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Perioperative Morbidity after Single-stage Bilateral Total Hip Arthroplasty

A Matched Control Study

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We asked whether the perioperative morbidity and mortality of patients having bilateral single-stage total hip arthroplasties would be increased. We retrospectively compared 400 patients who had bilateral total hip replacements with a matched group of 400 patients who had unilateral total hip replacements. Patients were matched according to age (± 1 year), gender, American Society of Anesthesiologists (ASA) classification, body mass index (± 4 kg/m^2), and diagnosis (osteoarthritis, 81.2%). There were no deaths in either group. The group of patients who had bilateral total hip arthroplasties had a greater number of minor complications per hip (0.34 ± 0.6 versus 0.25 ± 0.6) but only a trend toward an increased number of major complications per hip (0.037 ± 0.2 versus 0.015 ± 0.1). Patients who had bilateral total hip arthroplasties had a trend toward increased risk of dislocation (1.6%/hip versus 0.5%/hip). The patients in this group also had increased number of fat emboli syndrome per surgically treated hip (0.015 versus 0.0025). Based on a calculation per surgically treated hip, patients who had bilateral total hip arthroplasties had a similar percentage of blood transfusions (1.2 versus 0.9/hip), but more patients received allogeneic blood (23% versus 3.8%). The ASA classification was the only independent predictor for minor complications, major complications, and fat emboli syndrome. We think bilateral single-stage total hip arthroplasties have an acceptable perioperative risk for patients with ASA Class 1 or 2 physical status.

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Disabling hip arthritis affecting both hips is not uncommon.[22,23] Good long-term clinical results with high patient satisfaction have been reported for patients who have bilateral total hip arthroplasties (THA).[1,2,4,5,8,10,11,15,16,18–21,24–26] Single-stage bilateral THAs provide the potential advantage of one operative intervention with reduced cost and total rehabilitation time.[8,12,18] However, these advantages must be weighed against the potential increased risk of perioperative complications.[13–15,18,20,21]

We questioned whether the perioperative morbidity and mortality of patients who have bilateral single-stage THAs would be increased, whether predictive variables would identify patients at increased risk, whether risk of early postoperative dislocation is increased, whether postoperative fat emboli syndrome is more common in patients having bilateral THAs, and whether these patients have an increased risk of needing allogeneic blood transfusions?

MATERIALS AND METHODS

We retrospectively identified all patients who had single-stage bilateral THAs by two surgeons (TPS and EAS) between 1987 and 2000. The search yielded 400 patients. Each patient who had single-stage bilateral THAs was matched-paired with another patient who had a unilateral THA by the same two surgeons between 1994 and 2002. The selected pairs had the same underlying diagnosis, preoperative ASA classification,[7] gender, age (± 1 year) and body mass index (BMI) (± 4 kg/m^2) (Table 1). Hospital charts were reviewed retrospectively for each group by two independent investigators who were not involved in the surgery (KCS and AGDV). All patients in the single-stage bilateral THA group were evaluated preoperatively by an internist and anesthesiologist to exclude patients at high risk. The following information were collected: demographic data, American Society of Anesthesiology (ASA) classification,[7] operative time,

TABLE 1. Patient Characteristics

Parameter	One-stage Bilateral THAs	Unilateral THA
Number of patients	400	400
Male/Female	213/187	213/187
Age	60 ± 11 years (range, 20–84 years)	60 ± 11 years (range, 20–84 years)
Body mass index	27 ± 5 kg/m^2 (range, 16–49 kg/m^2)	28 ± 5 kg/m^2 (range, 18–52 kg/m^2)
ASA Class 1	83 (21%)	83 (21%)
ASA Class 2	255 (64%)	255 (64%)
ASA Class 3	62 (15%)	62 (15%)
Osteoarthritis, developmental dysplasia of the hip, slipped capital femoral epiphysis	358 patients	358 patients
Rheumatoid arthritis	10 patients	10 patients
Avascular necrosis	32 patients	32 patients
Cemented THA	51	1
Uncemented THA	35	33
Hybrid THA	314	366

estimated blood loss, intraoperative fluid, type of anesthesia, surgical approach, type of fixation, intraoperative and postoperative major and minor complications, intraoperative and postoperative transfusion requirements, and length of stay. Major complications were defined as serious complications which prolonged the hospital stay by more than 2 days compared with the average hospital stay during the same period or required reoperation. All other complications were considered minor. Fat embolism syndrome was defined using Gurd's criteria.[9]

In the group of 400 patients who had single-stage bilateral THAs, 391 patients (98%) received regional anesthesia, four patients (1%) received general anesthesia, and five patients (1%) received combined general and regional anesthesia. The more symptomatic hip was operated on first. A standard posterior approach was used for all patients. On completion of the first side, the incision was covered and the patient was turned for the second operation. All patients received a combination of a mechanical compression device with Coumadin (Bristol-Myers Squibb, Princeton, NJ) (180 patients (TPS)) or aspirin (220 patients (EAS)). Between 1991 and 1996, venograms or duplex ultrasound examinations were performed routinely in the majority of patients. From 1997, only patients who were symptomatic were examined for deep venous thrombosis. Two hundred thirty patients had routine venograms and ultrasound examinations.

All 400 patients who had unilateral THAs received regional anesthesia and a combination of a mechanical compression device with either Coumadin (Bristol-Myers Squibb) (72 patients) or aspirin (328 patients) for thromboembolic prophylaxis. Only patients who were symptomatic were examined for deep venous thrombosis. Seven patients had magnetic resonance venograms and 64 patients had Doppler ultrasound examinations.

Statistical analyses were performed using SPSS for Windows version 10 (SPSS Inc, Chicago, IL). T tests for independent samples were used to compare the mean of minor and major perioperative complications, the number of blood transfusions, and perioperative blood loss. Pearsons chi square test was used to compare the incidences of perioperative dislocations and fat emboli syndrome. Predictors for perioperative complications were determined using linear regression analysis. P values less than 0.05 were considered significant.

RESULTS

Patients who had single-stage bilateral THAs had a greater incidence of minor complications (Table 2). One hundred fifty-seven patients who had bilateral THAs and 77 patients who had unilateral THAs had at least one minor complication. There were an average of 0.68 ± 1.1 minor complications per patient in the bilateral THA group and an average 0.25 ± 0.6 minor complications per patient in the unilateral THA group ($p < 0.001$). If the total number of minor complications is distributed evenly between the two hips in the patients who had bilateral THAs, this equals an average of 0.34 ± 0.6 minor complications per hip in the bilateral THA group and 0.25 ± 0.6 in the unilateral THA group ($p = 0.019$). There was no difference in the incidence of minor complications in patients who had single-stage bilateral THAs before and after 1995 (0.69 ± 1.0 versus 0.67 ± 1.2; $p = 0.82$).

Patients who had single-stage bilateral THAs had a higher incidence of major complications (Table 3). Nineteen patients who had bilateral THAs and five patients who had unilateral THAs had at least one major complication. There was an average of 0.075 ± 0.4 major complications per patients in the bilateral THA group and an average 0.015 ± 0.1 major complications per patient in the unilateral THA group ($p = 0.01$). If the number of major complications is distributed evenly between both hips in the patients who had bilateral THAs, this equals an average of 0.037 ± 0.2 major complications per hip in the bilateral THA group and 0.015 ± 0.1 in the unilateral THA group ($p = 0.086$). There was no difference in the incidence of major complications in patients who had single-stage bilateral THAs before and after 1995 (0.082 ± 0.5 versus 0.063 ± 0.4; $p = 0.87$).

No patients in either group died during the hospital stay.

The ASA classification was the most consistent predictor for in hospital complications. In the patients who had single-stage bilateral THAs, the ASA classification and preoperative hemoglobin level predicted major complications ($p = 0.009$ and $p = 0.025$) (Fig 1). The ASA classification also predicted fat emboli syndrome ($p = 0.008$) and minor complications ($p = 0.018$) (Fig 2). Age and BMI did not predict minor complications ($p = 0.23$ and $p = 0.31$), major complications ($p = 0.08$ and $p = 0.12$), or fat emboli syndrome ($p = 0.34$ and $p = 0.96$). The total surgical time did not predict perioperative morbidity,

TABLE 2. Incidence of Minor Complications

Organ System	Minor Complication	Unilateral THA (number of complications)	Bilateral THAs (number of complications)
Cardiac	Preventricular contractions	0	6
	Sinus tachycardia	3	11
	Hypertension	3	5
	Bundle branch block	4	1
	Congestive heart failure	1	4
	Atrial fibrillation	1	6
Pulmonary	Respiratory depression	1	3
	Shortness of breath	1	7
	Bronchitis	0	2
	Pulmonary embolus	0	0
Gastrointestinal	Ileus	2	10
	Constipation	4	1
	Diarrhea	2	1
	Ulcer	0	4
	Nausea/vomiting	4	3
	Clostridium difficile colitis	1	2
	Bleeding	0	1
Renal	Urinary retention	2	2
	Hematuria	2	3
	Urinary tract infection	22	40
Hematalogic	Thrombocytopenia	0	11
	Coagulopathy	0	2
Neural	Mental status changes	1	12
	Confusion	2	7
	Suggestive of fat emboli Syndrome	1	6
	Dizzyness/syncope	9	9
	Temporary neurapraxia	0	4
Dermatologic	Rash/abrasion	5	20
	Heel ulcer	0	1
Other	Deep vein thrombosis (distal or superficial femoral vein)	6	14
	Deep vein thrombosis (Proximal)	3	8
	Superficial wound infection	0	2
	Wound drainage (> 5 days but resolved before discharge)	5	5
	Electrolyte disturbance	12	46
	Hematoma (wound)	2	1
	Dislocated hip	2	13
	Dislocated shoulder	0	1
Number of patients with complications/total number of complications		77/101	157/274
Mean ± SD of complications per patient		0.25 ± 0.6	0.68 ± 1.1
Mean ± SD of complications per surgically treated hip		0.25 ± 0.6	0.34 ± 0.6

but there was an increased incidence of fat emboli syndrome with longer surgical time ($p = 0.003$). Neither the ASA classification, age, nor BMI predicted the risk for postoperative dislocations ($p = 0.93$, $p = 0.30$, and $p = 0.35$, respectively). There was no correlation between gender and postoperative dislocation.

Patients who had single-stage bilateral THAs had a trend toward an incidence of in-hospital dislocations ($p = 0.098$). Thirteen of 800 hips (1.6%) in the bilateral THA group and two of 400 hips in the unilateral THA group (0.5%) dislocated during the hospital stay ($p = 0.098$). Based on the current data, 1144 patients (2288 hips) would have been necessary in the bilateral THA group to suggest single-stage bilateral THAs cause an increased risk for postoperative complications ($p = 0.05$; power = 0.80; one-sided test). Three of 13 hips in the THA bilateral group and none in the unilateral THA group had a recurrent dislocation during the hospital stay.

Patients who had single-stage bilateral THAs were more likely to have a fat emboli syndrome develop. Twelve patients who had bilateral THAs and one patient who had a unilateral THA had a fat emboli syndrome ($p = 0.048$), according to Gurd's criteria, which prolonged the hospital stay.[9]

TABLE 3. Incidence of Major Complications

Organ System	Major Complication	Unilateral THA (number of complications)	Bilateral THAs (number of complications)
Cardiac	Cardiac arrest	1	0
	Myocardial infarction	1	2
	Atrial fibrillation	1	2
	Congestive heart failure	0	1
Pulmonary	Required intubation	0	3
	Pulmonary embolism	3	5
	Pneumonia	0	4
	Pulmonary hematoma	0	1
Gastrointestinal	Gastrointestinal bleeding	0	1
Renal	Renal failure	0	1
Neural	Stroke	0	2
	Coma	0	1
Other	Fat embolism syndrome	0	6
	Deep wound infection	0	0
	Bacteremia	0	1
	Return to operating room	0	0
Number of patients with complications/total number of complications		5/6	19/30
Mean ± SD of complications per patient		0.015 ± 0.1	0.075 ± 0.4
Mean ± SD of complications per surgically treated hip		0.015 ± 0.1	0.037 ± 0.2

Patients who had bilateral THAs had more ($p < 0.0001$) blood transfusions than patients in the unilateral THA group (2.3 ± 1.1 versus 0.9 ± 0.5, respectively) with 23% of the patients in the bilateral THA group and 3.8% of the patients in the unilateral THA group having allogeneic blood. Patients who had bilateral THAs also had a greater amount ($p < 0.0001$) of perioperative fluid replacements than patients in the unilateral THAgroup (2444 ± 733 mL versus 1327 ± 386 mL, respectively). Based on a calculation per surgically treated hip, patients who had bilateral THAs had a similar percentage of blood transfusions (1.2 versus 0.9/hip) and perioperative fluid replacements (1222 versus 1327 mL).

DISCUSSION

Bilateral THAs have good long-term results, high patient satisfaction, and the potential advantage of one operative intervention with reduced cost and total rehabilitation time.[1,2,4,5,8,10–12,15,16,18–21,24–26] However those advantages must be weighed against the risk of perioperative complications.[13–15,18,20,21] We questioned whether the

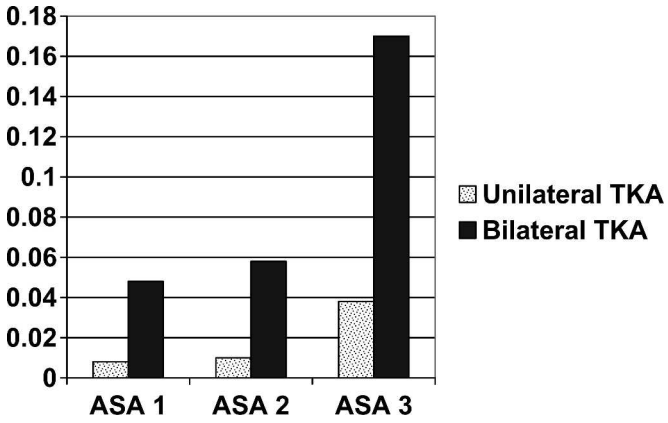

Fig 1. The number of major complications is shown for patients who had single-stage bilateral and unilateral THAs as determined by the ASA class.

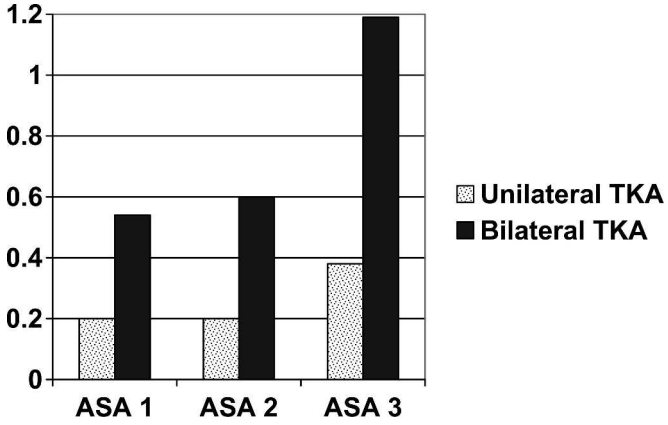

Fig 2. The number of minor complications is shown for patients who had single-stage bilateral and unilateral THAs as determined by the ASA class.

perioperative morbidity and mortality of patients who have bilateral single-stage THAs would be increased and, whether predictive variables can be identified.

Our study has several limitations. The ideal group for comparison would have been bilateral staged group, but for the purpose of this study, we assumed that the morbidity and mortality of the unilateral group was similar to that of a staged bilateral group. Because bilateral THAs have been the preferred treatment for patients with ASA Classes 1, 2, and 3 physical status at our institution, matching a group of patients with staged bilateral THAs was not possible. A second limitation is that some patients who had single-stage bilateral THAs had surgery at an earlier time than patients who had unilateral THAs. Although it might be suggested that this could increase the incidence of complications in the bilateral THA group, there were no differences in major and minor perioperative complications between patients who had bilateral THAs before and after 1995 ($p > 0.80$).

There was no perioperative deaths in our study patients, but there was an increase in complications in patients who had single-stage bilateral THAs. The majority of complications, including postoperative ileus symptoms (10 versus 2) and electrolyte disturbances (46 versus 12), probably are attributable to the extent of the surgery. Weinstein et al described a 9.3% incidence of urinary tract infections in patients older than 75 years who had bilateral THAs.[24] Considering that 10% of our study patients (Table 2) had urinary tract infections, routine screening is recommended on postoperative Day 3 or 4 after the urinary catheter is removed. Despite postoperative screening in the majority of patients who had bilateral THAs, the overall incidence of venous thromboembolic disease is low highlighting the efficacy of combination deep venous thrombosis prophylaxis at our institution.[6,26]

According to our results, the ASA classification is the main predictor for postoperative complications in patients having single-stage bilateral THAs (Figs 1 and 2). Age does not seem to be a predictor for fat emboli syndrome and minor and major complications. Although Weinstein et al described an increased incidence of minor complications in older patients having bilateral THAs, they considered the procedure safe and effective for older patients. [24]

Our results suggest an increase in the incidence of postoperative dislocations (1.6% versus 0.5%), however 1144 patients who had bilateral THAs would have been needed to show a difference. Weinstein et al evaluated patients who had bilateral THAs through an anterior approach and reported no postoperative dislocations.[24] In response to Weinstein et al, Matta stated that the anterior approach might be more suitable for single-stage bilateral THAs than the posterior approach.[15] According to our results and those in the literature,[15,24] patients should be informed about the increased risk of postoperative dislocations when a posterior approach is used for single-stage bilateral THAs.

The overall incidence of fat emboli syndromes prolonging the hospital stay for patients in the current study (3% of patients) was similar to the incidence in a previous study.[5] None of the 35 patients with uncemented stems had a fat emboli syndrome. This is in agreement with the study of Orsini et al, who reported less pulmonary emboli with uncemented components.[17] Consequently one of the senior authors (TPS) now almost exclusively uses uncemented stems for patients having bilateral THAs. Additional data are needed to document the impact of uncemented femoral components on the incidence of fat emboli syndrome because the number in the current study is too small to draw a conclusion.[3]

According to our results, patients having single-stage bilateral THAs have an increased need for allogeneic blood. Ritter et al reviewed the results of 196 consecutive patients who had bilateral THAs as a single operation compared with a control group of 427 patients who had unilateral THAs.[20] The mean blood loss was 300 mL for patients in the unilateral group and 700 mL for patients in the bilateral group. Blood replacement for patients who had unilateral THAs averaged 0.5 units versus three units for patients who had bilateral THAs.[20]

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