



EFFECT OF HOSPITAL PROTOCOL IMPLEMENTATION, ENFORCEMENT, AND PERFORMANCE IMPROVEMENT TRACKING ON OUTCOMES IN HIP FRACTURE PATIENTS

Surgery

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ABSTRACT

Introduction: Hip fractures are increasingly common injuries encountered by trauma surgical services. Risk of morbidity and mortality associated with such injuries may be dependent on the standardization of clinical care. Our institution sought to standardize the clinical care of hip fracture patients and created, implemented then enforced an algorithmic hip fracture management protocol. The goal of this study is to analyze outcomes of patients before and after utilization of a hip fracture management protocol.

Methods: We retrospectively analyzed 445 hip fracture patients hospitalized for over 24 hours at an urban level 1 trauma center from 2013-2018. We abstracted demographics, injury severity score (ISS), time to operative fixation, hospital length of stay (LOS), intensive care unit LOS, ventilator days, deep venous thrombosis (DVT) prophylaxis appropriateness and survival to hospital discharge.

The sample was stratified into three groups and compared based on timing and status of the hip fracture management protocol:

A: Antecedent events/no protocol from 1/1/2013–8/1/2014

B: Protocol implemented with no enforcement from 8/2/2014–8/1/2017

C: Protocol continued implementation with enforcement and performance improvement tracking from 8/2/2017- 3/31/2018

Results: Mean time to operative fixation in hours decreased across the time periods: 86.3±3.8 in group A, 48.0±1.1 in group B and 31.1±1.8 in group C (p<0.0001). Mean hospital LOS in days also decreased: 10.4±0.9 in group A, 7.4±0.3 in group B and 5.5±0.4 in group C (p<0.0001). Mean DVT prophylaxis appropriateness (1 = yes; 0 = no) achieved near perfection after protocol implementation: 0.8±0.02 in group A, 1.0±0.006 in group B and 1.0±0.009 years in group C (p<0.0001). Mean fraction of survival to hospital discharge improved after protocol implementation: 0.9±0.02 in group A, 0.99±0.007 in group B and 0.98±0.01 in group C (p=0.0203).

Conclusion: Implementation of an organized hip fracture management protocol with enforcement and performance improvement tracking shortens time to operative fixation, increases VTE prophylaxis appropriateness, decreases LOS and increases rate of survival to discharge.

KEYWORDS

SD, Standard Deviation; DVT, Deep Venous Thrombosis; LOS, Length of Stay

Introduction

Hip fractures are a major burden to the healthcare system and are becoming increasingly common particularly among females and older patients [1]. But despite operative and medical management advances over the past 30 years, mortality rates for hip fracture patients remain essentially unchanged [2].

In the United States, with an estimated 1.66 million hip fractures in 1990 and taking into account aging of the population, the number of hip fracture cases is expected to double by 2040 [3] and reach 6.26 million by 2050 [4]. Investigation into optimal clinical management is crucial to addressing the burgeoning number of cases.

Several factors play a role in the etiology and management complexity of hip fractures and include osteoporosis [5], diabetes [6], dialysis and kidney transplantation [7], previous fracture and/or injury [8] and seasonality [9]. In addition, physiologic stress resulting from hip fractures as well as delayed operative treatment may contribute to major complications, including deep venous thrombosis (DVT), pulmonary embolism, mental confusion/delirium, urinary tract infections, pressure ulcers, and loss of functional mobility [10, 11].

To begin addressing these and other factors, our institution sought to standardize the clinical care of hip fracture patients by creating, implementing then enforcing an algorithmic hip fracture management protocol (FIGURES 1-3).

The goal of this study is to analyze outcomes of hip fracture patients before and after utilization of a hip fracture management protocol.

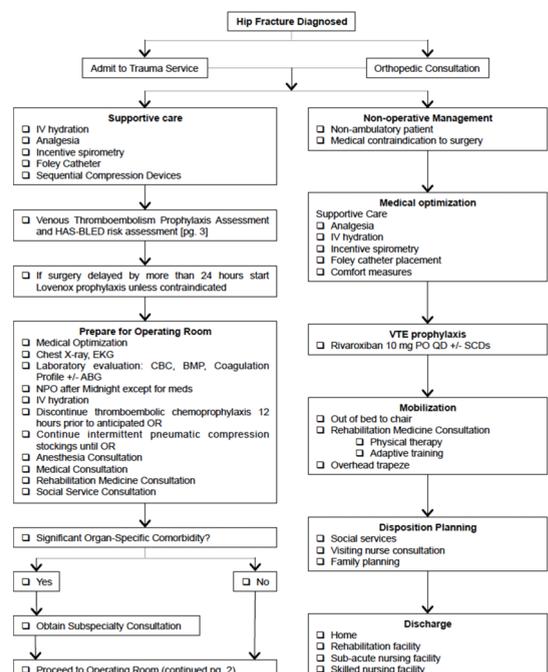


FIGURE 1. Hip fracture management protocol (page 1 of 3). Preoperative and non-operative treatment approach.

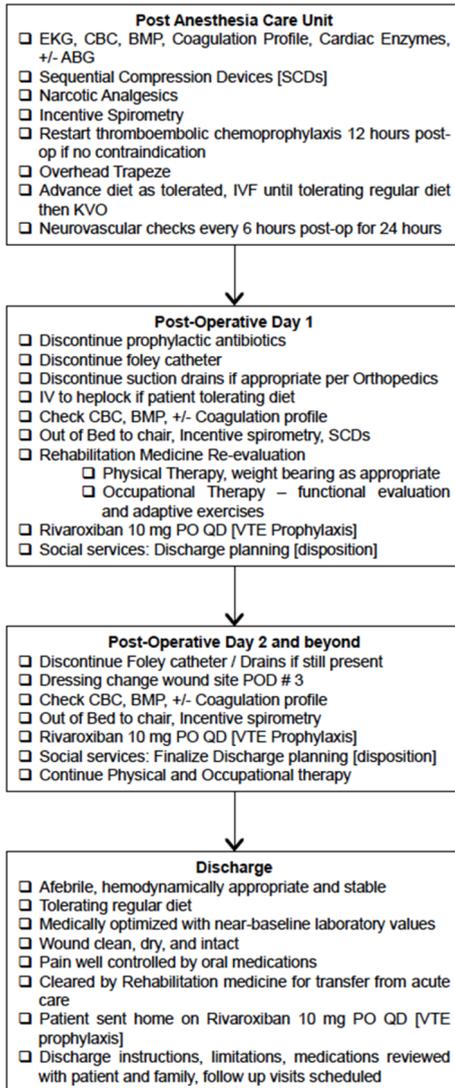


FIGURE 2. Hip fracture management protocol (page 2 of 3). Post-operative treatment approach.

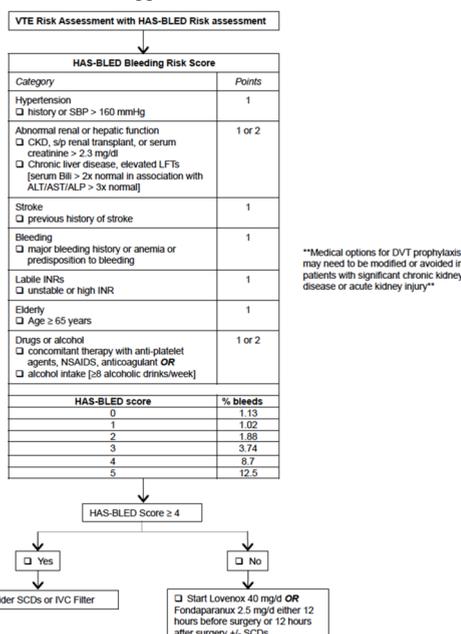


FIGURE 3. Hip fracture management protocol (page 3 of 3). Post-operative DVT prophylaxis guideline.

Methods

After institutional review board waiver was obtained for this study, drawing from our prospectively-accrued trauma registry, we retrospectively analyzed hip fracture patients who were hospitalized for over 24 hours at an urban level 1 trauma center from January 1, 2013 to March 31, 2018. All patients with an associated International Classification of Diseases hip fracture diagnosis code were included. We intended to exclude any patient who on chart review did not have a hip fracture; however, no exclusions were necessary as all abstracted patients were confirmed to have sustained hip fractures.

We abstracted demographics (age and sex), injury severity score (ISS), time to operative fixation, hospital length of stay (LOS), intensive care unit LOS, ventilator days, DVT prophylaxis appropriateness and survival to hospital discharge.

The sample was then stratified into three groups and compared based on timing and status of the hip fracture management protocol:

- A:** Antecedent events/no protocol from 1/1/2013–8/1/2014
- B:** Protocol implemented with no enforcement from 8/2/2014–8/1/2017
- C:** Protocol continued implementation with enforcement and performance improvement tracking from 8/2/2017- 3/31/2018

Statistical methods included *chi*-squared analysis for categorical data, *t*-test or one-way analysis of variance (ANOVA) for continuous data. By convention, the threshold for statistical significance was set to a *p*-value of <0.05. Analyses were performed using IBM SPSS Statistics software (Mac version 22; IBM Corp, Armonk, NY).

Results

A total of 445 patients were included: 29 in group A, 294 in group B and 122 in group C. The study population across the three groups were similar with regard to age, sex and injury severity scores (*p*>0.05).

ICU LOS and ventilator days did not differ significantly between the three groups. However, mean time to operative fixation in hours decreased across the time periods: 86.3±3.8 in group A, 48.0±1.1 in group B and 31.1±1.8 in group C (*p*<0.0001).

Mean hospital LOS in days also decreased: 10.4±0.9 in group A, 7.4±0.3 in group B and 5.5±0.4 in group C (*p*<0.0001).

Mean DVT prophylaxis appropriateness (1 = yes; 0 = no) achieved near perfection after protocol implementation: 0.8±0.02 in group A, 1.0±0.006 in group B and 1.0±0.009 years in group C (*p*<0.0001).

Finally, mean fraction of survival to hospital discharge improved after protocol implementation: 0.9±0.02 in group A, 0.99±0.007 in group B and 0.98±0.01 in group C (*p*=0.0203). (TABLE 1).

TABLE 1. Outcomes Before Implementation of a Standardized Hip Fracture Protocol (Group A), After Implementation (Group B) and After Implementation, Enforcement and Performance Improvement Tracking (Group C).

Outcomes	A (n=29)	B (n=294)	C (n=122)	p-value
Mean Time to Operative Fixation in Hours (SD)	86.3 (3.8)	48.0 (1.1)	31.1 (1.8)	<0.0001
DVT Prophylaxis Appropriateness [1=yes; 0=no] (SD)	0.79 (0.02)	1.0 (0.006)	1.0 (0.009)	<0.0001
Mean Hospital LOS in Days (SD)	10.4 (0.9)	7.4 (0.3)	5.5 (0.4)	<0.0001
Survival to Hospital Discharge	0.93 (0.02)	0.99 (0.007)	0.98 (0.01)	<0.0203

Discussion

We demonstrate that implementation and enforcement with performance improvement tracking of a standardized hip fracture management protocol results in shorter time to operative fixation,

shorter hospital LOS, more appropriate DVT prophylaxis administration and a higher survival to discharge.

Outcomes after hip fracture may be influenced by a multitude of factors, including patient characteristics, type and severity of the injury, and time to diagnosis and treatment [11]. However, as recovery may be challenging and extended with functional status often never returning to its pre-fracture state [12], trauma centers must incorporate and encourage evidence-based care to encourage efficient and effective outcomes. Team organization through evidence-based protocols may contribute to homogeneity of care and modulate outcome expectations; in addition, such protocols provide a foundation for multidisciplinary collaboration.

Mortality risk may be associated with increased time to operative fixation and may depend on patient characteristics and health status, type of injury, hospital resources and surgeon experience [11, 13-17]. Several countries have implemented targeted time to operation to avoid potential harm from delay with mixed results [18-21]. Nevertheless, progress to operative fixation remains a potential risk factor that could be modified.

The results of our study revealed that shorter time to operative fixation, shorter hospital length of stay and improved survival are interrelated and improved with the use of a hip fracture management protocol. We recommend using such a protocol to work towards a 24-hour window for operative fixation, but further investigation is recommended considering circumstances contributing to operative delay particularly stabilization of polytrauma and complex medical comorbidities requiring optimization.

After the implementation of our protocol, hospital LOS significantly decreased especially after enforcement and performance improvement tracking, and survival to hospital discharge improved. These benefits demonstrate improved quality of care and lower financial burdens, especially as occurrences of hospital-acquired conditions (HACs) correlate to hospital LOS.

Recent studies have shown that a shorter hospital LOS after hip fracture correlates with increased survival at 30 days post-discharge [22]. These results contrast with previous studies demonstrating increased rate of early mortality with shorter hospital LOS [23]. Considering the potential multisystem benefits of early appropriate discharge, we recommend a hip fracture management protocol integrate early discharge planning.

Limitations

Our study suffers from the well-known limitations of retrospective study and the limited generalizability of single-center data. However, the prospective accrual of data suggests that each group would be representative of our urban trauma surgical service hip fracture population.

We did not differentiate among types of hip fractures, and certain types of fracture may be associated with worse outcomes. We also did not collect data on the presence or absence of polytrauma, and variations in distribution of injuries more at-risk for prolonged LOS and mortality may have affected our analysis. Again, however, the prospective accrual of data through the trauma registry should minimize such selection biases.

Conclusions

Implementation of an organized hip fracture management protocol with enforcement and performance improvement tracking shortens time to operative fixation, increases VTE prophylaxis appropriateness, decreases LOS and increases rate of survival to discharge.

Notes

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