One-Stage Bilateral Total Hip Arthroplasty Compared With Unilateral Total Hip Arthroplasty

A Prospective Study

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Abstract: It is believed that patients undergoing 1-stage bilateral joint arthroplasty are at higher risk for developing cardiopulmonary and possibly other complications. The aim of this prospective matched study was to evaluate and compare the morbidity profile of patients undergoing 1-stage bilateral uncemented total hip arthroplasty (BTHA) vs unilateral uncemented THA (UTHA). One hundred consecutive patients undergoing 1-stage bilateral THA (50 patients, 100 hips) and unilateral THA (50 patients) were recruited and prospectively followed. There were no statistically significant differences in 90-day mortality, individual major (BTHA, 8%; UTHA, 10%) or minor (BTHA, 20%; UTHA, 26%) complications between the 2 groups. Bilateral THA patients required more autologous and allogenic blood transfusion and had lower hemoglobin at discharge than UTHA patients. Patients undergoing BTHA should expect a slightly higher incidence of complications related to postoperative anemia. **Key words:** total hip arthroplasty, bilateral, unilateral, complications, outcome.

The merits of performing bilateral total hip arthroplasty (BTHA) under one anesthetic continues to be debated in the orthopedic community. One-stage BTHA offers the advantages of 1-session anesthetic risks, a shorter disability and recovery period particularly important to younger patients, and reduced costs [1,2]. However, concerns regarding the safety of the procedure remain as higher complications have been reported [3-5]. Berend et al [3] in a recent retrospective study detected a nearly 2-fold increase in the incidence of pulmonary complications in the BTHA patients when compared to unilateral THA (UTHA). On the other hand, several studies have refuted these findings and indicated that 1-stage BTHA is indeed effective in relieving pain and restoring function to patients affected with bilateral hip arthritis without significantly increasing risks to the patient [1,2,6-12]. A major limitation with the available data is the retrospective nature of most of the studies, lack of detailed data pertaining to major and minor medical complications, and the long span of time over which the studies are conducted. The conflicting recommendations from these studies and anecdotal concerns regarding safety very likely are a factor in 1-stage BTHA not being widely performed in this country.

The objective of this matched prospective study was to determine the morbidity profile of 1-stage uncemented BTHA vs unilateral uncemented THA with special emphasis on minor and major medical complications.

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Materials and Methods

Inclusion Criteria

All patients undergoing 1-stage BTHA at our institution between July 1998 and June 1999 were eligible for inclusion. The prospective recruitment of patients continued until 50 patients were enrolled into each arm of the study. The patients were matched for age, sex, body mass index, American Society of Anesthesiology score, diagnosis, surgical approach, prosthesis, type of prosthesis fixation, surgeon, and anesthesia. A total of 100 patients (150 joints) were recruited into the study. The demographic distribution of the patients in each group is shown in Table 1. An institutional review board approval for the study was obtained. All patients were consented for the study and none declined to participate. Patients older than 80 years or those with active cardiopulmonary comorbidities such as coronary artery disease or severe chronic obstructive pulmonary disease (lung function reserve of <50% based on lung function tests) are not considered as candidates for 1-stage BTHA at our institution. In addition, patients with previous history of myocardial infarction, cerebrovascular accidents, or pulmonary embolus are also excluded from undergoing bilateral joint arthroplasty at our institution. All patients received thorough preoperative medical evaluation, including persantine-thalium scans or pulmonary function tests whenever indicated, to rule out or assess preexistent comorbidities that could place them at high risk for 1-stage arthroplasty.

Medical and Anesthetic Management

Preoperative, intraoperative, and postoperative management was the same for patients in both groups except for the inherent surgical differences between them. All patients were admitted the same day of surgery and underwent spinal anesthesia with bupivacaine and intrathecal narcotic (morphine 0.25 mg). Anesthesia care was provided using a peripheral intravenous line, pulse oximetry, and automated blood pressure measurements. Invasive monitoring was not used in any patients. Intraoperative cell saver suction was routinely used for all BTHA, but no postoperative drains were used.

Surgical Care

The surgery was performed by or under the direct supervision of one of the 3 senior authors (RHR, WJH, PFS). Patients were positioned supine, and anterolateral approach to the hip was used in all cases. All components were inserted press fit that included cementless tapered, collarless, and proximally coated femoral stem (Taperloc, Biomet, Warsaw, Ind) and uncemented plasma sprayed acetabular cups (Universal Ringloc, Biomet) in all cases. For the bilateral group, the more symptomatic side was operated on first. Before the preparation and draping of the contralateral side, the hemodynamic status of the patient was evaluated and contralateral surgery initiated if patient's hemodynamic condition was deemed to be stable. No contralateral THA was aborted during this study.

Postoperative Care

The established protocol for rehabilitation, prophylaxis against infection, and anticoagulation was the same in both groups. Foley catheters were discontinued on the second postoperative day, and the goal was home discharge or transfer to a rehabilitation facility by the fourth postoperative day. Patients were allowed to weight-bear immediately and encouraged to ambulate with the use of a walking aid until able to walk without a limp. Intravenous antibiotic (Ancef; GSK, Philadelphia, PA) was administered preoperatively and for 48 hours after surgery. Anticoagulation prophylaxis consisted of coumadin beginning the night of surgery and continuing at low dose (goal international normalized ratio, 1.5-1.7) for 6 weeks postoperatively. Staples were removed from the surgical

Table 1. Demographic Distribution of the Patients in the Cohort

	BTHA	UTHA	*P*
Age (y)			
Mean	58.8	62.1	.1
Range	(18-76)	(32-88)	
Sex			
Male	22	15	.15
Female	28	35	
Body mass index			
Mean	28.9	27.5	.19
Range	(17.8-39.7)	(19.8-44.7)	
ASA score			
Mean	2.10	2.16	.59
Grade 1	5	5	
Grade 2	35	32	
Grade 3	10	13	
Comorbidities			
Cardiac	27	31	.41
Pulmonary	5	5	1.00
Other			
Gastrointestinal	17	13	.38
Genito-urinary	4	5	.727
Metabolic	7	16	.03
Neurologic	2	2	1.00
Other	29	25	.42

ASA indicates American Society of Anesthesiologists.

Table 2. The Incidence of Complications in the Cohort

	BTHA		UTHA		
	Number	%	Number	%	*P*
Major					
Death	0	0	0	0	1.00
Arrhythmia	0	0	3	6	.079
Hypotension requiring pressors	2	4	0	0	.153
Angina	1	2	0	0	.315
Congestive heart failure	0	0	1	2	.315
Pulmonary embolism	0	0	1	2	.315
Epidural-induced respiratory depression	1	2	0	0	.315
Total major complications	4	8	5	10	.727
Minor					
Anemia	10	20	5	10	.161
Deep venous thrombosis	0	0	1	2	.315
Transfusion reaction	1	2	0	0	.315
Wound hematoma	0	0	1	2	.315
Ileus	1	2	0	0	.315
Urinary tract infection	5	10	5	10	1.000
Others	5	10	13	26	.037
Total minor complications	22	44	25	50	.548

wounds after 2 weeks. Patients were scheduled postoperative follow-up visits at 6 weeks, 6 months, 1 year, and yearly thereafter with radiographs obtained at each visit. Follow-up averaged 4.2 years (range, 2-5.6 years).

Data Collection

An intraoperative data form was used to record the details of the procedure including estimated blood loss, duration of the procedure, blood replacement, and all other relevant information. A detailed recording and analysis of all the perioperative medical and surgical complications for both groups of patients were performed prospectively. A hospital data form was used to record perioperative hemoglobins, total blood replacement, length of hospital stay, and need for rehabilitation. All complications occurring within 60 days of surgery were recoded prospectively, and patients were followed closely thereafter. Details surrounding each complication and circumstances leading to complications or unplanned unit or telemetry transfers were also extracted from the charts. A follow-up data form was used to record any complications in the posthospital period including the rehabilitation. In addition to recording data prospectively, each patient's hospital records, rehabilitation discharge summaries, and follow-up office notes were reviewed to avoid any errors of omission.

Statistical Analysis

Statistical analysis between the 2 groups was performed using a χ^2 test with a continuity correction for discrete variables, a Student *t* test was used for continuous variables, and the level of significance (α) was set at *P* value of less than .05. A power analysis was performed for selected results where no significant difference was found using a value of $\beta = .80$.

Results

Functional Outcome

There was a significant improvement in Harris Hip Score, and the mental and physical component of the SF-36 in both groups of patients. The difference in the improvement was not significant between the 2 groups ($P = .933$).

Complications

There were no deaths within 90 days of the surgery in either group. The incidence of major complications was 8% for patients in the BTHA group and 10% for patients in the UTHA group ($P = .727$)(Table 2). Six (12%) unplanned transfer to intensive care unit or telemetry unit occurred in the BTHA group compared with 2 (4%) for the UTHA group ($P = .268$). The mean length of stay was 2.25 days (range, 1-4 days) for the BTHA group and 4 days (range, 4 days) for the UTHA group.

The incidence of minor complications at 20% for the BTHA patients was not significantly different from 26% for the UTHA patients ($P = .476$). Hematological complications comprised the majority of complications in both groups especially the BTHA patients (Table 2).

Major and minor complications that occurred during patients' rehabilitation stays are also included. Two complications related to anemia in the BTHA group both occurred on the fifth postoperative day and included one allogenic transfusion and another patient who was treated with erythropoietin α. All major complications occurred during the hospital stay.

Blood Requirements

There was no significant difference in the mean preoperative hemoglobin of BTHA patients at 12.8 mg/dL (range, 10.6-16.1 mg/dL) to that of UTHA patients at 12.6 mg/dL (range, 10-15.4 mg/dL) ($P = .201$). The estimated intraoperative blood loss at a mean of 522.5 mL (range, 200-1400 mL) for the

BTHA group was greater than that for the UTHA group at a mean of 257 mL (range, 100-400 mL) ($P < .001$). The operative time was 62 minutes for the unilateral patients and 69 minutes per hip in the BTHA patients ($P = .9$). Intraoperative salvage used for BTHA patients yielded 0.54 U of blood that was retransfused. All BTHA patients and 45 UTHA patients predonated an average of 1.4 U (range, 1-2 U) of autologous blood which were infused during the surgical procedure. Ten patients (20%) in the BTHA group received allogenic blood transfusions compared to 5 patients (10%) in the unilateral group ($P = .001$). Our transfusion criteria for allogenic blood included symptomatic anemia with a hemoglobin of less than 8.0 mg/dL or less than 10.0 mg/dL in higher risk patients with known cardiopulmonary disease. The mean hemoglobin at discharge for the BTHA group at 9.6 g/dL was significantly lower than that for the UTHA group at 10.6 g/dL ($P < .0001$).

Length of Stay

The average length of hospital stay at 4.58 days (range, 3-11 days) for the BTHA group was not statistically different from a mean stay of 4.34 days (range, 3-8 days) for the UTHA patients ($P = .324$). More BTHA patients needed transfer to rehabilitation than the UTHA patients (96% vs 74%) ($P < .002$). The average length of stay in the rehabilitation between the 2 patients was not statistically different either (BTHA, 9.7 days; UTHA, 8.4 days) ($P = .168$).

Radiographic Findings

The components were found to be well positioned in all patients. All acetabuli were positioned within 35° to 50° of inclination and 10° to 20° of anteversion based on biplanar radiography. The femoral components were within 5° of varus or valgus alignment in all patients. Metaphyseal fit was acceptable in all hips. The uncemented components were determined to have osseointegrated in all patients. Limb length discrepancy measuring greater than 1 cm was noted in 3 patients in the UTHA group but none in the BTHA patients.

Readmissions

Within the first 6 months of follow-up, one BTHA patient was admitted to an outside hospital 4 weeks postoperatively with ankle cellulitis felt to be unrelated to her hip surgery. There were no additional patients in the UTHA group requiring readmission within 6 months of their index surgery. There were no reoperations in either group of patients.

Discussion

The general safety and efficacy of THA are beyond dispute [13-15]. Although majority of THAs being performed are unilateral, it is not infrequent for orthopedic surgeons to encounter patients with symptomatic bilateral arthritis of the hip. According to one study, osteoarthritis of the hip presents as bilateral disease in 42% of patients with this disease [6,16].

Bilateral THA performed under the same anesthesia confers some benefits that include patient convenience, reduced period of disability and recovery, shorter cumulative hospitalization, one anesthetic risk, reduced cost, and possibly more reliable restoration of limb length and correction of deformity [7,17]. Some also believe that optimal recovery from hip arthroplasty may be hampered by significant contralateral hip pain and disability [18]. The latter is particularly true in patients with severe flexion contracture of the contralateral hip resulting in functional leg length inequalities and gait abnormalities.

Bilateral 1-stage THA on the other hand may be associated with higher incidence of medical complications [3,5,10]. In fact the fear of increased morbidity and mortality averts some surgeons from performing 1-stage BTHA. There is a conflicting report in the literature regarding the safety of 1-stage BTHA. Some studies have reported a higher incidence of medical and surgical complications after this procedure compared to unilateral or staged bilateral THA [3], whereas others have refuted these findings and demonstrated acceptable safety for 1-stage BTHA [7,8,17]. Macaulay et al [10] recently reviewed the literature and found that BTHA was a safe procedure when performed in dedicated centers with similar effectiveness and morbidity to either unilateral or staged BTHAs for patients with few comorbid conditions. Other studies have detected higher incidence of medical, and in particular cardiopulmonary, complications in patients with 1-stage BTHA [3,10]. Most of the earlier studies, however, evaluated a heterogeneous group of patients undergoing mostly cemented THA and focused primarily on surgical complications or major medical complications omitting minor complications such as allogenic transfusions common to total joint arthroplasty [1,6,7,9,11,15,17,19-21]. These studies have not been able to identify preoperative factors which were predictive

of a major or minor medical and surgical complication in these patients. In addition, the studies were mostly retrospective in nature, with all the inherent problems of such a study design. There is scarcity of prospective studies comparing a well-matched group of patients. The lack of a consensus regarding the safety of 1-stage BTHA provided the impetus for the conduct of the current study.

This study highlights some important findings. Patients undergoing 1-stage BTHA were found to be at a slightly increased risk for minor medical complications mostly related to postoperative anemia. Bilateral THA patients required a higher volume of blood transfusion and despite the increased autologous and allogenic transfusion had a lower hemoglobin at discharge. Although the functional recovery of these patients with anemia was most likely adversely influenced, there was no difference in the mean length of hospital or rehabilitation stay. A significantly higher percentage of patients undergoing BTHA required transfer to rehabilitation facilities. There were 2 patients from the BTHA group in the series who required medical intervention for the treatment of symptomatic anemia during rehabilitation. This study, in contrast to previous reports, did not, however, detect a higher incidence of cardiopulmonary complications. The reason for the latter may be multifactorial. First, all the patients in this study underwent expeditious surgery receiving uncemented components. The patients were all positioned supine which may provide favorable physiologic milieu, in particular improved ventilation. Second, stringent selection criteria were in place limiting the bilateral procedure for healthy patients. We do not advocate or perform BTHA in patients with serious coexistent medical comorbidities or the elderly with obtunded physiologic compensatory mechanisms. Finally, all our patients, particularly those undergoing bilateral joint arthroplasty, are placed under vigilant postoperative surveillance with low threshold for transfer of these patients to the telemetry or the intensive care unit. Six patients in the bilateral and 2 patients in the UTHA group were subjected to such practice due to development of complications. The fact that a higher number of patients in the BTHA group required unplanned transfer to telemetry and/or intensive care unit needs to be noted. The latter may have marked adverse implications for hospital costs and the use of resources.

This study may suffer some shortfalls. Because of the relatively small sample size, the study is likely to have missed the difference in mortality or some other rare complications that could be significantly different. Fortunately, most major complications such as death, multiorgan failure, cardiac arrests, and so on are exceedingly rare after THA. It is conceivable that a study population consisting of many thousands would be needed to detect such a difference in major complication rates, if present. The other limitation of this study is the applicability of its findings, namely, to uncemented 1-stage BTHA being performed by high-volume surgeons under regional hypotensive anesthesia in patients subjected to strict preoperative selection criteria.

Despite the aforementioned limitations, this study demonstrates that 1-stage BTHA, when performed in a healthy group of patients, can be expected to have an acceptable incidence of medical complications. The patients need to be warned regarding the increased need for blood transfusion even despite preoperative autologous blood donation. Possible preoperative medical interventions such as administration of hematinics and erythropoietin may be considered in these patients.

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