplasty (THA). Dual-mobility (DM) socket in total hip arthroplasty showed a very low rate of dislocation in both primary and revision setting THA. Some literature reports show good results with low dislocation rates also in FNF treatment at short term follow-up. Aim of the study was to evaluate clinical and radiographic results of DM-THA in FNF treatment at mid-term follow up. *Methods:* Study population counted 31 implants in 30 patients treated with DM-THA for FNF between January 2010 and December 2012. Dislocation rate was identified, and HHS and OHS were completed. Twenty-four patients underwent also radiographic evaluation to assess cup integration and signs of loosening. *Results:* No episodes of hip dislocation nor intraprosthetic dislocation were found. Other postoperative complications were recorded in 9,67%. HHS and OHS showed a mean value of 81,22 and 37,37, respectively. There were no cases of clinical and radiographic signs of implant loosening. *Conclusions:* The present study confirms the good clinical results, low complications and very low dislocation rate with DM THA for FNF treatment. (www.actabiomedica.it)

Key words: dual-mobility, femoral neck, proximal femur fracture, THA dislocation, mid-term

Background and aim of the work

Femoral neck fractures (FNF) represent a major public health problem worldwide. Hip hemiarthroplasty (HA) represents the preferred method of treatment in most cases (1), due to relative technical ease and low invasiveness of the procedure. On the other hand, total hip arthroplasty (THA) is associated with a lower rate of re-operation, less pain and a better functional outcome (2). Therefore, THA is indicated by many authors for FNF treatment especially in younger patients without severe comorbidities and with relatively high functional demand. One of the most relevant complications of arthroplasty for FNF treat-

ment in represented by dislocation, with an incidence reported around 3.8% for HA and 10% for THA (3, 4, 5). Nonetheless, FNF patients are at high risk for prosthetic dislocation with respect to hip arthritis patients, because of a combination of muscular insufficiency, cognitive and neurologic disorders and recurrent falls that characterize this population of patients. With the introduction of the dual-mobility (DM) socket, many authors reported a lower dislocation rate both in primary THA and revision implants (6). On the other hand, DM implants can suffer a unique failure mechanism known as an intraprosthetic dislocation (IPD), in which the inner prosthetic femoral head disengages from the outer PE bearing, due to an abnormal PE

wear (7). However, the rate of this typically late complication (mean time to failure 8-11 years) encountered a 10 times reduction with the introduction of highly crosslinked PE (8). In a recent review made in 2017, De Martino et al. reported a low dislocation and IPD rate for DM THA both in primary surgery (0,9% and 0,7% respectively, mean 6.8 years follow-up) and in revision setting (3,3% and 1,3% respectively, mean 4,4 years follow-up) (6). Conversely, the use of DM implants in FNF treatment is much less studied in the literature, with few papers available in the latest years.

These studies showed good results at short-term follow-up with a lower rate of dislocation with respect to THA and an almost comparable rate of dislocation with respect to HA (ranging from 0 to 4,6%). Intra prosthetic dislocation seems also to be a negligible problem at short term with modern implants unless technical errors occur (18).

The aim of the present study is to evaluate at mid-term follow-up clinical and radiographic outcomes in a group of patients who underwent total hip replacement using a dual-mobility implant after femoral neck fracture, with particular focus on hip dislocation and intraprosthetic dislocation rate.

Materials and Methods

The present study was carried out on a population of patients treated for FNF at the Cattinara Hospital Orthopaedics and Traumatologic Unit in Trieste, Italy.

All the patients who underwent total hip replacement using a dual-mobility implant (Fig. 1) from January 2010 to December 2012 were included in the study. The population in exam counted 53 patients, of whom 45 women and 8 men, with a mean age at the time of surgery of 76,76 years (range 54,96-88,34; median 77,5). Surgery was performed by experienced surgeons through a direct lateral approach to the hip with the patient supine.

Full weight bearing and hip mobilization with a physiotherapist started on the first day after surgery. Patients were discharged from hospital after mean 9 days and moved to rehabilitation facilities for mean three to four weeks.

At follow up 15 patients had died for causes not related to hip replacement and 8 resulted to be not contactable. Therefore, the study population counted 30 patients, of whom 24 women and 6 men for a total of 31 implants (one patient underwent bilateral DM THA for bilateral not simultaneous FNF fracture within the period of study).

The acetabular component was the same in all patients (AVANTAGE® Acetabulum System - Biomet). On the femoral side an uncemented stem was used in all cases (Biomet Taperloc in 21 cases and Biomet PPF in 10 cases). Both cobalt-chrome (Co-Cr) and ceramic heads were used, in 25 and 6 cases respectively.

Clinical evaluation was conducted at follow-up by two independent observers (A.M., M.C.) who were not involved in surgical treatment.

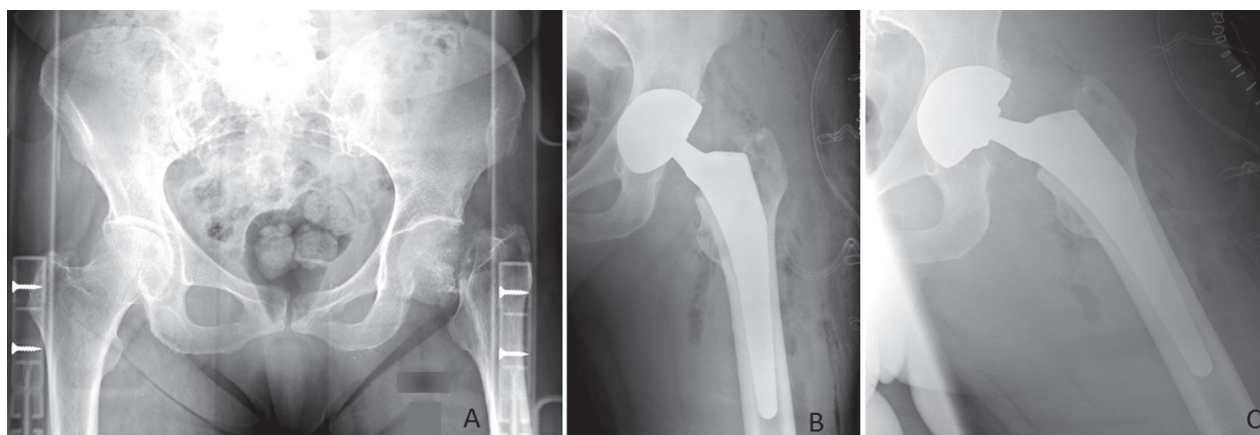


Figure 1. A 73 years old woman reported a left displaced FNF treated with a DM THA the day after trauma. A) pre-op radiograph showing left FNF B) AP and C) axial post-op radiographs of the prosthetic implant

Patients were examined between February and May 2017 with a mean follow-up of 5,67 years (range 4.30-7.68).

In all cases clinical and anamnestic evaluation were performed, recording relevant medical and neuromuscular comorbidities. Data regarding reintervention or post-operative complications such as periprosthetic fractures, surgical site infections and especially hip dislocations were collected. Subjective satisfaction of patients (rated as excellent, good, fair or bad) was registered. Objective evaluation of clinical results was carried out through the administration of the Harris Hip score (HHS) and the Oxford Hip Score (OHS). Radiographic evaluation was carried out at follow-up by the same independent observers (A.M., M.C.) on pelvis AP and Hip lateral views. The latest disposable radiographs were analyzed and compared to post-operative and intermediate radiographs. In 7 implants a recent radiographic exam was not disposable, therefore radiographic evaluation was conducted in 24 cases, with an average radiographic follow-up of 4,86 years (range 2-6,79). Radiographic examination was oriented to detect integration of the implant and eventual signs of loosening. Acetabular component osteointegration was evaluated applying Moore criteria: absence of radiolucent lines, presence of superolateral buttress, presence of medial stress-shielding, presence of radial trabecular pattern, presence of inferomedial buttress (22). Cup integration was considered when at least 3 criteria were met.

Results

At clinical follow up 6 patients (19.35%) resulted to be affected by relevant neuromuscular diseases, as advanced senile dementia, serious depression, hemiparesis after stroke, Parkinson disease (Tab. 1). Three of these patients were confined to bed or moved around by wheelchair.

No episodes of dislocation nor intraprosthetic dislocation were found.

Other postoperative complications were recorded in 3 cases on 31 implants (9,67%). In detail, a Vancouver Ag periprosthetic fracture, a superficial infection and a persistent thigh pain were registered. The

Table 1. Neuromuscular comorbidities in the study population

Sex	Age	Pathologies
F	76	Parkinson's disease
F	75	Cerebral stroke (2 years before)
M	55	Multiple sclerosis
F	83	Severe cognitive impairment
F	76	Dementia and severe depression
M	75	Cerebral stroke

latter patient rated her subjective satisfaction as fair, while the other 29 patients (30 implants) rated good or excellent.

Harris Hip score showed a mean value of 81,22 (range 54,60-97,02).

Oxford Hip Score revealed a mean value of 37,37 (range 19-48).

Radiographic evaluation showed the presence of 4 Moore's criteria in 2 cases and 3 criteria in other 8 cases. None of the cases showed all 5 criteria. In 15 cases less than 3 criteria were noted (Fig. 2).

Thus, in 10 cases on 25 (40%) full osteointegration of the cup according to Moore was recorded.

There were no cases of clinical and radiographic signs of cup or stem loosening.

Table 2 summarizes clinical and radiographic results of the present study population.

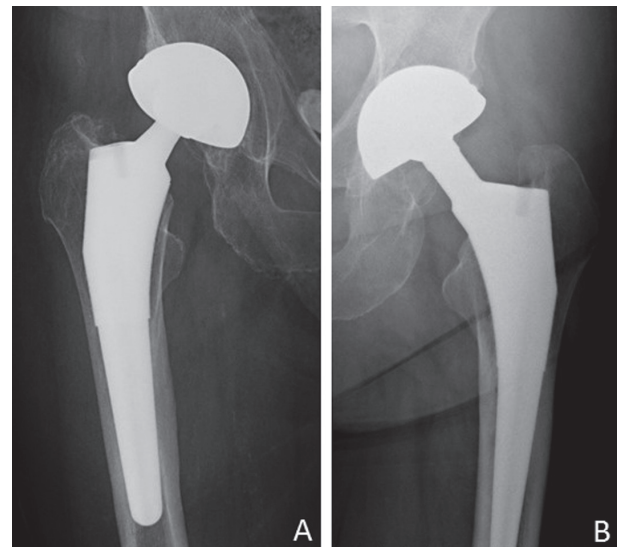


Figure 2. Five years follow-up radiographs of two different cases showing partial (A) and complete (B) cup integration according to Moore criteria. No sign of loosening is present

Table 2. Clinical and radiographic results of the population in exam

Pat.	HHS	OXS	Subjective outcome	Reintervention/Complications	Moore's criteria
1	79,01	39	Good	-	3
2	94,02	47	Excellent	-	3
3	97,02	47	Good	superficial infection	4
4	72,12	34	Good	-	2
5	66,85	33	Good	-	2
6	97,01	47	Excellent	-	2
7	86,65	43	Excellent	-	3
8	97	48	Excellent	-	3
9	95	48	Excellent	-	3
10	95	48	Excellent	-	2
11	55	22	Fair	persistent thigh pain	0
12	89	40	Excellent	-	3
13	89	48	Excellent	-	2
14	70,57	27	Good	-	2
15	74,49	31	Good	-	1
16	61,4	21	Good	-	3
17	64,7	23	Good	-	2
18	57,15	19	Good	-	-
19	74,9	34	Good	-	1
20	93,2	44	Excellent	-	4
21	85,2	44	Good	-	-
22	66,1	24	Good	-	2
23	88	37	Excellent	-	3
24	80,9	36	Excellent	-	1
24 bis	86,4	42	Excellent	-	2
25	54,6	26	Good	periprosthetic fracture (Vancouver Ag)	2
26	86,4	42	Good	-	-
27	92,7	45	Excellent	-	2
28	92,7	45	excellent	-	-
29	96	43	excellent	-	-
30	85	36	good	-	3

Discussion

There are few studies in the literature regarding DM THA for FNF treatment. However, some recent reports demonstrate a growing interest on this topic. In particular, the theoretical advantage of a very low dislocation rate together with good clinical results reported in the literature about OA might have led to the growing indication for DM THA in FNF treatment. In a recent review (18) these studies were analyzed and compared with the literature about FNF treatment with other implants. The results in terms of patients demographic characteristics and mortality were in line with the literature (20, 23, 24). Conversely, a relevant amount of neuromuscular diseases and cognitive impairment incidence (up to 42% of cases) was recorded

(14, 17). Nonetheless, Graversen et. al (19) conducted a study on 20 patients affected by dementia which the authors considered an ideal indication for DM THA. These data reflect the clinicians' choice to implant DM THA in patients at maximal risk of prosthetic dislocation. Moreover, data regarding dislocation rates for DM implants (0 to 4.6%) in FNF setting compare favorably with reported dislocation rates for conventional THA (ranging from 2% to 9%) (18, 20, 21). The present study data result to be in line with other reports in terms of patients demographic characteristics and mortality and percentage of neuromuscular or cognitive impairment. Moreover, both implant dislocation and intraprosthetic dislocation rate resulted to be 0%, which confirms literature reports about DM THA for FNF treatment at short term follow-up (9, 11, 12, 15, 17-19).

Functional outcomes with DM THA resulted to be mainly good or excellent in most literature reports and comparable to other THA papers in FNF setting. (18, 25) Results of the present study in terms of subjective satisfaction and objective functional outcome at HHS and OHS confirmed to be comparable to the literature. Accordingly, surgical site complications in the present paper (9.67%) were in line with other literature reports (3.6% to 11.1%) (10, 13-18).

The main difference between the present study and other literature reports about FNF treatment with DM THA is follow-up. At our knowledge indeed no study reported in the literature about this topic exceeds 3 years follow-up. (18) The present study compares then favorably with the literature, with mean follow-up of 5,67 years (range 4.30-7.68). Thus, the present study confirms the good clinical results and the low dislocation rate with DM THA for FNF treatment at longer follow-up with respect to other literature reports.

Moreover, radiological data about cup integration should be considered. No such data about DM THA for FNF treatment are reported in literature at our knowledge, which renders comparison unfeasible. However, the low incidence of full osteointegration signs (40%) at 5.67 years follow-up is relevant. In the authors opinion it may be due to a lack of primary stability in osteoporotic bone as DM cups do not allow screws placement, which might have been beneficial in some cases. Nevertheless, neither clinical nor radiographic signs of loosening were noted. Future studies with larger series and longer follow-up may be needed in order to clarify this finding and quantify its clinical relevance.

The main limits of the present study are the retrospective design, the limited sample size and the relatively high drop-off.

Strengths of the study are the relatively long follow-up with respect to other literature reports and the radiographic evaluation.

Conclusions

The present study confirms the good clinical results, low complications and very low dislocation rate with DM THA for FNF treatment at longer follow-up with respect to other literature reports.

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