The Journal of Arthroplasty 28 (2013) 517–520

Contents lists available at SciVerse ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Risk Factors for Early Mortality Following Modern Total Hip Arthroplasty

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ARTICLE INFO

Article history:
Received 20 March 2012
Accepted 26 June 2012

Keywords:
total hip arthroplasty
mortality
risk factors

ABSTRACT

The aim of this study was to evaluate the incidence of early mortality and identify risk factors for early death following modern uncemented THA. Between 2000 and 2006, we identified patients who died within 90 days of THA. Demographics, comorbidities, laboratory studies, and complications were analyzed as risk factors for mortality. 38 of 8261 patients undergoing THA (0.46%) died within 90 days postoperatively. Of these, 26% were due to myocardial infarction. Multivariate analysis revealed Charlson index >3, peripheral vascular disease, elevated postoperative glucose, and abnormal postoperative cardiac studies as independent predictors of early mortality following THA. Caution should be taken in patients with increased comorbidities, PVD, perioperative hyperglycemia, and impaired renal function in order to reduce mortality following THA.

For several decades, total hip arthroplasty (THA) has been a safe procedure associated with few complications. Though rare, early mortality following THA occurs at a rate of less than 1% [1–3]. Over the past decade, studies have demonstrated the rate of mortality following modern THA has remained low and may be declining despite the fact that THAs are now being performed in patients who are older and in those with multiple medical comorbidities [4].

By 2020, the number of THAs performed annually in the United States is projected to exceed 500,000 [5]. A significant increase in demand for joint replacement surgery underscores the importance of ensuring the safety of THA. Maintaining the low mortality rates associated with THA will be accomplished by scrupulous perioperative identification of any risk factors for early mortality. Previous studies have demonstrated several risk factors that may increase mortality in THA [2,4,6–9].

The purpose of this study was to (1) evaluate the incidence of early mortality within 90 days of surgery, (2) establish the most common cause of death postoperatively, and (3) identify new risk factors for early death following modern THA.

Methods

Study Design

After obtaining approval from the Institutional Review Board, the electronic institutional database was retrospectively queried and all patients undergoing THA at our institution from May 1, 2000 until July 1, 2006 were identified. Patients receiving partial hip arthroplasty were excluded from this study. The institutional electronic medical record, the Centers for Disease Control's National Death Index, as well as the Social Security Death Index were used to establish patient survivorship. Causes of death were identified using the International Statistical Classification of Diseases and Related Health Problems Version Nine (ICD-9) for those who died within ninety days of surgery. A total of 38 patients who died within 90 days of surgery were identified (Fig. 1). These patients were matched in a 1:3 ratio to controls by surgeon and day of surgery. A detailed chart review of these 152 subjects was conducted to collect demographic information (Table 1), medical history and underlying comorbidities, preoperative and postoperative laboratory data, diagnostic studies performed in hospital, and anesthesia records (Table 2). Overall quality of health was assessed by the American Society of Anesthesiologists (ASA) score and the Charlson Index.

Statistical Methods

Mean and standard deviation have been reported for each continuous variable, and frequency distributions for each categorical variable. Univariate analysis was performed to investigate the relationship and distribution of proposed risk factors of ninety-day mortality between the study and control groups. Univariate analysis consisted of Chi-squared statistics for categorical variables and the Student's t-test for continuous variables. Multivariate analysis was performed on all significant variables in univariate analysis with a stepwise logistic regression model to adjust for potential confounders in order to elicit independent predictors of ninety-day mortality. SPSS version 18.0 (Armonk, NY) software was used to perform all statistical analyses.

The Conflict of Interest statement associated with this article can be found at http://dx.doi.org/10.1016/j.arth.2012.06.040.

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0883-5403/2803-0025$36.00/0 – see front matter © 2013 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.arth.2012.06.040

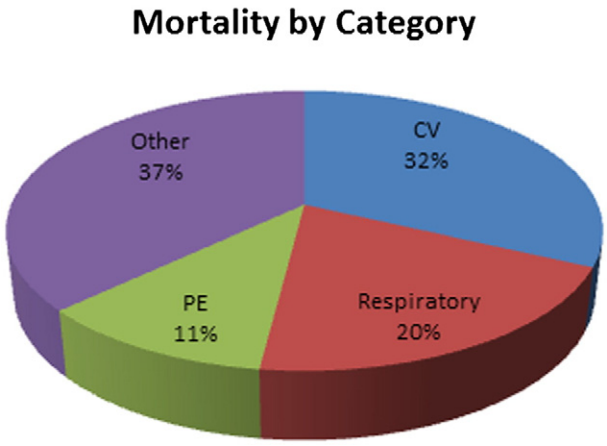

Fig. 1. Mortality following THA. Cardiovascular (CV) cause of death includes fatal myocardial infarction as well as fatal arrhythmia. PE = Pulmonary embolism.

Sources of Funding

No external sources of funding were obtained for this study.

Results

The overall ninety-day mortality rate in this series was 0.46% (38/8261). Myocardial infarction accounted for 26% (10/38) of early mortality cases (Table 3). The incidence of fatal pulmonary embolism in our series was 0.048% (4/8261). The mean time to death following THA was 40.5 days (range: 0–85 days). Postmortem examination was performed in only two cases.

Table 1
Demographic Variables.

Demographic Variable	Mortality Cases (N=38)	Patient Controls (N=114)	*P* Value
Age	78±11	65±14	<.0001
BMI	25±6	29±7	.007
Gender			
Male	19	51	.58
Female	19	63	
Race			
White	33	95	.7
Black	1	7	
Other	4	12	
Insurance			
Yes	26	54	.024
No	12	60	
ASA			
1 or 2	6	56	<.0001
3 or 4	32	58	
Charlson Index			
Less than or equal to 3	9	91	<.0001
Greater than 3	29	23	
Smoker			
No	29	85	.128
Yes	0	10	
Quit	9	19	
Primary vs. Revision			
Primary	24	32	.308
Revision	14	82	
Unilateral vs. Bilateral			
Unilateral	37	107	.402
Bilateral	1	7	
Cemented			
Yes	3	9	1
No	35	105	
Anesthesia Type			
General	11	9	.002
Spinal	27	100	
Conversion	0	5	

Table 2
Perioperative Risk Factors for early mortality.

Operative Variable	Mortality (N=38)	Control (N=114)	*P* Value
Length of Stay	13.3±15.9	5.1±5.8	.003
EBL (ml)	456±395	380±335	.29
OR Time	111 (49.18)	94 (45.28)	.055
Preoperative Hyperglycemia (≥126 mg/dl)			
Yes	13 (34.2%)	20 (17.5%)	.031
No	25 (65.8%)	94 (82.5%)	
Postoperative Hyperglycemia (≥126 mg/dl)			
Yes	31 (81.6%)	71 (62.3%)	.028
No	7 (18.4%)	43 (37.7%)	
Preoperative Anemia (Hgb ≤12.5 in ♀, ≤14 in ♂)			
Yes	28 (73.7%)	56 (49.1%)	.008
No	10 (26.3%)	58 (50.9%)	
New Onset Atrial Fibrillation Postoperatively			
Yes	3 (7.9%)	0 (0%)	.002
No	35 (92.1%)	114 (100%)	
Abnormal EKG Postoperatively			
Yes	17 (44.7%)	6 (5.3%)	<.0001
No	21 (55.3%)	108 (94.7%)	
Elevated Postoperative Troponins			
Yes	16 (42.1%)	5 (4.4%)	<.0001
No	22 (57.9%)	109 (95.6%)	
Beta blocker Dosed Perioperatively			
Yes	7 (18.4%)	22 (19.3%)	.905
No	31 (81.6%)	92 (80.7%)	
Elevated Preop Creatinine (≥1.2 mg/dl)			
Yes	14 (36.8%)	12 (10.5%)	<.0001
No	24 (63.2%)	102 (89.5%)	
Elevated Postoperative Creatinine (≥1.2 mg/dl)			
Yes	17 (44.7%)	12 (10.5%)	<.0001
No	21 (55.3%)	102 (89.5%)	
Coronary Artery Disease			
Yes	16 (42.1%)	12 (10.5%)	<.0001
No	22 (57.9%)	102 (89.5%)	
Dementia			
Yes	3 (7.9%)	1 (0.9%)	.019
No	35 (92.1%)	113 (99.1%)	
Diabetes			
Yes	2 (5.3%)	7 (6.1%)	1.000
No	36 (94.7%)	107 (93.9%)	
Peripheral Vascular Disease			
Yes	6 (15.8%)	2 (1.8%)	.001
No	32 (84.2%)	112 (98.2%)	
Renal Disease			
Yes	2 (5.3%)	2 (1.8%)	.242
No	36 (94.7%)	112 (98.2%)	

Table 3
Cause of Death, Postoperative Day of Day, and Total Number of Occurrences.

Cause of Death	Total No.	Postoperative Day
Myocardial infarction	10	0, 0, 4, 25, 44, 62, 75, 76, 76, 80
Pneumonia	8	5, 12, 29, 35, 36, 44, 71, 80
Pulmonary embolism	4	1, 7, 15, 78
Cerebrovascular accident	4	7, 42, 65, 87
Cancer	4	30, 43, 72, 73
Sepsis	3	13, 43, 82
Gastrointestinal bleed	2	34, 67
Arrhythmia	2	2, 6
Vascular injury	1	2

Causes of death were obtained directly from death certificates using ICD-9 coding. Pneumonia codes have been grouped to include both infectious and aspiration. Postmortem examination was performed in only two cases.