Comparative Study of Cemented versus Cementless Dual mobility Total Hip Arthroplasty in treatment of recent femoral neck fractures in elderly

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Background and aim of work

Femoral neck fractures (FNF) represent a major public health problem all over the world (1). Hip hemiarthroplasty (HA) represents the preferred method of treatment in most cases, that is due to relatively easier technique, less invasive and less time consuming procedure. On the other hand, total hip arthroplasty (THA) is associated with lower revision rates, less pain and more preferable functional outcomes (2). Hence, many studies recommend THA in treatment of FNF in younger population, without several comorbidities and higher physical demands. One of the most devastating complications of arthroplasty is dislocation, with incidence of about 3.8% in HA versus about 10.2% in THA (3, 4). In addition, FNF patients are more prone to dislocation in comparison to patients with other disease like osteoarthritis, which

Dual mobility (DM) concept was developed in 1974 by Bousquet and Rambert. DM cups combine both the "low friction" principle of THA, which was popularized by Charnley with the McKee-Farrar concept of a larger diameter femoral head, to improve implant stability (5). The goal was to achieve the greatest possible ROM in a stable environment, as well as to

reduce wear. may be related to muscular weakness, cognitive and neuromuscular disorders. (5)

There are now multiple designs available, some cemented and some as liners to be inserted into cementless shells. Most new designs take 28 mm heads and smaller. (6) Only a few have a proven track record and there is no long-term published clinical data on many designs. There are few comparative clinical studies on the expanded clinical use of DM bearing that demonstrate superior clinical outcomes compared with THA with a fixed bearing, particularly when larger diameter heads (32 or 36 mm) are used. Whilst clinical studies are rare in the literature, biomechanical studies on DM bearings conclude wider acetabular safe zone and larger jump distance for these implants. (7)

With the introduction of DM, many studies reported less dislocation rates as regard primary and revision cases. Unfavorably, DM possesses a unique failure mechanism, known as intraprosthetic dislocation (IPD), in which the inner prosthetic femoral head disassemble from the outer polyethylene (PE) bearing, due to abnormal PE wear (8). De Martino et al. reported a low dislocation rate of DM THA is primary and revision settings (0.7% and 0.9% respectively, mean follow up 6.8 years). Use of DM THA in FNF patients has been studied in only a few papers, showing good results as regard dislocation rate (0% to 4.6%). IPD seems to be a negligible problem at both short-term and mid-term follow up. (9)

Primary outcome is to assess and compare post-operative dislocation rates after cemented and cementless DMC in elderly patients with recent femoral neck fracture within 2 weeks of injury, who were admitted to Mansoura University Emergency Hospital (MUEH) in the period from January 2018 to January 2021. Secondary outcome includes duration of surgery, estimated intra-operative blood loss, time to first post-operative full weight-bearing, dislocation rate, post-operative infection rate and mortality in both groups.

Patients and methods

This is a combined retrospective and prospective study that was performed on elderly patients (above 55 years) admitted to Mansoura University Emergency Hospital (MUEH) with FNF, in the period from January 2018 to January 2021.

The following was performed to admitted patients:

1. History taking; age, sex, BMI, previous history of falls, neurmomuscular imbalance, medical co-morbidities.

2. Full clinical examination; to exclude other fractures.

3. Radiological investigations; plain radiographs including AP and lateral views of the affected hip, and AP view of the pelvis.

4. Laboratory investigations; complete blood count, bleeding profile, liver and renal functions and virology.

All patients were consented to be indulged in this study using a written consent; patients will be assigned into two groups; total number of patients were 122 patients, out of which 4 patients died after surgery, and 8 patients who were lost at follow up, total number of patients was 110 patients:

1. Group (1) of 79 patients underwent cemented DM THA

2. Group (2) of 31 patients underwent cementless DM THA

Inclusion criteria:

Patients above 55 years who are admitted to MUEH with recent femoral neck fractures

Exclusion criteria:

1. Pre-existing hip osteoarthritis
2. Pathological fractures
3. Stress fractures

After surgery, plain radiographs were done post-operatively to assess the procedure. Patients were clinically assessed according to Harris Hip Score (HHS). Patients were allowed to weight bear as soon as possible unless complications occurred. Patients were discharged when allowed, then follow up was done after 2 weeks, 1.5 months, 3 months, 6 months and 1 year including: plain x-ray of pelvis and hip, dislocation rate, Harris Hip Score (HHS). Radiographic assessment at final follow up was done using Moore's criteria.

The collected data was coded, processed and analyzed using SPSS program for windows. The appropriate statistical tests were used when needed. P values less than 0.05 (5%) is considered to be statistical significant.

Demographic data

Population included in this study were 110 patients, 79 patient underwent cemented DM THA while 31 patients underwent Cementless DM THA. Out of the 110 patients, there were 73 females (66.36%) and 37 males (33.64%). Cemented DM THA patients were 51 females (64.56%) and 28 males (35.44%), while Cementless DM THA patients were 22 females (70.97%) and 9 males (29.03%). No statistical significance was found between both groups as regard sex.

Mean age of the included patients was 66.5 years (ranging from 55 – 87 years), mean age of patients who underwent cemented DM THA was 69.38 years (ranging from 56 – 87 years), while mean age of patients who underwent Cementless DM THA was 59.32 years (ranging from 55 – 66 years). No statistical significant difference was found between both groups as regard age.

Patients were followed up at mean total duration of 26.35 months (ranging from 12 – 52 months).

Table 1: Demographic data

	Males	Females	P-value
Cemented DM THA (n=79)	28 (35.44%)	51 (64.56%)	0.37
Cementless DM THA (n=31)	9 (29.03%)	22 (70.97%)	0.29
All patients (n=110)	37 (33.64%)	73 (66.36%)	0.47

57 patients had hypertension (51.81%) , while 38 patients had diabetes mellitus (34.55%). 7 patients (6.36%) had history of stroke affecting the ipsilateral limb (6 patients in cemented group versus one patient in Cementless group). 10 patients (9.09%) suffered from parkinsonism or other cognitive impairment (8 patients in cemented group versus 2 patients in cementless group). No statistical significant difference was found between both groups as regards medical co-morbidity.

Table 2: Co-morbidities

	Hypertension	Diabetes	Stroke	Cognitive disorders	P-value
Cemented DM THA (n=79)	37	29	6	8	0.8
Cementless DM THA (n=31)	20	9	1	2	0.37
All patients (n=110)	57 (51.81%)	38 (34.55%)	7 (6.36%)	10 (9.09%)	0.21

Post-operative complications

Out of the 110 patients, 3 patients (2%) had at least a single episode of prosthetic dislocation (two patients in the cemented DM THA group, versus one patient in Cementless group), while only one patient in cemented group (0.09%) had the unique complication of intraprosthetic dislocation, and was scheduled for revision surgery. Statistically significant difference was found in which dislocation rate in cemented group was higher than Cementless group.

Table 3: Dislocation and Intra-Prosthetic Dislocation (IPD)

	Dislocation	IPD	P-value
Cemented DM THA (n=79)	2	1	0.41
Cementless DM THA (n=31)	1	-	0.29
All patients (n=110)	3 (2%)	1 (0.09%)	< 0.05*

Four patients (3.6%) suffered from infection; 3 patients (2.7%); two in cemented group versus only one in Cementless group had superficial infection which required only meticulous dressing and antibiotic coverage, all of them were completely healed and infection resolved. One patient (0.9%) in cemented group suffered from deep infection with draining sinus after 7 months of replacement, requiring two-stage revision later on. No statistical significant difference was found between both groups as regard incidence of post-operative infection.

Table 4 Superficial and deep post-operative infection

	Superficial infection	Deep infection with sinus	P-value
Cemented DM THA (n=79)	2	1	0.42
Cementless DM THA (n=31)	1	-	0.36
All patients (n=110)	3 (2.7%)	1 (0.9%)	0.29

Clinical and radiological were assessed at intervals of 6 weeks, 3 months, 6 months and 1 year after replacement. Harris Hip Score (HHS), Oxford Hip Score (OHS) and subjective clinical outcome were used to clinically assess patients at previously mentioned intervals. In 110 patients, Harris Hip Score (HHS) mean score was 69.6, 74.7, 78.6 and 85.3 at intervals of 6 weeks, 3 months, 6 months and one year respectively. Cemented group HHS mean score was 67.8, 73, 76.8 and 84.2 respectively, while Cementless group HHS mean score was 71.4, 76.4, 80.4 and 86.4 respectively. No statistical significant difference was found between both groups as regard clinical HHS at any interval after follow up.

Table 5: Clinical assessment using Harris Hip Score (HHS)

	HHS 6 weeks	HHS 3 months	HHS 6 months	HHS 12 months	P-value
Cemented DM THA (n=79)	67.8	73	76.8	84.2	0.23
Cementless DM THA (n=31)	71.4	76.4	80.4	86.4	0.36
All patients (n=110)	69.6	74.7	78.6	85.3	0.43

Radiographic evaluation was done by assessment of Moore's criteria, incidence of loosening, cup or stem migration at previously mentioned intervals. None of the 110 patients showed the five criteria of Moore at final follow up. Radiographic evaluation showed presence of 4 Moore's criteria in two patients (both in cemented group), presence of 3 or less Moore's criteria were observed in 26 patients (20 patients in cemented group versus 6 patients in Cementless group). No statistical significant difference was found as regard radiographic assessment at final follow up between both groups.

Table 6 Radiographic assessment using Moore's criteria

	5 Moore criteria	4 Moore criteria	3 or less Moore criteria	P-value
Cemented DM THA (n=79)	-	2	20	0.27
Cementless DM THA (n=31)	-	-	6	0.39
All patients (n=110)	-	2	26	0.21

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 lead to the growing indication for DM THA in FNF treatment.

Our study – in comparison 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 (10). Conversely, a relevant amount of neuromuscular diseases and cognitive impairment incidence (up to 42% of cases) was recorded, versus 9.09% in our study (11, 12)

Nonetheless, Graversen et. al 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. (13)

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%). Our study showed dislocation rates at various intervals of follow up of about 2% only, which goes in line with most literature. (10, 14,15)

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. Results of the present study in terms of subjective satisfaction and objective functional outcome at HHS confirmed to be comparable to the literature. (16,17)

Accordingly, surgical site complications in the present paper (3.6%) were in line with other literature reports (3.6% to 11.1%), no statistical significant difference was found between both study groups as regard incidence of infection. (10)

The main difference between the present study and other literature reports about FNF treatment with DM THA is follow-up. At our knowledge few studies reported in the literature about this topic exceeded 18 months follow-up. The present study compares then favorably with the literature, with mean follow-up of 26.35 months (range 12-52 months). 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.

The main limits of the present study is inability to allocate patients to groups randomly, both cemented and Cementless sets were prepared for each case and use of cemented or Cementless cup/stem or both was determined intra-operatively. Strengths of the study are the relatively long follow-up with respect to other literature reports and the radiographic evaluation, in addition to low rate of case drop-off at final follow up.

Conclusion

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. No statistical significant difference was found between cemented DM THA and Cementless DM THA, except for dislocation rate which was higher in cemented group.

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