Is cemented bipolar hemiarthroplasty a safe treatment for femoral neck fracture in elderly patients?

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Objectives: Controversy exists regarding the use of cement in hemiarthroplasty when treating a displaced femoral neck fracture in elderly patients. The primary hypothesis of this study was that the use of cement would afford better visual analog pain and activity scores in elderly patients.

Methods: This study included 133 patients over 65 years of age admitted to our clinics from 2006 to 2012 for the surgical treatment of a displaced femoral neck fracture. All patients were treated via hemiarthroplasty. The patients (66 males, 67 females; mean age: 78.16 years; range: 60–110 years) were followed-up regularly. All patients were divided into one of two groups: group A was treated with cement; and group B without. Both groups were compared in terms of preoperative features (demographics and associated diseases), pre- and postoperative complications, mortality rates, pain and activity levels, and hip scores. Hospitalization time, average surgical duration, and time from fracture to operation were also recorded. Mean follow-up duration was 30.9 (range: 5–51) months.

Results: We found no significant between-groups differences in terms of length of hospital stay, Harris Hip Score, complications, or follow-up mortality rates. Walking ability and pain scores were better in the cemented group in the early follow-up period. Duration of surgery and perioperative mortality rates were somewhat lower in the cementless group, but the difference was not statistically significant.

Conclusion: The use of cement during hip hemiarthroplasty in patients over 65 years of age had no negative impact on mortality or morbidity. Hemodynamic changes during cement application are important, but it is noteworthy that patients fitted with cemented endoprostheses had increased levels of activity and lower pain levels.

Keywords: hemiarthroplasty, cemented, femoral neck fracture

Introduction

Femoral neck fractures in the elderly are associated with high morbidity and mortality.¹ The optimal treatment remains controversial.² The fractures can be caused by low-energy trauma. Hemiarthroplasty using modular head partial prostheses is a common surgical procedure used to treat elderly patients with femoral neck fractures. These prostheses can be inserted with or without bone cement.³

Hemiarthroplasty⁴ contributes to early ambulation and good functional recovery. However, controversy persists as to whether cemented or uncemented hemiarthroplasty is preferable for elderly patients. While femoral neck fractures treated via cemented hemiarthroplasty may be less prone to periprosthetic fracture and prosthetic loosening, they are also more likely to trigger embolisms and decreased cardiac output during...
insertion of the bone cement.\textsuperscript{5} Conversely, although unce-
memented hemiarthroplasties are associated with higher rates of
postoperative prosthesis loosening, they require shorter op-
eration times and are associated with less intraoperative
blood loss. Treatment of a displaced femoral neck fracture is
currently determined by the mobility and functional demands
of the patient. Cementing the prosthesis affords more secure
fixation and may result in less postoperative midthigh pain
and a reduced long-term revision rate (loosening is less).\textsuperscript{6}

For decades, the optimal treatment choice has been
debated, and whether cemented is better than uncemented
hemiarthroplasty remains uncertain. Many studies have sug-
ggested that cemented hemiarthroplasty reduces the risk of
residual pain and affords better functional results.\textsuperscript{2,7}

A few studies found that uncemented implants yield
the same clinical results as cemented implants when used
to treat displaced femoral neck fractures.\textsuperscript{2,6,8} Nonetheless,
the postoperative rate of prosthesis loosening is higher after
uncemented hemiarthroplasty.\textsuperscript{6}

The purpose of this controlled trial was to compare the
results of hemiarthroplasty using a cemented\textsuperscript{9} or press-fit
uncemented implant,\textsuperscript{10,11} focusing on the following three
research aims: 1) Are any differences in intraoperative
events detectable?; 2) Are there any differences in functional
outcomes and quality of life at 1 year?; and 3) Are the rates
of postoperative morbidity and mortality similar between
the two groups?

Methods
Demographics
This retrospective multicenter study was performed at
Osmaniye State Hospital, Bozok University Faculty of
Medicine, Kayseri Training Hospital and Modern Dünyam
Hospital after Bozok University Faculty of Medicine ethics
committees approved the study (No 23/03). A total of 136 hip
fracture patients were treated with a cemented or cementless
hemiendoprostheses from 2006 to 2012. Institutional per-
mission was granted for the use of relevant medical records
and anesthetic data. During the study period, no institutional
guidelines on the choice of cemented or noncemented stems
were in place. The two groups exhibited similar demograph-
ics and clinical characteristics (Table 1). We reviewed the
records of all patients admitted with femoral neck fractures
and who died as inpatients following surgery. We recorded
demographic variables, dates of admission and surgery, types
of fracture, medical comorbidities, medications used, type
of implant used, seniority levels of the operating surgeon
and the anesthetist, hemodynamic status immediately before
and after cement application and in recovery, and time and
cause of death. Patient age, sex, number of associated comor-
bidities, and prefracture ambulatory status were all retrieved.
General health status was defined by the number of major
comorbidities including diabetes mellitus, congestive heart
failure, cardiac arrhythmias, ischemic heart disease, previous
cerebrovascular accidents, renal disease, Parkinson’s disease,
hypertension, chronic obstructive pulmonary disease, and
anticoagulation therapy. Ambulatory status was classified
using the Barthel Index of Activities of Daily Living and
the Harris Hip Score. Postoperative pain was assessed using
the visual analog scale with responses ranging from 0 to 10.
Postoperative complications were recorded. Among them,
three patients had an early revision operation, so they were
excluded.

Surgical procedure and rehabilitation
Comorbidity scores derived using guidelines of the American
Society of Anesthesiologists were recorded prior to surgery.
The surgeon performed cemented and cementless operations
using the same surgical technique: patients were placed in
the lateral decubitus position and longitudinal skin incisions
centered over the greater trochanter were made in the lateral
position. After removing the femoral head, the hip was gently
flexed, adducted, and internally rotated. The femoral canal
was reamed with reamers of increasing diameter. After corti-

cal reaming was attained, broaches were precisely placed and
the fit of each broach within the canal was assessed. Adequate
axial and rotational stability was assured; no motion of the
broach within the canal was permitted. Next, the trial femoral
stem was inserted and evaluated in terms of the responses to
rotational and extraction forces. After inserting the predeter-
mined (carefully dimensioned) femoral bipolar head, the hip
was reduced and the stability of the hip joint was retested.

Statistical analysis
Statistical analysis was performed using the NCSS 2007
(NCSS, LLC, Kaysville, UT, USA) statistical software.
Normality of the distribution of all parameters was tested
using the Kolmogorov–Smirnov test. Parametric tests were

\begin{table}
\centering
\begin{tabular}{|l|l|l|}
\hline
& Range & Mean ± SD \\
\hline Age (years) & 60–110 & 78.16±8.44 \\
Day of surgery & 1–9 & 2.97±1.62 \\
Barthel score & 0–100 & 43.80±29.12 \\
Harris Hip Score (n=72) & 40–80 & 73.50±7.47 \\
Mortality time (years) (n=68) & 0–3 & 0.53±0.72 \\
\hline
\end{tabular}
\caption{Demographics and clinical characteristics}
\end{table}
used to explore differences between variables that were normally distributed, and nonparametric tests were used to explore those that were not normally distributed. Normally distributed variables were expressed as means ± standard deviations. Student’s t-test was used to compare normally distributed data and the Mann–Whitney U-test was used otherwise. The Yates continuity correction test was applied, and Pearson’s correlation coefficients were calculated to examine the extent of the associations between variables. Statistical significance was defined as $P<0.05$ and $P<0.001$.

**Results**

The cemented and cementless groups did not differ significantly in terms of age, sex, number of major comorbidities, or prefracture ambulatory status (Table 1). The average age of the 67 female and 66 male patients was 78.14 ± 8.44 years (range: 60–110 years) at the time of injury. The median time between injury and surgical treatment was 2.97 ± 1.62 days. At the end of our follow-up evaluation, 68 patients had died. The mortality rate during the first year after surgery was 29.7%. This fell to 15.6% in the second year, and 9.4% in the third year.

<p>| Table 2 Baseline and demographic characteristics of patients according to treatment |
|--------------------------------------|--------------------------------------|--------------------------------------|</p>
<table>
<thead>
<tr>
<th></th>
<th>Cementless (n=66)</th>
<th>Cemented (n=67)</th>
<th><strong>P</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td>78.50±7.04</td>
<td>77.82±9.66</td>
<td>0.644*</td>
</tr>
<tr>
<td>Operation day</td>
<td>3.18±1.76 (3.00)</td>
<td>2.76±1.45 (3.00)</td>
<td>0.239*</td>
</tr>
<tr>
<td>Barthel score</td>
<td>43.03±29.70 (40.0)</td>
<td>44.55±28.75 (40.0)</td>
<td>0.728*</td>
</tr>
<tr>
<td>Harris Hip Score (n=72)</td>
<td>75.36±3.88 (76.0)</td>
<td>72.10±9.12 (76.0)</td>
<td>0.276*</td>
</tr>
<tr>
<td>Mortality time (years) (n=68)</td>
<td>0.63±0.84 (0.25)</td>
<td>0.41±0.56 (0.17)</td>
<td>0.911*</td>
</tr>
<tr>
<td>VAS score</td>
<td>3.18±1.76 (3.00)</td>
<td>2.86±1.45 (3.00)</td>
<td>0.257*</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>31 (47.0)</td>
<td>35 (52.2)</td>
<td>0.543*</td>
</tr>
<tr>
<td>Female</td>
<td>35 (53.0)</td>
<td>32 (47.8)</td>
<td></td>
</tr>
<tr>
<td>Cigarette smokers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+</td>
<td>16 (24.2)</td>
<td>18 (26.9)</td>
<td>0.882*</td>
</tr>
<tr>
<td>–</td>
<td>50 (75.8)</td>
<td>49 (73.1)</td>
<td></td>
</tr>
<tr>
<td>Morbidity factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+</td>
<td>54 (81.8)</td>
<td>56 (83.6)</td>
<td>0.968*</td>
</tr>
<tr>
<td>–</td>
<td>12 (18.2)</td>
<td>11 (16.4)</td>
<td></td>
</tr>
<tr>
<td>Intensive care</td>
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</tr>
<tr>
<td>+</td>
<td>20 (30.3)</td>
<td>19 (28.4)</td>
<td>0.955*</td>
</tr>
<tr>
<td>–</td>
<td>46 (69.7)</td>
<td>48 (71.6)</td>
<td></td>
</tr>
<tr>
<td>Complication</td>
<td></td>
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</tr>
<tr>
<td>+</td>
<td>20 (30.3)</td>
<td>23 (34.3)</td>
<td>0.756*</td>
</tr>
<tr>
<td>–</td>
<td>46 (69.7)</td>
<td>44 (65.7)</td>
<td></td>
</tr>
<tr>
<td>Mortality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EX</td>
<td>33 (45.5)</td>
<td>35 (48.4)</td>
<td>0.434*</td>
</tr>
<tr>
<td>Alive</td>
<td>33 (54.5)</td>
<td>32 (51.6)</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** *Student’s t-test; †Mann–Whitney U-test; ‡Pearson’s chi-squared; ‡Yates continuity correction.

**Abbreviations:** n, sample number; SD, standard deviation; VAS, visual analog scale; EX, exitus/death.

The follow-up periods of the cemented and cementless groups did not differ significantly. The mean Harris Hip Score of the group with cemented partial prostheses was 72.10±9.12, and that of the group with cementless partial prostheses was 75.36±3.88 points (no significant difference; $P=0.276$). The Barthel activity and pain scores were better in the cemented group ($P=0.728$). Thus, patients in both groups attained similarly good functional results. Of all patients, 25.6% (number [n]=34) of patients were smokers and 82.7% (n=110) had concurrent diseases. Of all patients, 29.3% (n=39) required intensive care, 32.3% (n=43) experienced complications, and the mortality rate was 47.1% (n=68) (Table 2). Two perioperative fat-embolic events were found in the cemented group and none in the uncemented group.

**Discussion**

Fractures of the proximal femur are common in the elderly. Osteoporosis, comorbidities, and increased levels of minor trauma increase the incidence and complicate the treatment of such fractures. Although cemented hemiarthroplasty has been used to treat most of these cases worldwide, noncemented prostheses are gaining popularity. Foss and
Kehlet\textsuperscript{12} concluded that randomized studies afforded only limited evidence that cementing the prosthesis may reduce the amount of postoperative pain and possibly improve mobility. Although serious cement-related complications have been reported, we hypothesized that, relative to cemented hemiarthroplasty, noncemented hemiarthroplasty would yield similar technical and functional outcomes and complication rates, but it would be associated with shorter operation times.

The literature abounds with early-stage success stories associated with the use of cemented bipolar hip replacements; complications are relatively few and mortality rates are low.\textsuperscript{13} Periprosthetic femoral fractures have been reported after uncemented hemiarthroplasty. Elderly and/or frail patients benefit from bone cement; this reinforces the osteoporotic proximal femur.\textsuperscript{13,14}

Elmaraghy et al\textsuperscript{15} suggested that cemented hemiarthroplasty had no effect on the formation of fat emboli. In another study, Donaldson et al\textsuperscript{16} suggested that morbidity and mortality rates might be minimized by preferring cementless arthroplasty in high-risk patients. The reported risk of cement-related death is low but not negligible.\textsuperscript{17,18} Although some uncemented hemiarthroplasties have yielded clinical results equivalent to those of their cemented counterparts, an increased risk of subsequent fracture is evident. The risk of periprosthetic fractures may also differ between cemented femoral stems differing in design.\textsuperscript{19}

Based on this theory, cementing the prosthesis could lead to higher mortality. However, the pooled results of our meta-analysis showed that perioperative mortality during fitting of a cemented prosthesis was 8.1%, and it was 8.3% for an uncemented prosthesis; these prostheses were associated with 3-year mortalities of 48.4% and 45.5%, respectively. Although not significant, the mortality rate was slightly higher in the cemented group. The low numbers of our cases and the shortness of follow-up times are the limitations of our study.

**Conclusion**

The aim of this study was to explore whether the uncemented femoral stem used in this trial would perform similarly to a cemented stem. We examined differences in Harris Hip and Barthel pain scores, femoral fractures, overall health outcomes, complications, rate of reoperation, and mortality rates.

**Disclosure**

The authors report no conflicts of interest in this work.

**References**

Cemented bipolar hemiarthroplasty and neck fracture