Geriatric Orthopaedic Surgery & Rehabilitation
Volume 13: 1–12

DOI: 10.1177/21514593221091062
journals.sagepub.com/home/gos
SAGE

Pre-Operative Medications as a Predictor for Post-Operative Complications Following Geriatric Hip Fracture Surgery

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Abstract

Background: Fragility hip fractures are a common orthopedic injury seen in Emergency Departments, with variable outcomes that can range from average to devastating. Currently, few reliable metrics to predict which patients will suffer post-operative complications exist. The aim of this study was to determine if the number and type of pre-operative medications can help predict post-operative complications. **Methods:** A prospectively collected database of hip fracture patients was retrospectively reviewed. Patients with isolated greater trochanteric fractures, periprosthetic fractures, or re-fractures were excluded. Pre-operative baseline characteristics as well as number and type of post-operative complications were reviewed. Any complication within 6 months of surgery and complications that could be directly attributable to the surgical procedure within 2 years of surgery were examined. Major complications (return to the operating room, deep infection, pulmonary, cardiac, and hematologic) and minor medical complications were assessed. A multivariate regression model was performed to identify independent risk factors. **Results:** Three-hundred ninety-one patients were included. A majority were aged 80–90 and female, and lived at home prior to presentation. Overall, 33.7% of patients suffered a complication within a 2-year follow-up period. Mortality rates were 5.4%, 10.0%, and 14.9% over 30 days, 1 year, and 2 years, respectively. After assessing this relationship while controlling for age, sex, injury type, pre-operative residence, ambulatory status, ASA score, and CCI score, the relationship remained significant for both an increased number of complications ($P = .048$) and a higher likelihood of having a complication ($P = .008$). Cardiovascular ($P = .003$), pulmonary ($P = .001$), gout ($P = .002$), or diabetes ($P = .042$) medications were associated with a higher likelihood for experiencing a complication. **Conclusions:** Our study suggests that there is a strong and linear relationship between the number and type of pre-operative medications taken and risk of post-operative complications. This exists for up to 8 medications, at which point further increase does not contribute to an increased risk of complication. This relationship exists even after controlling for confounding variables and can be used by surgeons to better counsel patients and families regarding their specific risk for suffering perioperative complications.

Keywords

hip fracture, geriatric trauma, fragility fractures, trauma surgery, complications

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Submitted December 15, 2021. Revised February 8, 2022. Accepted March 9, 2022

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Level of Evidence
Prognostic Level III

Introduction

Fragility hip fractures are one of the most common orthopedic injuries, with more than 250 000-300 000 fragility hip fractures annually in the United States alone. With the increasing geriatric population, this number is expected to continue to rise.[1-5] Despite the prevalence of this injury, outcomes can range from average, to poor. Today, it is commonly accepted that individuals who suffer fragility hip fractures will lose one level of mobility (ex. a community ambulator without assistive devices will now require assistive devices to navigate the community) based on the injury, or roughly equal to 70% of their prior function, and most patients will never regain their prior level of function.[6-11] Complication rates remain high, including delirium, pulmonary embolus, and myocardial infarction.[4,12-16] In-hospital mortality rates range from 4-7%, with one year mortality rates as high as 33%.[5,6,12,17-21]

There has been a substantial focus in metrics assessing risk factors for surgical complications related to fragility hip fractures. Despite this focus, the only two well-accepted trends revolve around timely surgery after medical optimization and early post-operative mobilization.[17-19,22] Many scoring systems, such as the Revised Cardiac Risk Index (RCRI), Charlson Comorbidity Index (CCI), American Society of Anesthesiologists Classification (ASA), and National Surgical Quality Improvement Program (NSQIP), have been utilized to help predict which patients are at risk of developing perioperative complications. Unfortunately, many of these scoring systems have not been as reliable at predicting risk when applied to fragility hip fracture patients. Additionally, the lack of accuracy of the application of these risk stratification tools can cause delays for further testing presenting an increased risk for poor post-operative outcomes. Therefore, they offer little guidance for clinicians on how to best counsel patients and families about surgical appropriateness and risk.[4,17,22,23] Additionally, these stratification systems are inconsistently applied between institutions and are not routinely calculated, making them ineffective screening tools.

In this study, we seek to determine the rate of complications from fragility hip fractures using a large internal database, and to evaluate different methods of risk-stratification to determine what factors increase the risk of post-operative morbidity and mortality in our hospitals' patient population. We hypothesize that the number of total medications and type will be a useful tool to quickly and accurately gauge the risk of post-operative complications. Number and type of medications may better represent the wide variety of conditions with which patients can present and can be a surrogate for overall health and physiology. This will in turn help orthopedic surgeons have a more reliable way to appropriately counsel families on the risk of undergoing hip fracture surgery and set appropriate expectations for patients and families in the perioperative period.

Methods

Approval and Data Collection

Approval was first obtained from our institutional review board (IRB number 007916), and a prospectively collected database from a single health-care group encompassing a level one trauma center and two allied community hospitals was retrospectively reviewed. All institutions had some variation of standard hip fracture protocols with geriatric or medicine co-management to optimize patients prior to surgical intervention. The study population included all patients aged 60 or greater with diagnoses of hip fracture, intertrochanteric femur fracture, femoral neck fracture, or subtrochanteric femur fracture as diagnosed by International Classification of Diseases, Ninth Revision (ICD-9) or ICD-10 codes, as well as post-operative diagnoses of hip fracture surgery by Current Procedural Terminology (CPT) codes 27125, 27130, 27235, 27236, 27244, or 27245. Patients were collected from 5/1/2015 through 5/29/2016. Our initial sample totaled 416 patients. All patients who had periprosthetic fractures, isolated greater trochanteric fractures, or those admitted for previously diagnosed hip fractures were excluded, leaving 391 patients eligible for review.

Baseline Demographic Information

Basic demographic information including age, sex, pre-operative residence (home, nursing home, assisted living, or hospice), ambulatory status (community vs home ambulator, with vs without assistive devices, and non-ambulator), creatinine on presentation, RCRI, CCI, ASA, NSQIP, total number of medications listed on medication reconciliation pre-operatively, and type of injury were collected (Table 1). Total number of medications was categorized by the following sub-types: cardiovascular, pulmonary, urinary, gout, hematology, rheumatology, gastrointestinal, psychiatric, endocrine, diabetes, pain, and cancer (Appendixes B and C). The number of each of these subsets of medications that patients were taking was also recorded.

Post-Operative Characteristics

After baseline demographic information was collected, the patients were evaluated regarding time to surgery

Table 1. Patient Demographics.

Categories	Total	
	No.	%
Age (N = 391)		
60–70	58	14.83
71–80	80	20.46
81–90	165	42.20
>90	88	22.51
Sex (N = 391)		
Female	299	76.47
Male	92	23.53
Pre-Operative Residence[a] *(n = 375)*		
Home	292	77.87
Assisted living	33	8.80
Nursing home	49	13.07
Hospice	1	.27
Ambulatory Status[a] *(n = 373)*		
Community ambulator without assistive device	147	39.41
Community ambulator with assistive device	104	27.88
Home ambulator without assistive device	25	6.70
Home ambulator with assistive devices	86	23.06
Non-ambulator	11	2.95
Creatinine on Presentation (N = 391)		
0–0.5	16	4.09
.51–1	242	61.89
1.01–1.5	100	25.58
>1.5	33	8.44
Revised Cardiac Risk Index (RCRI) (N = 391)		
0	250	63.94
1	82	20.97
2	42	10.74
3+	17	4.35
Charlson Comorbidity Index (CCI) (N = 391)		
0–3	64	16.37
4	102	26.09
5	91	23.27
6	56	14.32
7–15	78	19.95
American College of Surgeon's National Surgical Quality Improvement Program (NSQIP) (N = 391)		
0–5	26	6.65
5.1–10	117	29.92
10.1–15	120	30.69
15.1–20	91	23.27
>20	37	9.46
American Society of Anesthesiologists Classification (ASA)[a] *(n = 384)*		
1	3	.78
2	112	29.17
3	231	60.16
4	38	9.90
Total Number of Medications (N = 391)		
0–1	48	12.28
2–3	75	19.18

(continued)

Table 1. (continued)

Categories	Total	
	No.	%
4–5	84	21.48
6–7	78	19.95
8–9	62	15.86
10+	44	11.25
Type of Injury (N = 391)		
Femoral neck	192	49.10
Intertrochanteric	193	49.36
Subtrochanteric	6	1.53

[a]Categories where data was not collected for a subset of patients.

(<12 hours, 12–24 hours, 24–48 hours, 48–72 hours, or >72 hours), type of surgery (cephalomedullary nail, total hip arthroplasty, hemiarthroplasty, closed reduction and percutaneous pinning, or non-operative), post-operative creatinine, length of stay, discharge destination (home, acute rehabilitation, skilled nursing facility, or hospice), admitting service (orthopedics or medical), number of post-operative complications and severity (major or minor), number of 30-day complications and severity (major or minor), and post-operative mortality, including time to mortality (<6 months, 6 months-1 year, 1-2 years) if applicable (Table 2). 30-day complications served as a proxy for early time of occurrence, while total complications served as a proxy for late time of occurrence. Major complications included deep infection, pulmonary, neurologic, cardiovascular, and a return to the operating room (Appendix A). Minor complications included pneumonia, deep vein thrombosis, renal insufficiency, urinary tract infection, and delirium (Appendix A). Complications were defined as any readmission within 6 months of surgery, as well as any complication within the 2-year follow-up period that could be attributed to the surgery (eg ipsilateral DVT, periprosthetic fracture, revision surgery, and deep infection). The primary outcome of this study was the development of any complication attributable to a hip fracture within 2-year follow-up.

Statistical Analysis

These data were collected through REDCap and exported into both Microsoft Excel and STATA version 13.1 (StataCorp), where the data was analyzed in graphical, table, and linear regressions. A P-value < .05 was considered statistically significant. Linear regressions assessed the relationship between complications and number of medications while controlling for age, sex, injury type, pre-operative residence, ambulatory status, time to surgery, ASA score, and CCI score. Logistic regressions were used to study the relationship between the presence of a complication (yes/no) and number of medications while controlling for age, sex, injury type, pre-operative residence, ambulatory status, time to surgery, ASA score, and CCI score. The variables included in the regressions were selected by the research team based on an attempt to limit potential confounders. All figures plotted the relationship between mean number of complications and different variables with 95% confidence interval bands. The relationship between the number of complications and the above mentioned variables were calculated; a two-sample t-test with equal variances was used for continuous variables, and Pearson chi-square tests were used for categorical variables. Lastly, ANOVA tests followed by Tukey tests were done to compare differences among groups. Standard statistical packages from STATA version 13.1 (StataCorp) were used for all analyses.

Results

Baseline Demographic Information

A total of 391 patients were included in the study with a mean age of 82.6 years (Range 60-104). Most patients in the study were females (76.5%), lived at home (77.9%), and were community ambulators without assistive devices (39.4%) or with assistive devices (27.9%). Patients were evenly distributed regarding number of medications and a similar number of patients had a femoral neck or intertrochanteric hip fracture (49.10% vs 49.36%) (Table 1).

Post-Operative Characteristics

The most frequent time to surgery was 12-24 hours (38.3%) or 24-48 hours (25.2%). The most common type of surgery performed was a cephalomedullary nail (42.7%). No compression hip screws were used in our cohort of patients. A majority of patients were admitted by orthopedics (77.2%) and had a discharge to a skilled

Table 2. Post-Operative Characteristics.

Categories	Total	
	No.	%
Time to Surgery[a] (n = 389)		
<12 hours	54	13.88
12–24 hours	149	38.30
24–48 hours	98	25.19
48–72 hours	41	10.54
>72 hours	47	12.08
Type of Surgery (N = 391)		
Cephalomedullary nail	167	42.71
Total hip arthroplasty	30	7.67
Hemiarthroplasty	103	26.34
Closed reduction and percutaneous pinning	65	16.62
Non-operative	26	6.65
Length of Stay[a] (n = 385)		
0–2	21	5.45
3	75	19.48
4	108	28.05
5	61	15.84
6	49	12.73
7+	71	18.44
Discharge Destination[a] (n = 387)		
Home	23	5.94
Hospice	14	3.62
Acute Rehabilitation	18	4.65
Skilled Nursing Facility	332	85.79
Admitting Service (N = 391)		
Orthopedics	302	77.24
Medicine	89	22.76

[a]Categories where data was not collected for a subset of patients.

Table 3. Number of Complications by Type.

Complication Type		Total # of Patients with Complication, No. (%)	
		Yes	No
Major	Deep Infection	12 (3.1)	379 (96.9)
	Pulmonary	26 (6.6)	365 (93.4)
	Hematologic	33 (8.4)	358 (91.6)
	Neurological	10 (2.6)	381 (97.4)
	Cardiac	41 (10.5)	350 (89.5)
	Return to Operating Room	9 (2.3)	382 (97.7)
Minor	Pneumonia	15 (3.8)	376 (96.2)
	Deep Vein Thrombosis	2 (.5)	389 (99.5)
	Renal Insufficiency	24 (6.1)	367 (93.9)
	Urinary Tract Infection	14 (3.6)	377 (96.4)
	Delirium	32 (8.2)	359 (91.8)
	Superficial Infection	0 (0)	391 (100)

Table 4. Number of Complications.

Number of Complications	Total	%
0	263	67.26
1	76	19.44
2	29	7.42
3	15	3.84
4	4	1.02
5	2	.51
6	1	.26
7	0	0
8	0	0
9	0	0
10	1	.26

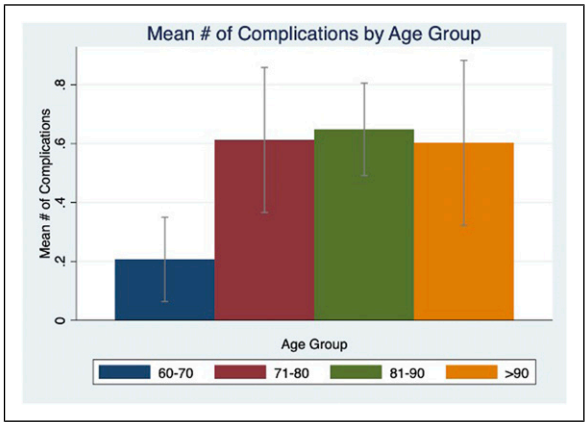

Figure 1. Mean number of complications by age group.

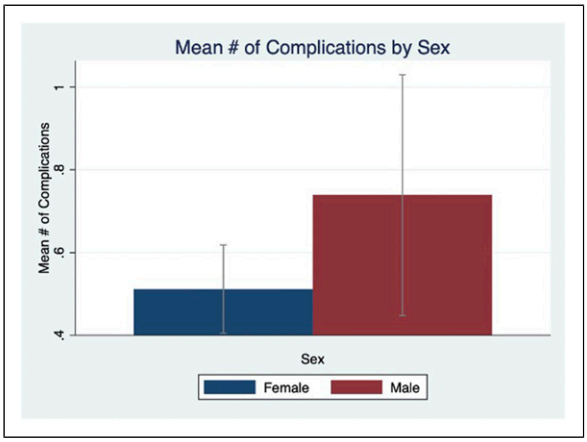

Figure 2. Mean number of complications by sex.

nursing facility (85.8%). Patients had a mean length of stay of 5.2 days (median of 4 days) (Table 2).

Overall, 33.7% of patients suffered some form of complication post-operatively over our two-year follow-up. The most common major complications were cardiac (10.5%) and hematologic (8.4%). The most common minor complications were delirium (8.2%) and renal insufficiency (6.1%) (Table 3). Overall, the mean number of complications per patient was .57 (+/− .05) (Table 4). The final post-operative mortality was 14.9%, with a 30-day rate of 5.4%, 6-month rate of 8.5%, 1-year rate of 10.0%, and 2-year rate of 14.9%.

Relationship Between Complications and Patient Demographics

Increasing age was associated with a higher number of complications (P = .024) (Figure 1). Gender approached statistical significance for overall complications but failed to reach statistical significance. (P = .076) (Figure 2).

A higher number of complications were significantly correlated with increasing CCI score (P = .012), RCRI score (P = .041), NSQIP score (P < .001), and ASA score (P < .001) (Figure 3-6). More specifically, the 5 (P = .017), 6 (P = .036), and 7-15 (P = .015) CCI score groups were all associated with an increased number of complications compared to the 0–3 CCI score group (Figure 3). The >20 NSQIP score group was associated with an increased number of complications compared to the 0–5 (P = .027), 5.1–10 (P = .009), and 10.1-15 (P = .044) NSQIP score groups (Figure 5). An ASA score of 4 was associated with an increased number of complications compared to an ASA score of 2 (P = .004) (Figure 6).

Community ambulators with assistive devices (P < .001) and home ambulators with assistive devices (P = .035) were associated with an increased number of complications compared to community ambulators without assistive devices (Figure 7).

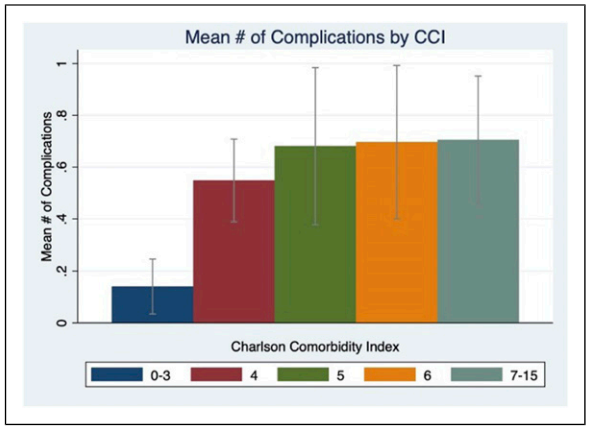

Figure 3. Mean number of complications by CCI.

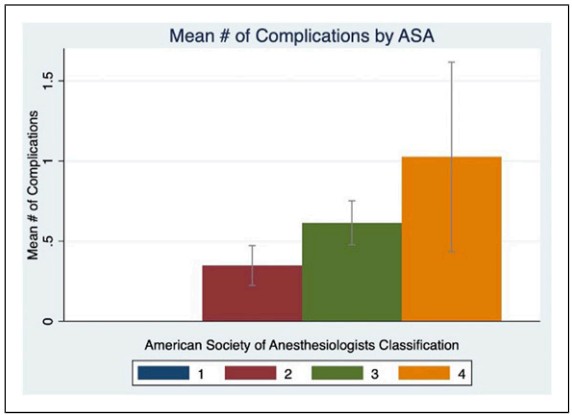

Figure 6. Mean number of complications by ASA

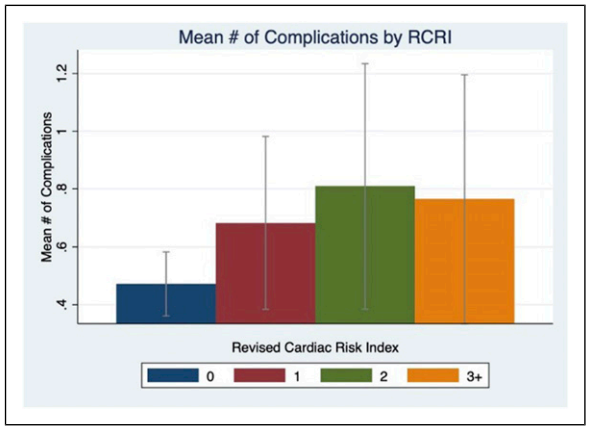

Figure 4. Mean number of complications by RCRI

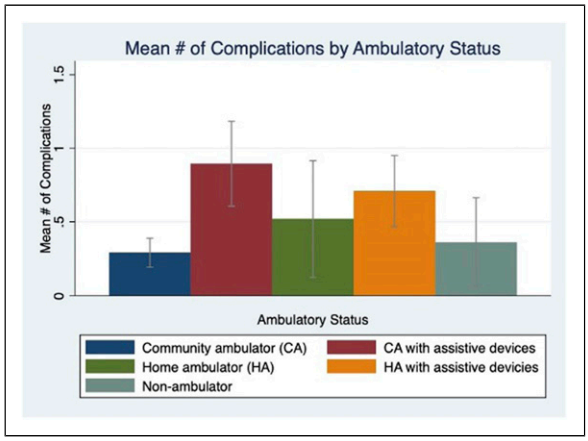

Figure 7. Mean number of complications by ambulatory status.

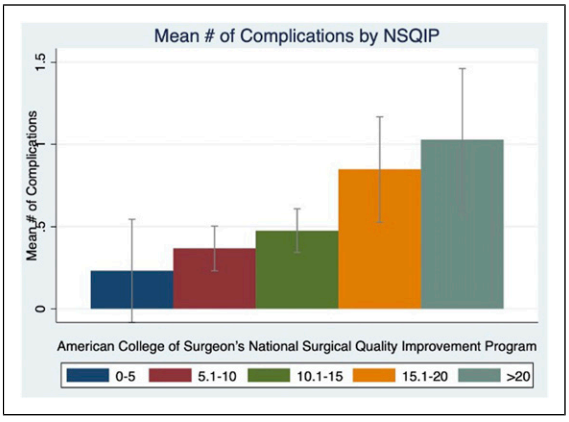

Figure 5. Mean number of complications by NSQIP

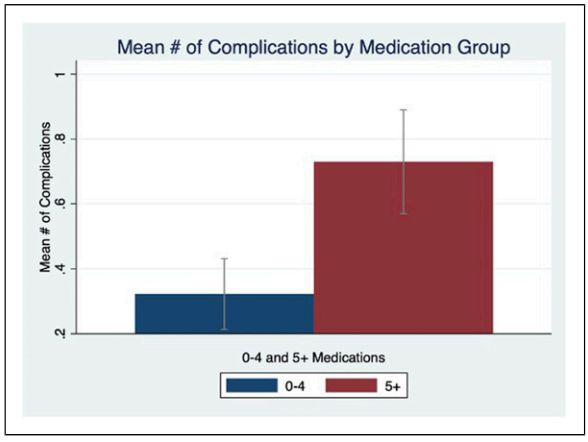

Figure 8. Mean number of complications by medication group.

Relationship Between Complications and Medications

There was a significant difference in the number of complications for each additional medication added up until greater than 8 medications ($P = .001$). Greater than 8 medications no longer conferred significance. The largest statistical significance was found when looking at the group of patients who took 0–4 and 5+ medications (Figure 8).

The number of medications patients were taking pre-operatively was significantly associated with an increased number of complications ($P < .001$) and a higher likelihood of having a complication ($P < .001$). This remained significant while controlling for age, sex, injury type, pre-operative residence, ambulatory status, ASA score, and CCI score for both an increased number of complications ($P = .048$, $R^2 = .11$) and a higher likelihood of having a complication ($P = .008$, pseudo $R^2 = .09$) (Table 3).

Taking cardiovascular ($P = .003$), pulmonary ($P = .001$), gout ($P = .002$), or diabetes ($P = .042$) medications was also associated with a higher likelihood for experiencing a complication and total number of complications ($P = .034$; $P = .026$; $P = .010$, respectively).

Discussion

Fragility hip fractures represent one of the leading causes of hospital admission in this population, and the incidence of these fractures is expected to drastically increase over the coming years.[12,24,25] They incur large hospital costs and negatively impact patients and their families with high complication rates and a low rate of return to prior function.[1,3-5,11] While orthopedic surgeons are well aware that early operative intervention helps decrease morbidity and mortality once patients are medically optimized, there is little data to reliably suggest which patients will suffer post-operative complications.[3-6,12-18]

Complication rates across previous studies vary, with rates ranging from 12.5% up to 56.8%.[26-29] Our study fell within this range with a total of 33.7% of patients suffering at least one complication. Additionally, our study reported major and minor complication rates of 24.8% and 17.1%, which was higher than a comparable study on hip fractures that reported a 13.6% and 22.0% rate for major and minor complication rates, respectively.[26] When assessing mortality rates after hip fracture surgery, rates vary from 4.3-13.3% for deaths within 30 days and 18.8-24.5% within the first year.[27,30-32] Our study reported a 30-day mortality rate of 5.4%, a 1-year rate of 10%, and a 2-year rate of 14.9.

Previous work suggests that pre-operative albumin, as well as the ASA class, can help predict who will have poor outcomes.[3,12] However, some studies have questioned the inter-observer reliability of the ASA classification.[33,34] Our study did not examine the risk of pre-operative albumin in regard to risk for complications as it was not part of the standard workup at our institution.

To our knowledge, this is the first study that examines these different risk stratification tools together and evaluates them against each other. Our study found that when controlling for other potential confounding variables, the number of pre-operative medications had a strong correlation in a linear manner with the likelihood of post-operative complications. Overall, each increase in number of medications was statistically significant until a patient was on greater than 8 medications, after which any additional increase failed to reach statistical significance. Additionally, our study controlled for both ASA and CCI, and still found number of medications to be significant, suggesting that it can be independently predictive of poor post-operative outcomes. By controlling for ASA and CCI, we were able to take into account the relative health of the patient and better measure the impact of the number of medications on post-operative complications. Cardiovascular, pulmonary, gout, and diabetes medications were each independently associated with a higher likelihood of experiencing a complication, indicating that these medications in particular confer a higher risk of post-operative complication. The optimal statistical cutoff for number of medications and incidence of complications was empirically determined through regression to be 0-4 and 5+ medications, as this demarcation showed the largest statistical significance in the analysis (Figure 8).

While higher CCI and RCRI risk scores were independently associated with a larger number of post-operative complications, these relationships did not remain significant when controlling for age, sex, injury type, pre-operative residence, and ambulatory status. This result was different from other hip fracture surgery outcome studies that have supported both a higher rate of post-operative complications higher CCI scores.[31,35] High RCRI risk scores have also been associated in a previous hip fracture outcome study with increased incidence of both 30- and 90-day post-operative mortality,[36] but was not found to be significant in our study when controlling for other variables. This suggests that while these risk stratification tools may have correlation with poor outcomes, they are also potentially confounded by other factors. This is likely the case because none of these risk stratification tools evaluate the full spectrum of the patient's health.

While further research is necessary to investigate this relationship, evaluating this data is an important step in elucidating which patients will do better when undergoing operative intervention for fragility hip fractures. These findings can also be used at the time of admission as an adjunct to help counsel patients or families and inform providers as to the risks of surgery as an adjunctive screening tool to assist in patient counseling.

Our study does have limitations, namely, the retrospective nature of this investigation. However, the data were collected in a prospective manner, and regressions were run in order to control for important confounding variables including previously accepted risks for post-operative complications. Additionally, our institution uses relatively few dynamic hip screws, which are a commonly employed treatment modality for certain types of fragility hip fractures and may influence results once further investigation is performed to include these devices. This study takes place in a mix of public and private hospitals located in an urban area in the Northeast of the United States; therefore, the generalizability of these data to rural areas or other countries may be limited due to lack of access to medication or differences in prescribing practices. Having our data from an internal database, the number of cases is lower than multi-center studies. This also limited our ability to conduct certain data analyses such as assessing the relationship between number of specific diseases and number of medications.

Conclusion

Fragility hip fractures are acommon and serious problem encountered by orthopedic surgeons, and their prevalence is expected to increase as the population ages. It is important for surgeons to be able to adequately counsel patients or family regarding their pre-operative risks for surgery, even if the goal of early operative intervention once medically optimized is well established. Our data suggest that there is a strong and linear relationship between the number of medications a patient takes pre-operatively and the risk of complications post-operatively following surgery for fragility hip fractures. This relationship exists even after controlling for possible confounding variables including previously studied risk stratification tools. This relationship exists *up to 8 medications*, at which point any additional medication does not confer an increased risk of post-operative complication. Additionally, taking medications for cardiac, pulmonary, gout, or diabetic disorders increases risk of complication more than other subtypes of medication. While further research is indicated to further study these risks, medication number and type may be used as an adjunct by orthopedic surgeons at the time admission to counsel patients or families and determine recommendations regarding the risk of post-operative complications for this increasingly common injury.

Appendix A: List of Major and Minor Complications

Major Complications	
Infection	Deep infection requiring OR
Pulmonary	Respiratory failure
Hematologic	PE
Neurologic	CVA
Cardiac	STEMI, NSTEMI
Renal	Acute renal failure
Other return to OR	Periprosthetic fracture, implant failure, other revision
Minor Complications	
Infection	Superficial infection
Pulmonary	COPD exacerbation not requiring escalation of care
Hematologic	DVT, anemia requiring transfusion
Neurologic	TIA, delirium
Renal	UTI, renal insufficiency

Appendix B: Medications by Sub-type

Medication Sub-Type	Medications Included
Cardiovascular	Beta blockers, calcium channel blockers, ace inhibitors, angiotensin II receptor blockers, thiazide diuretics, other diuretics, vasodilators, anti-arrythmics, statins, and aldosterone antagonists
Pulmonary	Beta agonists, inhaled corticosteroids, combination inhalers, leukotriene modifiers, and anticholinergics
Urinary	Alpha antagonists, 5-a-reductases, and anticholinergics
Gout	Allopurinol, colchicine
Hematology	Anti-platelets, anti-coagulants
Rheumatology	Steroids, disease-modifying antirheumatic drugs (DMARDs), biologics, bisphosphonates
Gastrointestinal	Proton pump inhibitors, H2 blockers

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Medication Sub-Type	Medications Included
Psychiatric	Benzodiazepines, serotonin reuptake inhibitors (SSRIs), MAO inhibitors, norepinephrine-dopamine reuptake inhibitors, typical antipsychotics, atypical antipsychotics, mood stabilizers, anticonvulsants, stimulants, tricyclic antidepressants (TCAs), dementia medications, Parkinson's medications, sleep medications
Endocrine	Levothyroxine
Diabetes	Oral diabetic medications, insulin
Pain	Narcotics, non-steroidal anti-inflammatory drugs (NSAIDs), acetaminophen
Cancer	Chemotherapy drugs, hormonal drugs

Appendix C: Breakdown of Patient Medications

Medication Sub-Type	Total # of Patients on Medication, No. (%)		# of Medications	
	Yes	No	Range	Mean (+/− SD)
Cardiovascular	309 (79.03)	82 (20.97)	0–7	2.10 (+/− .08)
Pulmonary	69 (17.65)	322 (82.35)	0–3	.27 (+/− .03)
Urinary	38 (9.72)	353 (90.28)	0–2	.11 (+/− .02)
Gout	22 (5.63)	369 (94.37)	0–2	.06 (+/− .01)
Hematology	189 (48.59)	200 (51.41)	0–2	.58 (+/− .03)
Rheumatology	24 (6.14)	367 (93.86)	0–2	.07 (+/− .01)
Gastrointestinal	120 (30.69)	271 (69.31)	0–2	.31 (+/− .02)
Psychiatric	207 (52.94)	184 (47.06)	0–8	1.01 (+/− .07)
Endocrine	96 (24.55)	295 (75.45)	0–1	.25 (+/− .02)
Diabetes	73 (18.67)	318 (81.33)	0–4	.23 (+/− .03)
Pain	92 (23.53)	299 (76.47)	0–3	.29 (+/− .03)
Cancer	6 (1.53)	385 (98.47)	0–5	.03 (+/− .01)

Appendix D: Rates of Complications by Co-variable before Regression

Table B1: Mean Number of Complications by Age Group

Age Group	N	Mean	95% Confidence Interval	
60–70	58	.207	.061	.353
71–80	80	.613	.363	.862
81–90	165	.648	.491	.806
>90	88	.602	.319	.885

Table B2: Mean Number of Complications by Sex

Sex	N	Mean	95% Confidence Interval	
Female	299	.512	.404	.619
Male	92	.739	.445	1.033

Table B3: Mean Number of Complications by CCI

CCI Score	N	Mean	95% Confidence Interval	
0–3	64	.141	.033	.248
4	102	.549	.389	.709
5	91	.681	.376	.987
6	56	.696	.395	.998
7–15	78	.705	.456	.955

Table B4: Mean Number of Complications by RCRI

RCRI Score	N	Mean	95% Confidence Interval	
0	250	.472	.361	.583
1	82	.683	.380	.986
2	42	.810	.373	1.246
3+	17	.765	.300	1.229

Table B5: Mean Number of Complications by NSQIP

NSQIP Score	N	Mean	95% Confidence Interval	
0–5	26	.231	−.099	.560
5.1–10	117	.368	.230	.505
10.1–15	120	.475	.343	.607
15.1–20	91	.846	.522	1.170
>20	37	1.027	.579	1.475

Table B6: Mean Number of Complications by ASA

ASA Score	N	Mean	95% Confidence Interval	
1	3	0	0	0
2	112	.348	.223	.473
3	231	.615	.477	.752
4	38	1.026	.417	1.635

Table B7: Mean Number of Complications by Ambulatory Status

Ambulatory Status	N	Mean	95% Confidence Interval	
Community Ambulator (CA)	147	.293	.193	.392
CA with assistive devices	104	.894	.604	1.185
Home ambulator (HA)	25	.520	.105	.935
HA with assistive devices	86	.709	.466	.953
Non-ambulator	11	.364	.025	.703

Table B8: Mean Number of Complications by Medication Group

Medication Group	N	Mean	95% Confidence Interval	
0–4	158	.323	.213	.433
5+	233	.730	.569	.890

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethics Statement

This project was approved by the Lifespan Incorporated Institutional Review Board, approval number 884196-8.

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