Revision Total Hip Arthroplasty Using the Cement-in-Cement Technique

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abstract

The cement-in-cement technique is useful in the setting of revision total hip arthroplasty (THA), especially to gain acetabular exposure, change a damaged or loose femoral component, or change the version, offset, or length of a fixed femoral component. The goal of this retrospective study was to assess the clinical and radiographic characteristics of revision THA using the cement-in-cement technique. Between 1971 and 2013, a total of 63 revision THAs used an Omnifit (Osteonics, Mahwah, New Jersey) or Exeter (Howmedica, Mahwah, New Jersey) stem and the cement-in-cement technique at the senior author’s institution. Aseptic loosening (74%) was the predominant preoperative diagnosis followed by periprosthetic fracture (14%), instability (8%), and implant fracture (6%). Mean clinical follow-up was 5.5±3.8 years. The Harris Hip Score had a statistically significant increase of 18.5 points (P<.001) after revision THA using the cement-in-cement technique. There were 13 returns to the operating room, resulting in an overall failure rate of 21%. Eleven (18%) cases required revision THA, but only 1 (2%) revision THA was for aseptic removal of the femoral component. All other femoral implants had no evidence of component migration, cement mantle fracture, or circumferential lucent lines at final follow-up. The patients who underwent cement-in-cement revision THA at the senior author’s institution had good restoration of function but a high complication rate. [Orthopedics. 2017; 40(2):e348-e351.]

Cement-in-cement revision total hip arthroplasty (THA) is defined as the removal of a femoral component from its intact cement mantle and the replacement of a cemented femoral component into the same cement mantle. This is a powerful technique for revision THA, especially to gain acetabular exposure; change a damaged or loose femoral component; change the version, offset, or length of a fixed femoral component; or repair a Vancouver B1 periprosthetic fracture with an intact cement mantle.1

The cement-in-cement technique requires an intact bone–cement interface, removal of the femoral component with a high-speed burr and femoral extractor, reaming or roughening of the old cement mantle, meticulous drying of the canal, and application of wet cement to allow bonding and interdigitation to the old cement mantle.1,3 The new cement mantle has 94% of the shear strength of the old cement mantle and is stronger than the old cement–bone interface.4,5 In addition, prior fatigue to the old cement mantle does not affect final construct strength.6

Cementation of the femoral component is not as common in the United States as in Europe. Hence, opportunities for more advanced cementation techniques are not encountered as frequently and may have drastically different results.

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Unfamiliarity with cemented implants and the technical requirements of the cement-in-cement technique may make cemented revision THA a less attractive option in the United States. The goal of this retrospective study is to assess the clinical and radiographic characteristics of revision THA using the cement-in-cement technique. This retrospective study is the largest reported American series of revision THAs using the cement-in-cement technique.

**Materials and Methods**

A retrospective review of the prospectively collected database at the senior author’s (R.T.T.) institution from 1971 to 2013 identified 759 cemented revision THAs using an Omnifit (Osteonics, Mahwah, New Jersey) or Exeter (Howmedica, Mahwah, New Jersey) femoral component with a minimum of 2 years of clinical follow-up. Of the 759 cemented revision THAs, 63 (8%) revision THAs in 62 patients used a cement-in-cement technique. The components implanted with this technique included 43 Omnifit (68%, EON or C-Taper) and 20 Exeter V40 (32%) stems.

Mean age, height, weight, body mass index (BMI), and operative time were recorded (Table 1). Aseptic loosening of the implant–cement interface with an intact cement–bone interface was the primary indication for revision THA using the cement-in-cement technique (Table 2). The preoperative, postoperative, and latest radiographs of all femurs were reviewed.

At the senior author’s institution, patients are scheduled for regular clinical evaluations at 1, 2, and 5 years following the arthroplasty and every 5 years thereafter. Radiographs from the most recent follow-up were evaluated using the Harris criteria for cemented femoral component loosening. The operative reports and clinical notes were reviewed to correlate clinical findings and confirm the use of the cement-in-cement technique.

Functional status was evaluated both pre- and postoperatively. Pre- and postoperative Harris Hip Scores (HHS) were calculated from clinical examinations and patient surveys. Complications were recorded from the clinical and operative record. Failure was defined as revision surgery for any reason.

All values are reported as the mean, and errors are reported as standard deviation, where applicable. Comparisons of patient-reported outcomes were performed using a t-test. Statistical significance was set at P<.05. The institutional review board reviewed and approved this study prior to initiation.

**Results**

Mean clinical follow-up after revision THA was 5.5±3.8 years and mean radiographic follow-up was 4.1±3.9 years. There were 18 deaths at final follow-up. These patients had more than 2 years of clinical and radiographic follow-up and were included in this study. Mean HHS prior to revision THA was 49.8±18.4. The mean postoperative HHS after revision THA using the cement-in-cement technique was 68.3±20.2. There was a statistically significant improvement (P<.001) in HHS after revision THA using the cement-in-cement technique.

One (2%) implant demonstrated radiographic evidence of radiographic loosening, stem migration, cortical remodeling, and cement mantle fracture after cement-in-cement revision THA (Figure 1). All of the other femoral implants had no evidence of component migration, cement mantle fracture, or circumferential lucent lines at final follow-up (Figure 2).

Five (8%) revision THAs occurred due to aseptic loosening. Four of these were on the acetabular side, necessitating acetabular revision without stem revision. The 1 (2%) loose femoral stem after cement-in-cement technique requiring revision THA to a fluted, tapered, modular Link MP femoral stem at 5 years. There were 4 (6%) deep infections requiring either permanent resection arthroplasty or placement of a nonarticulating antibiotic cement spacer. There were 3 (5%) instances of instability. Only 2 required revision THA: 1 to a constrained liner and the other to a larger diameter femoral head. There were 2 (3%) periprosthetic fractures. The Vancouver C periprosthetic fracture required open reduction and internal fixation. The other was a greater trochanter fracture. One case required operative removal of a symptomatic cable (2%). There were 3 wound healing issues not requiring a return to the operating room and 1 sciatic nerve palsy. There were no cases of deep venous thrombosis, pulmonary embolism, or other documented complication. There were 13 returns to

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**Table 1**

Demographics of Patients After Revision THA Using the Cement-in-Cement Technique

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean±SD, y</td>
<td>69.2±14.1</td>
</tr>
<tr>
<td>Sex, male:female, No.</td>
<td>21:41</td>
</tr>
<tr>
<td>Side, left:right, No.</td>
<td>31:32</td>
</tr>
<tr>
<td>Height, mean±SD, cm</td>
<td>164±10</td>
</tr>
<tr>
<td>Weight, mean±SD, kg</td>
<td>78±21</td>
</tr>
<tr>
<td>Body mass index, mean±SD, kg/m²</td>
<td>28.6±6.7</td>
</tr>
<tr>
<td>Operative time, mean±SD, min</td>
<td>227±90</td>
</tr>
</tbody>
</table>

**Table 2**

Indication for Revision THA Using the Cement-in-Cement Technique

<table>
<thead>
<tr>
<th>Indication</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aseptic loosening</td>
<td>45 (74.4)</td>
</tr>
<tr>
<td>Periprosthetic fracture</td>
<td>9 (14.3)</td>
</tr>
<tr>
<td>Instability</td>
<td>5 (7.9)</td>
</tr>
<tr>
<td>Implant fracture</td>
<td>4 (6.3)</td>
</tr>
</tbody>
</table>

Abbreviation: THA, total hip arthroplasty.
the operating room resulting in an overall failure rate of 21%. Eleven cases required revision THA (18%), but only 1 revision THA was for aseptic removal of the femoral component (2%).

**DISCUSSION**

In the current series, the authors report the clinical and radiographic outcomes of 63 cement-in-cement revision THA. There are several case series reporting on the cement-in-cement technique. However, many of these represent the European and Asian experience with the procedure, where cemented primary THA is much more common.

Lieberman et al is the largest American series to date, with 19 revision THAs using the cement-in-cement technique. They reported no femoral loosening at just under a mean of 5 years of follow-up. McCallum and Hozack is the most recent American series to date, with 15 revision THAs using the cement-in-cement technique, but it has very short-term follow-up.

The current retrospective study is the largest reported American series of revision THA using the cement-in-cement technique. The authors report only 1 (2%) aseptic femoral loosening at 5 years postoperatively. There were 10 additional revision THAs for complications unrelated to femoral stability.

The patients who underwent cement-in-cement revision THA at the senior author’s institution had good restoration of function. There was a statistically significant difference between pre- and postoperative HHS (49.8±18.4 and 68.3±20.2, respectively). This is comparable to HHS following all revision THAs in the setting of trauma (65±16.8) and aseptic loosening (74±19). However, in a similar series reported by Quinlan et al, postoperative HHS were higher (mean, 85.2; range, 51.9-98.5). Despite the improvement in postoperative HHS, there was a high complication rate, with 13 (21%) requiring further operative hip interventions.

Perforation during femoral preparation is reported as high as 16% with the cement-in-cement technique. The current authors did not observe any femoral perforations, most likely because if they occurred, then the revision THA was con-
verted to a cementless revision THA. It is impossible to assess the rate of conversion because the authors have little insight into the surgeon’s intent to perform cement-in-cement revision THA.

There are several limitations to this study. First, retrospectively analyzed data have several known limitations, including loss to follow-up and selection bias. Second, THA surgery was performed by multiple orthopedic surgeons, all fellowship-trained in total joint arthroplasty but each with differing approaches to the THA itself.

**CONCLUSION**

The cement-in-cement technique offers durable femoral fixation and improvement in outcomes scores. However, meticulous assessment of the intact cement mantle to ensure an intact bone–cement interface without lucency beyond zone 1 and 7 is essential because lucency beyond zone 1 or 7 may predict femoral implant failure of the cement-in-cement technique. Accordingly, it may be necessary to use a distally fixed cementless stem in cases where solid cement-cement and bone–cement interfaces cannot be achieved. Careful preparation of the femoral canal with reaming or ultrasonication and meticulous removal of blood and drying of the canal are essential and may enhance stability.

**REFERENCES**