

Preoperative Testing for Hip Fracture Patients Delays Surgery, Prolongs Hospital Stays, and Rarely Dictates Care

Joseph Bernstein, MD, MS,* Frances O. Roberts, MD,† Brent B. Wiesel, MD,‡
and Jaimo Ahn, MD, PhD, FACS*

Objectives: To determine how often preoperative testing is requested for geriatric hip fracture patients, to assess the extent to which preoperative testing is associated with delayed surgery, and to measure the frequency with which preoperative testing changes patient management.

Design: Retrospective.

Setting: Academic health system.

Patients: Two hundred fifty consecutive geriatric hip fracture patients admitted through the emergency department and underwent surgery.

Intervention: Hip fracture surgery.

Main Outcome Measurements: The patients were categorized according to whether additional preoperative tests were requested. For each patient, the times of presentation and surgery were recorded, yielding a “time-to-surgery interval.” The results of any tests, the actions resulting from testing, and the length of hospital stay were also noted.

Results: Additional preoperative testing was performed for 67 patients (27%). For those patients, the mean time-to-surgery was 73 hours. For the 183 patients who had no testing, the mean time-to-surgery was 37 hours. Moreover, 42 of the 67 patients with testing (63%) had time-to-surgery greater than 48 hours, compared with only 37 of the 183 (20%) patients without testing. The mean length of stay for tested patients was 12.0 days compared with 9.0 days for nontested patients. In only 2 of the 67 tested patients was further care offered based on the test result.

Conclusions: Testing was associated with greater time-to-surgery and length of stay. Furthermore, testing rarely influenced management. Patients might be able to have surgery more expeditiously and leave the hospital earlier if testing were deferred.

Key Words: delay to surgery, hip fracture, trauma

Level of Evidence: Prognostic Level II. See Instructions for Authors for a complete description of levels of evidence.

(*J Orthop Trauma* 2016;30:78–80)

INTRODUCTION

Surgical treatment of an acute hip fracture is urgent: longer surgical waiting times for patients with hip fractures have been associated with elevated rates of mortality, more in-hospital complications, and slower return to function.^{1–4}

Surgical treatment of an acute hip fracture must likewise be undertaken with caution, as many patients have substantial medical comorbidities. To that end, medical testing [beyond the routine battery of basic blood tests, chest x-rays, electrocardiogram (EKG), and urinalysis] may be needed, even if that testing requires an investment of time and therefore longer time to surgery.

The optimal level of preoperative testing is not clear.^{5,6} On the one hand, testing may impose delays, and on the other hand, such testing may identify important information and help make surgery less dangerous. One fair metric of whether preoperative testing in a given patient is appropriate is whether the test will “influence patient treatment.”⁷

We hypothesize that preoperative testing for patients undergoing hip fracture surgery is frequently ordered yet only infrequently changes patient management.⁸ We further hypothesize that preoperative testing delays surgery and would, accordingly, be associated with a longer hospital stay. To assess these hypotheses, we asked the following research questions: How often is preoperative testing requested for geriatric hip fracture patients? How frequently does this preoperative testing change the patient’s management? And last, to what extent does such testing delay surgery or increase length of stay?

METHODS

Under an Institutional review board–approved protocol, a sample of 250 geriatric patients who were admitted through the emergency department and received surgical treatment for fracture of the proximal femur (including femoral neck, intertrochanteric, pertrochanteric, subtrochanteric fractures) at our Health System from September 2008 to September 2012 were reviewed.

Using health system records, patients over the age of 60 years who were admitted with an isolated hip fracture were identified. Patients were excluded if they were transferred

Accepted for publication August 25, 2015.

From the *Department of Orthopaedic Surgery, University of Pennsylvania School of Medicine, Philadelphia, PA; †Department of Orthopaedic Surgery, Northwestern University, Chicago, IL; and ‡Department of Orthopaedic Surgery, Georgetown University Hospital, Washington, DC.

Presented in part at the Annual Meeting of the Association of Bone and Joint Surgeons, New York City, NY, 2014.

The authors report no conflict of interest.

Reprints: Joseph Bernstein, MD, MS, 424 Stemmler Hall, Department of Orthopaedic Surgery, University of Pennsylvania, Philadelphia, PA 19104-6081 (e-mail: joseph.bernstein@uphs.upenn.edu).

Copyright © 2015 Wolters Kluwer Health, Inc. All rights reserved.

from another hospital, had a high energy mechanism, incomplete medical record, unknown date of fracture, periprosthetic fracture, prophylactic fixation, nonunion/malunion, or revision surgery.

For each patient, the following information was recorded: age; gender; type of fracture and laterality; mechanism of injury; additional injuries; the day of the week the patient presented; time of presentation to the emergency room; the approximate time of fracture as indicated in the emergency room history; the service to which the patient was admitted; the service of the consultants requested; the time of surgery; the orthopaedic surgeon on call at the time of admission; the orthopaedic surgeon who performed the surgery; the type of surgery performed; the additional tests that were ordered preoperatively; the results of those tests; the actions that may have been taken in response to these tests; the American Society of Anesthesiologists score; the length of stay; the disposition of the patient on discharged.

We assumed that all patients admitted from the emergency department with an isolated hip fracture would be treated operatively. To verify that assumption, the health system's database was queried to identify whether any patients admitted with hip fracture and who met the inclusion criteria for the study in all other ways yet did not have an operation.

Our a priori power analysis suggested that 50 patients who received additional testing would be needed to achieve 80% power. The effect size of interest was a difference between a 50% rate of delays greater than 48 hours and a 20% rate. Based on the assumption from pilot studies that 20% of all patients would receive additional testing, a target sample of 250 was identified. Mean differences between groups were analyzed using the Student's *t* test and differences in proportions were analyzed using the χ^2 test. *P*-values <0.05 were considered statistically significant.

RESULTS

To create the 250 patient samples, 389 charts had to be reviewed: 139 patients were excluded based on predetermined criteria (noted previously) before yielding the target sample size of 250. There were no patients who otherwise met the inclusion criteria yet in fact did not have surgery. The demographics of the patients are shown in Table 1.

Additional preoperative testing beyond basic laboratory testing, chest x-ray, EKG, and urinalysis, was performed for 67 of the 250 patients (27%). The types of tests ordered include transthoracic echocardiogram; cardiac stress test; carotid ultrasound; rule out myocardial infarction; electroencephalogram; implantable cardioverter-defibrillator interrogation; and endoscopy. Their frequency is shown in Table 2.

The mean time to surgical intervention for patients with additional testing was 73.2 hours compared with 37.2 hours in the group without additional testing (*P* < 0.0001). Moreover, 42 of the 67 patients with testing (63%) had time-to-surgery intervals greater than 48 hours, compared with only 37 of the 183 patients without testing (20%; *P* < 0.05).

The mean length of stay for patients with additional testing was 12.01 days compared with 9.01 days for the group without further testing (*P* = 0.008).

TABLE 1. Patient and Operation Characteristics

Demographics	Patients With Testing (n = 67)	No further Testing (n = 183)
Mean age, y (SD)	82 (10.5)	80 (8.6)
Gender	43% male	26% male
Fracture type, %		
Femoral neck	48	46
Intertrochanteric	43	47
Subtrochanteric	9	7
Mean delay to surgery (range), h	73 (17–371)	37 (7–176)
>24 h, %	91	69
>48 h, %	63	20
American Society of Anesthesiologist score, %		
2	12	20
3	81	72
4	7	8

Of the 67 patients who had additional testing, one patient underwent further evaluation: this patient had a cardiac catheterization after a positive stress test before surgery. In one other patient, a cardiac catheterization was recommended but refused; this patient underwent surgery and survived past discharge. Five patients, none of whom were offered additional testing, died prior to discharge.

No significant differences were found between the primary groups with regard to age, time from fracture until presenting at the emergency department, or American Society of Anesthesiologist score.

DISCUSSION

Geriatric patients who undergo surgery more than 48 hours after presenting with a low-energy hip fracture face an increased risk of mortality compared with patients who undergo more timely procedures.⁹ Owing to confounding effects, however, the assertion that delay necessarily increases mortality risk is controversial¹⁰: it may well be that patients who undergo surgery after a delay were held back precisely because they were sicker a priori.² Alternatively, it may be the case that delay inflicts harm, as patients languish while awaiting surgery.¹¹ Regardless, it can be stated without controversy that unnecessary delay should be avoided.

TABLE 2. Preoperative Tests Ordered

Preoperative Test	Number of patients
None	183
Transthoracic echocardiogram	52
Cardiac stress test	15
Carotid ultrasound	4
Rule out myocardial infarction	3
Electroencephalogram	3
ICD interrogation	1
GI endoscopy	1

In this study, we addressed the question whether additional preoperative testing, defined as preoperative testing beyond the standard preoperative tests such as basic laboratory tests, chest x-ray, EKG, and urinalysis, creates unnecessary delay. We found that such testing was performed on 27% of a cohort of 250 patients, and for these patients, the mean time-to-surgery interval was almost twice as long as the time-to-surgery for nontested patients (73 vs. 37 hours). We found also that the mean length of stay of tested patients was 33% longer (12 vs. 9 days for nontested patients). Critically, in only 2 of the 67 tested patients was any further care offered based on the test result.

Our study is limited by the fact that we studied an urban, academic, tertiary care center, and thus, our observations may not be generalizable to rural or community practices. Also, it is possible that other hospitals are so “efficient” that testing could be obtained there without imposing a delay. (The word “efficient” is placed in quotes, as the ready availability of testing facilities may itself represent an inefficient use of resources.)

We also excluded patients transferred to our hospitals from our study and thus cannot comment about this group of patients (representing almost 20% of the patients who underwent surgery at our hospitals).

Furthermore, we found no patients who otherwise met the inclusion criteria yet did not have surgery. It may well be that additional testing in patients with hip fracture who ultimately do not have surgery is important, especially to the extent that the testing identifies a reason to not have surgery. Nonetheless, because no such patients were detected, it is likely that this scenario is rare, and therefore the overall conclusions are not unseated by this limitation.

Another limitation of our approach is that focusing solely on whether testing dictates management may overlook certain benefits. It is not hard to imagine responses to tests that are not recorded as explicit actions. For example, a test may be used to better quantify the risk of surgery, to help choose between modes of anesthesia (with or without invasive monitoring), or select medications.¹²

Additional testing was performed in 27% of all patients in our sample. Given that there are approximately 300,000 hip fractures per year in the United States, the testing of these patients alone represents significant medical effort (and likely, significant medical expense).

Not surprisingly, additional testing lead to a longer length of stay. Although cost data were not collected, it stands to reason that those patients who had additional testing generated greater costs, both for the tests themselves as well as for the longer stay.

In our series, preoperative testing led to a mean of 36 hours additional time to surgery compared with patients who did not have testing. This finding is consistent with results found in other studies.^{12–14} Moreover, 63% of patients with testing had time-to-surgery intervals greater than 48 hours, compared with 20% of patients without testing. This is an important finding, given that geriatric patients who undergo surgery 48 hours or more after presenting to the hospital with

a low-energy hip fracture have an increased risk of mortality compared with patients who undergo earlier surgery.⁹

Our results should not be taken to derogate the value of a preoperative medical consultation. Geriatric hip fracture patients certainly benefit from the help of medical consultants or even a dedicated hip fracture program¹⁵; these patients are generally older, and likely have comorbidities such as cardiac, pulmonary, or neurologic disease. However, it seems that preoperative evaluations include additional testing that is, at best, used as a screening procedure with a low positive yield. It is therefore reasonable to suggest that many patients could perhaps be taken to surgery more expeditiously if testing that can wait until after surgery is indeed deferred.

REFERENCES

1. Hamlet WP, Lieberman JR, Freedman EL, et al. Influence of health status and the timing of surgery on mortality in hip fracture patients. *Am J Orthop (Belle Mead NJ)*. 1997;26:621–627.
2. Holt G, Smith R, Duncan K, et al. Does delay to theatre for medical reasons affect the peri-operative mortality in patients with a fracture of the hip? *J Bone Joint Surg Br*. 2010;92:835–841.
3. Koval KJ, Rust CL, Spratt KF. The effect of hospital setting and teaching status on outcomes after hip fracture. *Am J Orthop (Belle Mead NJ)*. 2011;40:19–28.
4. Moja L, Piatti A, Pecoraro V, et al. Timing matters in hip fracture surgery: patients operated within 48 hours have better outcomes. A meta-analysis and meta-regression of over 190,000 patients. *PLoS One*. 2012;7:e46175.
5. Abbas K, Umer M, Askari R. Preoperative cardiac evaluation in proximal femur fractures and its effects on the surgical outcome. *Acta Orthop Traumatol Turc*. 2012;46:250–254.
6. Cluett J, Caplan J, Yu W. Preoperative cardiac evaluation of patients with acute hip fracture. *Am J Orthop (Belle Mead NJ)*. 2008;37:32–36.
7. Fleisher LA, Beckman JA, Brown KA, et al. ACC/AHA 2007 guidelines on perioperative cardiovascular evaluation and care for noncardiac surgery: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery) developed in collaboration with the American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Rhythm Society, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society for Vascular Medicine and Biology, and Society for Vascular Surgery. *J Am Coll Cardiol*. 2007;50:1707–1732.
8. Ricci WM, Brandt A, McAndrew C, et al. Factors affecting delay to surgery and length of stay for patients with hip fracture. *J Orthop Trauma*. 2015;29:e109–114.
9. McGuire KJ, Bernstein J, Polsky D, et al. The 2004 Marshall Urist award: delays until surgery after hip fracture increases mortality. *Clin Orthop Relat Res*. 2004;428:294–301.
10. Morrison RS, Chassin MR, Siu AL. The medical consultant's role in caring for patients with hip fracture. *Ann Intern Med*. 1998;128:1010–1020.
11. Lefavre KA, Macadam SA, Davidson DJ, et al. Length of stay, mortality, morbidity and delay to surgery in hip fractures. *J Bone Joint Surg Br*. 2009;91:922–927.
12. O'HEireamhoin S, Beyer T, Ahmed M, et al. The role of preoperative cardiac investigation in emergency hip surgery. *J Trauma*. 2011;71:1345–1347.
13. Ricci WM, Della Rocca GJ, Combs C, et al. The medical and economic impact of preoperative cardiac testing in elderly patients with hip fractures. *Injury*. 2007;38(suppl 3):S49–S52.
14. Murry J, Truitt MS, Mani U, et al. Have echocardiograms affected recommended therapy in geriatric trauma patients? *J Trauma Nurs*. 2014;21:150–152.
15. Bernstein J. Not the last word: geriatric hip fracture centers: the time has Come. *Clin Orthop Relat Res*. 2015;473:2214–2218.