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Nonoperative treatment of hip fractures

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Abstract We retrospectively reviewed a population database and a case series to compare the mortality of operative and nonoperative treatment of hip fractures in patients with severe comorbidity. Nonoperative treatment of hip fractures (bed rest or early weight bearing) was administered based on medical assessment of perioperative risk. Comparison of 30-day mortality was performed between the nonoperatively and operatively treated groups. We found that of 50,235 of hip fractures that occurred between 1992 and 1998, 89.4% were treated operatively. Thirty-day mortality rate in the nonoperatively treated patients (18.8%) was higher than the rate in operatively treated patients (11.0%) (odds ratio 1.7 times, 95% confidence interval (CI) 1.6, 1.8). In the case series, of 62 elderly patients with severe comorbidity treated nonoperatively, 41 had bed rest/traction, while 21 were mobilized early. A group of operatively treated patients (n=108) was compared to nonoperatively treated patients. Mortality with nonoperative treatment was higher with bed rest (73%) compared to early mobilization (odds ratio 3.8, 95% CI 1.1-14.0). There was no significant difference in mortality between operatively treated patients (29%) and patients treated nonoperatively with immediate mobilization (19%). Bed rest was 2.5 times

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Division of Orthopaedic Surgery and Health Policy and Analysis, Sunnybrook and Women's Health Sciences Centre, 2075 Bayview Avenue, MG 365, Toronto, Ontario, M4N 3M5, Canada more likely to be associated with mortality compared to operative treatment (95% CI 1.1–5.5).

Résumé Nous avons examiné rétrospectivement une base de données de la population et une série de cas pour comparer la mortalité du traitement opératoire et nonopératoire de fractures de la hanche dans les malades avec co-morbidités sévères. Le traitement non-opératoire (repos ou reprise précoce de l'appui) a été administré d'après une estimation médicale des risque peri-opératoires. La comparaison de la mortalité à trente jours a été faite entre les deux groupes. 89.4% des fractures (n=50,235) a été traité opérativement. Le taux de la mortalité à trente jours chez les malades traités non-opérativement (18.8%) était plus haut que le taux chez les malades opérés (11.0%) (proportion des chances 1.7 fois, intervalle de confiance 95% (CI 1.6, 1.8)). Dans la série étudiée, soixante-deux malades assez âgés avec comorbidités sévères ont été traités non-opérativement. Quarante et un ont eu un traitement par traction réductrice tandis que vingt et un malades ont été mobilisés précocément. Un groupe de malades opérés (n=108) a été comparé à des malades traité non-opérativement. La mortalité aprés traitement non-opératoire était plus haute chez les patients alités (73%) que chez ceux mobilisés rapidement (proportion des chances 3.8, intervalle de confiance 95% de 1.1-14.0). Il n'y avait pas de différence notable de mortalité entre les malades traités opérativement (29%) et les malades traités non-opérativement avec mobilisation immédiate (19%). L'alitement avait 2.5 fois plus de risque de mortalité que le traitement opératoire (95% CI 1.1-5.5).

Introduction

Most hip fractures are treated operatively, either by internal fixation or replacement arthroplasty. Surgery is generally performed as soon as possible, once the patient is stabilized medically in order to minimize complications [7, 9, 31]. Comorbid medical conditions are common in

patients with hip fracture and are associated with increased mortality following surgery [19, 25, 31]. Certain factors associated with increased mortality include dementia, institutionalized patients, postoperative pneumonia, malignancy, increased age, and deep-wound infection [5, 8, 16, 20, 23, 33]. The cause of death after surgical treatment of hip fracture is often related to cardiac complications, thromboembolism, and sepsis [31]. In some individuals with severe comorbidity, the risk of perioperative complications may be quite high, and nonoperative management may be considered. Complications of nonoperative management of hip fractures include the development of pressure sores, pneumonias, thromboembolic disease, and urinary tract infections [32] in addition to nonunions and malunions [21, 24]. Little is known regarding the outcome of nonoperative treatment for hip fractures [24, 32]. A previous study found that high-risk patients with significant comorbidity had a 49.4% mortality risk. The authors noted that the 1-year overall risk of death with surgical treatment was 21.6% [31].

The purpose of this study was to evaluate population trends in treatment and mortality rates for patients with nonoperatively treated hip fractures in the province of Ontario. In order to obtain more detailed clinical information, we also intended to compare a clinical group of patients treated nonoperatively to a matched group of operatively treated patients with respect to mortality and morbidity.

Materials and methods

We reviewed the Canadian Institute for Health Information database for the province of Ontario from 1992 to 1998. Mortality and comorbidity information was obtained about patients above the age of 65 years with a diagnosis of hip fracture (pertrochanteric, transcervical, and unspecified). Mortality rates and relative risk estimates were calculated based on type of treatment received and Charlson comorbidity scores [3, 6].

For the clinical review, hospital records and a hip fracture database were examined at two teaching hospitals from April 4, 1989 to November 26, 1995. Patients with a diagnosis of subcapital, basocervical, pertrochanteric, or intertrochanteric fracture who had been treated nonoperatively were included in the investigation. Exclusion criteria included greater trochanteric fractures, isolated lesser trochanteric fractures, and acetabular and pelvic fractures not associated with the above-named types of hip fractures. Chart abstraction was undertaken using a standardized data abstraction form to gather information regarding age, gender, type of hip fracture, mechanism of injury, comorbidity, length of hospital stay, treatment (bedrest and traction, early mobilization, internal fixation, or arthroplasty), and classification of physical status according to American Society of Anaesthetists (ASA grade). The ASA grade is a validated method of estimating patient mortality risk based on physiological parameters [18, 27].

A second group of hip-fracture patients treated operatively was matched to the nonoperative group by age, gender, hip-fracture type, and ASA grade. For the majority of patients, ages were matched within 2 years, except at the extreme ages above 90 years where age matching was within 5 years. We attempted to perform a two-to-one match for operative to nonoperative patients; however, at the extremes of age, several instances occurred in which only one patient with the appropriate matching prerequisites in the

Age and treatment distribution of patients with hip fractures

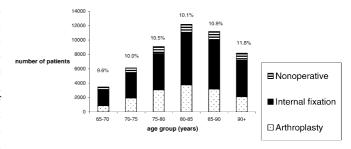


Fig. 1 Distribution of patients according to age category and fracture treatment type. The proportion of patients receiving nonoperative treatment within each age category are shown above each bar as a percentage

operative group database was found for the corresponding nonoperative patient.

The main outcome measure was 30-day mortality. We chose to examine 30-day perioperative mortality since our objective was to determine the immediate short-term risk of death associated with hip fractures. In-hospital death, length of hospital stay, and occurrence of serious complications (myocardial infarction, stroke, pulmonary embolus, infection, etc.) were abstracted from the hospital record.

The proportion of complications and incidence of death was compared across the matched treatment groups using the chi-square test. Relative risk calculations with 95% confidence limits were used to compute the risk of death for each form of treatment after stratification by ASA grade. For the population data, comorbidity adjustment was made using the Charlson index.

Results

Population data analysis

Of the 50,235 patients with hip fractures treated in Ontario between 1992 and 1998, 10.6% were treated nonoperatively (Table 1). Of the 25,237 pertrochanteric fractures, 89% were treated with internal fixation; 61% of transcervical fractures were treated with arthroplasty. Of the operatively treated patients, 25.2% had one or more comorbidities compared with 28.2% of the nonoperatively treated group (P<0.001).

The proportion of patients receiving nonoperative treatment was relatively constant across the different age groups (9.6–11.8%, Fig. 1). The distribution of patients relegated to operative and nonoperative treatments for hip fractures and their respective mortalities was relatively constant over the time period of the study (Table 2).

Nonoperatively treated patients were 1.7 times (95% confidence interval (CI) 1.6–1.8) as likely to die within 30 days as operatively treated patients overall (Table 1). Mortality with nonoperative treatment remained higher than operative treatment for all fracture types (Table 1). In transcervical fractures treated operatively, the risk of dying within 30 days was 1.5 times (95% CI 1.3–1.7)

Table 1 Ontario population data: Comparison of mortality rates for operative and nonoperative treatment of hip fractures (1992–1998). Mortality rates, expressed as a percentage, are given

in parentheses for each group; 95% confidence intervals (CI) are given in parentheses for the relative risk estimates

	Operative Treatr	nent	Relative risk		
	Arthroplasty	Internal fixation	Nonoperative Rx	Nonoperative vs. operative	Arthroplasty vs. internal fixation
Fracture type:					
Pertrochanteric Transcervical Unspecified	617 (13.4) 13,337 (10.9) 921 (11.1)	22,473 (12.0) 6,698 (7.4) 878 (13.8)	2,147 (19.2) 1,789 (20.0) 1,375 (16.7)	1.6 (1.4, 1.8) 2.1 (1.9, 2.4) 1.3 (1.1, 1.6)	1.1 (0.9, 1.4) 1.5 (1.3, 1.7) 0.8 (0.6, 1.1)
Charlson group:					
0 1 2	11,085 (9.3) 3,184 (15.4) 606 (19.0)	22,498 (9.3) 6,256 (14.8) 1,295 (22.1)	3,811 (14.9) 1,194 (26.5) 306 (37.3)	1.6 (1.5, 1.8) 1.8 (1.6, 2.1) 1.8 (1.4, 2.3)	1.0 (0.9, 1.1) 1.0 (0.9, 1.1) 0.86 (0.6, 1.1)
Age distribution (years):	:				
65–70 70–75 75–80 80–85 85–90 90+	862 (4.4) 1,913 (5.7) 3,054 (8.5) 3,763 (10.3) 3,180 (14.1) 2,103 (18.9)	2,283 (3.3) 3,594 (5.3) 5,074 (7.7) 7,204 (10.5) 6,788 (13.2) 5,106 (19.5)	334 (10.2) 610 (12.0) 956 (13.8) 1,226 (17.8) 1,223 (21.3) 962 (29.1)	2.8 (1.9, 4.2) 2.2 (1.7, 2.9) 1.7 (1.4, 2.1) 1.7 (1.4, 2.0) 1.6 (1.4, 1.8) 1.5 (1.3, 1.7)	1.3 (0.9, 1.9) 1.1 (0.9, 1.4) 1.1 (0.9, 1.3) 0.98 (0.86, 1.1) 1.1 (0.98, 1.2) 0.97 (0.85, 1.1)

Table 2 Hip fracture mortality by year, type of treatment, and Charlson comorbidity index for Ontario population (1992–1998). Mortality rates, expressed as a percentage, are given in parentheses for each group

	1992	1993	1994	1995	1996	1997	1998
Arthroplasty Internal Fixation Nonoperative	1,908 (11.2) 4,415 (10.4) 742 (19.0)	2,045 (10.5) 4,418 (11.0) 748 (18.9)	2,068 (10.4) 4,338 (9.9) 765 (20.1)	2,073 (10.3) 4,164 (12.1) 715 (20.1)	2,266 (12.8) 4,316 (12.4) 820 (19.8)	2,239 (11.6) 4,258 (10.9) 802 (19.0)	2,276 (10.2) 4,140 (10.3) 719 (14.7)
Charlson group: 0 1 2	4,972 (8.7) 1,699 (16.6) 394 (24.4)	5,055 (9.5) 1,742 (15.8) 414 (21.3)	5,616 (9.4) 1,302 (16.4) 253 (22.5)	5,360 (10.6) 1,311 (16.9) 281 (26.0)	5,695 (11.3) 1,467 (19.2) 240 (27.5)	5,701 (10.6) 1,333 (15.4) 265 (24.2)	4,995 (8.8) 1,780 (14.3) 360 (19.7)

higher following replacement arthroplasty versus fracture fixation. In pertrochanteric or unspecified fractures, no difference in mortality risk was seen between replacement arthroplasty and internal fixation treatments. Mortality risk remained the same across the Charlson comorbidity scores and across the various age groups (Table 1).

With increasing comorbidity on the Charlson index, it was noted that mortality increased for both nonoperative and operative treatment. The overall mortality rate for patients with a Charlson score of zero, including both operative and nonoperative forms of treatment, was 9.9% 37, 394 patients. For patients with a Charlson comorbidity index of 1, the combined mortality rate was 16.3% 10, 634 patients. The mortality rate for patients with a Charlson score of 2 or above was 23.3% of 2, 207 patients. Nonoperatively treated patients had a higher risk of death at all comorbidity levels (Table 1) compared to operatively treated patients. It should be noted that 71.7% of nonoperatively treated patients had Charlson scores of zero.

Increasing age was associated with an increasing risk of death within 30 days. Nonoperatively treated patients at all ages were at increased risk of death compared with operatively treated patients (Table 1).

Clinical cohort comparison

We identified 62 patients who had been treated nonoperatively for transcervical or pertrochanteric hip fractures (Table 3). Forty-one patients were treated with bedrest or traction, and 21 were mobilized early. Those in the early mobilization group were allowed bed-to-chair transfers with assistance immediately, with progression to ambulation as tolerated as soon as possible. Oral nonnarcotic analgesia and urinary catheterization was used to promote patient comfort in all nonoperatively treated patients. No differences in age or fracture type were found between the early mobilization and bedrest groups (*P*>0.05) (Table 3). The proportion of women patients was higher in

Table 3 Demographic and unadjusted complication rates of operatively and nonoperatively treated patients with hip fractures. *ASA* American Society of Anesthetists, grade classification of risk for anesthesia (see text for details on grading criteria)

	Operative	Nonoperative		P value *	P value **
		Bedrest	Early mobilization		
Number Age (years + standard deviation) Men Women Length of stay (days) Subcapital fracture Intertrochanteric fracture	108 79.07+13.21 39 (36.1%) 71 (63.9%) 28.79+27.15 52 (48.1%) 56 (51.9%)	41 76.92+16.97 19 22 23.71+40.01 21 20	21 78.77+10.79 3 18 24.10+22.50 12 9	0.60 0.01 0.01 0.96 0.66 0.66	0.51 0.93 0.93 0.32 0.52 0.52
Surgical treatment:					
Internal fixation Hemiarthroplasty Total hip arthroplasty	76 31 1				
ASA grade:					
I II III IV	0 4 (3.7%) 64 (59.3%) 40 (37.0%)	0 0 18 (44%) 23 (56%)	0 3 (14%) 16 (76%) 2 (10%)	0.01 0.02 0.0004	0.72 0.57 0.67
Preoperative comorbidities:					
Dementia Renal failure Cancer Parkinson's Thyroid Cataract Acute myocardial infarction Cerebrovascular disease Chronic obstructive lung disease Hypertension, ischemic heart disease Diabetes mellitus Depression	28 (25.9%) 9 (8.3%) 9 (8.3%) 6 (5.6%) 7 (6.5%) 12 (11.1%) 44 (40.7%) 24 (22.2%) 32 (29.6%) 63 (58.3%) 14 (13.0%) 2 (1.9%)	13 6 8 2 3 2 12 6 10 18 4 0	9 1 6 0 2 0 7 2 5 7 1 3	0.39 0.25 0.42 0.30 0.76 0.30 0.74 0.57 0.96 0.42 0.49	0.19 0.53 0.008 0.49 0.70 0.07 0.19 0.13 0.45 0.02 0.33 0.27
Complications:					
Acute myocardial infarction Bowel obstruction Chest pains Congestive heart failure Cerebrovascular disease Deep venous thrombosis Delirium (new) Depression Ischemic heart disease Local infection Pulmonary embolism Pneumonia Renal failure Urinary tract infection Hospital deaths	6 (5.6%) 1 (0.9%) 0 6 (5.6%) 4 (3.7%) 6 (5.6%) 1 (0.9%) 1 (0.9%) 1 (0.9%) 5 (4.6%) 8 (7.4%) 1 (0.9%) 4 (3.7%) 13 (12.0%)	7 0 1 3 1 1 0 0 0 0 0 0 7 3 0 27	0 0 0 0 0 1 0 0 0 0 0 0 2 0 1 2	0.04 - 0.47 0.20 0.47 0.62 - - - 0.42 0.20 0.16 0.00003	0.18 0.45 0.19 0.84 0.44 0.49 0.45 0.45 0.45 0.45 0.45 0.11 0.11 0.13
Deaths	31 (28.7%)	30	4	0.00005	0.0007

the early mobilization group (P=0.01). The bedrest group contained a relatively higher number of patients with ASA grade IV in comparison with the early mobilization group (P=0.0004). Patients in the two groups were similar with respect to preadmission comorbidities, except in the category of depression, which occurred with greater frequency in the early mobilization group (P=0.01). The bedrest group had significantly more acute myocardial infarctions compared to the early mobilization group

(P=0.04). This may have been a factor that actually necessitated restriction to bedrest. In-hospital mortality was significantly higher in the bedrest group (27 of 41 patients) compared to the early mobilization group (2 of 21) (P=0.00003). This also held true for overall number of deaths (P=0.00005) within 1 month.

Further mortality analysis (Table 4) revealed that the relative risk of death associated with bedrest treatment compared to early mobilization was 3.8 (95% CI

Table 4 Odds of death by American Society of Anesthetists (ASA), classification of risk for anesthesia (see text for details on grading criteria) grade and treatment for the hospital cohort. CI confidence interval

Mortality rate per treatment type	Deaths	Survival	Treatment type	Odds ratio (95% CI)
Overall mortality:				
Bedrest Early mobilization Operative	30 (73%) 4 (19%) 31 (29%)	11 17 77	Bedrest vs early mobilization Operative vs early mobilization Bedrest vs operative	*3.8 (1.1–14.0) 1.5 (0.5–4.9) *2.5 (1.1–5.5)
Mortality in patients with ASA grade III:				
Bedrest Early mobilization Operative	8 (44%) 2 (12.5%) 16 (25%)	10 14 48	Bedrest vs early mobilization Early mobilization vs operative Bedrest vs operative	3.4 (0.6–19.3) 0.5 (0.1–2.4) 1.8 (0.6–5.4)
Mortality in patients with ASA grade IV:				
Bedrest Early mobilization Operative	22 (96%) 1 (50%) 14 (35%)	1 1 26	Bedrest vs early mobilization Operative vs early mobilization Bedrest vs operative	1.9 (0.07–53.0) 1.4 (0.08–24.0) 2.7 (0.3–22.0)

^{*} Indicates values that were significant at P<0.05 – that is, the confidence interval excludes 1.0

1.1–14.0); however, the difference was no longer significant after stratifying by ASA grade given the size of the sample.

Discussion

Between 1992 and 1998, of all patients with hip fractures treated in Ontario, 11% were treated nonoperatively, with the percentage relatively stable. Of all patients treated, 18.8% died within 1 month of fracture. The 30day mortality rate was higher in the nonoperatively treated patients compared to operatively treated patients, regardless of age or the presence or absence of comorbidity. Previous studies have shown relatively high rates of mortality of nonoperative treatment of hip fractures. Ions and Stevens reported a 60.8% mortality rate at 6 months in nonoperatively treated patients with hip fractures and severe medical comorbidity [13]. Hornby et al. randomly assigned 106 patients with extracapsular hip fractures to internal fixation or traction treatment. At the end of 6 months, no statistically significant difference in mortality, pain, or complications was noted [10]. More specifically, patients assigned to operative fixation (n=55) had a 6-month mortality rate of 24% compared to a mortality rate of 22% in the 51 patients assigned to nonoperative traction treatment. Raaymakers prospectively evaluated 170 patients with impacted femoral neck fractures treated with early mobilization [26]. Of these, 16% had died within 1 year and 86% had achieved union. The 11% risk of death within 30 days of surgical treatment in our investigation is consistent with other studies [4, 15, 32]. Medical comorbidity does increase mortality, which was seen in one study of 12 patients with end-stage renal disease and who sustained hip fractures and underwent surgical treatment [30]. A 50% mortality rate was found at 1 year [30]. Levi found that 3-month mortality was increased in patients who received noncemented hemiarthroplasty [14].

An interesting observation was that replacement arthroplasty was associated with a higher mortality rate than internal fixation in patients with transcervical fractures. Several studies found no difference in mortality rates between patients with displaced subcapital hip fractures undergoing either hemiarthroplasty or internal fixation [2, 12, 22, 28, 29]. Other previous investigations found increased mortality rates with arthroplasty compared to internal fixation in patients with transcervical hip fractures [1, 11, 15, 34]. Some reasons cited for these differences include older age and increased medical comorbidity in patients selected for hemiarthroplasty [34]. In the present study, no differences in age or comorbidity were seen between the arthroplasty and internal fixation groups, yet the difference in mortality for the two procedures occurred. The population data did not specify the type of arthroplasty that had been performed, either unipolar or bipolar hemiarthroplasties. It is possible that differences in blood loss, operative time, and fat embolism associated with the use of cement may have been related to the variation in mortality in the arthroplasty and internal fixation groups. This is a potentially important issue that deserves further consideration through a prospective study, since - using administrative data - we were unable to account for the differences in mortality in this patient group.

In the clinical review, we noted that overall mortality in the operatively treated group was not significantly different as compared to those patients mobilized early in the nonoperative treatment group. This information may be useful for families of medically unwell patients as they evaluate the risks of proposed surgical treatment of hip fractures. In a patient who is medically unfit for surgery but is able to be mobilized, nonoperative treatment with early mobilization represents an alternative that is not necessarily associated with immediate or definite mortality.

The data obtained from the CIHI database and the clinical samples are subject to the usual selection bias in-

herent in nonrandomized studies. The assessment was limited to mortality associated with hip-fracture treatment. Quality-of-life assessment could not be performed. Consequently, patient function, pain, and quality of life associated with nonoperative versus operative treatment remains unknown. This investigation was limited to short-term assessment of mortality, since our purpose was to assess immediate perioperative risk of death associated with hip-fracture treatment. This information would be useful to patients and families making decisions regarding treatment, and should constitute a component of future prospective studies.

Other limitations of our study included the use of the ASA grade for stratifying comorbidity. ASA grade was used to stratify patients in the clinical cohort in an effort to reduce bias between the operative and nonoperative treatment groups. We recognize that ASA grade is an incomplete method for adjusting for significant comorbidities. Other authors have used scoring systems to assess perioperative risk [17]. ASA grade may not always reflect the impact of major concurrent illnesses. ASA simply designates the category of anesthetic risk to the patient based on current medical problems. Nevertheless, those patients deemed unfit for surgery who were mobilized, still had a lower risk of death than those not mobilized.

While operative treatment of hip fractures certainly has its benefits, as documented in several previous studies [7, 35], it is not without risk of death. In a patient who is medically unfit for surgery, it is important to consider nonoperative treatment on an individual basis, taking into account concurrent medical problems and functional demands. If nonoperative treatment is chosen, and if it is medically allowable for the patient not to be restricted to bedrest, then the patient should be mobilized to minimize the many complications associated with prolonged recumbency, despite not having undergone fracture fixation. Information from this study will help health care providers and caregivers to assess the potential risk of hip-fracture treatment and to enable more informed decision making for families and patients confronted with a hip fracture in the face of severe medical comorbidity.

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