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Original Article

Cemented vs. Cementless Hemiarthroplasty for Displaced Intra-Capsular Fractures of the Hip: A Retrospective Comparison Study

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SUMMARY

Hemiarthroplasty is the most common treatment for displaced femoral neck fractures in the elderly. Evidence of better functional outcomes with cemented implants is limited, although serious cement-related complications have been reported. This study compared clinical outcomes of cementless vs. cemented hemiarthroplasty 3 months after surgery. Data were taken from the Proximal Femoral Fracture Out-patient Clinic at Meir Medical Center. Of 227 patients operated in the orthopedic department from March 2012–December 2014, 123 underwent bipolar hemiarthroplasty with cement and 107 without cement. As age could affect outcomes, patients were grouped according to those younger than 80 or 80-years-old and older. Patients were assessed for functionality and pain using the Harris Hip Score at discharge, 6 weeks and 3 months after surgery. Pain was measured as part of the total Harris Hip Score. The only statistical difference we found was in favor of the older group of patients with cemented hemiarthroplasty at discharge. This was not clinically significant, as both results were in the same category in the pain and total Harris Hip scores. There were no statistically significant differences at 6 weeks and 3 months between either the surgical or the age groups. We did not find any clinical differences between patients with cemented vs. cementless hemiarthroplasty for displaced femoral neck fractures. Considering that the cementing process can cause serious complications or death, we recommend using cementless hemiarthroplasty for the treatment of femoral neck intracapsular fractures in elderly patients.

1. Introduction

Hip fractures related to osteoporosis are frequently encountered in elderly patients. As the size of the aging population and average life expectancy are increasing, the frequency of these fractures is steadily increasing.[1]

One of the most common hip fractures is displaced intracapsular fracture of the femoral neck. These unstable fractures in the elderly are usually treated using bipolar hemiarthroplasty, with or without cement.[2]

Most studies that compared cemented and cementless stems for hemiarthroplasty suggest that cement results in fewer prosthesis-related complications, including infections, peri-prosthetic fractures and reoperations, with less post-operative thigh pain and better mobility.[3] According to a 2010 Cochrane review, a cemented prosthesis is the implant of choice for hemiarthroplasty.[4] However, more recent studies involving uncemented prostheses suggest that these implants can achieve the same functional outcomes as cemented prostheses, with reduced blood loss and operative time.[5–7] A 5-year follow-up, randomized trial found no difference in functional outcomes between the two procedures.[8]

We report the clinical results of patients treated in the Department of Orthopedic Surgery in a tertiary care medical center with hemiarthroplasty for displaced femoral neck fractures. They were followed in our designated proximal femur fracture clinic.

2. Methods

2.1. Inclusion criteria

All patients, 65 years old and older, who were operated in the Department of Orthopedic Surgery, with bipolar hemiarthroplasty, for intra-capsular femoral neck fractures, between March 2012 and December 2014 were included in the study. The diagnosis was based on AP pelvis x-ray and affected hip axial view x-ray that were done in the Emergency room.

Retrospective data were collected from the proximal femur fracture clinic.

All patients were operated by a senior surgeon, using the direct lateral approach to the hip joint. The implants used were cementless or cemented femoral stem with bipolar head (Pavi, Group Lapine, France), according to surgeon preference.

In the cemented group, the proximal femur was prepared with broaches of increasing sizes till rotational stability was achieved. The cemented femoral stem which was used was 2 mm smaller than the last broach. The cement bed was cleaned with repeated high-pres-

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sure pulsatile lavage. The canal was dried with suction and a dry sponge. A distal cement restrictor was then inserted to the femoral canal. We used one dose of Surgical Antibiotic Simplex P Cement (Stryker; USA), which was prepared in a pressurization gun. Each dose of cement included 0.5 g of Erythromycin and 3,000,000 I.U Colistin within the 41 g cement powder. The cement was injected into the femoral canal in retrograde filling technique and pressurized into the canal. The stem was then inserted into the femoral canal.

Physiotherapy-All patients stated physiotherapy on the 1st post-operative day. Patients were instructed to walk full weight bearing on the operated leg with the assistance of a walker. Patients who had stairs at home were trained using the stairs with the walker before discharge. Since the Harding approach to the hip joint was used in all surgeries, patients were instructed for full range of motion of the affected leg, except for active abduction and cross leg adduction which were started only 6 weeks following the operation. Patients were discharged either to a rehab center or to their homes. In both cases physiotherapy was continued 5 times a week with a physiotherapist for 3 weeks. When they achieved an independent walking, they were admitted to a physiotherapy center in their vicinity twice a week to allow better walking either with a walking aid or without.

2.2. Data collection

Patients were assessed for functionality and pain using the Harris Hip Score (HHS) at discharge from the hospital (visit 0), 6 weeks after surgery (visit 1) and 3 months following surgery (visit 2). Pain was measured as part of the total HHS as: none or ignores pain - 44, slight pain - 40, mild pain - 30, moderate pain - 20 and marked pain - 10.

As we did not have death cases in the first 3 months, we extended the follow-up time, only for mortality, to one year.

2.3. Statistical analysis

Data are presented as numbers and percentages. Continuous parameters of time in follow-up were evaluated using paired t-test or Wilcoxon non-parametric test or Shapiro-Wilk test according to data distribution. Differences between two groups were calculated with Student t-test or Mann-Whitney non-parametric test. Nominal variables were evaluated with chi-square. Kaplan-Meyer survival analysis was used to compare between the two groups. $p < 0.05$ was considered statistically significant. All data were analyzed using SPSS-22 software (IBM Corp., Armonk, NY).

The study was approved by the Research Ethics Committee of the "Meir Medical Center" (0714-18-MMC). Informed consent was not required due to the retrospective nature of the study.

3. Results

A total of 227 patients were included in the study. There were 157 (69.2%) women and 70 (30.8%) men. All underwent bipolar hemiarthroplasty, of which 123 (54.2%) cemented and 104 (45.8%) cementless. There was no statistically significant difference in gender between the cement and cementless groups.

The average age in the cemented group was 83.3 ± 5.7 years, while the average age was 79 ± 7.1 years in the cementless group ($p < 0.0001$). As age could affect outcomes, patients were grouped according to those younger than 80 or 80-years-old and older.

At discharge, among patients younger than 80-years, we found no statistically significant differences between cemented and cementless technique in HHS (35.4 and 39.4 respectively, $p = 0.274$) or pain scores (17.8 and 20.8, respectively, $p = 0.259$). Among the older group, HHS were 34.8 and 40.8 ($p = 0.036$) for cemented and cementless technique, respectively. Pain scores were 21.0 and 17.4, respectively ($p = 0.015$, Table 1). These differences were not clinically meaningful, as both results are in the same HHS category for pain and for total HHS.

At the first follow-up visit, 6 weeks after surgery, among patients younger than 80, there were no statistical differences between cemented and cementless techniques in HHS (73.3 vs. 70.6, $p = 0.542$) or pain (38.7 vs. 39.6, $p = 0.713$). The older group of patients had similar findings, with no statistical differences in HHS (68.8 vs. 67.7, $p = 0.735$) or pain (41.2 and 41.6, $p = 0.779$) between cemented and cementless techniques, respectively.

At the 3-month post-operative visit, we found no statistical differences for both age groups in HHS and pain scores. In the younger group, HHS was 76.1 with cement and 78.9 with cementless technique ($p = 0.639$). Pain scores in this group were 39.3 with cement and 41.4 without cement ($p = 0.540$). In the older age group, HHS was 74.6 with cement and 73.4 in the group without cement ($p = 0.818$). Pain in the group of older patients was 40.3 and 40.4 with cemented and cementless techniques, respectively ($p = 0.988$).

3.1. Infection rate, the need for revision, and mortality

3.1.1. Readmission due to infection

Among all patients, 13 (5.7%) had an infection during the first 3 months after surgery, 4/123 patients (3.8%) in the cementless group, and 9/104 patients (7.9%) in the cemented group ($p = 0.093$).

We distinguished between superficial infection, which had resolved with only antibiotic therapy, and deep infection that needed revision. In the cementless group, 1 of the 4 patients needed revision, as compared to 5 of 9 in the cemented group, who had deep infection and needed revision ($p = 0.096$) (Table 2).

Table 1
Pain and Total Harris Hip Scores (T score), cemented vs. cementless according to patient age group.

Age group	< 80 years					≥ 80 years				
	Cemented		Cementless		p-value	Cemented		Cementless		p-value
	N	Mean ± SD	N	Mean ± SD		N	Mean ± SD	N	Mean ± SD	
Pain score										
Discharge	38	20.8 ± 9.1	18	17.8 ± 9.4	0.259	29	21.03 ± 8.6	47	17.4 ± 6.1	0.036
6 weeks	28	39.6 ± 7.0	12	38.7 ± 8.9	0.713	17	41.6 ± 5.8	26	41.2 ± 3.8	0.779
3 months	19	41.1 ± 4.3	6	39.3 ± 9.6	0.540	17	40.4 ± 9.8	13	40.3 ± 5.0	0.988
6 months	18	38.2 ± 10.1	5	34.4 ± 14.9	0.506	13	37.8 ± 9.4	10	39.4 ± 8.1	0.682
T-score										
Discharge	38	39.4 ± 13.1	18	35.4 ± 11.4	0.274	29	40.8 ± 12.1	47	34.8 ± 8.7	0.015
6 weeks	28	70.6 ± 11.1	12	73.3 ± 15.8	0.542	17	67.7 ± 11.3	26	68.8 ± 8.6	0.735
3 months	19	78.9 ± 12.3	6	76.1 ± 14.8	0.639	17	73.4 ± 14.3	13	74.6 ± 11.1	0.818
6 months	18	79.3 ± 18.8	5	75.6 ± 22.0	0.704	13	74.9 ± 16.7	10	75.8 ± 13.6	0.896

Table 2
Hospitalization due to infection or need for revision.

Variable	Cemented (N = 104)	Cementless (N = 123)	p-value
Infection	9 (7.3%)	4 (3.8%)	0.093
Revision	5 (4.1%)	1 (0.9%)	0.096

3.1.2. Mortality

In the cementless group, 6 patients died in the first year after surgery (4.9%), 1 in the first 6 months (0.8%). In the cemented group, 14 (13.5%) patients died within the first year after surgery (p = 0.033), of which 12 (11.5%) died within the first 6 months (p = 0.001; Table 3).

Table 3
Mortality by type of implant.

Mortality	Cemented (N = 104)	Cementless (N = 123)	p-value
≤ 6 months	12 (11.5%)	1 (0.8%)	0.001
7–12 months	2 (1.9%)	5 (4%)	0.458
Total 1 year	14 (13.5%)	6 (4.9%)	0.033

4. Discussion

Along with the trend of global aging, femoral neck fracture has become an increasingly serious problem for senior patients. Bipolar hemiarthroplasty with or without cement is still the most common treatment for displaced intra-capsular femoral neck fractures in the elderly. For decades, the optimal treatment choice has been debated. It has not yet been determined whether cemented hemiarthroplasty is better than uncemented for displaced femoral neck fractures. Many studies have suggested that cemented hemiarthroplasty can reduce the risk of residual pain and provide better functional results, with no difference in general complications or mortality rates after 3 months.[8,9,11,14] However, the results of recent studies involving uncemented prostheses suggest that these implants can achieve the same functional outcome as cemented prostheses with reduced blood loss and shorter operative time.[5–7]

When operating on the elderly population, we should always remember that the use of bone cement results in more hemodynamic instability and cardiopulmonary complications termed as 'cement reaction' or 'bone cement implantation syndrome.[11] Lennox and McLauchlan[12] concluded that cement should not be used in frail elderly patients. Another major disadvantage of a cemented prosthesis is that revision arthroplasty is more difficult. Uncemented prostheses can avoid the adverse effects of cement, while the primary drawback of cementless implants is that they are more expensive than those without.[13]

The aim of this study was to compare the 3-month outcomes of cementless and cemented implants in terms of pain, function, morbidity, and mortality. We reviewed the electronic medical records of 227 patients retrospectively and evaluated the 3-month follow-up reports. Since outcome could be related to age, the study sample was analyzed according to patients younger than 80-years-old and those 80-years old and older.

Other studies compared clinical outcomes between cemented and cementless hemiarthroplasty in patients with displaced femoral neck fractures. Based on a review of the literature, we could not conclude which implant had better results.

Khan et al.[14] performed a review involving 18 prospective and retrospective studies and claimed that despite longer operative time and more intraoperative blood loss, cemented hemiarthroplasty is more advantageous in terms of mobility, lower revision rate and less thigh pain, without increased postoperative complications and mortality rates at 1 month.

A meta-analysis by Luo et al.[15] that included 8 randomized controlled trials, found that there was no significant difference between cemented and cementless implants regarding mortality, reoperation rate and postoperative complications. However, used of cemented stems can reduce the risk of residual pain and achieve better functional recovery. Azegami et al.[16] performed a meta-analysis that pooled 8 randomized controlled trials, with similar findings. Other research[18] suggested that there was no clinically or statistically significant difference in postoperative hip function recovery.

Similarly, an updated meta-analysis[17] found no significant differences between the two groups in terms of mortality, hospital stay, blood loss, operative time, residual pain or complications.

A recent, comparative study with long-term follow-up, found no significant differences between cemented and cementless hemiarthroplasty terms of functionality. Neither re-operations nor mortality were reported. Patients with cemented hemiarthroplasties had more blood loss and minimal post-operative complications.[18]

We also found no statistical differences regarding pain and mobility between groups in patients younger than 80-years-old. In patients older than 80 years, statistically significant differences were found in pain and HHS at discharge only. These differences were not clinically meaningful as both results are in the same category in the pain and total HHS scores. In addition, there were no significant differences in the scores at the 6-week post-operative visit (Figure 1, Figure 2).

We compared mortality, infection rate and the need for revision due to deep infections after surgery. According to Bell et al.[19] cementless stems are associated with shorter mean operative time, fewer complications and lower all-cause rate of further surgery.

In a recent retrospective study, Frenken et al.[20] found no significant differences in mortality after 1 year, total other complications, immobility at the time of discharge and total prosthesis-related complications between groups. Significantly more peri-

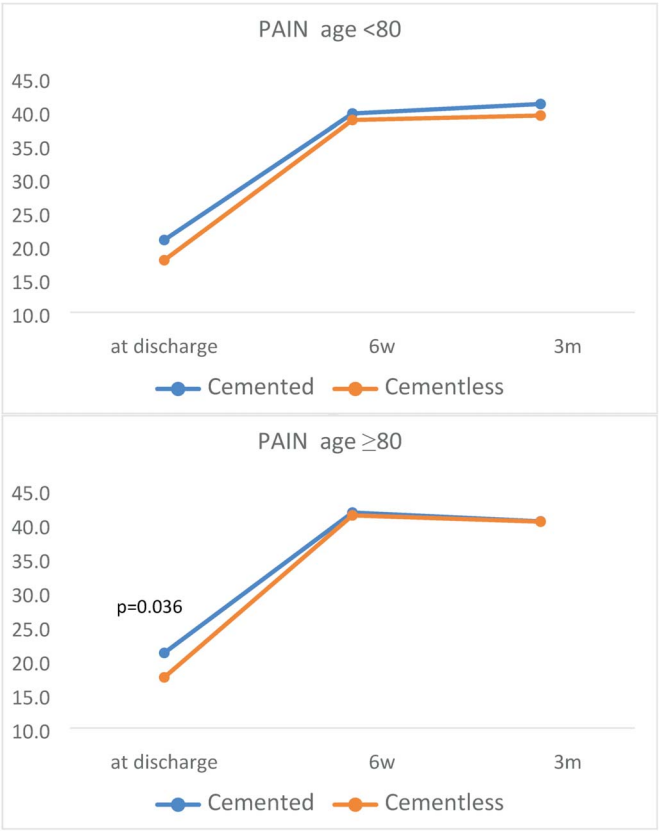

Figure 1. Pain according to age ≥ 80 years or < 80 years, and type of procedure, cemented vs. cementless.

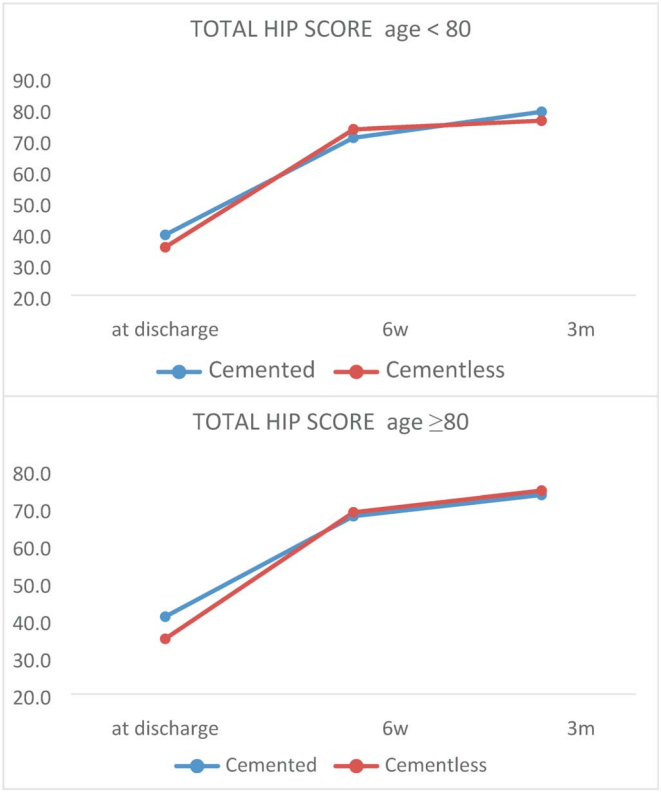

Figure 2. Total Harris Hip Score (HHS) by age ≥ 80 years and < 80 years and type of procedure: cemented vs. cementless.

prosthetic fractures and post-operative infections were seen in the cementless group, with significantly more reoperations compared to the cemented group. Significantly fewer cardiovascular complications, less blood loss and shorter surgery times were found in the cementless group. In a 5-year follow-up of a randomized trial, Langslet[10] found similar rates of infections, dislocations, and 5-year mortality between groups.

Although there were no statistically significant differences in infection rate between the two groups in our study, Table 2 indicates that differences were in favor of the cementless group, as 4 of 123 patients in the cementless group (3.8%) had an infection that required hospitalization, only one of whom needed revision. In the cemented group, 9 of 104 (7.3%) patients had an infection requiring hospital admission ($p = 0.093$) and 5 required revision ($p = 0.096$).

During the first year after surgery, the mortality rate was higher in the cemented group than in the cementless group. This difference was more pronounced during the first 6 months, as 12 patients in the cemented group, and only one in the cementless group died ($p = 0.001$) (Table 3).

We found no differences in morbidity between the two groups. None of the death cases in the first year was due to infection, and we did not find any explanation for the differences in mortality. We recommend further investigation of effects of the cement on mortality in the post-operative period and not only during surgery.

5. Conclusions

Our results show no advantages to using cemented stems. We aware of the disadvantages of cementless stems reported by other researchers, but we did not find them in our study. On the contrary, we found lower mortality in the cementless group. Considering our findings, together with the intra-operative risk of cement usage, we believe that cemented prostheses should not be chosen automatically in hemiarthroplasty for fragile elderly patients. Additional prospective studies are needed to support these results and to determine criteria for choosing type of implants.

Conflict of interest

The authors have not received grant support or research funding for this study, and they do not have any proprietary interests in the materials described in this article.

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