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Using Care Bundles to Improve Surgical Outcomes and Reduce Variation in Care for Fragility Hip Fracture Patients

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Abstract

Introduction: Fragility hip fractures constitute a large proportion of orthogeriatric admissions to orthopedic wards. This study looked at reducing variation in care in fragility hip fracture patients using a novel approach with care bundles. The care bundle comprises 5 elements targeted at providing adequate analgesia, early mobilization, improving recognition of delirium, and decreasing rates of urinary infections. **Methods:** A total of 198 patients who sustained a fragility hip fracture during the intervention period were included in the study. The primary outcome measure was compliance in applying the bundle to the study population, and secondary outcome measures were in-hospital mortality, acute length of stay, delirium and duration of delirium, and urinary tract infections. **Results:** During the 12-month intervention period, compliance to the bundle of care was 47% (n = 92) based on the "all-or-none" approach. This was 28% higher than the preintervention rate. Overall, there was an increased rate of compliance across all individual elements of the bundle in the intervention group when compared to the preintervention group ($P = .01$). The most significant clinical result was a 10.5% reduction in "in-hospital mortality" in the intervention group ($P < .001$). **Conclusion:** This study demonstrated that the implementation of specific care bundle in patients with fragility hip fracture significantly reduces variation in care.

Keywords
care bundle, fragility hip fracture

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Introduction

Fragility hip fractures constitute a common health demand among the elderly population. The period 2007 to 2008 saw a total of 17 192 hospital admissions for hip fractures in Australia alone.[1] This sector of the community often suffers from multiple comorbidities corresponding to high morbidity and mortality rates. There is also a significant financial burden due to these fractures. Estimates from the Australian Institute for Health and Welfare report the cost of the acute care period from A$2000 to A$20000 per hospitalized hip fracture patient.[2] The incidence of fragility hip fractures is not likely to decrease due to the worldwide trend of aging population.

An abundance of guidelines and pathways advocating coordinated multidisciplinary and timely care to improve outcomes for hip fracture patients has been published.[21] In recent times (2010), the best practice tariff (BPT) for hip fractures in the United Kingdom introduced a concept of financial incentive to improve care of hip fracture patients. The BPT indicators included elements of timely access to surgery within 36 hours and involvement of orthogeriatricians. To qualify, all elements of the BPT must be achieved and were monitored through the national hip fracture database. Studies investigating the introduction of the BPT for hip fracture showed a significant improvement in patient care measured against the guidelines.

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As a result, more patients were assessed by an orthogeriatrician, had decreased length of stay, and had shorter time to surgery. All of which resulted in an improvement in mortality rates and significant financial benefits for hospitals.[3-6]

The aim of this study was to evaluate the introduction of a similar project called a care bundle aimed at reducing variation in patients hospitalized within an orthogeriatric model of care with fragility hip fracture. The orthogeriatric model of care introduced in 2006 at our hospital is underpinned by a collaborative multidisciplinary approach to fragility hip fractures as first described by Devas and Irvine.[25] In a response to improve outcomes for fragility hip fracture patients in the area of surgical care, a novel initiative was introduced to provide consistent pre and postoperative care, thereby reducing variation in care. The Global Innovation Group as part of the Health Round Table[22] Initiative in Australia introduced the concept of a bundle of care for fragility hip fracture patients at a large tertiary trauma center in Queensland. The concept was to implement a standard of care aimed at reducing variation in care from the time of presentation in the emergency department (ED) through to the postoperative care period.

Care bundles have historically been implemented in critical care settings including intensive care units, medical wards, and EDs. Care bundles are a relatively new concept introduced in the United States by the Institute for Health Care Improvement (IHI) in 2002. Institute for Health Care Improvement defines a bundle of care as ''a structured way of improving the processes of care and patient outcomes: a small, straightforward set of evidence-based practices—generally three to five—that, when performed collectively and reliably, have been proven to improve patient outcome.''[7] (http://www.ihi.org/sites/search/pages/results.aspx?k=bundle+of+care) Care bundles differ from standardized protocols in that care bundles are a set of interventions that when used together as a bundle of care significantly reduce variation in patient care and improve patient outcomes. A bundle is a set of evidence-based practices that when performed together and reliably have been proved to improve patient outcomes. Furthermore, a bundle is a structured way of improving the processes of care.[23] The effectiveness of a bundle is that it is based on evidence, responds to a clinical need, and is executed with consistency. A bundle aims to reduce variation in care by bundling evidence-based changes into a package that clinicians know must be adhered to for every patient every time. In Australia, the implementation of care bundles do not attract any financial reimbursement.

When implementing bundles, there are certain guidelines developed by the IHI to adhere to. The elements should be descriptive to allow for transfer and customization between hospitals. They should be formulated for a defined population cohort who reside in one location or close vicinity. The elements of the bundle should be delivered in a multidisciplinary environment with agreement between health workers. And finally bundles are evaluated on compliance with an all-or-none approach. Therefore, all elements of the bundle are required to be completed to be classified as a compliant bundle. The only exception being if the element is medically contraindicated in that patient, in which case they are classified as a completed element.

Each of the 5 bundle elements is supported by medical evidence and independently affects patient outcomes including mortality and morbidity. The inclusion of each element of the Neck of Femur (NoF) bundle was a combination of evidence in the literature and discussion by senior clinicians including the directors of orthopedics, geriatrics, ED, anesthetics, division of surgery, and the NoF nurse. The first element of the bundle was that every patient who presented through the ED received a femoral nerve block. In general, patients who have an increased degree of pain are at risk of longer hospital stays and delays in mobilization.[8] In addition, it is difficult to administer high-dose analgesics to elderly patients who experience pain due to complications of respiratory depression, drowsiness, mental confusion, and hypotension. As such, femoral nerve blocks provide a viable and effective manner of delivering analgesia to fragility hip fracture patients.[9,10] A Cochrane review on the use of nerve blocks showed that femoral nerve blocks inserted before surgery reduce the degree of pain and the need for parenteral analgesia in fragility hip fracture patients.[11] However, there is limited evidence that outcomes such as mortality and medical complications are reduced with femoral nerve blocks. Other methods of analgesia, which have shown benefit in femoral neck fractures, include fascia iliaca blocks by reducing the need for additional opioid analgesia.[12]

The second element of the bundle included sitting all fragility hip fracture patients out of bed day 1 to ensure early ambulation after surgery. It is well accepted that early mobilization is vital to avoiding postoperative medical complications. In particular, fragility hip fracture patients benefit from less postoperative delirium and pneumonia as well as shorter length of stay.[13]

With regard to cognitive screening, the third and fourth elements were included in the bundle as delirium represents a common and difficult problem in fragility hip fracture patients, affecting 38% to 61% of patients. The third consisted of all patients having a Mental State Questionnaire (MSQ) performed prior to surgery, while the fourth element was that all patients have a daily confusion assessment method (CAM) performed on day 1 postoperatively until discharge or up until day 5. Delirium is linked to long length of stay and several surgical complications including urinary tract infections[24] (UTIs), wound infections, anemia, and increased risk of mortality.[14] Confusion assessment method is a screening tool for delirium that was published in the literature in the 1990s to help improve the recognition of delirium.[15] A systematic review of major studies regarding CAM showed that this delirium tool improved the identification of delirium in the clinical setting when completed by individuals trained in performing the CAMs.[16] The MSQ is also an important historical cognition tool in recognizing cognitive deficits present in fragility hip fracture patients on admission and provides a baseline for comparison during their admission. Early recognition of impaired cognition is the key when treating complications that can occur as a result of cognitive impairment.[17]

The fifth element of the bundle, early removal of indwelling urinary catheters (IDCs) for fragility hip fracture patients within 48 hours, was implemented to reduce episodes of UTIs and aid early mobilization. Studies have found that the duration of catheterization is the most important risk factor for developing an UTI. Therefore, any benefit from an IDC for a patient after surgery is offset by the risk of an UTI, with an estimated 5% to 10% risk per day beyond the first 48 hours of catheterization.[18] A large retrospective cohort study found that IDCs that remain more than 2 days postoperatively may result in an increase in UTIs.[19]

Methods

Patient Population

A retrospective cohort study was conducted in a level 1 tertiary trauma center in Queensland, Australia. Patients who sustained a fragility hip fracture during the intervention period from June 2013 to May 2014 and who met the inclusion criteria were included in the bundle initiative. The inclusion criteria were as follows:

1. Patients who sustained a fragility hip fracture secondary to low-energy trauma.
2. Fragility hip fracture encompassed subcapital, subtrochanteric, and intertrochanteric fractures.
3. Patients admitted through the ED.
4. Patients admitted to the orthopedic ward aged 65 years and older.

The exclusion criteria were as follows:

1. Patients not diagnosed as having sustained a fragility hip fracture secondary to low-energy trauma.
2. Patients not admitted to the hospital via the ED.
3. Patients younger than 65 years of age.

A total of 198 patients fulfilled the inclusion criteria for the study, and 13 patients were excluded from the study. Data regarding bundle compliance and clinical outcomes were recorded for both the intervention group and the preintervention group. The preintervention group comprised of 221 patients who sustained a fragility hip fracture from June 2012 to May 2013. Both groups had baseline data collected consisting of age, sex, and American Society of Anesthesiology (ASA) score.

The femoral nerve block component of the bundle was instituted by the ED. The remaining 4 elements of the bundle were instituted by the orthopedic team including surgeons, geriatric doctors, nurses, and allied health workers. Bundle compliance was monitored with simple goal forms available during ward rounds and multidisciplinary meetings. Orthopedic nurses involved in delivering the bundle of care were trained in performing the MSQ and CAM assessment. Training regarding the CAM assessment tool was provided to 2 nursing staff at the initiation of the intervention period and revised 6 months later.

The primary outcome measure was compliance in applying the bundle to the study population. If all the elements of the bundle were documented as complete or medically contraindicated, the bundle was classified as completed. If any component of the bundle was incomplete, the outcome measure was stated as incomplete, unless the bundle element was medically contraindicated. In this case, the bundle was labeled as complete.

Secondary outcome measures were surgical outcomes including in-hospital mortality, acute length of stay, delirium, duration of delirium, and UTIs. These outcomes were used to compare outcomes of bundle between the preintervention and intervention periods.

Table 1. Comparison of Baseline Characteristics (Preintervention vs Intervention).

Baseline	Preintervention (n = 221)	Intervention (n = 198)	*P* Value
Age	Average 80, SD 11	Average 80, SD 10	.53
Sex, M:F	69:152 (31%:69%)	47:151 (24%:76%)	.11
ASA	Average 3	Average 3	.04

Abbreviations: ASA, American Society of Anesthesiology; F, female; M, male; SD, standard deviation.

Statistical Analysis

The data were collected by a trained nurse in fragility hip fractures and entered into a Microsoft Excel spreadsheet (Microsoft excel version 2010). The SPSS software (version 22.0) was used for evaluation of the study results. The baseline characteristics and bundle compliance of the preintervention and intervention patients were compared by using χ^2 for categorical variables and *t* test for continuous variables. To analyze the difference between the intervention and preintervention periods, McNemar and independent *T* test were employed. Statistical significance was defined as a *P* value <.05.

Results

The preintervention and intervention cohorts consisted of 221 and 198 patients, respectively. Baseline characteristics including sex, age, and ASA score were used for statistical analysis and comparison (Table 1)

During the intervention period, compliance to the bundle of care was 47% (n = 92) based on the all-or-none approach. When compliance was assessed for each individual bundle element, the highest compliance during the intervention period was 92% (n = 182) for Femoral Nevrve Blocks (FNBs). This was 28% higher than the preintervention rate. The lowest rate of compliance within the intervention period was 67% (n = 133) for the removal of IDCs within 48 hours, which was 6% higher than the preintervention group. Overall bundle compliance improved across all individual elements of the bundle in the intervention group when compared to the preintervention group (Table 2). Statistical significance (*P* = .01) was found for the overall bundle compliance and CAM assessment.

Clinical outcomes were compared between the intervention and preintervention periods (Table 3). A significant finding was seen regarding in-hospital mortality, which saw a 10.5%

Table 2. Compliance by Individual Bundle Elements.

Bundle Components	Preintervention (n = 221), n (%)	Intervention (n = 198), n (%)	*P* Value
Femoral nerve block	141 (64%)	182 (92%)	.01
MSQ preoperatively	168 (76%)	161 (81%)	.23
Sit out of bed day 1	188 (85%)	179 (90%)	.13
IDC removal within 48 hours	135 (61%)	133 (67%)	.23
CAM assessments	7 (3%)	136 (69%)	.01
Overall compliance	0 (0%)	92 (47%)	.01

Abbreviations: CAM, confusion assessment method; IDC, indwelling urinary catheter; MSQ, Mental State Questionnaire.

Table 3. Comparison of Clinical Outcomes (Preintervention vs Intervention).

Bundle Components	Preintervention (n = 221), n (%)	Intervention (n = 198), n (%)	*P* Value
Mortality	29 (13%)	5 (2.5%)	.01
Delirium	46 (21%)	55 (28%)	.01
UTI	64 (29%)	40 (20%)	.01
Acute LOS	Average 6	Average 6	.31

Abbreviations: LOS, length of stay; UTI, urinary tract infection.

reduction in the intervention group ($P < .001$). There was a 7% increase in the rate of delirium, reflecting an increase in the recognition of delirium ($P < .001$). A 9% decrease in the rate of UTIs was evident between the preintervention and intervention groups ($P < .001$). The acute length of stay between both the preintervention and intervention groups remained the same at 6 days.

Discussion

Significant advancements in the care of the patient with a fragility hip fracture have been made globally, since the orthogeriatric model of care was first described by Devas and Irvine in the 1950s. The implementation of a bundle of care within the framework of an orthogeriatric model aims to recognize any areas of variation in care and implement small evidence-based interventions to reduce variation. Our hypothesis was that if care was provided to fragility hip fracture patients in bundles, they were more likely to be applied and produce subsequent improvements in clinical outcomes and reduction in variation in care.

The study showed that despite widespread education and promotion of the bundle, the bundle compliance based on an all-or-none approach was 47% during the intervention period. Our study found that even with a limited compliance rate, there were improvements in surgical outcomes for patients. Notably, there was a 10.5% reduction in mortality between the 2 cohorts. However, a limitation of this study is that only in-patient mortality was used. One-month and 1-year mortality was not included in this study. It is also likely that compliance and clinical outcomes in our study were also influenced by having a consistent structure to the management of fragility hip fracture patients during the entire period of the study.

We found that compliance with the CAM tool was 1 of the lowest (69%) during the intervention. This is possibly due to the rigorous and time-consuming nature of the assessment tool, which may act as a deterrent for nursing staff applying this tool to the study population. The manner in which the CAM tool is used is also important in that it must be performed correctly to provide accurate results. We found that intense supervision and involvement of the NoF nurse was required to educate, remind, and motivate nursing staff to perform the CAM assessment, which was a new and underutilized tool. Perioperative delirium in fragility hip fracture patients has been estimated to be as high as 50%, and it is imperative that it is diagnosed to enable effective treatment

One of the reasons why hospitals see improvements after the implementation of a bundle is based on how a team functions cohesively together when they have a shared goal of implementing the bundle.[20] There is an improvement in the culture of safety and increased care and attention of a subset of patients leading to a positive chain reaction in improving clinical outcomes.

Conclusion

Although there has been widespread research of bundles, currently there is still uncertainty regarding the effectiveness and potential outcomes from such an intervention. The primary end point in the development of care bundles is to improve clinical outcomes with the emphasis on improving teamwork within a multidisciplinary setting by reducing variation in clinical care. This study has showed that by implementing a care bundle, within an orthogeriatric model of care, there was a 10.5% reduction in mortality, a reduction in UTIs, and improvements in all elements of the bundle of care implemented. Bundles have opened a new avenue to better manage and improve outcomes for surgical patients to reduce variation in clinical outcomes. The recent establishment of the Australia and New Zealand Hip Fracture Registry (ANZHFR) will enable comparisons of various models of care and contribute to initiatives across varying hospitals focusing on evidence-based quality outcomes. The challenge for health-care providers is to seek evidence-based improvements in delivering quality health care. Further research is needed regarding the role that care bundles have in improving surgical outcomes for surgical patients, in particular, fragility hip fracture patients.

Declaration of Conflicting Interests

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References

1. A snapshot of osteoporosis in Australia. Canberra: Australian Institute of Health and Welfare. 2011. http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=10737418747&libID=10737418746. Accessed December 5, 2016.
2. The problem of osteoporotic hip fracture in Australia. Canberra: Australian Institute of Health and Welfare. 2010. Bulletin 76. http://www.aihw.gov.au/publication-detail/?id=6442468333. Accessed December 4, 2016.
3. Chamberlain M, Pugh H. Improving inpatient care with the introduction of a hip fracture pathway. *BMJ Qual Improv Rep*. 2015;4(1):pii:u204075.w2786.
4. Boulton C, Wakeman R. Lessons from the national hip fracture database. *Orthop Trauma*. 2016;30:123-127.
5. Patel NK, Sarraf KM, Joseph S, Lee C, Middleton FR. Implementing the National Hip Fracture Database: an audit of care. *Injury*. 2013;44(12):1934-1939.
6. McDonald R, Zaidi S, Todd S, et al. *A Qualitative and Quantitative Evaluation of the Introduction of Best Practice Tariffs*. London, UK: Department of Health; 2012.
7. Resar R, Griffin FA, Haraden C, Nolan TW. *Using Care Bundles to Improve Health Care Quality*. IHI Innovation Series white paper. Cambridge, Massachusetts: Institute for Healthcare Improvement; 2012. www.IHI.org.
8. Morrison RS, Magaziner J, McLaughlin MA, et al. The impact of post-operative pain on outcomes following hip fracture. *Pain*. 2003;103(3):303-311.
9. Singh A, Kohli V, Bajwa S. Intravenous analgesia with opioids versus femoral nerve block with 0.2% ropivacaine as preemptive analgesic for fracture femur: a randomized comparative study. *Anesth Essays Res*. 2016;10(2):338-342
10. Dikcman E, PushkarLikourezos A, et al. Ultrasound-guided nerve blocks for intracapsular and extracapsular hip fractures. *Am J Emerg Med*. 2016;34(3):586-589.
11. Parker MJ, Griffiths R, Appadu B. Nerve blocks (subcostal, lateral cutaneous, femoral, triple, psoas) for hip fractures. *Cochrane Database Syst Rev*. 2002;(1):CD001159.
12. Williams H, Paringe V, Shenoy S, Michaels P, Ramesh B. Standard preoperative analgesia with or without fascia iliaca compartment block for femoral neck fractures. *J Orthop Surg (Hong Kong)*. 2016;24(1):31-35.
13. Kamel HL, Iqbal MA, Mogallapu R, et al. Time to ambulation after hip fracture surgery: relation to hospitalization outcomes. *J Gerontol A Biol Sci Med Sci*. 2003;58(11):1042-1045.
14. Berggren D, Gustafson Y, Eriksson B, et al. Postoperative confusion after anesthesia in elderly patients with femoral neck fractures. *Anesth Analg*. 1987;66(6):497-504.
15. Inouye SK, Van Dyck CH, Alessi CA, et al. Clarifying confusion: the confusion assessment method. A new method for detection of delirium. *Ann Intern Med*. 1990;113(12):941-948.
16. Wei LA, Fearing MA, Sternberg EJ, et al. The confusion assessment method: a systematic review of current usage. *J Am Geriatr Soc*. 2008;56(5):823-830.
17. Okwemba S, Copelan L. Improving Mental Status Questionnaire (MSQ) completion on admission to the Acute Surgical Receiving Unit (ASRU), Ninewells Hospital, Dundee. *BMJ Qual Improv Rep*. 2014;3(1). pii: u205217.w2159.
18. Schaeffer AJ. Catheter-associated bacteriuria. *Urol Clin North Am*. 1986;13(4):735-747.
19. Wald HL, Ma A, Bratzler DW, et al. Indwelling urinary catheter use in the postoperative period: analysis of the national surgical infection prevention project data. *Arch Surg*. 2008;143(6):551-557.
20. Pronovost P, Needham D, Berenholtz S, et al. An intervention to decrease catheter-related bloodstream infections in the ICU. *N Engl J Med*. 2006;355(26):2725-2732.
21. Lynch G, Tower M, Venturato L. Identifying outcomes associated with co-managed care models for patients who have sustained a hip fracture: an integrative literature review. *Int J Orthop Trauma Nurs*. http://dx.doi.org/10.1016/j.ijotn.2015.03.001. Accessed December 4, 2016.
22. Health Roundtable. https://www.healthroundtable.org/. Published 2015. Updated March 2015. Accessed March 2015.
23. Institute for Healthcare Improvement. What Is a Bundle? http://www.ihi.org/resources/Pages/ImprovementStories/WhatIsaBundle.aspx. Published 2015. Updated March 2015. Accessed March 2015.
24. Zywiel MG, Hurley RT, Perruccio AV, Hancock-Howard RL, Coyte PC, Rampersaud YR. Health economic implications of perioperative delirium in older patients after surgery for a fragility hip fracture. *J Bone Joint Surg Am*. 2015;97(10):829-836.
25. Devas MB. Geriatric orthopaedics. *Br J Med*. 1974;1(5900):190-192.