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ORIGINAL ARTICLE

Retrospective Cohort Study

Two surgical pathways for isolated hip fractures: A comparative study

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Abstract

BACKGROUND

Hip fractures (HF) are common among the aging population, and surgery within 48 h is recommended. Patients can be hospitalized for surgery through different pathways, either trauma or medicine admitting services.

AIM

To compare management and outcomes among patients admitted through the trauma pathway (TP) *vs* medical pathway (MP).

METHODS

This Institutional Review Board-approved retrospective study included 2094 patients with proximal femur fractures (AO/Orthopedic Trauma Association Type 31) who underwent surgery at a level 1 trauma center between 2016-2021. There were 69 patients admitted through the TP and 2025 admitted through the MP. To ensure comparability between groups, 66 of the 2025 MP patients were propensity matched to 66 TP patients by age, sex, HF type, HF surgery, and American Society of Anesthesiology score. The statistical analyses included multivariable analysis, group characteristics, and bivariate correlation comparisons with the χ^2 test and *t*-test.

RESULTS

After propensity matching, the mean age in both groups was 75-years-old, 62% of both groups were females, the main HF type was intertrochanteric (TP 52% *vs* MP 62%), open reduction internal fixation was the most common surgery (TP 68% *vs* MP 71%), and the mean American Society of Anesthesiology score was 2.8 for TP and 2.7 for MP. The majority of patients in TP and MP (71% *vs* 74%) were geriatric (≥ 65-years-old). Falls were the main mechanism of injury in both groups (77% *vs* 97%, P = 0.001). There were no significant differences in pre-surgery anticoagulation use (49% *vs* 41%), admission day of the week, or insurance status. The incidence of comorbidities was equal (94% for both) with cardiac comorbidities being dominant in both groups (71% *vs* 73%). The number of preoperative consultations was similar for TP and MP, with the most common consultation being cardiology in both (44% and 36%). HF displacement occurred more among TP patients (76% *vs* 39%, P = 0.000). Time to surgery was not statistically different (23 h in both), but length of surgery was significantly longer for TP (59 min *vs* 41 min, P = 0.000). Intensive care unit and hospital length of stay were not statistically different (5 d *vs* 8 d and 6 d for both). There were no statistical differences in discharge disposition and mortality (3% *vs* 0%).

CONCLUSION

There were no differences in outcomes of surgeries between admission through TP *vs* MP. The focus should be on the patient's health condition and on prompt surgical intervention.

Key Words: Isolated hip fractures; Admitting service; Trauma center; Time to surgery; American Society of Anesthesiologists score; Preoperative consultations

Core Tip: We evaluated 2094 hip fracture patients admitted for surgery to a level 1 trauma center over a 5-year period. Patients were stratified based on the admitting service, either trauma or medical. After a propensity score matching comparison of 66 patients in each group it was revealed that there was no difference in outcomes. Predictors of a prolonged hospital length of stay were increased American Society of Anesthesiology score and delayed time to surgery. Predictors of mortality were increased American Society of Anesthesiology score and increased age. The health condition of the patient, but not the admitting service, was the defining factor for management and outcomes.

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INTRODUCTION

As life expectancy rises around the world along with the number of elderly individuals, the incidence of hip fractures (HF) is estimated to reach 6.3 million in 2050[1]. Each year in the United States alone over 300000 people aged 65 and older are hospitalized for HF[2-4].

Patients can be hospitalized for operative fixation of HF through different pathways, including trauma, orthopedic, and medicine admitting services[5-8]. In the studies comparing surgical *vs* nonsurgical pathways it has been reported that the admitting service can affect the management patterns and outcomes of patients with HF[5,6,9].

For example, in one study by Greenberg *et al*[5], the authors determined that patients with HF admitted to the medicine service had longer hospital stays than patients admitted to the orthopedic service, even after controlling for demographics and preoperative comorbidities. A 2018 study by Lott *et al*[6] also concluded that patients with HF admitted to the medicine service had longer lengths of stay (LOS) and more complications compared to patients admitted to the trauma/orthopedic service. In contradiction to these conclusions, other studies determined that there were no differences in complication rates or LOS between the admitting services[8,10].

The impact of preoperative pathways on the outcomes was previously addressed in diverse cohorts of patients, which differed in inclusion/exclusion criteria such as age, hospital settings, mechanism of injury, preoperative medication, or surgical management[7,8,10-12]. The rationale for our study was the existing controversy over which hospital service is best suited for the optimal admission process for patients with HF and associated with the best outcomes.

At our institution patients with HF can be admitted through the Emergency Department or through the Trauma Department depending on how they are transported to the hospital by the first responders. If the patient is admitted through the Emergency Department, the hospitalist or internal medicine physician will admit the patient to the Medical Service. If the patient is admitted through the Trauma Department, the trauma surgeon will admit the patient to the Trauma Service. After a radiographic confirmation of a HF, a consultation of the orthopedic surgeon is requested by the admitting service. After admission to either service, the internal medicine physician or the trauma surgeon may request additional consultations if necessary for preoperative clearance.

We analyzed the clinical characteristics and outcomes of patients admitted for HF surgery through trauma services and compared to those admitted through medical services.

MATERIALS AND METHODS

This Institutional Review Board-approved retrospective cohort study was granted a waiver of informed consent and included 2094 adult patients (≥ 18-years-old) with HF who underwent operative fixation at an urban level 1 trauma center between January 1, 2016 and May 31, 2021. All patients presented with AO/Orthopedic Trauma Association fracture Type 31A-C[13]. Patients with other traumatic, non-orthopedic injuries requiring surgical intervention, including head, thoracic, or abdominal injuries were excluded. Additional exclusion criteria were: In-hospital HF; patients with pathologic fractures; periprosthetic fractures; open fractures; previous fracture; or surgery at the current fracture site.

Patients were stratified in two groups based on the admitting service: Those who were admitted through the trauma pathway (TP) of the level 1 trauma center (n = 69); and those who were admitted through the medical pathway (MP) (n = 2025).

To ensure comparability between groups, propensity matching by age, sex, type of HF, type of HF surgery, and American Society of Anesthesiology (ASA) score was performed, which resulted in 66 patients in each group for comparison (Figure 1). In the propensity matching process there were 3 TP patients who did not match and therefore were excluded from the comparison.

Analyzed variables included age, sex, body mass index, mechanism of injury, Glasgow Coma Score, comorbidities, pre-injury anticoagulation use, ASA score, insurance status, admission day of the week, number of preoperative consultations, type of HF, presence of fracture displacement, time to surgery, time of surgery, type of HF surgery, intensive care unit and hospital lengths of stay (ICULOS, HLOS), discharge disposition, and mortality. We also analyzed the weekend effect of admissions in the propensity matched groups.

Variables were identified *via* the International Classification of Diseases 9th and 10th edition and extracted from patient's electronic medical records. Geriatric age was defined as 65 years or older[14]. Weekend effect was defined as any of the following due to admission from Friday to Sunday: A longer time to surgery; longer HLOS; or higher mortality[12,15-17]. Extended HLOS was defined as more than 6 d. This number was based on our data and the commonly reported HLOS for patients with HF[3,18-20].

Statistical analysis

Statistical analysis was performed using IBM SPSS Statistics software version 23.0 (IBM, Armonk, NY, Untied States). Propensity score matching was completed without replacement, with a 0.2 caliper and with a randomized order of patients while drawing matches, which resulted in a one-to-one paired selection. The analyses included group characteristics and bivariate correlation comparisons. Categorical variables were analyzed with the χ^2 test. Variable means were analyzed using independent samples t-test and Mann Whitney U test. Multivariable analysis for the predictors of extended LOS and mortality was performed in the total population. Receiver operating characteristic (ROC) area under the curve analysis was used to determine threshold values for extended length of stay and mortality prediction variables. One way analysis of variance was used for the analysis of age and HLOS by ASA score. Statistical significance was assumed when the calculated P value was below 0.05.

RESULTS

Over the duration of 65 mo, 2094 patients with HF were admitted for surgical repair: 69 (3.3%) patients through TP; and 2025 (96.7%) through MP.

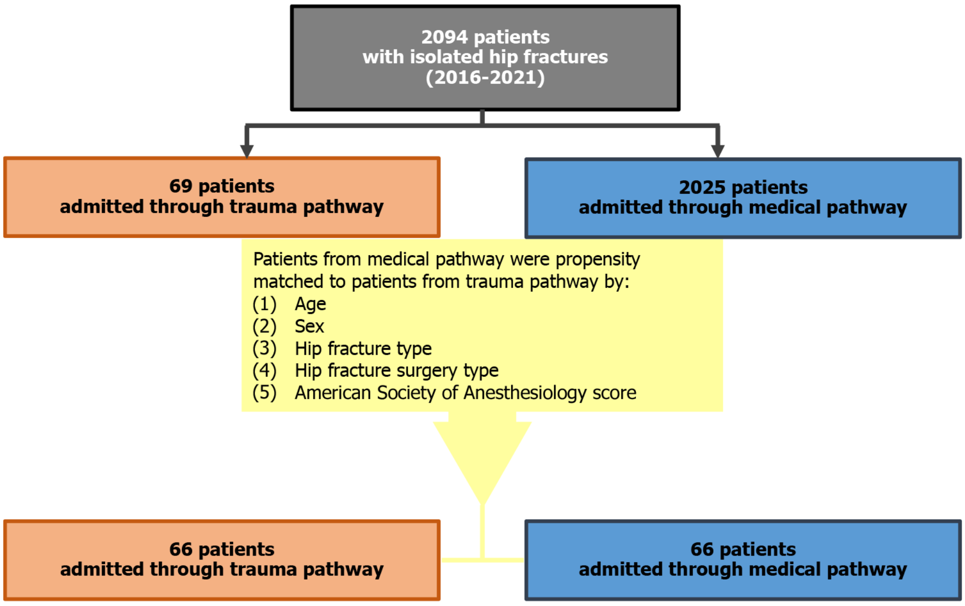

Figure 1 Study design and flow chart of all patients with hip fractures.

General comparison

The general comparison between all TP and MP patients is presented in Table 1. MP patients were older and included more geriatric patients; however, geriatric patients comprised more than two-thirds of each group. Falls were the prevailing mechanism of injury in both groups, comprising at least 74% in each group. The analyzed cohorts had slightly different types of HF. There were no differences in sex, admission day, ASA score distribution, time to surgery, type of HF surgery, HLOS, discharge disposition, and mortality.

Multivariable analysis and ROC analysis showed that increased ASA score and extended time from admission to surgery were two statistically significant predictors for the extended HLOS. The significant predictors for mortality were age > 83 (P = 0.000, odds ratio: 6.0) and ASA score ≥ 4 (P = 0.000, odds ratio: 5.1). The threshold values were based on the ROC curve with area under the curve or concordance index of 0.697 (95% confidence interval: 0.640-0.755) and 0.698 (95% confidence interval: 0.630-0.765).

Propensity matched comparison

The comparison of propensity matched patients, 66 TP and 66 MP, is presented in Table 2. Propensity matched TP patients had statistically higher motor vehicle collisions as a mechanism of injury (falls were still the prevailing mechanism of injury in more than three-quarters of patients in both groups), a higher presence of HF displacement, more requests for neurological consultation, and a longer duration of surgery.

There were no differences between the groups in body mass index, comorbidities, anticoagulation use, admission day, number of consultations before surgery, insurance status, and mean time from admission to HF surgery. An additional analysis of the time from admission to surgery through TP and MP divided in 12-h increments is presented in Figure 2. At any 12 h interval, the number of patients in the TP and MP groups was similar, with two-thirds (63.6% in TP and 66.7% in MP) having surgery within 24 h and over 90% (95.5% in TP and 93.9% in MP) having surgery within 48 h of admission.

The two groups had comparable ICULOS and HLOS. The similar distribution of HLOS in propensity matched TP and MP is shown in Figure 3. The discharge disposition and mortality were also comparable. The 2 expired patients in the TP group were 87-years-old and 96-years-old. One patient had renal failure and was discharged to hospice. The other patient had a cardiac arrest during surgery.

Within the propensity matched TP group there were 41 patients admitted on a weekday and 25 patients admitted on a weekend. The two sub-groups had comparable time to surgery (22.8 h *vs* 22.5 h, P = 0.926), HLOS (5.6 d *vs* 7.6 d, P = 0.130), and mortality (2.4% *vs* 4.0%, P = 0.720). Within the propensity matched MP group there were 37 patients admitted on a weekday and 29 patients admitted on a weekend. The two sub-groups had comparable time to surgery (21.7 h *vs* 24.7 h, P = 0.490) and HLOS (5.3 d *vs* 6.9 d, P = 0.239). There was no mortality in the MP sub-groups.

Mean age and HLOS stratified by ASA score in the different patient groups is presented in Table 3. One way analysis of variance demonstrated that in the total population, age and HLOS both increased significantly (both P = 0.000) as ASA increased. In the propensity matched TP population, age increased significantly (P = 0.001) as ASA increased from 2 to 4. Higher ASA was associated with older age and longer HLOS.

Table 1 General comparison between all trauma pathway and medical pathway patients, *n* (%)

Variable	Trauma, *n* = 69	Medicine, *n* = 2025	*P* value
Age in yr	72.9 (17.5)	83.2 (9.2)	0.000[a]
Geriatric	47 (68.1)	1928 (95.2)	0.000[a]
Sex, female/male	44 (63.8)/25 (36.2)	1367 (67.5)/658 (32.5)	0.515
Mechanism of injury	-	-	0.000[a]
Fall	51 (73.9)	2005 (99.0)	-
MVC	18 (26.1)	11 (0.5)	-
Stress fracture	0 (0.0)	9 (0.4)	-
Admission day	-	-	0.171
Monday	10 (14.5)	317 (15.7)	-
Tuesday	12 (17.4)	281 (13.9)	-
Wednesday	16 (23.2)	268 (13.2)	-
Thursday	5 (7.2)	311 (15.4)	-
Friday	10 (14.5)	297 (14.7)	-
Saturday	7 (10.1)	276 (13.6)	-
Sunday	9 (13.0)	275 (13.6)	
Hip fracture type	-	-	0.000[a]
Femoral neck/head	28 (40.6)	972 (48.0)	-
Intertrochanteric	35 (50.7)	1020 (50.4)	-
Intertrochanteric with subtrochanteric	6 (8.7)	33 (1.6)	-
Hip surgery type	-	-	0.205
Total arthroplasty	4 (5.8)	177 (8.7)	-
Hemi arthroplasty	15 (21.7)	613 (30.3)	-
Open reduction and internal fixation	47 (68.1)	1116 (55.1)	-
Pinning	3 (4.3)	119 (5.9)	-
ASA score before hip surgery	2.8 (0.6)	2.9 (0.6)	0.044[a]
ASA score before hip surgery	-	-	0.079
I	1 (1.4)	9 (0.4)	-
II	21 (30.4)	393 (19.4)	-
III	41 (59.4)	1393 (68.8)	-
IV	6 (8.7)	230 (11.4)	-
No. of consultations before hip surgery	0.9 (0.9)	0.9 (0.8)	0.620
Time: Admission to hip surgery in h	23.0 (13.4)	27.0 (28.5)	0.255
Hospital length of stay in d	6.3 (4.4)	5.7 (4.9)	0.347
Mortality	2 (2.9)	62 (3.1)	0.938
Hospital disposition	-	-	0.068
Skilled nursing facility	28 (40.6)	1147 (56.6)	-
Rehabilitation	25 (36.2)	589 (29.1)	-
Home	13 (18.8)	212 (10.5)	-
Hospice	1 (1.4)	51 (2.5)	-
Expired in hospital	1 (1.4)	11 (0.5)	-
Long-term acute care facility	1 (1.4)	15 (0.7)	-

$^aP < 0.005$ denotes significant difference.

ASA: American Society of Anesthesiologists; MVC: Motor vehicle collision; SD: Standard deviation.

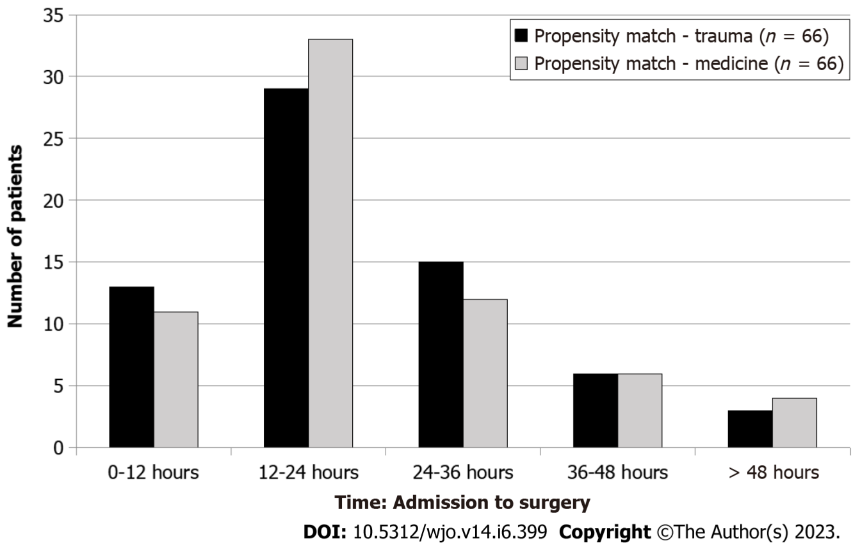

Figure 2 Time from admission to surgery in propensity matched trauma and medical pathway groups in 12 h increments.

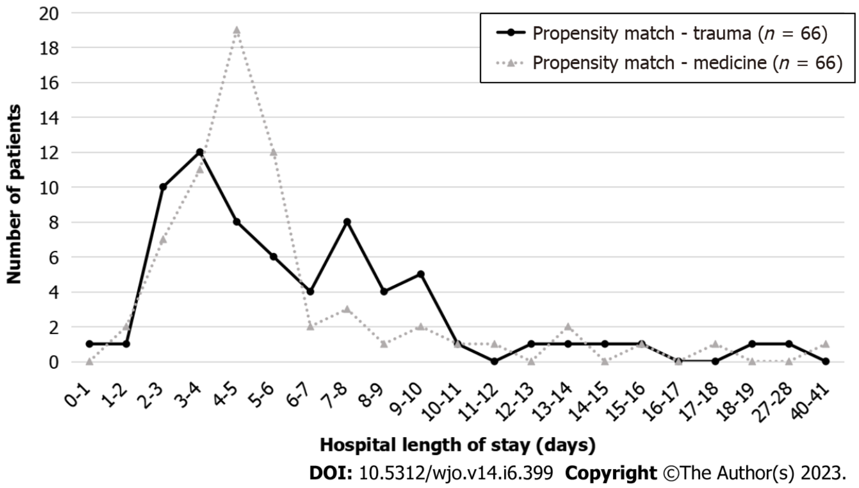

Figure 3 Number of patients in propensity matched trauma and medical pathway groups stratified by hospital length of stay.

DISCUSSION

In studies that relate to different admission pathways and how the admission pathway affects the outcomes in patients with HF, there is a noticeable difference in the age of included patients, ranging from 50-years-old to 75-years-old[7,9-11]. Other inclusion/exclusion criteria also differ significantly, as some HF studies exclude patients undergoing total hip replacement, patients who expired before hospital discharge, patients who were not admitted to a surgical ICU, or include only patients with mechanism of injury as fall or only patients with presurgical transthoracic echocardiography[7,12,17,19,21]. There is also a broad array of different settings ranging from level 1 trauma centers to safety-net and tertiary hospitals[8,19,22,23].

In our study, we utilized propensity score matching to address the imbalance in the characteristics of TP and MP patients, as was recommended by Chuang *et al*[10] in their comparison of medicine *vs* orthopedic service for management of HF. There are only two published studies on patients with HF that utilized the propensity score matching methodology. However, they were conducted to evaluate the impact of preoperative echocardiography[24,25].

Our results indicated that ASA score as a measure of patient's condition is a predictor of a longer HLOS and mortality. Our findings support the conclusions reported by Garcia *et al*[26] that an increase

Table 2 Characteristics of propensity matched patients admitted through the trauma pathway and medical pathways, *n* (%)

Variable	Trauma, *n* = 66	Medicine, *n* = 66	*P* value
Age	75.0 (14.5)	75.0 (13.3)	0.990
Sex, female/male	41 (62.1)/25 (37.9)	41 (62.1)/25 (37.9)	1.000
ASA Score before hip surgery	-	-	0.498
II	19 (28.8)	23 (34.8)	-
III	41 (62.1)	40 (60.6)	-
IV	6 (9.1)	3 (4.5)	-
Hip fracture type	-	-	0.057
Femoral neck/head	27 (40.9)	25 (37.9)	-
Intertrochanteric	34 (51.5)	41 (62.1)	-
Intertrochanteric with subtrochanteric	5 (7.6)	0 (0.0)	-
Hip surgery type	-	-	0.650
Total arthroplasty	4 (6.1)	6 (9.1)	-
Hemi arthroplasty	15 (22.7)	10 (15.2)	-
Open reduction and internal fixation	45 (68.2)	47 (71.2)	-
Pinning	2 (3.0)	3 (4.5)	-
Geriatric	47 (71.2)	49 (74.2)	0.696
BMI	24.9 (6.6)	24.9 (5.0)	0.988
Comorbidities	62 (93.9)	62 (93.9)	1.000
Cardiac comorbidities	47 (71.2)	48 (72.7)	0.846
Anticoagulation	32 (48.5)	27 (40.9)	0.381
Mechanism of injury, Fall/MVC	51 (77.3)/15 (22.7)	64 (97.0)/2 (3.0)	0.001[a]
Admission day	-	-	0.401
Monday	9 (13.6)	7 (10.6)	-
Tuesday	11 (16.7)	8 (12.1)	-
Wednesday	16 (24.2)	10 (15.2)	-
Thursday	5 (7.6)	12 (18.2)	-
Friday	10 (15.2)	13 (19.7)	-
Saturday	7 (10.6)	10 (15.2)	-
Sunday	8 (12.1)	6 (9.1)	-
Glasgow coma score	14.6 (0.8)	15.0 (0.2)	0.000[a]
Hip fracture displacement	50 (75.8)	26 (39.4)	0.000[a]
No. of consultations before hip surgery	1.8 (0.9)	1.7 (0.9)	0.198
Consultations before surgery	-	-	-
Cardiology	29 (43.9)	24 (36.4)	0.375
Neurology/neurosurgery	12 (18.2)	1 (1.5)	0.001[a]
Pulmonology	2 (3.0)	5 (7.6)	0.244
Time: Admission to hip surgery in h	22.7 (12.7)	23.0 (16.9)	0.892
Orthopedic surgery length in h	1.0 (0.6)	0.7 (0.3)	0.000[a]
ICULOS in d	4.5 (4.3)	8.0 (4.6)	0.066
HLOS in d	6.3 (4.5)	6.0 (5.4)	0.709
Mortality	2 (3.0)	0 (0.0)	0.154

Hospital disposition	-	-	0.507
Skilled nursing facility	29 (43.9)	31 (47.0)	-
Rehabilitation	29 (43.9)	26 (39.4)	-
Home	6 (9.1)	9 (13.6)	-
Expired in hospital/hospice	2 (3.0)	0 (0.0)	-
Insurance status	-	-	0.060
Public	48 (72.7)	47 (71.2)	-
Private	10 (15.2)	17 (25.8)	-
Uninsured	8 (12.1)	2 (3.0)	-

[a]$P < 0.005$ denotes significant difference.

ASA: American Society of Anesthesiologists; BMI: Body mass index; HLOS: Hospital length of stay; ICULOS: Intensive care unit length of stay; MVC: Motor vehicle collision; SD: Standard deviation.

Table 3 Mean age and hospital length of stay stratified by American Society of Anesthesiologists score, *n* (%)

ASA, score	All patients, *n* = 2094			Propensity matched trauma group, *n* = 66			Propensity matched medicine group, *n* = 66		
	n %	Age, mean	HLOS, mean	*n*	Age, mean	HLOS, mean	*n*	Age, mean	HLOS, mean
1	10 (0.5)	65.0	5.3	-	-	-	-	-	-
2	414 (19.8)	77.1	4.7	19	65.6	5.8	23	74.0	5.7
3	1434 (68.5)	84.1	5.7	41	77.5	6.5	40	76.4	6.3
4	236 (11.3)	85.8	7.5	6	87.7	6.9	3	64.0	4.4

ASA: American Society of Anesthesiologists; HLOS: Hospital length of stay.

in ASA score has a strong association with an increased LOS in elderly patients with HF. Our observations are also in compliance with reports that the ASA score is associated with mortality, LOS, and time to surgery[17,27,28]. Mok *et al*[28] correspondingly recommended that ASA score be added as a criterion for allocation of high-risk patients with HF and for indicating the appropriate admitting service.

In our study, the average number of consultations per patient was similar in all groups. Cardiology was the most common consultation in the TP and MP cohorts. While cardiac comorbidities were registered in approximately 70% of patients, cardiology consultations were implemented in only around 40% of patients. Our data are remarkably similar to that recently reported by Hoehmann *et al*[19], with a 44.4% rate of cardiology consultations in patients with HF in a geriatric population of 65 years and older. Neurology was the second most common consultation in TP patients, while pulmonology was the second most common in MP patients. Having a similar Glasgow Coma Score in both groups and having excluded traumatic brain injury patients, the higher rate of neurological consultations in TP patients may be a result of precaution, attributed to the higher number of motor vehicle collisions as a mechanism of injury.

Surgical intervention for HF is recommended within 48 h[29,30]. Recent studies indicate that surgery within 24 h of admission is associated with shorter HLOS or mortality[31-33]. Delaveau *et al*[11] also recommended “early” surgery within 24 h of admission in orthogeriatrics. Two-thirds of our patients underwent hip surgery within 24 h of admission, and the majority of patients were geriatric. In our study, less than 5% of patients had surgery later than the recommended 48 h benchmark, compared to 9.5% in the report from level I and II trauma centers by deMeireles *et al*[7] and compared to 16.3% in the review of the National Trauma Data Bank by Bhatti *et al*[2] that included level I-IV trauma centers and other hospitals. Our findings support the notion that a longer time to surgery is correlated with extended HLOS. The longer time of orthopedic surgery in our TP patients can be attributed to displaced HF occurring more often.

Elkbuli *et al*[9] in his comparison conducted in a similar setting to ours found that patients with isolated HF admitted to a surgical service had shorter ICULOS and that mortality did not differ from the nonsurgical admission pathway. However, nonsurgical admission patients were younger. In our propensity matched comparison study, mortality was also not statistically different. ICULOS tended to be shorter in TP patients, but the difference did not reach statistical significance. However, our patients were propensity matched by age.

Our data did not show the weekend effect reported by others, as there was no delay of surgery, longer HLOS, or higher mortality[15,16,34,35]. Our observations were in line with reports by Nijland *et al*[12] and Yeo *et al*[22] who also did not find the weekend effect.

The distribution of insurance types between TP and MP patients did not show statistical significance. However, it seems that there was a trend towards less insured patients in TP. In the study by Bhatti *et al*[2] there was no difference in repair times for patients with public insurance or no insurance when compared to patients with private insurance.

The main conclusion of our study was that the health condition of the patient, but not the admitting service, was the defining factor in the management and outcomes of patients with HF. Our conclusion was similar to a recent report by Bauman *et al*[8] concluding that the severity of illness impacts the outcomes more than the admitting service.

In an analysis of geriatric patients with isolated HF as a result of a fall surgically treated at 35 level 1 or level 2 trauma centers, deMeireles *et al*[7] did not find an association between the admitting service and mortality or hospice discharge. However, they found that it was the comorbidity burden that correlated with an increased risk of mortality.

Limitations

This study had limitations that must be considered when interpreting the results. The retrospective nature of this study brings up deficiencies in prerecorded data and the assessments available for extraction and analysis. Although collection of data was completed for a considerable amount of time, the records of only one hospital were analyzed.

CONCLUSION

There were no notable differences in the management and outcomes between patients who underwent HF surgery but were admitted through two different pathways (trauma *vs* medicine). Prolonged LOS was associated with an increased ASA score and longer time to surgery, while mortality was associated with an increased ASA score and age. The admission pathway was not the defining factor in the management of patients with HF. The focus should be on the patient's health condition upon admission and a prompt surgical intervention.

ARTICLE HIGHLIGHTS

Research background

Isolated hip fractures (HF) are common, especially among the elderly population, and falls are the main mechanism of injury. Depending on the hospital settings and institutional policies, patients can be admitted for surgery through different pathways (medicine or trauma). There is a scarcity of studies utilizing the propensity score matching methodology in the analysis of the data on this subject.

Research motivation

It has been reported that the admitting service may influence the outcomes of patients with HF. The motivation behind this study were the conflicting conclusions and ongoing debates over which admitting service is associated with better results. We hypothesized that it is necessary to contribute new data and a new outlook to help achieve improvements in the treatment of patients with HF.

Research objectives

To analyze the characteristics and compare the outcomes of similarly injured patients with HF admitted through trauma *vs* medicine service at an urban level 1 trauma center.

Research methods

This was a retrospective cohort study. Patients with HF were divided into two groups based on the admitting service: Trauma *vs* medicine. Propensity score matching was utilized to ensure comparability between the groups. Patients were propensity matched by age, sex, HF type and surgery, and the American Society of Anesthesiology score. The statistical analyses included group characteristics, bivariate correlation comparisons, multivariable analysis, and one way analysis of variance.

Research results

Time to surgery, time in the intensive care unit, hospital length of stay, discharge disposition, and mortality were not statistically different between the two groups. The average number of preoperative consultations was similar in both groups with cardiology consultation being the most common. Higher

American Society of Anesthesiology score was associated with a longer hospital stay and mortality.

Research conclusions

The health condition of the patient, but not the admission pathway, is the defining factor in the management and outcomes of patients with HF.

Research perspectives

Research should be conducted across multiple medical centers to include larger cohorts with more focus on predictors of adverse outcomes as well as the potential cost differences between the admission pathways.

FOOTNOTES

Author contributions: Fokin AA and Weisz RD conceptualized the research study; Fokin AA, Wycech Knight J, Puente I, and Weisz RD designed the methodology; Fokin AA, Puente I, and Weisz RD were the project administrators and supervisors; Wycech Knight J, Darya M, and Stalder R performed the research; Wycech Knight J performed the software analysis; Fokin AA, Wycech Knight J, Darya M, Stalder R, Puente I, and Weisz RD performed formal data analysis and validation; Fokin AA, Wycech Knight J, Darya M, and Stalder R wrote the original draft of the manuscript; Fokin AA, Wycech Knight J, Darya M, Stalder R, Puente I, and Weisz RD performed manuscript review and editing; and all authors read and approved the final manuscript.

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