

Comparison of Blood Loss Between Short-Stem and Conventional Femoral Implants in Total Hip Arthroplasty

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Abstract

Background: Although the postoperative results of total hip arthroplasty (THA) are generally successful, the standard technique and implant design have many proposed modifications. The purpose of the current study was to determine if using short-stem femoral implants minimized the intraoperative blood loss during THA when compared with conventional THA.

Methods: The medical records of patients who underwent THA using short-stem and conventional femoral implants between 2009 and 2013 were reviewed. Patients with previous surgical procedures for treating the acetabulum or proximal femur and patients without reported hematocrit levels were excluded; subsequently, a total of 53 patients for each group (short-stem or conventional implants) were included. Demographic and outcome variables were collected and analyzed for statistical significance using the Fisher exact test.

Results: No significant difference was noted in the patient mass index, preoperative hematocrit level, postoperative decrease in hematocrit level, and mean operating time between the groups. On unadjusted analysis, age, sex, transfusion rates, and blood loss were significant between the groups ($P < 0.001$, $P = < 0.001$, $P = 0.04$, and $P = 0.01$, respectively). On adjusted analysis for age and sex, no significant difference in transfusion rate was noted ($P = 0.12$ and $P = 0.01$, respectively).

Conclusions: The use of short-stem implants may not be significantly related to a reduced blood loss compared with conventional implants. However, further studies are needed to analyze the clinical significance between blood loss and implant use.

Introduction

More than 330,000 total hip arthroplasty (THA) procedures are performed in the United States annually.¹ Despite generally successful postoperative results, the standard technique and implant design have many proposed modifications, especially when used on younger patients. Use of neck-preserving, short-stem femoral implants in particular may be a potential alternative to conventional femoral stems. Results of biomechanical studies have shown that these implants can reproduce anatomical hip kinetics and may decrease risk of periprosthetic fractures.^{2,3}

Short-stem implants rely primarily on metaphyseal fixation. Reports of their use in laboratory studies indicate a physiological load transfer and reduction of stress shielding through this mechanism.⁴⁻⁶ Additionally, results of medium-term follow-up in younger patients with short-stem femoral components are encouraging.⁷⁻⁹ Decreased thigh pain, ease of revision, and reduced rate of dislocation have been reported using short-stem implants in THA.^{10,11}

However, no study to date has analyzed intraoperative blood loss for comparing the effectiveness between use of short-stem and conventional femoral implants. We reviewed the medical records of patients to determine if using short-stem devices diminished the blood loss during THA. We hypothesized that short-stem femoral implants would result in lower intraoperative blood loss and transfusion rates compared with conventional femoral implants.

Methods

Approval from our Human Research Review Committee was obtained for this study (HRRC #13-548). The medical records of patients were reviewed electronically at our university hospital for patients who underwent THA using Metha Short Hip Stem (Aesculap Implant Systems, Center Valley, PA) between 2009 and 2013. A total of 53

patients matched the search criteria and were compared with a control group of 53 patients who underwent THA using conventional femoral stems between the same years. Exclusion criteria were patients with previous surgical procedures for treating the acetabulum or proximal femur. Additionally, patients without noted preoperative and postoperative hematocrit levels were not included.

All surgical procedures were performed by the senior author, using a standard posterior approach to the hip in the lateral position. Tranexamic acid was not used in treating any of the patients.

Patient demographics in the short-stem and conventional implant groups were recorded. Outcome variables of transfusions performed, pre- and postoperative hematocrit levels, operating time, and blood loss were also noted. Measurement of postoperative hematocrit level was reported at 24 hours postoperatively. Operating time was obtained from the record of the surgical nurse at the time of operative procedure. The surgeon recorded blood loss immediately after the procedure.

The Fisher exact test was used for statistical analysis. A *P* value of < 0.05 was considered to represent a statistically significant difference between the groups treated with short-stem and conventional femoral implants.

Table 1. Demographics of 106 patients who underwent total hip arthroplasty using conventional or short-stem implants

Variable	Patients with conventional implants (n = 53)	Patients with short-stem implants (n = 53)	<i>P</i> value
Sex			< 0.001
Male	17	36	—
Female	36	17	—
Mean (range) age, y	59.2 (31-80)	49.9 (18-60)	< 0.001
Mean (range) BMI	33.9 (19-52)	31.8 (19-45)	< 0.19
Mean (range) PHL	42.6 (34-50)	42.9 (28-51)	0.82

BMI, body mass index; PHL, preoperative hematocrit level.

Results

Concerning patient demographics (Table 1), no significant difference was noted in body mass index and preoperative hematocrit level between short-stem and conventional femoral implant groups.

However, sex and age were significant, with the patients' mean age at 9.3 years younger in the short-stem implant group compared with conventional implants. In the short-stem implant group, women had a significantly increased transfusion rate (*P* = 0.02).

Postoperative variables corresponding to blood loss are shown in Table 2. Decrease in postoperative hematocrit level and mean operating time were not significant between the groups. Transfusion rates were significant, with patients in the short-stem implant group receiving fewer transfusions (*P* = 0.04). Additionally, blood loss was significantly less for patients in the short-stem implant group (*P* < 0.01).

Adjusted statistics for age and sex were analyzed after significant differences were noted between group demographics. No significant difference in transfusion rate was identified between groups when data were adjusted for sex (*P* = 0.12) and age (*P* = 0.01).

Table 2. Unadjusted outcome variables of 106 patients who underwent total hip arthroplasty using conventional or short-stem implants

Variable	Patients with conventional implants (n = 53)	Patients with short-stem implants (n = 53)	<i>P</i> value
Transfusions performed (%)	17 (32.1)	7 (13.2)	0.04
Mean decrease in PHL ^a	26%	25.7%	0.86
Mean operating time, min	127.9	131.4	0.5
Mean blood loss, mL ^b	552.8	397.7	0.01

PHL, postoperative hematocrit level.

^aHematocrit levels were reported at 24 hours postoperatively.

^bBlood loss was recorded immediately after the procedure.

Discussion

Many potential benefits have been proposed with the use of short-stem femoral implants in THA. Reports of long-term outcomes are still lacking, but early results are promising regarding level of function, wear rates, and patient outcomes.⁵⁻⁷ Despite the theoretical decrease in blood loss caused by abbreviated canal preparation, we found no statistically significant difference in blood loss between the short-stem and conventional implant groups. Although we noted a difference in transfusion rates, the significance was eliminated when adjusted for age and sex. No significant difference was observed in mean operating time between the groups.

The current study has several limitations. As commonly reported, accurate measurements of intraoperative blood loss are inherently difficult. Additionally, transfusion criteria may differ depending on other patient and physician factors. Finally, because we obtained data through electronic records, any statistical significance in the demographic differences between groups was likely the result of surgeon preference. Short-stem implants were preferentially used in younger patients and mostly male patients, presumably because of a perceived increase in demand of these devices.

Despite the theoretical benefits of short-stem implants used in THA, it remains unclear whether these devices contribute to diminished intraoperative blood loss compared with conventional implants. Subsequently, prospective randomized controlled trials would be useful in addressing the limitations of bias in our retrospective review. Larger sample sizes may show a significant difference.

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Conflict of Interest

The authors report no conflicts of interest.

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