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Establishing a Geriatric Hip Fracture Program at a Level 1 Community Trauma Center

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BACKGROUND: Traditional care of patients with geriatric hip fracture has been fragmented with patients admitted under various specialty services and to different units within a hospital. This produces inconsistent care and leads to varying outcomes that can be associated with increased length of stay, delays in time from admission to surgery, and higher readmission rates.

PURPOSE: The purpose of this article is to describe the process taken to establish a successful geriatric hip fracture program (GFP) and the initial results observed in a single institution after its implementation.

METHODS: All patients 60 years or older, with an osteoporotic hip fracture sustained from a low energy mechanism (defined as a fall from 3-ft height or less), were included in our program. Fracture patterns include femoral neck, intertrochanteric, pertrochanteric, and subtrochanteric femur fractures including displaced, nondisplaced, and periprosthetic fractures. Preprogram data included all patients admitted from January 1, 2012, through December 31, 2014; postprogram data were collected on patients admitted between May 1, 2016, and May 1, 2018.

RESULTS: Demographic characteristics of the populations were similar. After the GFP was implemented, the proportion of patients who were treated surgically within 24 and 48 hours increased. The average number of hours between admission and surgery significantly reduced from 35.2 to 23.2 hours. Overall length of stay was decreased by 1.8 days and readmission within 30 days of discharge was lower. Reasons for readmission were similar in both timeframes. The rate of inpatient death was similar in the two groups. Mortality within 30 days of surgery appeared somewhat higher in the post-GFP period.

CONCLUSION: Our program found that, with the utilization of a multidisciplinary approach, we could positively influence the care of patients with geriatric hip fracture through the implementation of evidence-based practice guidelines. In the first 2 years after initiation of the GFP, our institution saw a decrease in time from admission to surgery, length of stay, and blood transfusion requirements.

The purpose of this article is to describe the process to establish a successful geriatric hip fracture program (GFP) and the initial results observed in a single institution after its implementation. This GFP was established at a 774-bed tertiary, Level 1 community trauma center that serves a 27-county area in northwest Ohio and southeast Michigan.

Using baseline data, practices, and lessons learned from existing literature, a program outline was developed by the physician champion demonstrating the anticipated benefits to patients, the hospital, the healthcare system, and our region. The physician champion presented the plan to hospital administration to gain support for a hospital-wide, multidisciplinary effort to change the treatment strategy of our hip fracture population. With this support in place, a Geriatric Fracture Program Coordinator (GFPC) position was developed and key stakeholders joined the GFP implementation team.

GFP Implementation Team

The physician champion completed residency and fellowship in two different healthcare settings, both with established GFPs. This experience provided insight into models for improvement in care for older adults with hip fractures. The physician champion along with the GFPC played key roles in communicating and collaborating with healthcare teams—including physicians, nurses,

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and allied health professionals—to support the change in culture surrounding the hip fracture population.

The GFPC position was financially supported by the hospital, based on anticipated cost-savings the program would create. The GFPC is a master's prepared registered nurse with orthopedic expertise and knowledge of patient flow. A key emphasis of the role is data collection and analysis skills to track key process and outcome criteria for evaluating rollout and impact of the program. This data was used to inform the implementation process, allowing the team to make corrections to ensure success.

A steering committee was established; it included members of the hospital's administrative leadership team, unit and department leadership, physicians, nurses, trauma director, physical/occupational therapy (OT), radiology, discharge planners, and a process improvement engineer (see Table 1). Unit directors and educators were the liaisons to direct care staff. They communicated input and plans and brought feedback to the committee.

Project Design

Program Guidelines and Goals Development

The GFP was modeled after the University of Rochester's Geriatric Fracture Center at Highland Hospital. It is based on five principles: (1) most patients benefit from surgical stabilization of their fracture, (2) shorter time to surgery reduces the time available for iatrogenic illness, (3) comanagement of patients with frequent communication reduces the risk of iatrogenesis, (4) standardized protocols decrease adverse outcomes, and (5) discharge planning begins at admission (Basu et al., 2016). Table 2 provides further information on these program principles.

The program's practice guidelines standardize preoperative testing, laboratories, and procedures to reduce delays in operative treatment and reduce costs associated with unnecessary testing (see Table 3). The preoperative assessment is structured with the intent to minimize patient transport needs, improve comfort, and facilitate timing to minimize delays due to missed/omitted tests. Postoperative guidelines ensure correct use of postoperative antibiotics, correct use of mechanical and chemical deep vein thrombosis prophylaxis, early patient mobilization, optimization of patient nutrition, and initiation of treatment for osteoporosis and hypovitaminosis D as indicated (American Academy of Orthopaedic Surgeons [AAOS], 2014; American College of Surgeons [ACS], n.d.; Mears & Kates, 2015). Efforts to reduce the risk of delirium included avoiding medications associated with delirium risk, managing pain, using families to aid with reorientation efforts, and minimizing patient tethers, including urinary catheters, braces, drains, and restraints (Mears & Kates, 2015). A standardized order set for pain control was developed with the help of a pharmacist. The regimen uses acetaminophen along with the lowest dose opiate as necessary. The use of nonsteroidal anti-inflammatory

Table 1. Steering Committee

Group	Members
Hospital administration (attended ad hoc)	VP of Nursing Services, VP of Medical Affairs, VP of Finance, Associate VP of Orthopaedic and Spine Hospital
Nursing[a]	GFP coordinator, ER director and educator, trauma director, orthopaedic and trauma floor leadership and educators, surgery department
Physicians	GFP physician champion[a], ER, hospitalist[a], anesthesia[a], trauma, cardiology
Other[a]	Process improvement engineer, lead radiology technician, therapy services (physical, occupational and speech), care navigator/social work, pharmacy, dietician, information technology

Note. ER = emergency room; GFP = geriatric hip fracture program; VP = vice president.
[a]Key stakeholders.

Table 2. GFP Program Principles

Surgical stabilization
- Mobility limitations, functional impairment, and pain addressed with fracture stabilization (Friedman et al., 2008)
- Nonoperative treatment is rarely used (Friedman et al., 2008)
- Standard fixation concepts based on fracture patterns and patient needs with cost-effective implant selection (AAOS, 2014; Egol et al., 2014; Swart et al., 2014)

Minimize time to surgery (Friedman et al., 2008)
- Delays increase the risk of decubiti, DVT/VTE, respiratory complications, infection, and delayed functional improvement (AAOS, 2014)
- Delays are a result of multifactorial issues (OR access, surgeon availability, medical optimization needs). Modifiable factors include time spent in ER, time from diagnosis to medical assessment/optimization, preoperative testing, OR access, surgeon availability
- Surgery is considered urgent (but not emergent)

Comanagement of care avoids iatrogenic illness (Friedman et al., 2008)
- Comanagement between the medical and orthopaedic specialists, whereby each manages respective goals daily
- Meetings with coordinator, GFP physician champion, and lead hospitalist to discuss inpatient and 30-day mortality and 30-day readmissions

Standardized protocols (Friedman et al., 2008)
- Eliminate inconsistency
- Facilitate the implementation of evidence-based, high-quality care
- Function as reproducible standard of care for all patients
- Address each phase of care, from admission through discharge

Discharge planning starts upon admission (Friedman et al., 2008)
- Involve social work or care navigation early, ideally in the ER, to assess for social support, to assess for modifiable barriers to home discharge, and to initiate placement process
- Provide consistent delivery of discharge materials and instructions on topics such as weight-bearing status/limitations, deep vein thrombosis prophylaxis medications, wound care, follow-up care, and physician contact information
- Develop a feedback loop with skilled nursing facilities

Note. DVT = deep vein thrombosis; ER = emergency room; GFP = geriatric fracture program; OR = operating room; VTE = venous thromboembolism.

Table 3. GFP Practice Guidelines

Preoperative management	Emergency room
	• Send out GFP alert sent out after hip fracture is confirmed
	• Provide orthopaedic consultation with initial response by orthopaedic physician assistant then notification of on-call orthopaedic attending physician
	• Obtain appropriate radiographs prior to leaving ER: chest (one view), pelvis, AP hip, cross-table lateral hip, AP femur, cross-table lateral femur
	• Obtain adequate IV access
	• Insert urinary catheter
	• Begin preoperative evaluation by completing a type and screen, CBC, BMP, prealbumin, vitamin D 25 hydroxy, PT/INR (in patients with hepatic failure or those taking warfarin), EKG, and urinalysis with reflex culture
	• Plan for surgical management on hospital day 1 (if possible), or hospital day 2
	• Admit as inpatient to hospitalist or trauma surgery (when applicable), to the orthopaedic unit with the trauma unit as overflow—unless a higher level of care is indicated
	• Initiate social work/care navigator consultation
	Inpatient unit
	• Hospitalist or trauma surgeon to evaluate and treat any medical comorbidities
	  ○ Diagnose and treat dehydration, rhabdomyolysis; assess cardiopulmonary disease; optimize comorbid conditions; provide a surgical risk assessment (Mears & Kates, 2015)
	  ○ If indicated, pursue additional testing require to optimize comorbid conditions or support surgical risk assessment
	  ○ Evaluate for coagulopathy and initiate reversal of warfarin with oral vitamin K (Gleason & Friedman, 2014)
	  ○ Assess etiology of syncope as indicated
	• Cardiology consultation in patients with existing or newly diagnosed cardiac pathology (Fleisher et al., 2014; Mears & Kates, 2015; Ricci et al., 2007)
	  ○ Assess for history of CAD (CABG/stents), arrhythmia, pacemaker/defibrillator, valvular disease, CHF
	  ○ Facilitate the use of our health system's cardiology group
	  ○ Standardize criteria for preoperative echocardiogram
	  ○ Utilize echocardiogram on-call technician for preoperative examinations when indicated for early operating start times (especially on weekends)
	• Orthopaedic consultation completed with a focused plan and timing for surgical management
	  ○ Position patient for comfort, eliminating Buck's traction (to eliminate tethers)
	  ○ Obtain procedural consent and place on chart
	• Nursing to review ER workup—if incomplete then obtain orders from the orthopaedic physician assistant
	  ○ Complete mental status examination (Maxwell et al., 2008)
	  ○ Confirm urinary catheter placement, EKG is complete and on the chart; obtain and maintain patent IV, complete preoperative radiographs and laboratory tests
	  ○ Apply knee high compression stockings to uninjured lower extremity
	  ○ Apply sequential compression device to bilateral lower extremities
	  ○ Teach patient how to use incentive spirometer at least 10 times per hour
	  ○ Assess/document skin (including stage 0 ulcers)
	  ○ Ensure position of comfort and that ice is applied to the hip
	  ○ Elevate heels with waffle boots to prevent skin breakdown
	• Social work/care navigation to evaluate patient on day of admission, preferably in the ER
	  ○ Discuss home environment, family/support network, barriers, or obstacles to discharge
	  ○ Provide consistent discharge information to the rehab facilities

Operative management	• If surgical stabilization is considered urgent, and as necessary, ensure Sunday operating room access (AAOS, 2014; NICE, 2017) • Adhere to Surgical Care Improvement Project (SCIP) guidelines • Select orthopaedic implant as guided by fracture pattern and patient characteristics (AAOS, 2014; ACS, n.d.; Egol et al., 2014; NICE, 2017; Swart et al., 2014)

Postoperative management	• Nursing: Review postoperative nursing goals and obtain orders for missing interventions when applicable
	• Adhere to SCIP guidelines
	  ○ Limit antibiotics to 24-hour postoperatively
	  ○ Remove urinary catheter by postoperative day 2 (goal for postoperative day 1 unless specifically indicated)
	  ○ Educate providers, physician assistants, nurse practitioners, and nurses to ensure compliance
	• Provide adequate deep vein thrombosis prophylaxis (Marsland et al., 2010; Mears & Kates, 2015)
	  ○ Use of mechanical prophylaxis including application of bilateral lower extremity compression stocking and use of sequential compression device
	  ○ Ensure early mobilization by dangling feet at the edge of the bed, sitting patient in chair for all meals
	  ○ Anticipate initiation of pharmacological prophylaxis on postoperative day 1 with appropriate medication selection at prophylactic doses at a minimum of 4 weeks
	• Monitor medications to maintain pain control, minimize narcotics, and avoid delirium-inducing drugs
	• Monitor hemoglobin and hematocrit, restrict use of transfusions (AAOS, 2014)
	• Minimize tethers by removing catheters; discontinue IV fluids; avoid immobilizers, braces, and restraints (Friedman et al., 2008)

(*continues*)

TABLE 3. GFP PRACTICE GUIDELINES (CONTINUED)

	• Provide osteoporosis education, including enrollment in "Own the Bone" (Mears & Kates, 2015) • Provide physical and occupational therapy with early postoperative assessments on day of surgery (AAOS, 2014; Mears & Kates, 2015) ❍ Work with patients one to two times per day ❍ Orthopaedists: Provide clear weight-bearing instructions • Provide dietitian consult to assess and intervene for protein-deficient malnutrition (AAOS, 2014; Mears & Kates, 2015) ❍ Provide early involvement for patients with secondary causes of osteoporosis ❍ Provide education for elderly patients with diabetes

Note. AP = anteroposterior; BMP = basic metabolic panel; CABG = coronary artery bypass graft; CAD = coronary artery disease; CBC = complete blood count; CHF = congestive heart failure; EKG = electrocardiogram; ER = emergency room; GFP = geriatric fracture program; IV = intravenous; PT/INR = prothrombin time/international normalized ratio.

drugs was avoided due to multiple risks—including bleeding and renal injury (see Table 4) (AAOS, 2014; ACS, n.d.; Mears & Kates, 2015).

Inclusion criteria for enrollment in the GFP include all patients 60 years or older, with an osteoporotic hip fracture sustained from a low-energy mechanism (defined as a fall from ≤3-ft height). Fracture patterns include femoral neck, intertrochanteric, pertrochanteric, and subtrochanteric femur fractures including displaced, nondisplaced, and periprosthetic fractures. Exclusion criteria are patients younger than 60 years, those who sustained a fracture from a traumatic mechanism, or who have a fracture resulting from a pathologic (neoplastic) fracture.

PROCESS MAPPING

Prior to program implementation, the project leadership team was brought together in a 2-day meeting. Led by a process engineer, the first step was to map the current process of care for patients with hip fracture from admission through discharge. Process mapping is an exercise adopted from the Six Sigma process used in manufacturing, first developed for the Japanese automotive industry. Process mapping involves visual representation of each step of a process—what is actually done rather than what is supposed to be done—under the premise that one cannot manage that which cannot be measured (Marriott, 2018). The goal during process mapping is to identify the "who," "what," "where," and "when" of processes. Questions to assist during the process are shown in Table 5 (ACT Academy, n.d.; Damelio, 2011).

Visually laying out the steps and the order in which they occur allows for a breakdown of multiple, complex processes for identification of roles, resources used, and outputs. Identification of each step in the process facilitates recognition of inefficiencies, bottlenecks, and duplication of efforts, laying the groundwork for quality improvement. Frontline staff should be included in discussions of process steps to provide insight into what is actually done and where inefficiencies exist. Such bottom-up approaches may be more effective, as

TABLE 4. RECOMMENDED AND DISCOURAGED MEDICATIONS

Recommended medications: to minimize narcotics, provide adequate analgesia, minimize risk of sedation and delirium
Acetaminophen 1000 mg oral every 8 hours around the clock
Oxycodone (Roxicodone) age based to reduce narcotic use • Age <75: 5 mg oral every 4 hours as needed for pain score <7 10 mg oral every 4 hours as needed for pain score 7–10 • Age ≥75: 2.5 mg oral every 4 hours as needed for pain score <7 5 mg oral every 4 hours as needed for pain score 7+-10
Hydromorphone (Dilaudid) for breakthrough pain medication only 0.3–0.5 mg i.v. every 2 hours as needed for breakthrough pain
Senna (Senokot-S) two tablets at bedtime
Cholecalciferol (vitamin D_3) 2,000 IU daily
Ergocalciferol (vitamin D) 50,000 IU weekly for 8 weeks
Calcium citrate 400 mg oral three times a day
Trazadone 50 mg oral at bedtime as needed for insomnia
Haloperidol (Haldol) 0.5 mg i.v. as needed for agitation
Ondansetron (Zofran) 4 mg i.v. every 4 hours as needed for nausea
Discouraged medications: avoid due to the risk of sedation, delirium, and adverse effects
Diphenhydramine (Benadryl)
Benzodiazepines
Zolpidem (Ambien) Promethazine (Phenergan)
Morphine
Acetaminophen combined with oxycodone/hydrocodone (Percocet/Norco)
Calcium carbonate (calcium citrate is preferred)

TABLE 5. ANALYSIS OF A COMPLEX PROCESS MAP

Questions to consider when reviewing process map
How many steps are in the process and can any be removed?
Are steps being done in the correct order?
Are they being done by the correct person/department?
How long does each step take? What delays occur between steps and can they be avoided?
Which steps add value—are there any that do not contribute to the goal?
Are there any duplicate steps or obvious bottlenecks?
How much work is being repeated/corrected?
Can any steps be combined and/or completed by a single person/department?
How many patient transfers occur between staff/departments? Can this be reduced?
Do we give patients information and, if so, at what stage? Is it useful information?

Data from ACT Academy. (n.d.). *Conventional process mapping. NHS improvement.* https://improvement.nhs.uk/documents/2143/conventional-process-mapping.pdf.

they generate greater involvement in the process (Hong, 2013).

The Six Sigma method of process mapping has been adopted by healthcare, with the "Plan Do Study Act (PDSA)" paralleling "Define Measure Analyze Improve Control (DMAIC)" in business. Previous studies in healthcare have reported success in identifying inefficiencies and variations in care using process mapping, from diagnosis of appendicitis in the emergency room (ER) and small bowel obstruction management in general surgery to care coordination programs for the Veterans Health Association (Abbas et al., 2018; DeGirolamo et al., 2018; McCreight et al., 2019).

Mapping the current care process laid the foundation for subsequent discussion of improvement. Two patient care pathways were described: one for hip fracture patients arriving and admitted through the hospital's ER; the second, for hip fracture patients directly admitted to a hospital unit. Mapping of the current process highlighted fragmentation in the current care model, including variability in admission services and orthopaedic consultations, lack of consistency regarding preoperative laboratory and radiographic assessments, significant variability in preoperative risk assessments/testing, and postoperative management. This examination of the existing process provided further support for change.

The second day of the meeting focused on analyzing the mapped process for gaps, bottlenecks, and inefficiencies and making recommendations for change. To capture the complexity of the process from admission to discharge, three phases were identified: preoperative, intraoperative, and postoperative. To identify areas of opportunity in each phase, interviews were held with experts including frontline, direct patient care staff in the ER, trauma, and orthopaedics departments. In the preoperative phase, multiple bottlenecks and inefficiencies were identified including laboratory and radiology requirements. It was determined that performance of the preoperative steps was segmented: laboratory draws for some tests occurred in the ER with additional orders completed after the patient was admitted and on the floor. Similarly, radiographs to diagnose hip fracture occurred in the ER, but did not include full-length views of the femur, requiring additional scans. Finally, the preoperative readiness assessment, which could have been conducted in the ER, did not occur until the patient arrived on the floor. Care was streamlined by breaking down boundaries based on location of care and provider role. It was determined that, in the ER, care could not focus simply on diagnosis and admission to a care unit, but rather it had to begin from the premise that hip fracture patients will be admitted with the goal of surgery within 24 hours and no later than 48 hours after injury. To accomplish this we examined what could be done in the ER without adding significant time to the ER stay. To this end, we integrated processes for complete x-rays, laboratory draws, intravenous (IV) access, and catheter insertion while in the ER. All of these changes were believed to improve patient comfort, minimize patient transport and transfer needs, and expedite care by initiating the preoperative risk assessment early in the process allowing for more efficient follow-up. Streamlining of these processes was implemented to create value by standardizing practices to improve outcomes, enhance the patient experience, and ultimately reduce costs to the patient and hospital.

Another inefficiency identified was variability in care based on the admitting physician group. Each of the many admitting hospitalist groups, primary care physicians, or surgeons had different management styles, training backgrounds, and pre-, intra-, and postoperative practices. To improve efficiency in care, the process was changed so that patients with GFP were to be admitted to the health system's hospitalist group or trauma services department (when deemed appropriate). All providers on these two services received education regarding the GFP goals and how to care for the geriatric patient population with agreed-upon practice guidelines to achieve surgical optimization 24 hours a day, with the goal of preventing delays in surgical management.

Following mapping of the current state, a "Go-Live" date was established, leaving approximately 3 months to implement each phase of care. The GFPC organized a series of meetings to involve and instruct all impacted departments. These programs were timed and structured to fit the needs of each department and were led by the GFPC or workgroup specialists. The department-specific programs were designed to educate clinicians and staff on principles of the program, proposed process changes, and the impact of the changes on their department and on the quality of patient care.

Preoperative

The admission process was streamlined to decrease the length of time required and decrease variability in care orders. In the prior process, fracture care orders were not initiated until the patient was on the unit and seen by the admitting team. In the redesign, guided by the principle that those with suspected hip fractures would require hospitalization and surgery, the aim was to alert all relevant departments/care teams so that care could be efficiently facilitated. The ER physician directed the ER charge desk to send a "burst page." This page notified the team including: (a) GFP coordinator, (b) orthopaedic physician assistant (available 24 hours a day, 7 days a week), (c) administrative supervisor (in event there is a high patient census to assist in bed flow), (d) access and bed control, (e) orthopaedic and trauma unit bed pager (to anticipate the admission and if necessary move patients to accommodate the hip fracture patient), (f) ER leadership (to assist with any delays and ensure hip fracture guidelines are followed), (g) operating room (OR) front desk (to alert of a pending OR case the same day or the next day), (h) PT (to anticipate therapy on postoperative day zero or one), and (i) ER care navigator (to begin the discharge process). The burst page facilitated immediate bed assignment—to either the orthopaedic or trauma unit prior to receiving a specific physician order. Furthermore, the burst page sent the patient's ER number and age to key participants that need early involvement in the patient's care, hereby preventing omission or delay. To facilitate consistency in care, most patients were admitted to the hospitalist group, which was available 24/7. If the patient sustained more than one injury, the patient is admitted to trauma services.

Another component of the admission process that was strengthened was inclusion of the nursing care navigators or social worker with the burst page so that the patient could be seen early on to assess for issues related to discharge planning. This patient interaction established the foundation for discharge planning, identified barriers to care, and obtained preferences for site of care upon discharge.

Admission workflow changes in radiology were planned to obtain all necessary x-rays (chest radiograph and full-length femur radiographs) after diagnosis of the hip fracture but prior to leaving the department in order to minimize the need for patients to transfer beds and minimize transport needs within the hospital. The patient was to have the initial hip x-ray series taken and then remain in the radiology department to await the read from the radiologist. Further x-rays could be requested if needed and the patient was still in the department allowing for this to occur efficiently. Following completion of all necessary radiographs, the patient returned to their ER room until the remainder of workup was complete.

The surgery desk was included on the "burst page" at the time of patient presentation. This allowed for an orthopaedic surgical case to be added to the surgery schedule, thereby reducing delays in obtaining an OR and meeting the goal for surgery on the day of admission or by hospital day two.

Intraoperative

Intraoperative care considerations were planned to facilitate the requirement set forth by the Surgical Care Improvement Project and National Surgical Quality Improvement Program guidelines. Surgical stabilization was considered urgent and could require nonroutine scheduling such as Sunday OR access (AAOS, 2014; National Institute for Health and Care Excellence [NICE], 2017). Additional considerations included correct and appropriate implant selection guided by fracture pattern and patient characteristics (AAOS, 2014; ACS, n.d.; Egol et al., 2014; NICE, 2017; Swart et al., 2014).

Postoperative

Postoperative management began with educating nursing staff regarding program goals. Upon arrival to the inpatient unit, nursing staff reviewed postoperative orders and, when applicable, obtained orders for missing interventions. Bedside staff were proactive in placing sequential compression devices and compression stockings to bilateral lower extremities. Nursing and PT and OT worked together to sit patients on the side of the bed on postoperative day zero and then out of bed by postoperative day one. Nursing and providers monitored medications to maintain pain control while minimizing the use of narcotics to avoid the risk of delirium. Additionally, to decrease the risk of delirium, the reduction of "tethers" was recommended as soon as possible after surgery (Friedman et al., 2008). Tethers include things like catheters, continuous IV fluids, braces, immobilizers, and restraints. Given the importance of osteoporosis education to decrease the risk of another osteoporotic fracture, nursing provided education to patients on the importance of calcium and vitamin D supplementation (AAOS, 2014; Mears & Kates, 2015). They also provided training to staff and providers on the importance of supplementation both while inpatient and continuing after discharge.

To optimize nutritional status, all hip fracture patients received a standard house nutritional supplement twice a day (unless there were dietary restrictions) and a consult to the dietitian (AAOS, 2014; Mears & Kates, 2015). Expectations regarding timing of first PT and OT sessions were set (AAOS, 2014; Mears & Kates, 2015). The goal was for the first session to be held on the day of surgery if the patient was out of surgery and back to their room by 3:30 p.m. Individual parameters such as level of alertness and lower extremity sensation also affected whether or not PT and OT could be initiated.

All Phases of Care

Crossing all phases of care, evidence-based geriatric hip fracture order sets standardized care and ensured adherence to current guidelines. This contributed to (a) elimination of variability, (b) facilitation of implementation of evidence-based, high-quality care at each phase of care, and (c) and ensuring reproducible standards of care for all patients at each phase of care (Friedman et al., 2008). Order sets were developed for each phase of care, including at the time of ER admission, preoperative, and postoperative order sets.

Evaluation

Institutional Review Board approval was obtained to collect retrospective, preprogram data on all hip fracture patients admitted from January 1, 2012, through December 31, 2014, and prospectively postimplementation from May 1, 2016, to May 1, 2018. Patients who were younger than 60 years or were managed nonsurgically were excluded from analysis. Baseline patient characteristics—including age, gender, body mass index (BMI), preoperative laboratory values, American Society of Anesthesiologists (ASA) classification, and comorbidities—were collected to describe the patient population and facilitate population comparisons. The Charlson Comorbidity Index (CCI) was used to generate a numeric, comparable measure of health status on admission (Charlson et al., 1987). The CCI assigns a score based on 17 comorbid conditions and is based on Cox proportional hazard models for 1-year mortality. The resulting numeric score can be used to estimate risk of mortality and may also be used for estimates of resource use or to adjust analyses for comorbidity confounding.

Outcome measures included length of stay (LOS), time to surgery, and 30-day readmission rate. Due to differences in documentation between the retrospective and prospective data collection periods, due to transition to a different electronic medical record during the

Table 6. Patient Characteristics Before and After GFP

Patient Characteristics	Before GFP	After GFP	*p*
Women, *n* (%)	242 (72.5)	211 (69.2)	.36
Charlson Comorbidity Index, *n*	5.60 ± 1.9	6.32 ± 2.1	.0002
Mean BMI (kg/m²)	25.83 ± 5.8	25.53 ± 5.5	.53
Medical comorbidities, *n*	3.03 ± 1.9	3.30 ± 2.2	.10
ASA class, *n* (%)			.66
1	0 (0.0)	1 (0.3)	
2	24 (7.2)	22 (7.2)	
3	203 (60.8)	192 (63.0)	
4	106 (31.7)	90 (29.5)	
5	1 (0.3)	0 (0.0)	

Note. ASA = American Society of Anesthesiologists; BMI = body mass index; GFP = geriatric fracture program.

post-GFP period, postoperative complications were not compared.

In the period prior to GFP, 334 patients were eligible to be included in analysis, while 305 were included in the post-GFP period. Demographic characteristics of the populations compared before and after the implementation of the GFP were similar and are presented in Table 6. In both groups, the majority of patients were female (72.5% before vs. 69.2% after), with similar average age and BMI in each group. The number of comorbid conditions on admission was similar in the two groups; however, the CCI score was higher on average in the post-GFP patients (5.6 vs. 6.3, $p < .001$). Laboratory values prior to surgery (white blood cell count, hemoglobin, and hematocrit) were similar in the pre- and post-GFP groups. The majority of patients in both groups were classified as 3 or more ASA.

Evaluation of outcomes pre- and post-GFP is reported in Table 7. Prior to implementation of the GFP, 42.2% of patients underwent surgery within 24 hours of admission; after GFP was implemented, the proportion of patients who were treated surgically within 24 hours increased to 67.2% ($p < .0001$). Prior to implementation of the GFP, 82.3% of patients were surgically treated within 48 hours of admission; after the GFP was implemented, that percentage increased to 97.0% ($p < .0001$). The average time between admission and surgery was significantly reduced from 35.2 to 23.2 hours ($p < .0001$). Additionally, the overall inpatient LOS decreased with implementation of GFP; prior to the program's implementation, the average LOS was 7.2 days compared to 5.4 days post-GFP ($p < .0001$). Of interest, 47.8% of patients required a transfusion in the period before GFP was implemented; this was reduced to 34.1% after GFP was fully deployed ($p = .0006$).

Additional outcome measures including 30-day readmission rate and mortality were also compared. The rate of readmission within 30 days of discharge was nonsignificantly lower in the post-GFP period (13.5% vs. 11.1%, $p = .37$). Reasons for readmission were similar in both timeframes, as shown in Table 8. The rate of inpatient death was similar in the two groups (1.2% vs. 1.6%, $p = .6$). Mortality within 30 days of surgery appeared to be somewhat higher in the post-GFP period (8.4% vs. 12.1%, $p = .14$), though this was not statistically significant.

Table 7. Program Evaluation Before and After GFP

Program Evaluation	Before GFP	After GFP	*p*
Mean time to surgery, hours	30.23 ± 29.5	22.79 ± 12.0	<.0001
Surgery within 24 hours, *n* (%)	141 (42.2)	205 (67.2)	<.0001
Surgery within 48 hours, *n* (%)	275 (82.3)	296 (97.0)	<.0001
Preoperative ECHO, *n* (%)	108 (39)	46 (16)	<.0001
PRBC transfusions, *n* (%)	143 (47.8)	104 (34.1)	.0006
30-day readmissions, *n* (%)	45 (13.5)	34 (11.1)	.37
30-day mortality, *n* (%)	28 (8.4)	37 (12.1)	.14

Note. ECHO = echocardiogram; GFP = geriatric fracture program; PRBC = packed red blood cells.

Discussion

Evaluation of this program suggests that the implementation of evidence-based practice guidelines, process efficiencies and the utilization of a multidisciplinary approach, positively impacted the care of geriatric hip fracture patients. In the first 2 years after initiation of the GFP, decreases in time from admission to surgery, LOS, and blood transfusion requirements were

Table 8. Reason for Readmission Between Periods[a]

Readmission Reason	Before GFP, *n* (%)	After GFP, *n* (%)	*p*
Altered mental status	16 (4.8)	12 (3.9)	.57
Anemia	4 (1.2)	4 (1.3)	.92
Cardiopulmonary	27 (8.1)	24 (7.8)	.87
Decubitus ulcer	6 (1.8)	3 (1.0)	.37
Deep vein thrombosis	2 (0.6)	0 (0)	.17
Prosthesis failure	2 (0.6)	4 (1.3)	.36
Pulmonary embolism	2 (0.6)	1 (0.3)	.61
Repeat fall	5 (1.5)	4 (1.3)	.83
Surgical site infection	5 (1.5)	4 (1.3)	.83
Stroke	2 (0.6)	1 (0.3)	.61
Urinary tract infection	12 (3.6)	9 (2.9)	.62
Wound complications	2 (0.6)	2 (0.6)	.94
Other medical	32 (9.6)	19 (6.1)	.11

Note. GFP = geriatric fracture program.
[a]Distribution of readmission reasons was similar between groups before and after GFP implementation.

appreciated. Interestingly, when compared to pre-GFP, there was less variability and more consistency in LOS and time to surgery, as shown by the reduction in standard deviation in the post-GFP group. There was no improvement in 30-day postoperative mortality, which slightly, but nonsignificantly, increased in the post-GFP period. This could be explained with the higher CCI, in patients in the post-GFP period. In the post-GFP period, more patients were discharged to a skilled nursing facility after discharge from the hospital and we had transitioned to a more integrated electronic medical record system that gave us the ability to view documentation from other healthcare systems.

The decrease in LOS with implementation of a GFP is similar to those that have been previously published in the literature (Giusti et al., 2011; Kates, 2015; Katrancha et al., 2017; Schnell et al., 2010). A decrease in the cost of treatment has been reported as a result of the improved quality of care that can be provided after developing a GFP (Della Rocca et al., 2013; Giusti et al., 2011; Kates et al., 2011). At the time of analysis, there was no capability to fully evaluate the impact of our program on direct cost; however, savings associated with the reduction in LOS alone is estimated at $227,000 for the post-GFP period presented herein.

Kates et al. (2012) identified barriers to establishing an organized GFP. They surveyed physicians who previously expressed an interest in developing an organized GFP and found the most frequent barriers to implementation were (a) lack of physician leadership (79%), (b) need for a clinical case manager (78%), (c) lack of anesthesia support (71%), (d) lack of OR availability (71%), (e) issues with cardiac clearance (76%), and (f) lack of administrative support (62%). Of the 40% of physicians that had an organized GFP, their listed "severe barriers" included (a) OR access (15%), (b) need for medical or geriatric leadership (15%), (c) need for a clinical case manager (11%), and (d) cardiac surgical clearance (7.4%). Having a nurse GFP coordinator and physician champion was instrumental in the development of this program. Once the coordinator was hired, it was possible to establish the GFP in 3 months. The quick launch of the program was likely successful due to presence of a physician champion who had previously obtained administrative support and was already familiar with the research and literature that were the foundation for practice guidelines.

In the present study, OR availability was not a barrier, as the institution is a Level 1 trauma center and the orthopaedic trauma physicians had daily OR time available in the event of emergent orthopaedic surgery. There is conflicting literature regarding whether geriatric hip fracture patients can be managed effectively in Level 1 trauma centers due to the competing trauma load that can lead to decreased prioritization of lower-acuity patients, including geriatric hip fractures (Ling et al., 2015). One study found that when compared to Level 2 and nontrauma centers, geriatric hip fracture patients that were treated at Level 1 trauma centers had longer times from admission to surgery, LOS, and higher odds of 30-day readmission and venous thromboembolism (Metcalfe et al., 2016). In contrast, Nelson-Williams et al. (2015) found that there were no differences in either mortality or discharge disposition in patients managed at a Level 1 or Level 2 trauma center when compared to lower level trauma centers (Level 3 or nondesignated trauma centers). Our results demonstrate the ability to effectively manage patients with geriatric hip fracture within a Level 1 trauma center, which further improved with the implementation of a GFP.

The main barrier experienced during scale-up of the program was in regard to cardiac clearance. There was a disconnect between the cardiology and anesthesia services, specifically in regard to the need for echocardiograms (ECHOs). This issue was addressed during a meeting with cardiology, anesthesiology, hospitalist service, the orthopaedic physician champion, and the GFP coordinator. After discussion of the ECHO guidelines from a cardiac and anesthesia standpoint, set standards and efforts to tighten indications when ordering ECHOs were agreed upon. Indications for a cardiac consult included patients with known cardiac issues or with new cardiac problems (new murmur, acute myocardial infarction, etc.). The ECHO technician on call would be utilized for preoperative examinations when needed for early OR start times (especially on the weekends). These guidelines allowed for significant decrease of unnecessary use of ECHOs leading to possible cost-savings and decreases in time to surgery.

Conclusion

The traditional care of hip fracture patients can lead to fragmented and inconsistent care. The use of standardized guidelines, process improvement, and order sets eliminated variability and facilitated the implementation of evidence-based care allowing for reproducible outcomes during each phase of care—preoperative, intraoperative, and postoperative. With the utilization of a standardized program, including those set at geriatric hip fracture centers such as ours, healthcare organizations can see a reduction of inhospital complications, a shorter length-of-stay, and lower readmission rates.

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