

Safety of Single-Stage Bilateral Direct Anterior Approach Total Hip Arthroplasty Performed in All Eligible Patients at a Honolulu Hospital

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Abstract

Total hip arthroplasty (THA) is a commonly performed surgery, with candidates often requiring bilateral replacement. Simultaneous, single-stage bilateral THA offers several advantages and the direct anterior approach (DAA) for THA is well-suited for this procedure. In Hawai'i, single-stage bilateral DAA THA has yet to be adopted as a primary practice, and currently, there is limited research on patient outcomes following single-stage bilateral DAA THA in heterogeneous patient populations. In this study, we present our experience regarding intraoperative and 90-day complication rates encountered in a consecutive, all-inclusive cohort of single-stage bilateral DAA THA performed at the Straub Medical Center in Honolulu, Hawai'i, from January 2016 to May 2018.

A total of 99 patients were included with a mean age of 64.7 ± 10.1 (mean \pm standard deviation) years. The sample consisted of 43 (43.4%) males. Mean BMI was 27.0 ± 5.3 kg/m². The racial composition consisted of 50 (50.5%) Asian, 37 (37.4%) Caucasian, 8 (8.1%) Hawaiian/Pacific Islander, 1 (1.0%) African-American, 3 (3.0%) undisclosed. Mean operating time was 180 ± 23 minutes. Mean intraoperative blood loss was 386 ± 75 mL, and 11 (11.1%) patients received a postoperative allogenic blood transfusion. There were no major intraoperative complications. The only major local complication observed was one patient who developed high-grade heterotopic ossification requiring surgery. No major systemic complications occurred. The overall complication rate was 0.5%. In conclusion, we demonstrate that single-stage bilateral DAA THA is a safe option for the treatment of bilateral hip pathology in a wide spectrum of patients.

Keywords

total hip arthroplasty; direct anterior approach; bilateral

Abbreviations

ASA = American Society of Anesthesiologists' Classification System

DAA = Direct Anterior Approach

HO = Heterotopic Ossification

THA = Total Hip arthroplasty

Introduction

Total hip arthroplasty (THA) is one of the most common orthopedic procedures performed in the United States, and the demand for THA is projected to steadily increase in the future due to the aging population.^{1,2} A substantial portion of THA candidates present with disease involvement in both joints and thus require bilateral replacement.^{3,4} Simultaneous, single-stage bilateral THA has been demonstrated to have several advantages over sequential, two-stage bilateral THA including only one anesthesia event, a shorter overall hospital length of stay, and

lower associated healthcare costs.⁵⁻⁸ The majority of studies have also found that single-stage bilateral THA has similar or lower rates of major postoperative complications compared to staged bilateral THA yet controversy still exists over which method is safer.^{6,9-16}

The direct anterior approach (DAA) for THA is a muscle-sparing procedure that is well-suited for single-stage bilateral operations as the supine position of the patient precludes the need for intraoperative repositioning.^{3,17} Additionally, there is evidence to suggest that the DAA for unilateral THA is associated with less blood loss and lower rates of transfusion.^{18,19} Multiple studies have demonstrated that the DAA is a feasible option for single-stage bilateral THA with low rates of short-term postoperative complications.^{3,17,20-23} However, DAA THA alone is known to have a steep learning curve, therefore, the added complexity of a single-stage bilateral is concerning and may not be appropriate for an inexperienced surgeon.^{24,25}

Although single-stage bilateral DAA THA has been performed by the senior author since 2005, this procedure has yet to be adopted as a primary practice in other high volume arthroplasty institutions in Hawai'i, perhaps due to the surgical complexity and perceived risk of systemic adverse events. Additionally, there is very limited research for patient outcomes following a single-stage bilateral DAA THA in a heterogeneous patient population, as seen in Hawai'i. Therefore, the purpose of this study was to evaluate intraoperative and 90-day perioperative complication rates in a consecutive, all-inclusive cohort of single-stage bilateral total hip arthroplasties performed at Straub Medical Center in Honolulu, Hawai'i.

Methods

Study Design and Patient Population

A retrospective, Internal Review Board approved analysis was conducted for 99 consecutive patients (198 hips) having undergone elective single-stage bilateral DAA THA between January 2016 to May 2018 at the Straub Medical Center in Honolulu, Hawai'i. All cases were performed by a single, fellowship-trained arthroplasty surgeon. Inclusion criteria for this study included: (1) diagnosed with bilateral hip osteoarthritis, rheumatoid arthritis, or avascular necrosis, (2) no history of prior hip replacement, and (3) had undergone a single-stage bilateral THA via the DAA. The standard of care during the

study period was inclusive of all patients meeting radiographic and clinical evidence for hip arthroplasty. Therefore, no patient was excluded from surgical consideration based on physical or comorbidity status.

Surgical Procedure

Bilateral, single-incision DAA THA was used for all patients, and the surgical procedure for all cases was uniform.¹⁷ The consecutive hip arthroplasty procedures were all performed with the patient in supine position on a specialized fracture table (Hana®, Mizuho OSI, Union City, CA, USA). Patients received general anesthesia, and an ultrasound guided paravertebral block was performed on both sides prior to or shortly after entering the operating room by an experienced anesthesiologist. All patients received an intraarticular pericapsular injection of local anesthetic (ropivacaine or bupivacaine), ketorolac, and epinephrine in the amount calculated for their body mass by the anesthesiologist, and half the maximum dose was used for each hip. Patients with allergies or contraindications to any of the above were excluded from receiving those interventions. All patients received one dose of an appropriate antibiotic prior to incision. All patients received 1 gram of tranexamic acid before incision and before starting closure of the second surgical site. A broach only technique was performed for femoral canal preparation. All patients received a cementless femoral stem (Ovation® Tribute or Alpine®, Ortho Development, Draper, UT) and acetabular implants with a ceramic femoral head and a neutral-faced highly cross-linked polyethylene insert.

Intraoperative fluoroscopy was used to assist with femoral stem and acetabular cup positioning as well as hip offset and leg length assessment. After completion of the initial surgery and wound closure of the first hip, the contralateral hip was sterilely prepped and draped, and a new set of surgical instruments was opened. Approximately 30 minutes elapsed to allow for set up and re-arrangement of the room prior to incision of the second hip. Neither intraoperative red blood cell salvage nor autologous blood donation prior to surgery was performed.

Postoperative Protocol

Patients started physical therapy on the day of surgery as soon as physically able to participate. No weight bearing restrictions or hip dislocation precautions were applied. Patient disposition was assessed based on medical stability and repeated post-operative functional evaluations by experienced physical therapists. Patients were discharged either directly home or transferred to an acute inpatient rehabilitation facility or skilled nursing facility as indicated by repeated functional assessments of safe independent function. All patients participated in six weeks of outpatient physical therapy. Follow up appointments were scheduled at 2 weeks, 6 weeks, 6 months, and 1 year following surgery. Postoperative adverse events which occurred within 90 days following surgery were recorded.

Outcomes

Patient demographics, preoperative comorbidities, including the American Society of Anesthesiologists' Classification System (ASA) class,²⁶ surgical indication, and perioperative variables, such as hospital length of stay, estimated blood loss, required allogenic blood transfusion, and preoperative and pre-discharge hemoglobin levels, were collected. Surgical and systemic complications occurring within the first 90 days post-operative were collected from routine clinic visits, readmission and emergency room records and any unexpected medical evaluation. A surgical complication was defined as an intraoperative fracture, superficial or deep infection requiring additional surgery, periprosthetic fracture, hip dislocation, heterotopic ossification (HO) requiring additional surgery or early failure of the implant. A systemic complication was defined as a cardiac or vascular event requiring readmission, including but not limited to: myocardial infarction, stroke, deep vein thrombosis, and pulmonary embolism.

Results

A total of 99 patients underwent single-stage bilateral DAATHA. The mean age at time of surgery was 64.7 ± 10.1 (mean \pm SD) years, and the sample consisted of 43 (43.4%) males. The mean body mass index was 27.0 ± 5.3 kg/m². The racial composition of the sample consisted of 50 (50.5%) Asian, 37 (37.4%) Caucasian, 8 (8.1%) Hawaiian/Pacific Islander, 1 (1.0%) African-American and 3 (3.0%) undisclosed. Four (4.0%) patients were classified as ASA class 1, 59 (59.5%) as class 2, 35 (35.4%) as class 3, and 1 (1.0%) as class 4.

The mean operating time (defined as time of incision of first hip to dressing application of the second hip) was 180 ± 23 minutes. The mean intraoperative blood loss was 386 ± 75 mL, and 11 (11.1%) patients required a postoperative allogenic blood transfusion based on clinical symptoms. The mean preoperative and postoperative hemoglobin levels prior to discharge were 13.2 ± 1.9 g/dL and 10.9 ± 1.9 g/dL, respectively. There were no intraoperative femoral fractures noted before wound closure.

The average hospital length of stay was 46 ± 27 hours. Eleven (11%) of 99 patients were discharged within 24 hours, and 55 (55%) patients were discharged within 48 hours. A total of 50 (50.5%) patients required transfer to an acute inpatient rehabilitation facility from the hospital, and 48 (48.5%) patients were discharged directly to a home environment. Only one (1.0%) was discharged to a skilled nursing facility. No readmissions occurred within the 90-day postoperative period.

At 90-day postoperative follow-up, the only major local complication observed was one patient who developed high-grade HO requiring surgery. No other major local complications occurred, thus the overall major complication rate was 0.5%. No patients developed a periprosthetic infection, periprosthetic

fracture, wound complications requiring surgery or hip dislocation. Additionally, no patient suffered a systemic complication, such as a deep vein thrombosis or pulmonary embolism. One patient presented to the emergency room due to epigastric discomfort, and another patient made a postoperative phone call concerned about a possible adverse medication reaction which was unrelated.

Discussion

The single-stage bilateral THA, when compared to the two-stage bilateral THA, has been reported to have lower anesthetic risk, shorter overall hospital stay, and lower healthcare costs.⁵⁻¹¹ Despite the potential advantages, the incidence of perioperative complications have previously been reported as high as 7.3%,^{3,20-23,27-31} leading to safety concerns when performing the single-stage bilateral THA.¹⁰⁻¹⁶ In the current study, only one perioperative complication occurred (0.5%), diagnosed as a high-grade HO and required surgery to excise ectopic bone. Previous research has reported the incidence of HO following DAA THA from 3.4% to 9.4%,³²⁻³⁵ therefore, this is most likely not due to the bilateral protocol. Additionally, there were no major systemic complications in the current study, and major complications have been rare in previous other studies. Following single-stage bilateral DAA THA, studies have reported a 2.3% rate of myocardial infarction and congestive heart failure but in patients over the age of 75, as well as pulmonary embolism.^{23,36} In the current study, although the average age of 64.7 years old and average body mass index of 27 suggest a low risk THA sample, 36.4% of patients had an ASA category of either 3 or 4. The absence of significant perioperative and systemic complications, therefore, could indicate that a single-stage bilateral DAA THA may be appropriate even for less healthy patients presenting with bilateral joint disease.

An additional concern for the single-stage bilateral THA is the perceived risk of increased intraoperative blood loss and a higher transfusion requirement associated with a longer surgical event.^{10,13,14,16} In general, the muscle sparing technique of the DAA THA has been shown to have lower blood loss and lower incidence of required blood transfusions than the lateral and posterior approaches.¹⁷⁻¹⁹ Previous research evaluating the single-stage bilateral DAA THA have reported intraoperative blood loss between 401.6 ml to 738.8 mL,^{3,20,22,23,27,28,31,37} all above the average blood loss in the current study of 386 mL. The lower blood loss volume observed in the current study is likely a result of multiple factors, including the use of tranexamic acid, the length of the surgery, and the experience of the surgeon. In a study of 22 bilateral DAA THA using tranexamic acid, Parcels, et al.²⁷ reported an average blood loss of 473 mL and transfusion rate of 23%. The low blood loss and transfusion rate (11%) in the current study, therefore, cannot be fully explained by use of tranexamic acid. Further explanation may be provided by surgical time, however, differences in reporting and

methodologies make direct comparison difficult. Surgical time was reported as an average of 180 minutes in both the current study and by Parcels, et al, however, the time reported in the current study included the preparation of the second hip following the completion of the first hip as opposed to preparation of both hips prior to beginning. Therefore, the lower blood loss and transfusion rate in the current study is likely contributable to the surgeon's experience in these procedures and ability to perform the procedure efficiently.

There are a few limitations that warrant acknowledgment. First, the study is limited by its retrospective design; however, the surgical procedure did not change over the study period. Secondly, a lack of a comparison group with a staged cohort or a cohort using another surgical approach was not available. Therefore, it is not possible to comment on the effect of the surgical experience or technique. Third, only complications occurring during short-term follow-up within 90 days were reviewed, leaving the long-term clinical and patient reported outcomes of single-stage bilateral DAA THA unknown. Finally, all surgeries in the current study were performed by a single surgeon, with over ten years of experience. Although this may remove the effect of varied surgical techniques, the single surgeon design may limit the generalizability to other surgical approaches or levels of surgical experience.

Conclusion

In an unselected cohort of 99 patients having undergone single-stage bilateral DAA THA, one patient underwent an additional surgery for HO and no other patients sustained serious perioperative or systemic complications. Compared to previous research, the low transfusion rate and low complication rates in the current study may reflect surgical experience and efficiency regarding the performance of DAA THA but do demonstrate that single-stage bilateral DAA THA is a safe option for the treatment of bilateral hip pathology in a wide spectrum of patients.

Conflict of Interest

None of the authors identify a conflict of interest.

Disclosures

Dr. Cass Nakasone reports being a consultant and receives royalties from Ortho Development Corporation.

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