Clinical Research Article

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Impact of local anesthesia block on pain medication use and length of hospital stay in elderly indigenous patients in Alaska hospitalized for fragility fracture

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Abstract

Introduction: Fragility fractures (low-energy, minimal-trauma fractures) are common in the aging population and can lead to decreased function, increased mortality, and long-lasting pain. Although opioids are helpful in reducing acute postoperative pain, they present risks that may lead to increased morbidity and mortality.

Materials and Methods: This was a retrospective review of medical records of all Alaska Native and American Indian people older than 50 years, who received surgery for hip fracture repair between January 2018 and June 2019 (n = 128).

Results: We found that receipt of a peripheral nerve block (PNB) is a predictor for decreased length of hospital stay. However, receipt of PNB did not predict a reduction in postoperative morphine milligram equivalents opioid doses.

Discussion: Further study is required to determine whether one PNB method is superior to others based on individual-level characteristics.

Keywords: anesthesia block, fragility fracture, hip fracture, pain management, pain

1. Introduction

Osteoporosis occurs in over 6 million hip fractures each year.[1] Approximately 20% of patients with hip fracture die within a year after fracture, 40% lose the ability to walk independently, 10% suffer another fracture within the 1 year,[2] and 5%–10% are diagnosed with a subsequent hip fracture within 3 years, costing the US health care system over $17 billion per year.[3] Fragility fractures, often referred to as low-energy, minimal-trauma fractures, are becoming more common in the aging population.[4,5] Fragility fractures such as proximal femur fractures can be disabling, leading to decreased function, increased mortality, and long-lasting pain. Despite opioid medications not being a first-line treatment for chronic, nonmalignant, surgical pain, 25% of adults 65 years and older filled at least one opioid prescription in the past year.[6] Age-related alterations in metabolism, higher burden of comorbid conditions, and polypharmacy make elderly patients more vulnerable to drug-related harm, fractures, and recurrent fractures postoperatively.[7]

To limit opioid exposure in elderly patients requiring surgical treatment, peripheral nerve blocks (PNBs) and regional anesthesia have been used to enhance patient analgesia.[8] PNBs reversibly inhibit nerve transmission binding voltage-gated sodium channels in the nerve plasma membrane, blocking pain signals from reaching the brain, which could potentially decrease both postoperative opioid requirements and the risk of opioid-related adverse events in elder patients receiving surgical treatment for hip fractures. In 2018, the International Fragility Fracture Network issued a consensus statement recommending anesthetists develop and implement analgesia protocols that incorporate nerve blockade to minimize opioids, nonsteroidal anti-inflammatories, and sedative medications.[9] Interventions that include PNBs have been shown to be low risk, increasing mobility, and reducing pain in patients undergoing surgery for a fragility fracture.[10] Relatively little is known about the osteoporosis femur fracture risk and the effectiveness of current management strategies in the Alaska Native (AN) and American Indian (AI) population in Alaska. A limited number of studies on osteoporosis risk reduction, prevention, and management exist in AI communities and even fewer in AN people.[6,11] Most health research with and for AN and AI people has been conducted with tribal communities living on reservations, receiving care primarily by the federal government (Indian Health Service).[11] Alaska Native individuals are generally of shorter stature and have been attributed to unique environmental influences, diet, and genetics.[7] A majority of AN and AI individuals in Alaska live in an urban setting and receive care directly from interdisciplinary health care teams within the Alaska Native Medical Center (ANMC)

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tribally owned and operated health care system.[12] It is unclear whether opioid-sparing, multimodal approaches to pain management using PNBs are effective in AN/AI communities. Clinical trials are currently examining opioid use in single-shot nerve block versus continuous peripheral nerve infusion in anterior cruciate ligament repair; however, the use in fragility fractures including proximal femur fractures in the AN community is not evaluated. This review sought to determine whether PNBs are predictive in reducing postoperative opioid use and length of hospitalization in AN/AI elder patients requiring surgery for fracture repair.

2. Materials and Methods

ANMC is a tribally owned and operated health corporation that provides comprehensive medical services (including acute, specialty, primary, and behavioral health services) to 166,000 AN/AI people living across Alaska.

Consistent with the International Fragility Fracture Network recommendations, ANMC hospitalists, in collaboration with pharmacy personnel, established a multimodal care protocol. Per the protocol, 1 of 7 anesthesiologists evaluated candidates for PNB for patients admitted to the hospital with a fragility fracture.

A retrospective review was undertaken of medical records of all AN and AI beneficiaries eligible for health care services within ANMC and who were age older than 50 years, who received surgery for fracture repair between January 2018 and June 2019. ANMC provides services to 158,000 beneficiaries across the state of Alaska covering >660,000 square miles. Individuals with a history of chronic opioid use (use of long-acting opioids, >7 days) were excluded. The time frame was chosen based on the change in regional anesthesia use and site initiation of a project design. Procedures were reviewed and approved by the Alaska Native Tribal Health Consortium research review committee and Alaska Area Institutional Review Board and deemed non-research.

The following patient data were extracted (by information technology services or chart review) from the Cerner electronic medical record: age, sex, geographic region, height, weight, postoperative day of ambulation, chronic conditions, acute and chronic medications received, and type of surgery for hip fracture (International Classification of Diseases-10). Pertinent

TABLE 1

Baseline Characteristics (N = 128).

Characteristic	No PNB (n = 67), n (%)	PNB (n = 61), n (%)	P*
Sex, male	20 (29.9)	17 (27.9)	0.8049
Age (years), mean (SD)	75.6 (9.8)	74.0 (10.3)	0.3800
Region			0.4611
Far north	7 (10.5)	10 (16.4)	
Interior	1 (1.5)	2 (3.3)	
Southeast	3 (4.5)	5 (8.2)	
South central	31 (46.3)	22 (36.1)	
Southwest	23 (34.3)	22 (36.1)	
Non-Alaska	2 (3.0)	0 (0)	
Height (cm), mean (SD)	156.6 (10.7)	157.6 (10.7)	0.5852
Weight (kg), mean (SD)	61.6 (16.0)	58.8 (15.7)	0.3255
Postoperative day of ambulation, mean (SD)	1.8 (1.4)	1.7 (1.3)	0.5708
Diabetes	7 (10.5)	10 (16.4)	0.3222
Current smoker within 1 year	10 (14.9)	24 (39.3)	**0.0018**
Functional health status			0.9193
Independent	52 (77.6)	49 (80.3)	
Partially dependent	14 (20.9)	11 (18.0)	
Totally dependent	1 (1.5)	1 (1.6)	
Hypertension requiring medication	46 (68.7)	37 (60.7)	0.3437
CKD 3 or 4	9 (13.4)	5 (8.2)	0.3431
Steroid/immunosuppressant use	2 (3.0)	9 (14.8)	**0.0177**
Chronic liver failure	2 (3.0)	2 (3.3)	0.9240
History of fracture	11 (16.4)	12 (19.7)	0.6320
Osteoporosis or fragility fracture history	19 (28.4)	20 (32.8)	0.5867
Laboratory values, mean (SD)			
Serum creatinine	0.8 (0.5)	0.8 (0.2)	0.2635
BUN	19.4 (11.6)	17.2 (10.4)	0.2806
Calcium	8.9 (0.6)	8.7 (0.6)	0.1110
AST/SGOT[c]	29.2 (19.1)	24.8 (10.5)	0.1117
ALT[c]	23.3 (17.0)	21.8 (21.6)	0.6816
Vitamin D	32.1 (12.1)	30.7 (13.1)	0.5911
Postoperative ICD-10 code			0.0690
Osteoporosis with current pathological fracture (M80-)	13 (19.4)	21 (34.4)	
Fracture of head and neck of femur (S72.0-)	23 (34.3)	12 (19.7)	
Pertrochanteric fracture (S72.1-) or subtrochanteric fracture of femur (S72.2-)	25 (37.3)	26 (42.6)	
Others	6 (9.0)	2 (3.3)	

Bold entries are statistically significant ($P \leq 0.05$).

ALT, alanine aminotransferase; AST, aspartate aminotransferase; BUN, blood urea nitrogen; CKD, chronic kidney disease; ICD, International Classification of Diseases; PNB, peripheral nerve block; SGOT, serum glutamic oxaloacetic transaminase.

* Categorical data were compared using the Pearson χ^2 test; continuous data were compared using the pooled t test for equal variances and unpooled t test for unequal variances.

laboratory variables that would affect medication metabolism and response (serum creatinine, blood urea nitrogen, aspartate aminotransferase, alanine aminotransferase, serum calcium, and vitamin D) were also collected. The primary outcome of this study was length of stay (LOS), and the secondary outcome was morphine milligram equivalents (MME) dose from postoperative days 1 to 3.

Baseline variables between those who received a PNB (fascia iliaca compartment block) and those who did not were compared using the *t* test and χ^2 test for continuous and categorical data, respectively. Simple linear regression was performed for each variable, and those found to be statistically significant were added to the multiple linear regression model with the block variable. In both regression models, categorical variables were recoded into dummy continuous variables. *P*-values ≤ 0.05 were considered statistically significant.

3. Results

In total, 128 patients were included in the analysis: 61 patients (46% urban) received a PNB and 67 patients (54% urban) did not receive a PNB (Table 1). The mean (SD) LOS for patients receiving a PNB and patients who did not receive a PNB was 10.2 (6.5) days and 13.5 (11.6) days, respectively. In the simple linear regression for LOS, the following variables were statistically significant: PNB, sex, age, height, weight, postoperative day of ambulation, diabetes, and functional health status (Table 2). When these variables were added to the multiple linear regression, PNB, age, postoperative day of ambulation, and diabetes remained significant.

The mean (SD) MME dose from postoperative days 1 to 3 for patients receiving PNB and those who did not receive PNB was 22.6 (20.9) mg and 21.5 (21.2) mg, respectively. In the simple linear regression for mean MME dose from postoperative days 1 to 3, only age, history of fracture, and osteoporosis were significant (Table 2). In the multiple linear regression model with these variables and PNB, age remained significant. However, receipt of PNB did not predict a reduction in postoperative MME opioid doses.

TABLE 2

Regression Models Results for LOS.

Variable*,†	*P*
Simple linear regression	
Block	0.0495
Sex	0.0031
Age	0.0112
Height	0.0416
Weight	0.0028
Postoperative day of ambulation	<0.0001
Diabetes	0.0141
Functional health status	0.0394
Multiple linear regression	
Block	0.0476
Age	0.0041
Postoperative day of ambulation	0.0003
Regression model results for mean MEQ dose from postoperative days 1 to 3	
Diabetes	0.0280
Simple linear regression	
Block	0.7706
Age	0.0009
History of fracture	0.0060
Osteoporosis or fragility fracture history	0.0006
Multiple linear regression	
Block	0.9372
Age	0.0059

LOS, length of stay; MEQ, milliequivalents.
* Only statistically significant variables are shown ($P \leq 0.05$); block variable are always shown.
† Categorical variables recoded into dummy continuous variables.

4. Discussion

Access to health care services is limited in many areas of Alaska requiring the use of frontline health care providers in the community to screen patients and provide protocol-based care to individuals in rural and underserved communities.[10,13–15] The focus of the codeveloped multimodal care protocol was to better identify, treat, and prevent fractures, improving health outcomes and reducing complications. The multimodal care protocol standardizes care, prompting laboratory assessment (eg, vitamin D and serum calcium), screening for secondary causes of osteoporosis, and guiding pharmacologic and nonpharmacologic treatment (eg, vitamin D, calcium, bisphosphonates, improved pain control, using less narcotics, improved early mobility, etc).

Care of hip fractures is complicated by the number of comorbid conditions, limited physiologic reserve, cognitive impairment, and frailty. Early fracture repair and mobilization is associated with better health outcomes, decreased composite mortality, and medical complications (myocardial infarction, deep vein thrombosis, pulmonary embolism, and pneumonia).[16–18] Poor pain control impedes postoperative rehabilitation, is associated with adverse physiological and psychological consequences, and reduces patients' health-related quality of life.[19] Many patients complain of pain >1 year after fracture unrelieved by analgesics, affecting mobility, functional activity, independence, sleep, and energy.[19,20] Approximately 10% of opioid-naive older adults who received postoperative prescription for an opioid continue to request and take opioids for pain 3 months after surgery.[11] Increased use of opioids in older adults, although helpful in reducing postoperative pain, can lead to additional risks (eg, falls, constipation, misuse, and/or addiction), requiring safer pain management options such as PNBs.

Local anesthetics and opioid drugs have been used to treat postoperative pain since the early 1980s. PNBs, single-shot or catheter-based, have been shown to provide improved and extended pain control, reduce opioid utilization, and improve patient satisfaction and health outcomes in both upper and lower extremity surgeries such as hip fractures. However, PNBs are still not widely available to all persons with fractures. It is unclear whether clinical response differs based on fracture site, general and spinal techniques used, depth of sedation, and/or individual patient difference. In our study, PNB use, age, postoperative day of ambulation, and history of diabetes significantly predicted LOS. However, further study is required to determine whether one PNB method is better than another based on individual-level characteristics (age, sex, hip fracture severity, previous hip fracture, and individual-level variations in nerve distributions and pain blockade). The results support further study of PNBs for postoperative pain control, including different PNB methods and patient-level characteristics that may affect outcomes. Given the study design, we were unable to account for all residual confounders. There may be other factors that affect our outcomes of interest.

Notable limitations of this pragmatic study include but are not limited to the following: small sample population, nonrandom therapy selection by providers, cultural bias regarding therapy selection and pain management support, and lack of previous research studies on the topic. However, the diverse communities participating in this study

are historically understudied and have a history of variable response to pain management strategies warranting further study.[12]

5. Conclusion

In our study, PNB use, recommended by the multimodal care protocol, was shown to significantly predict decreased LOS postoperatively by AN and AI elder patients surgically treated for hip fracture.

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