Original Investigation

Outcomes After Hip Fracture Surgery Compared With Elective Total Hip Replacement

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IMPORTANCE Patients undergoing surgery for a hip fracture have a higher risk of mortality and major complications compared with patients undergoing an elective total hip replacement (THR) operation. The effect of older age and comorbidities associated with hip fracture on this increased perioperative risk is unknown.

OBJECTIVE To determine if there was a difference in hospital mortality among patients who underwent hip fracture surgery relative to an elective THR, after adjustment for age, sex, and preoperative comorbidities.

DESIGN, SETTING, AND PARTICIPANTS Using the French National Hospital Discharge Database from January 2010 to December 2013, patients older than 45 years undergoing hip surgery at French hospitals were included. The *International Statistical Classification of Diseases and Related Health Problems, 10th Revision* (*ICD-10*), codes were used to determine patients' comorbidities and complications after surgery. A population matched for age, sex, and preoperative comorbidities of patients who underwent elective THR or hip fracture surgery was created using a multivariable logistic model and a greedy matching algorithm with a 1:1 ratio.

EXPOSURE Hip fracture.

MAIN OUTCOMES AND MEASURES Postoperative in-hospital mortality.

RESULTS A total of 690 995 eligible patients were included from 864 centers in France. Patients undergoing elective THR surgery (n = 371 191) were younger, more commonly men, and had less comorbidity compared with patients undergoing hip fracture surgery. Following hip fracture surgery (n = 319 804), 10 931 patients (3.42%) died before hospital discharge and 669 patients (0.18%) died after elective THR. Multivariable analysis of the matched populations (n = 234 314) demonstrated a higher risk of mortality (1.82% for hip fracture surgery vs 0.31% for elective THR; absolute risk increase, 1.51% [95% CI, 1.46%-1.55%]; relative risk [RR], 5.88 [95% CI, 5.26-6.58]; $P < .001$) and of major postoperative complications (5.88% for hip fracture surgery vs 2.34% for elective THR; absolute risk increase, 3.54% [95% CI, 3.50%-3.59%]; RR, 2.50 [95% CI, 2.40-2.62]; $P < .001$) among patients undergoing hip fracture surgery.

CONCLUSIONS AND RELEVANCE In a large cohort of French patients, hip fracture surgery compared with elective THR was associated with a higher risk of in-hospital mortality after adjustment for age, sex, and measured comorbidities. Further studies are needed to define the causes for these differences.

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Although hip surgery can improve mobility and pain, it can be associated with major postoperative medical complications and mortality.[1] Patients undergoing surgery for a hip fracture are at substantially higher risk of mortality and medical complications compared with patients undergoing an elective total hip replacement (THR).[2,3] The increased risk might be due to the advanced age and comorbidities of hip fracture patients relative to elective THR patients.[2-4] Although patient characteristics may explain the higher risk for a poor outcome among patients undergoing hip fracture surgery, it is possible that physiological processes associated with hip fracture (eg, the acute inflammatory, stress, hypercoagulable, and catabolic states)[5-9] may account for some of the increased risk.[10,11] These processes may account for some of the perioperative morbidity and mortality and, therefore, may represent modifiable risk factors. For example, surgery may be performed earlier in a patient's disease course to minimize the time patients are exposed to these intrinsic factors to improve outcomes.[12] To better understand the potential contribution of these processes to adverse outcomes, we determined the difference in in-hospital mortality between patients undergoing hip fracture surgery and elective THR after adjusting for the known risk factors age, sex, and patient comorbidities.

Methods

Data Sources

The Agence Technique de l'Information Sur l'Hospitalisation (ATIH) waived the need for consent according to the Enforcement (decree No. 94-666). Since 1996, all French hospitals caring for medical and surgical patients have submitted anonymized patient data to the French Hospital Discharge Database (FHDD). Each discharge summary submitted to the FHDD is linked to a national grouping algorithm leading to a French diagnosis related group[13]; thereby allowing patient comorbidities to be recorded and linked.[14] The study was conducted according to the approval given by the ATIH. Authorization was also obtained from the Commission Nationale de l'Informatique et des Libertés (agreement No. 1375062). The data provided were anonymized.

Patients and Procedures

We identified and included all patients older than 45 years who underwent elective THR or hip fracture surgery requiring anesthesia, performed in France from January 1, 2010, to December 31, 2013. Patients with multiple trauma were excluded. For each patient the following information was extracted: age, sex, primary diagnosis (ie, reason for hospital admission), patient comorbidities (coded according to the *International Statistical Classification of Diseases and Related Health Problems, 10th Revision* [*ICD-10*]),[15] procedures performed during the hospital stay (coded according to the French classification for medical procedures in the *Classification Commune des Actes Médicaux* [*CCAM*]),[16] length of stay (LOS) in the hospital (days), and in-hospital complications and mortality after surgery. Using a previously established process, 3 physicians, with expertise in *ICD-10* coding, independently aggregated *ICD-10* codes into broader disease groups to resemble the clinical observations commonly recorded during preoperative assessments (eTable 1 in the Supplement). All disagreements were resolved through a consensus process that involved discussions among the 3 physicians. The Simplified Acute Physiology Score (SAPS II)[17] was used to measure the severity of disease for patients admitted to an intensive care unit (ICU).

Outcomes

The primary outcome was in-hospital mortality, defined as death after surgery and prior to hospital discharge, regardless of LOS. Secondary outcomes included in-hospital major postoperative complications (ie, a composite of myocardial infarction, heart failure, stroke, renal failure, sepsis, and mortality) and each of the individual components of the composite except for mortality. We also evaluated readmission for any cause within 72 hours after initial hospital discharge and in-hospital mortality during readmission.

Statistical Analyses

Continuous and categorical variables were compared using parametric or nonparametric methods as appropriate. A matched population of patients who underwent elective THR and hip fracture surgery was created using a multivariable logistic model and a greedy matching algorithm with a 1:1 ratio and a caliper width of 10^{-5} with no replacement.[18] The matching procedure was carried out by categorizing age (in 5-year age intervals) in which elective THR and hip fracture patients were matched within each age strata. All preoperative variables were included in the matching model and are presented in **Table 1**. Patients receiving hip fracture surgery and elective THR for whom no match was found were discarded from the matched analyses. After matching, balance of covariates between the groups was assessed using the standardized differences expressed as a percentage for each covariate,[19] and globally using the L_1 measure (in which a value of 0 indicates identical distributions between groups and 1 indicates complete imbalance) and post-matching C statistic (in which a value of 0.5 indicates perfect balance).[20] Any baseline covariate with an absolute standardized difference greater than 5% was considered to be imbalanced, because such a difference may have a statistical effect on the results depending on the prognostic importance of the covariate.

Relative risk (RR) and the 95% CIs for primary and secondary outcomes were computed using conditional Poisson regression. *P* values were 2-tailed, and values less than .05 were considered significant.

To explore the potential statistical effect of unmeasured confounders related to patient frailty on the primary outcome, we conducted a sensitivity analysis, replicating the main analysis for the primary and secondary outcome on patients younger than 60 years and residing at home prior to surgery (ie, the group of patients at lowest risk of frailty). We also conducted sensitivity analyses in which RR estimations were adjusted for the hospital LOS.

Table 1. Preoperative Patient Characteristics in the Unmatched and Matched Study Populations for Hip Fracture Surgery vs Total Hip Replacement

	Population					
	Unmatched (n = 690 995)			Matched (n = 234 314)		
	Group, No. (%)			Group, No. (%)		
	Hip Fracture Surgery (n = 319 804)	Elective THR (n = 371 191)	Standard Difference, %	Hip Fracture Surgery (n = 117 157)	Elective THR (n = 117 157)	Standard Difference, %
Demographics						
Age, mean (SD), y	81.7 (10.6)	70.2 (10.2)	110.9	75.0 (10.6)	75.0 (10.6)	0.02
Men	80 640 (25.2)	164 732 (44.4)	−41.1	36 876 (31.5)	36 709 (31.3)	0.31
Public center[a]	248 103 (77.6)	132 750 (35.8)	93.1	77 914 (66.5)	77 904 (66.5)	0.02
Residing in own home prior to surgery	299 337 (93.6)	368 955 (99.4)	−31.9	115 511 (98.6)	115 448 (98.5)	0.45
Medical history						
Hypertension	116 239 (36.3)	137 871 (37.1)	−1.6	37 967 (32.4)	37 844 (32.3)	0.22
Ischemic heart disease	21 585 (6.7)	15 960 (4.3)	10.7	4774 (4.1)	4607 (3.9)	0.73
Cardiac arrhythmia	19 021 (5.9)	12 076 (3.2)	12.9	4096 (3.5)	4046 (3.4)	0.23
Chronic heart failure	3730 (1.2)	1638 (0.4)	8.1	371 (0.3)	376 (0.3)	−0.08
Heart valve disease	8421 (2.6)	7811 (2.1)	3.5	2034 (1.7)	2034 (1.7)	0.00
Peripheral vascular disease	6827 (2.1)	5391 (1.4)	5.1	1542 (1.3)	1419 (1.2)	0.94
Dementia	52 399 (16.4)	2214 (0.6)	59.1	1868 (1.6)	1888 (1.6)	−0.14
Cerebrovascular disease	7040 (2.2)	1513 (0.4)	15.9	709 (0.6)	660 (0.6)	0.55
Hemiplegia or paraplegia	4930 (1.5)	791 (0.2)	14.3	456 (0.4)	416 (0.4)	0.56
Chronic obstructive pulmonary disease	10 113 (3.2)	8270 (2.2)	5.8	2385 (2.0)	2325 (2.0)	0.36
Pulmonary circulation disorder	1109 (0.3)	290 (0.9)	5.8	74 (0.1)	75 (0.1)	−0.03
Chronic respiratory failure	4716 (1.5)	2134 (0.6)	8.9	662 (0.6)	651 (0.6)	0.13
Chronic alcohol abuse	9189 (2.9)	3430 (0.9)	14.3	1613 (1.4)	1597 (1.4)	0.12
Cancer	14 784 (4.6)	9055 (2.4)	11.8	4065 (3.5)	4013 (3.4)	0.24
Cancer with metastasis	2825 (0.9)	1227 (0.3)	7.1	588 (0.5)	597 (0.5)	−0.11
Diabetes	35 446 (11.1)	33 203 (8.9)	7.1	10 508 (9.0)	10 389 (8.9)	0.36
Obesity	6829 (2.1)	38 099 (10.3)	−34.2	3401 (2.9)	3358 (2.9)	0.22
Chronic renal failure	12 075 (3.8)	5186 (1.4)	15.3	1718 (1.5)	1736 (1.5)	−0.13
Preoperative chronic dialysis	1513 (0.5)	318 (0.1)	7.3	115 (0.1)	114 (0.1)	0.03

Abbreviation: THR, total hip replacement.

[a] Hospitals owned and managed by the French government.

Statistical analyses were carried out in R software (R Foundation), version 3.1, and matching procedures were performed using MatchIt package (R Foundation), version 2.4-21.

Results

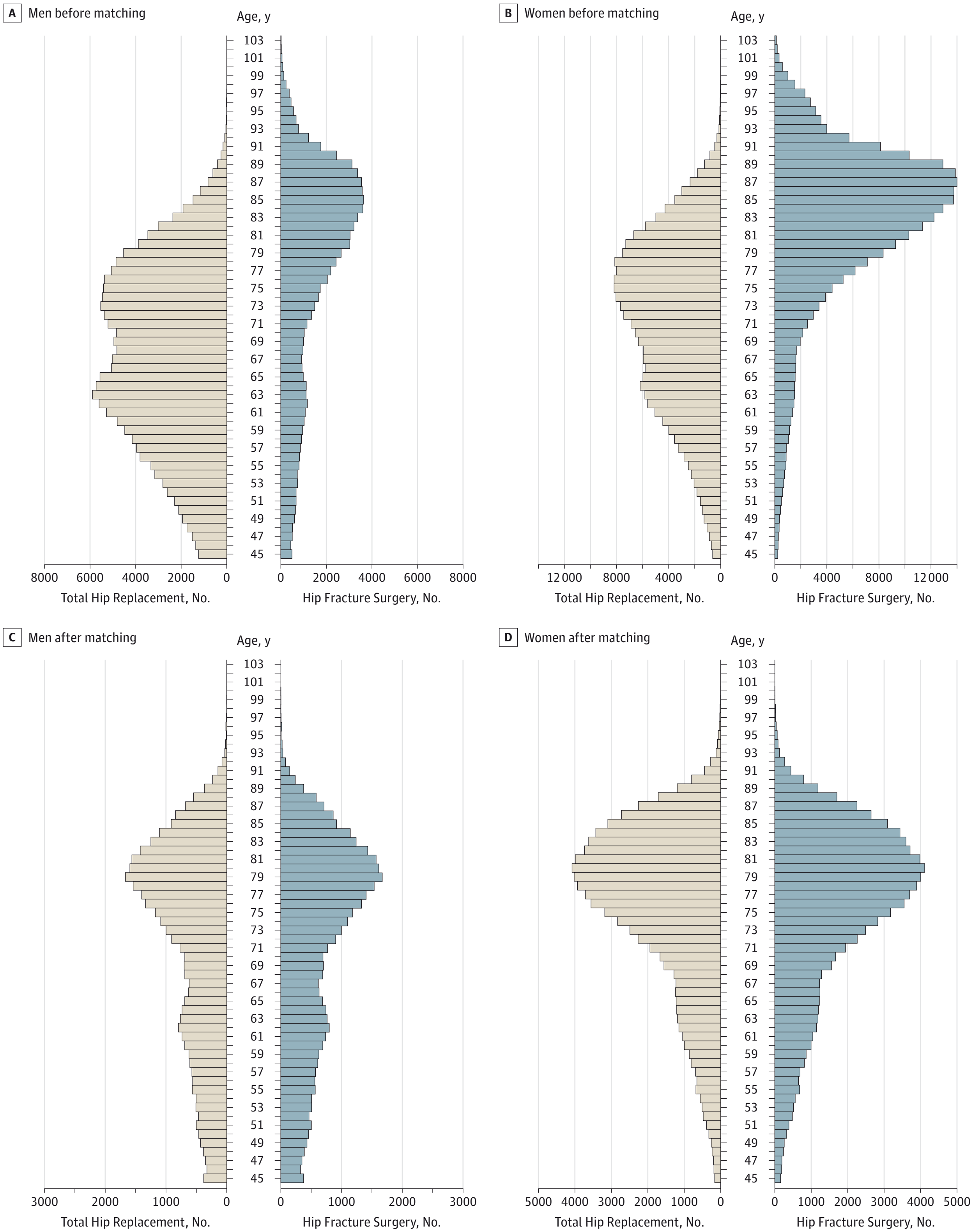
During the study period, 690 995 eligible patients from 864 centers in France were identified and included in this study. Elective THR was carried out in 371 191 patients and hip fracture surgery in 319 804 patients. Table 1 reports the baseline patient characteristics of these 2 groups, and the **Figure** shows the age and sex distributions.

Unmatched Study Populations

In the unmatched study population, patients undergoing an elective THR were younger and had fewer preoperative comorbidities. The mean LOS for patients who underwent hip fracture surgery was longer than for those who underwent an elective THR (12.09 days [95% CI, 12.07-12.13] for hip fracture surgery vs 7.80 days [95% CI, 7.79-7.81] for elective THR; *P* < .001). Over the study period, the mean length of hospital stay decreased in the hip fracture group (from 12.77 days [95% CI, 12.70-12.81] in 2010 to 11.72 days [95% CI, 11.67-11.77] in 2013; *P* < .001) and the elective THR group (from 9.19 days [95% CI, 9.13-9.23] in 2010 to 8.11 days [95% CI, 8.08-8.12] in 2013; *P* < .001). Postoperatively, patients who underwent surgery for a hip fracture were less frequently discharged to their home (35.8% for hip fracture surgery vs 60.0% for elective THR; *P* < .001). Readmissions within 72 hours of discharge after the index surgery were more common among patients who underwent hip fracture surgery (3897 patients [1.3%]) compared with patients who underwent an elective THR (1647 patients [0.4%]; *P* < .001).

Table 2 reports the in-hospital outcomes for the unmatched study groups. After hip fracture surgery, 10 931 patients (3.42% [95% CI, 3.35%-3.47%]) died and, after elective THR surgery, 669 patients (0.18% [95% CI, 0.17%-0.19%]) died (absolute risk increase, 3.23% [95% CI, 2.98-3.51]; RR, 18.96 [95% CI, 17.54-20.50]; *P* < .001). All the other individual complications were more common in the patients receiving hip fracture surgery compared with those receiving the elective THR,

Figure. Comparison of Age Distribution in Patients Who Underwent Total Hip Replacement or Hip Fracture Surgery Before and After Matching



with RRs ranging from 3.41 to 7.23. At least 1 major postoperative complication occurred in 32 913 patients receiving hip fracture surgery (10.29% [95% CI, 10.18%-10.40%]) and in 5955 patients receiving elective THR (1.60% [95% CI, 1.56%-1.64%]; absolute risk increase, 8.69% [95% CI, 8.38%-8.94%]; RR, 6.41 [95% CI, 6.24-6.59]; $P < .001$).

Table 2. Postoperative Outcomes in the Unmatched Study Population (n = 690 995)

	Group, No. (%)			
	Elective THR (n = 371 191)	Hip Fracture Surgery (n = 319 804)	RR (95% CI)	*P* Value
In-hospital mortality	669 (0.18)	10 931 (3.42)	18.96 (17.54-20.50)	<.001
Postoperative				
Myocardial infarction	612 (0.16)	1797 (0.56)	3.41 (3.11-3.74)	<.001
Heart failure	2855 (0.77)	16 678 (5.22)	6.78 (6.52-7.05)	<.001
Stroke	332 (0.09)	2067 (0.65)	7.23 (6.44-8.11)	<.001
Renal failure	823 (0.22)	3355 (1.05)	4.73 (4.38-5.11)	<.001
Sepsis	291 (0.08)	1122 (0.35)	4.48 (3.93-5.09)	<.001
Any postoperative complication	5955 (1.60)	32 913 (10.29)	6.41 (6.24-6.59)	<.001
ICU admission	1015 (0.27)	4856 (1.52)	5.55 (5.19-5.94)	<.001
Readmission within 72 h of discharge	1647 (0.44)	3897 (1.22)	2.75 (2.59-2.91)	<.001
In-hospital mortality during readmission	25 (1.52)	488 (12.52)	9.24 (6.16-13.88)	<.001

Abbreviations: ICU, intensive care unit; RR, relative risk; THR, total hip replacement.

Table 3. Postoperative Outcomes in Matched Study Population (n = 234 314)

	Group, No. (%)			
	Elective THR (n = 117 157)	Hip Fracture Surgery (n = 117 157)	RR (95% CI)	*P* Value
In-hospital mortality	362 (0.31)	2130 (1.82)	5.88 (5.26-6.58)	<.001
Postoperative				
Myocardial infarction	259 (0.22)	419 (0.36)	1.62 (1.39-1.89)	<.001
Heart failure	1368 (1.17)	3114 (2.66)	2.28 (2.14-2.43)	<.001
Stroke	171 (0.15)	461 (0.39)	2.70 (2.26-3.21)	<.001
Renal failure	346 (0.30)	763 (0.65)	2.21 (1.94-2.50)	<.001
Sepsis	104 (0.09)	322 (0.27)	3.10 (2.48-3.86)	<.001
Any postoperative complication	2741 (2.34)	6890 (5.88)	2.50 (2.40-2.62)	<.001
ICU admission	435 (0.37)	1496 (1.28)	3.44 (3.09-3.83)	<.001
Readmission within 72 h of discharge	636 (0.54)	1135 (0.97)	1.78 (1.62-1.97)	<.001
In-hospital mortality during readmission	14 (2.20)	95 (8.37)	4.05 (2.30-7.17)	<.001

Abbreviations: ICU, intensive care unit; RR, relative risk; THR, total hip replacement.

In the unmatched study population, postoperative ICU admission was also more frequent in patients who underwent a hip fracture surgery compared with an elective THR (1.52% for hip fracture surgery vs 0.27% for elective THR, *P* < .001), and the SAPS II at ICU admission was higher among patients receiving hip fracture surgery compared with those receiving elective THR (45.37 [95% CI, 44.65-46.08] for hip fracture surgery vs 34.97 [95% CI, 33.69-36.25] for elective THR; *P* < .001). Among patients readmitted within 72 hours after the initial hospital discharge, in-hospital mortality during the second stay was higher in those receiving hip fracture surgery (12.5% for hip fracture surgery vs 1.5% for elective THR; *P* < .001).

Matched Study Populations

The matching procedure retained 117 157 patients who underwent hip fracture surgery and 117 157 patients who underwent an elective THR. When compared with the unmatched populations, patients who underwent hip fracture surgery included in the matched population were younger (mean age: 75.0 years [95% CI, 74.94-75.06] for matched population vs 81.7 years [95% CI, 81.66-81.74] for unmatched population; *P* < .001) and patients who underwent elective THR included in the matched population were older (mean age: 75.0 years [95% CI, 74.94-75.06] for matched population vs 70.2 [95% CI, 70.17-70.23] for unmatched population; *P* < .001). After matching, there were no clinically important differences in baseline characteristics across the patient groups (Table 1 and Figure). Standardized differences in baseline characteristics were all less than 1%. Global balance metrics, the L_1 measure and C statistic, demonstrated minimal imbalances between groups after matching (L_1 measure: 0.592 before matching vs 0.427 after matching; C statistic: 0.882 before matching vs 0.503 after matching).

Table 3 reports the in-hospital outcomes for the matched study groups. In the matched population, 2130 patients died after hip fracture surgery (1.82% [95% CI, 1.75%-1.90%]) and 362 patients died after elective THR (0.31% [95% CI, 0.28%-0.34%]; absolute risk increase: 1.51% [95% CI, 1.46%-1.55%]; RR, 5.88 [95% CI, 5.26-6.58]; *P* < .001). All other individual complications were more common in patients who underwent hip fracture surgery compared with those who underwent elective THR, with RRs ranging from 1.62 to 3.44. A major postoperative complication occurred in 6890 patients receiving hip fracture surgery (5.88% [95% CI, 5.75%-6.01%]), and 2741 patients receiving elective THR (2.34% [95% CI, 2.25%-2.43%]; absolute risk increase, 3.54% [95% CI, 3.50%-3.59%]; RR, 2.50 [95% CI, 2.40-2.62]; *P* < .001).

The sensitivity analysis, which focused on patients younger than 60 years who were residing at home before surgery, included 12 683 patients who underwent hip fracture surgery (4.0% of all patients who underwent hip fracture surgery) and 12 683 patients who underwent elective THR (3.4% of all patients who underwent elective THR). In this matched population, 58 patients died after hip fracture surgery (0.46% [95% CI, 0.34%-0.57%]), and 10 patients died after elective THR (0.08% [95% CI, 0.03%-0.13%]; absolute risk increase, 0.38% [95% CI, 0.16%-0.83%]; RR, 5.80 [95% CI, 2.96-11.35]; $P < .001$). eTable 2 in the Supplement reports the primary and secondary outcomes for this younger group who resided at home before surgery. As per the results of the primary outcome, patients with a hip fracture also demonstrated higher risk-adjusted associations with the secondary outcomes (except for postoperative myocardial infarction and postoperative heart failure).

The mean hospital LOS for patients was longer among patients who underwent hip fracture surgery compared with patients who underwent an elective THR (11.61 days [95% CI, 11.56-11.64] for hip fracture surgery vs 9.3 days [95% CI, 9.28-9.32] for elective THR; $P < .001$). eTable 3 in the Supplement reports the results of the analyses that did and did not include hospital LOS in the adjusted analyses. The results were similar for these analyses. For example, after adjustment for LOS, the RR for in-hospital mortality associated with hip fracture surgery relative to elective THR was similar to our primary analysis not adjusted for LOS (in-hospital mortality RR: 5.67 [95% CI, 5.07-6.34] for LOS-adjusted analysis vs 5.88 [95% CI, 5.26-6.58] for unadjusted primary analysis; $P < .001$ for both analyses).

Patients in the hip fracture surgery group were more frequently admitted to the ICU postoperatively (1.3% for hip fracture surgery vs 0.4% for elective THR; $P < .001$) and stayed longer in the ICU than patients who underwent an elective THR (6.3 days [95% CI, 5.8-6.8] for hip fracture surgery vs 4.5 days [95% CI, 3.8-5.2] for elective THR; $P < .001$). Patients in the hip fracture surgery group and the elective THR group demonstrated no significant difference in SAPS II values at ICU admission (40.1 [95% CI, 39.0-41.1] for hip fracture surgery vs 39.0 [95% CI, 37.1-40.9] for elective THR; $P = .261$) and in-hospital mortality in patients admitted to the ICU (18.1% for hip fracture surgery vs 15.9% for elective THR; $P = .264$). Hospital readmission within 72 hours was more frequent in patients who underwent hip fracture surgery (1.0% for hip fracture surgery vs 0.5% for elective THR; $P < .001$) and in-hospital mortality during the second admission was higher in patients receiving hip fracture surgery compared with those receiving elective THR (8.4% vs 2.2%; $P < .001$).

Discussion

Patients undergoing surgery for a hip fracture were older and had more comorbidities than patients who underwent an elective THR, and these differences accounted for some of the difference in outcomes between these groups. The primary finding of this study was that among patients who received hip fracture surgery or elective THR and were matched for age, sex, and preoperative medical conditions, the risks were higher after hip fracture surgery for in-hospital mortality (absolute risk increase, 1.51% [95% CI, 1.46%-1.55%]; RR, 5.88 [95% CI, 5.26-6.58]) and major postoperative complications (absolute risk increase, 3.54% [95% CI, 3.50%-3.59%]; RR, 2.50 [95% CI, 2.40-2.62]). If the absolute risk increases of 1.51% for in-hospital mortality and 3.54% for major postoperative complications were modifiable, they would be consistent with the number needed to treat of 59 patients for in-hospital mortality and 28 patients for major postoperative complications. Hip fracture may be associated with physiologic processes that are not present in circumstances leading to elective THR and increase the risk of morbidity and mortality following surgery.

Strengths of the study include our evaluation of a large contemporary sample of patients who underwent hip surgery in France. We took into account an extensive list of comorbidities to obtain matched patient groups who underwent an elective THR or a hip fracture surgery. The balance of covariates between the groups suggests that the RR estimates were not biased by imbalances in the recorded variables.

This study had several limitations including potential misclassification of outcomes. In-hospital mortality was defined as the primary outcome to minimize the statistical effect of these limitations. We were unable to evaluate the cause of death because these data were not available. Misclassification of secondary outcomes and potential underestimation of their frequencies remains possible; however, this would be expected to be similar in both groups. Nevertheless, we cannot completely exclude differential misclassification between the surgical groups, which could have biased the RR estimates.

Another limitation of this study is the nonstandardized follow-up period. The follow-up period was limited to the in-hospital admission period, and it is different between the 2 patient groups. Because the absolute difference in the duration of follow-up was short (ie, a difference of 2.3 days), it is unlikely that this difference in follow-up explains the magnitude of risk associated with hip fracture surgery relative to an elective THR. Although there is no national mortality database that we could link to the FHDD to capture 30-day mortality, we evaluated hospital readmissions within 72 hours of the index hospital discharge and assessed mortality during readmissions. Readmissions and in-hospital mortality during readmission were higher in the patients who underwent a hip fracture surgery relative to an elective THR. Moreover, the sensitivity analyses, adjusting for LOS, produced similar results as the main analyses and supported our main findings (eTable 3 in the Supplement).

An additional limitation of our study is the possibility of residual confounding (ie, that there were unmeasured factors affecting one group or another that were not measured by the data available for analysis). There is also the possibility of a selection bias that adjustment cannot resolve because patients having an elective THR are selected for their ability to withstand the stresses of surgery before the operation. Moreover, we did not have information on the mechanism of injury (eg, a fall due to instability, orthostatic hypotension, or poor nutritional status) or concomitant injuries. These un-

measured comorbidities in patients with hip fracture may have influenced outcomes. Although residual confounding is probable, physiologic mechanisms, such as acute stress and inflammatory states resulting from the fractures, likely explain our findings because the diverse array of preoperative comorbidities that we adjusted for in our analyses, the magnitude of effect we found, and our sensitivity analyses restricted to younger patients living at home prior to surgery (ie, the group of patients at lowest risk of frailty before surgery) demonstrated results similar to the overall analyses.

We were not able to adjust for whether surgery was performed by a consultant or surgical resident because this information was not available. In France, surgical residents are not allowed to operate on patients alone without consultant supervision. Even if that were the case, resident-performed procedures like the ones assessed in this study have clinical outcomes equivalent to those when a consultant (attending surgeon) performs the procedures alone.[21-23] Furthermore, hip fracture surgery is generally considered less invasive than total hip arthroplasty. These points suggest that if the surgeons performing the hip fracture surgeries were relatively less experienced than the surgeons performing the elective THRs, the effect on our results was likely minimal.

A meta-analysis of prospective cohort studies (22 studies among women and 17 studies among men) of age- and sex-matched patients with and without hip fractures demonstrated, after adjustment for comorbidities, that patients experiencing a hip fracture had an increased risk of mortality at 3 months (relative hazard, 5.75 [95% CI, 4.94-6.67] among women and 7.95 [95% CI, 6.13-10.30] among men).[24] Although these data establish a patient experiencing a hip fracture is at an increased risk of mortality compared with a patient who has not sustained a hip fracture, these data do not determine if the risk relates to surgery or something intrinsic to the hip fracture. A large administrative database study evaluated outcomes between patients undergoing surgery for a hip fracture and an elective THR between the years 1990 and 2007.[25] Similar to our findings, this study demonstrated that hip fracture surgery was associated with worse outcomes than THR (eg, in-hospital mortality, 1.8% for hip fracture surgery vs 0.2% for THR). In contrast to our study, the study by Sassoon et al[25] only reported unadjusted results.

In a recent study, patients with hip fracture admitted to a dedicated geriatric unit with a multidisciplinary approach after surgery had a lower risk-adjusted 6-month mortality compared with patients admitted to an orthopedic floor.[26] In our matched analysis, patients admitted to the ICU in both groups had similar disease severity (ie, SAPS II) and experienced similar in-hospital mortality. Our results also suggest the possibility that the medical specialty (ie, intensivists) and location of postoperative care after a hip fracture may be associated with outcomes.

Despite the benefits of hip surgery, it increases a patient's risk of major morbidity and mortality. The more comorbidity a patient has prior to surgery, the higher their risk of a major complication after surgery.[1] Patients undergoing hip fracture surgery are older and have higher burdens of comorbidities compared with patients undergoing elective THR. Some authors have assumed these differences account for the higher risk of complications in patients undergoing hip fracture surgery relative to elective THR. Our data suggest this is not the entire explanation and that factors intrinsic to a hip fracture may also influence the outcomes.

A hip fracture results in trauma, pain, bleeding, and immobility. These factors initiate inflammatory, hypercoagulable, stress, and catabolic states[5-7,9,27-30] that have the potential to cause complications (eg, myocardial infarction, pulmonary embolism, pneumonia, sepsis, stroke, major bleeding, disability, or mortality).[10,31] It is possible to minimize a patient's exposure to these harmful factors through rapid surgery.[12,32,33] Studies suggest that reducing the delay between a hip fracture and surgery may limit the consequences of the fracture, and the risk-adjusted mortality and major complications after hip fracture surgery may then more closely approximate those of patients undergoing elective THR.[33]

Conclusions

In a large cohort of French patients, hip fracture surgery compared with elective THR was associated with a higher risk of in-hospital mortality after adjustment for age, sex, and measured comorbidities. Further studies are needed to define the causes for these differences.

ARTICLE INFORMATION

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