Palliative Management of Nonoperative Femoral Neck Fractures With Continuous Peripheral Pain Catheters: 20 Patient Case Series

Christopher H. Rashidifard, DO¹, Nicholas M. Romeo, DO¹, Paul Muccino, DO¹, Mark Richardson, MD¹, and Thomas G. DiPasquale, DO¹

Abstract
Introduction: To identify the success of pain catheters in the management of pain in nonoperatively treated femoral neck fractures (FNFs) in supplement to current multimodal protocols for end-of-life pain management. Methods: Twenty patients aged older than 50 years with FNFs were selected in a retrospective fashion at a level 1 trauma center. These patients were treated nonoperatively with indwelling continuous peripheral pain catheters to palliate pain. Adjunctive pain control for patients undergoing nonoperative management of FNFs was provided with an indwelling continuous intra-articular/peripheral nerve ropivacaine pain catheters. Pain scores 24 hours before/after continuous pain catheter placement, ambulation status before/after continuous pain catheter placement, mortality at 30 days/1 year, and length of hospital stay were measured. Results: Twenty patients were identified with an average age of 84.55 years. The average length of stay was 4.85 days with a decrease of 4.45 points on the visual analog scale and an improvement of 90% in ambulation status. Thirty-day and one-year mortality were 65% and 95%, respectively. Conclusion: This case series provides orthopedic surgeons with an option for and data on the success of this adjunct to palliate patients who elect to undergo nonoperative management of FNFs. This study also helps define which patients may be candidates for nonoperative management of geriatric hip fractures.

Keywords
femoral neck fractures, osteoporosis, palliative management, pain catheter

Received May 9, 2016; revised November 10, 2016; accepted November 11, 2016.

Introduction
Intracapsular femoral neck fractures (FNFs) account for 50% of all hip fractures and 20% of the workload for orthopedic surgeons. As life expectancy in the worldwide population has increased, there has been an increase in the number of hip fractures with a projection of 6.26 million in 2050.¹ The majority of these fractures occur in elderly patients with osteoporosis secondary to low energy falls. This patient population requires a multidisciplinary approach, as they may have complicated preexisting medical comorbidities and cognitive impairments.

The surgical management of FNFs is dependent on multiple factors including fracture displacement, patient age, and activity level. Surgical options range from percutaneous screw fixation to total hip arthroplasty. Postoperatively, patients who undergo surgical management have a 46% probability of regaining their previous level of mobility, and 15% to 20% of the patients do not return to their previous residence.²⁻⁵

Although surgical management of FNFs is the current standard of care, select patients/families may elect to proceed with nonoperative management due to their significant preexisting medical conditions, minimal baseline ambulatory level, and/or goals of care. Previously, these patients would require oral opiate pain medication to palliate their pain until a functional girdle stone forms, which may take several weeks. In addition, mobilization is crucial for these patients as it is directly tied to survival.⁶⁻⁷

¹ Department of Orthopedics, Wellspan York Hospital, York, PA, USA
Corresponding Author: Christopher H. Rashidifard, Department of Orthopedics, Wellspan York Hospital, PCT 1st Floor Ortho, 1001 South George Street, York, PA 17403, USA. Email: crashidifard@wellspan.org

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Ideal pain management of elderly patients with FNFs includes a multimodal approach.8 Opioid usage in this patient population has been shown to exacerbate cognitive impairments, worsen acute delirium, and potentially increase the probability of additional falls. Thus, a clinical need exists for adjunct medications to be utilized with this subset of patients undergoing nonoperative management. The advent of continuous indwelling analgesic catheters provides a feasible adjuvant to pain management in this patient cohort.

Pain management utilizing an indwelling peripheral nerve sheath catheter that dispenses local anesthetic medication has been described with successful upper extremity surgery, joint arthroplasty, and in nonorthopedic surgical procedures.9,10 However, the use of peripheral or intracapsular catheters for pain management in patients with FNFs treated nonoperatively, to our knowledge, has yet to be described in published literature.

This study intends to identify the efficacy of indwelling catheters to palliate patients with FNFs treated nonoperatively. These catheters are intended to supplement our current multimodal protocol with the objectives of comparing pre- and post-catheter pain scores and ambulatory level. In addition, we compared 30-day mortality, 1-year mortality, and length of stay to previously reported percentages.

Methods

Patients were identified from a level 1 trauma center hospital electronic medical record from January 2009 to May 2015. All patients with an FNF, utilizing International Classification of Diseases, Ninth Revision codes in combination with a common procedural terminology (CPT) code for placement of intracapsular continuous ropivacaine analgesic catheters were included. Patients with a CPT code for surgical intervention were excluded. A retrospective chart review was conducted to include the following data: basic patient demographics, past medical history, visual analog pain scores 24 hours before/after continuous pain catheter placement, ambulation status before and after continuous pain catheter placement, mortality at 30 days and 1 year, and length of hospital stay. Chronic disease was defined as cardiac disease, peripheral vascular disease, diabetes mellitus, hypertension, hyperlipidemia, chronic kidney disease, chronic obstructive pulmonary disease, or atrial fibrillation.

Inclusion criteria:

- Patients aged 50 and older with an FNF, Orthopaedic Trauma Association 31-B1, 31-B2, 31-B3, who were treated nonoperatively.
- Intracapsular or peripheral nerve continuous analgesic catheters placed by the Department of Anesthesia.
- Inpatient or observational admission status with documented visual analog scale (VAS) charting by floor nursing.
- Intracapsular/peripheral nerve continuous analgesic catheter placement CPT code.

Exclusion criteria:

- Patients who self-discontinue analgesic pain catheter placement within 24 hours of placement.
- Patients with advanced dementia or cognitive impairments that make them incapable to subjectively rate pain.

Results

Twenty patients were identified from a retrospective chart review with all patients having 30-day and 1-year mortality data. The average age of the included patients was 84.55 with a 75% female predominance. Forty-five percent of patients in this cohort had 3 major chronic diseases and 65% of patients had a cognitive disorder. Ambulation level prior to FNFs was 5% nonambulatory, 45% transfers only, 30% minimal community ambulator, and 20% household ambulatory. After sustaining the FNF, all patients were limited to bed rest secondary to pain. Fifty-five percent of the patients had a palliative care consult during their hospital stay (Table 1). The average length of stay was 4.85 days with 1 outlier that required a 17-day...
hospital stay. When the outlier was removed, the average length of stay was reduced to 4 days.

During the hospital stay, pain scores were measured utilizing the VAS charted by the floor nursing staff. The VAS were averaged for 24 hours before and after placement of continuous analgesic catheter placement. On average, after placement of a continuous analgesic catheter placement, there was a decrease of 4.45 points in VAS scores. After catheter placement, 90% of the patients improved ambulation level when participating with physical therapy, which was defined as being able to transfer to chair or ambulate with a walker. Fifteen of the patients were able to transfer to a chair, 3 were able to ambulate with a walker, and 2 remained on bed rest. The 30-day and 1-year mortalities in the patient group were 65% and 95%, respectively (Table 2).

**Discussion**

The current standard of care for elderly patients sustaining FNFs is operative management; however, there is a subset of patients who may be at too high risk for surgery and/or wish to not undergo surgical management secondary to their significant medical comorbidities, minimal baseline ambulation level, and/or comfort care goals. This small patient population still requires palliation of pain and early mobilization. With the increasing number of elderly patients sustaining a FNF, orthopedic surgeons can expect to manage patients who may wish to not have surgical management for numerous reasons. This case series gives surgeons results of an additional modality to improve pain control and mobilization in this patient subset. To our knowledge, this is the only case series that describes pain management of nonoperatively treated FNFs with continuous analgesic pain catheters as an augment to traditional pain management techniques.

Pain secondary to hip fractures can be debilitating; all 20 patients in this study were initially placed on bed rest activity level secondary to pain. Pain control with opiate and nonopiate pain medication can be a limiting factor in the geriatric population. Opiate pain medications have been shown to further exacerbate baseline cognitive disorders. This is certainly a concern as 65% of our studied patient population presented with baseline cognitive disorders. Recent initiatives have been created to reduce the incidence of delirium in geriatric patients and delineates modifiable and nonmodifiable risks to reduce acute delirium. Many of the modifiable risks were demonstrated in our patient cohort: opiate pain medications, pain, emotional distress, and sleep deprivation secondary to pain. In addition, acute delirium has been attributed to poor hospital outcomes. With the application of continuous pain catheters as an adjunct to pain control in our cohort, we demonstrated the reduction in opiate medication consumption and hopefully the incidence of acute delirium.

This study attempts to evaluate the efficacy of intracapsular/peripheral continuous analgesic pain catheters in hopes of improving pain management regiments used to treat geriatric patients with FNFs who are being treated nonoperatively. In this series, VAS were reduced by 4.45 points in a 24-hour period when these catheters were placed by our anesthesiology staff. This modality allowed 90% of patients to improve their ambulatory status to a minimum of transfer to chair. Patients who remain in a bedridden state are more likely to have negative outcomes secondary to pressure ulcer, aspirations, and

| Table 2. Results. |
|-------------------|
| Patient | Length of Stay, days | 30-Day Mortality | 1-Year Mortality | Ambulation Status After Catheter Placement | 24-Hour VAS Score Average Prior to Catheter Placement | 24-Hour VAS Score Average After Catheter Placement |
|--------|----------------------|------------------|-----------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| 1      | 4                    | Deceased         | Deceased        | Transfers                                     | 9                                             | 0                                             |
| 2      | 4                    | Living           | Deceased        | Transfers                                     | 7                                             | 0                                             |
| 3      | 2                    | Deceased         | Deceased        | Bed rest                                      | 5                                             | 1                                             |
| 4      | 3                    | Deceased         | Deceased        | Transfers                                     | 6                                             | 0                                             |
| 5      | 3                    | Deceased         | Deceased        | Transfers                                     | 9                                             | 0                                             |
| 6      | 5                    | Living           | Deceased        | Transfers                                     | 7                                             | 3                                             |
| 7      | 4                    | Deceased         | Deceased        | Bed rest                                      | 7                                             | 3                                             |
| 8      | 3                    | Deceased         | Deceased        | Household with walker                         | 7                                             | 4                                             |
| 9      | 6                    | Living           | Deceased        | Household with walker                         | 8                                             | 3                                             |
| 10     | 1                    | Living           | Living          | Transfers                                     | 5                                             | 2                                             |
| 11     | 9                    | Deceased         | Deceased        | Transfers                                     | 8                                             | 5                                             |
| 12     | 4                    | Deceased         | Deceased        | Household with walker                         | 8                                             | 5                                             |
| 13     | 7                    | Deceased         | Deceased        | Transfers                                     | 6                                             | 0                                             |
| 14     | 17                   | Living           | Deceased        | Transfers                                     | 6                                             | 3                                             |
| 15     | 4                    | Deceased         | Deceased        | Transfers                                     | 7                                             | 3                                             |
| 16     | 5                    | Living           | Deceased        | Transfers                                     | 9                                             | 4                                             |
| 17     | 5                    | Living           | Deceased        | Transfers                                     | 4                                             | 4                                             |
| 18     | 5                    | Deceased         | Deceased        | Transfers                                     | 5                                             | 0                                             |
| 19     | 3                    | Deceased         | Deceased        | Transfers                                     | 6                                             | 4                                             |
| 20     | 3                    | Deceased         | Deceased        | Transfers                                     | 7                                             | 3                                             |
pulmonary decline. The improvement of ambulatory status seen in our cohort has the potential to decrease these negative outcomes attributed to a prolonged bed rest status. In addition, this series of patients demonstrated a shorter hospital length of stay at 4 days when compared to the 2010 national average of 5.8 days published by the Centers of Disease Control (CDC).17

Although this series of patients demonstrated improved pain scores and decreased hospital length of stay, 30-day mortality was 65% and 1-year mortality was 95%. This significant mortality rate could be due to 1 of 2 reasons. First, this may be due to the significant comorbidities that burden these patients leading to a high likelihood of fatality whether treated with or without surgery. This could be supported by the work of Ooi et al, who in their study of nonagenarians showed similar mortality of those treated both operatively and nonoperatively for proximal femur fractures.18 Conversely, one could argue that mortality rate was so strikingly high due to the fact that these patients were treated nonoperatively. This could be disputed by the fact that, despite not undergoing operative treatment, 90% of patients were at minimum able to ambulate to a chair and 16.7% were able to ambulate a distance. This is supported by the work of Parker et al who conducted a Cochrane review showing no difference in mortality of hip fractures treated with or without surgery.19 Additionally, Raaymakers and Marti reported only a 16% mortality rate at 1 year for patients with impacted FNFs treated with nonoperative management and early mobilization.8 We cannot conclude that either of these theories are true or false due to lack of a comparative group and with our small subset of patients.

The limitations of this study remain with the small patient subset, which can be attributed to the recent attainment of disposable continuous analgesic catheter systems at our hospital and that the majority of FNFs that were treated operatively. Additionally, this data set would likely be more powerful if there was a control group that did not receive continuous analgesic catheters, which is currently being collected and reviewed. With that addition of a control group, our hopes are to be able to show statistical significance in decreased length of stay and visual analog pain scores. Other limitations consist of variability in catheter placements including intracapsular blocks, peripheral nerve blocks, or a combination of both.

This case series provides orthopedic surgeons with an option for and data on the efficacy of this adjunct to palliate patients who are not candidates for surgical management of their FNFs. In addition, it helps define which patients may be candidates for nonoperative management of geriatric hip fractures and further discusses the mortality that is attributed to patients who are not able to be managed operatively.

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

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

**References**

1. Dennison E, Mohomed MA, Cooper C. Epidemiology of osteoporosis. *Rheum Dis Clin North Am.* 2006;32(4):617-629.
2. Jensen J, Rasmussen T, Christensen S, et al. Internal fixation or prosthetic replacement in fresh femoral neck fractures. *Acta Orthop Scand.* 1984;55:712.
3. Parker MJ, Khan RJ, Crawford J, Pryor GA. Hemiarthroplasty versus internal fixation for displaced intracapsular hip fractures in the elderly. A randomised trial of 455 patients. *J Bone Joint Surg Br.* 2002;84(8):1150-1155.
4. Rogmark C, Carlsson A, Johnell O, Sernbo I. A prospective randomised trial of internal fixation versus arthroplasty for displaced fractures of the neck of the femur. Functional outcome for 450 patients at 2 years. *J Bone Joint Surg Br.* 2002;84(2):183-188.
5. Tidemark J, Zethraeus N, Svensson O, Törnkvist H, Ponzer S. Quality of life related to fracture displacement among elderly patients with femoral neck fractures treated with internal fixation. *J Orthop Trauma.* 2002;16(1):34-38.
6. Parker MJ, Palmer CR. A new mobility score for predicting mortality after hip fracture. *J Bone Joint Surg Br.* 1993;75(5):797-798.
7. Marconda M, Costa G, Cerbasi S, et al. Factors predicting mobility and change in activity of daily living after hip fracture: a 1-year prospective cohort study. *J Orthop Trauma.* 2016;30(2):71-77.
8. Raaymakers E, Marti R. Non-operative treatment of impacted femoral neck fractures. A prospective study of 170 cases. *J Bone and Joint Surg Br.* 1991;73(6):950-954.
9. Blecken L, Solla C, Fileta BB, Howard R, Morales CE, Buckenmaier CC. Serum free ropivacaine concentrations among patients receiving continuous peripheral nerve block catheters: is it safe for long-term infusions? *Anesth Analg.* 2014;118(1):225-229.
10. Ahsan ZS, Carvalho B, Yao J. Incidence of failure of continuous peripheral nerve catheters for postoperative analgesia in upper extremity surgery. *J Hand Surg Am.* 2014;39(2):324-329.
11. Yu B, Zhang X, Sun P, Xie S, Pang Q. Non-stimulation needle with external indwelling cannula for brachial plexus block and pain management in 62 patients undergoing upper-limb surgery. *Int J Med Sci.* 2012;9(9):766-771.
12. Feibel RJ, Dervin GF, Kim PR, Beaulé PE. Major complications associated with femoral nerve catheters for knee arthroplasty: a word of caution. *J Arthroplasty.* 2009;24(6 suppl):132-715.
13. Chidiac EJ, Perov S. Outpatient continuous peripheral nerve catheters. *Anesth Analg.* 2007;104(5):1303-1304.
14. Pelissier P, Svartz L. Continuous local anesthetic infusion after trapeziectomy for pain relief. *J Hand Surg Br.* 2006;31(6):692-693.
15. Reuben SS, Steinberg RB. Continuous shoulder analgesia via an indwelling axillary brachial plexus catheter. *J Clin Anesth.* 2000;12(6):472-475.
16. Szucs S, Iohom G, O’Donnell B, et al. Analgesic efficacy of continuous femoral nerve block commenced prior to operative fixation of fractured neck of femur. *Perioper Med (Lond)*. 2012;1:4.

17. Centers for Disease Control and Prevention/National Center for Health Statistics. 2015. http://www.cdc.gov/nchs/data/nhds/4procedures/2010pro4_numberprocedureage.pdf. Accessed April 10, 2016.

18. Ooi LH, Wong TH, Toh CL, Wong HP. Hip fractures in nonagenarians—a study on operative and non-operative management. *Injury*. 2005;36(1):142-147.

19. Parker MJ, Handoll HH, Bhargara A. Conservative versus operative treatment for hip fractures. *Cochrane Database Syst Rev*. 2000;(4):CD000337.