



Prolonged Duration of Sciatic Nerve Blockade in the Elderly after Foot and Ankle Surgery

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1. Abstract

1.1 Background and Objectives: Perioperative morbidity related to anesthesia renders elderly patients vulnerable because age related factors affect medication effects, clearance and metabolism. Regional anesthesia within a multimodal regimen reduces opioid adverse effects in the elderly and improves immediate analgesia but not long term recovery and prolonged nerve blockade has been reported. The purpose of this study was to assess analgesic effects of sciatic nerve blockade in the elderly.

1.2 Methods: Postoperative sciatic nerve blockade was administered for foot and ankle surgery to patients over age 18 years. Preoperative, post-anesthesia unit and 24 hour postoperative pain scores and opioid doses for these same intervals were recorded.

1.3 Results: 47 patients enrolled and 12 (25.5%) were over age 70. Preoperative, immediate and 24 post-operative pain scores and total intraoperative and immediate postoperative opioid doses were lower in the elderly. The total 24 hour postoperative opioid doses in the elderly were lower compared to the younger group.

1.4 Conclusions: Total 24 hour postoperative cumulative opioid doses after sciatic nerve blockade in patients over 70 are lower than in younger patients. Further observations in greater numbers of patients and improved ultrasound to assess sciatic nerve structure in the elderly are warranted to study this effect.

2. Background and Objectives

Age associated decreases in physiologic function and acquired comorbidities and frequent poly-pharmacy are some of the

factors that attenuate the surgical stress response and alter the pharmacodynamic and pharmacokinetic mechanisms of anesthetic medications administered to elderly patients and render this population more susceptible to perioperative morbidities [1,2]. Multimodal perioperative analgesic therapy is recommended for the elderly in order to reduce opioid related adverse effects and regional anesthesia is a major component of this approach but although it is effective for immediate post-operative pain control and recovery, any beneficial effect on long term outcomes or improved quality of life has not been demonstrated [3,4]. Multiple physiologic and neuro-anatomic mechanisms increase duration of action and sensitivity and decrease the onset time of local anesthetics in neuraxial and regional anesthesia in the elderly [5,6]. Prolonged duration of action of upper extremity brachial plexus blockade using the axillary and supraclavicular approach has been demonstrated in the elderly [7,8]. The purpose of this study was to observe the analgesic effects of sciatic popliteal nerve blockade in the elderly.

3. Methods

After receiving IRB approval from the University of Washington Human Subjects Division, patients provided written informed consent prior to undergoing elective foot and ankle surgery for degenerative joint disease and were enrolled for participation in a sciatic nerve block study. The preoperative data collected were age, gender, ASA physical status, height, weight, calculated Body Mass Index (BMI), and worst pain score in the preceding 24 hour interval. Exclusion criteria were pre-existing cognitive deficits, chronic and neuropathic or traumatic lower extremity associated pain and chronic opioid maintenance therapy. Patients with a chronological age of 70 years and above were placed in the elderly group and all others in the non-elderly group. General inhalational endotracheal

anesthesia with sevoflurane and intraoperative analgesia with intravenous fentanyl, morphine and/or hydromorphone was administered to all patients for their surgery. Inadequate pain relief following nerve blockade was treated with supplemental analgesia with intravenous fentanyl, morphine and/or hydromorphone and oral oxycodone in bolus doses in the immediate postoperative period and as patient controlled analgesia in the 24 hour period following surgery. As a result of the variety of analgesic narcotic medications administered peri-operatively due to both patient and prescribing practitioner preferences, all opioid dosages were converted to equipotent values in mg of intravenous morphine sulphate using a standardized opioid conversion calculator in order to permit comparison of opioid dosages between patients. All patients received a single bolus postoperative Sciatic Nerve Blockade (SNB) in the Post Anesthesia Care Unit (PACU) with the administration of 25 ml 0.25% bupivacaine under ultrasound guidance. The nerve block procedure was the supine lateral popliteal sciatic approach using a SonoSite M Turbo machine with a 38mm linear array probe and Life-Tech ProBloc II 100 mm 30 degree bevel needles in the short axis view. The total intraoperative, PACU discharge and 24 hour cumulative ward unit doses of opioid converted to mg intravenous morphine were recorded separately along with the patient's self-reported pain score on discharge from the PACU and 24 hours after admission to the ward. All patients received patient controlled analgesia with hydromorphone 1 mg/ml concentration with settings of 0.2 mg per 6 minute intervals with no 4 hour limiting lockout and were converted to oral oxycodone on the first postoperative day.

4. Results

47 patients met the criteria for inclusion and 12 (25.5%) were age 70 and above. Table 1 lists the demographic and observed pain scores and opioid doses recorded for each patient group. The groups were comparable for gender distribution with almost equal male to female ratios, ASA physical status and BMI. The pain scores for each group at each time interval are plotted in Figure 1. The elderly group pain scores were 1 point lower at each time measurement but this did not reach statistical significance by paired Student's t-test. There were no significant gender based differences in pain scores and opioid consumption in all groups.

Table 1: Patient demographics, perioperative pain scores and opioid doses categorized by age.

N=47	Age below 70 years	Age above 70 years
Number	35	12
Females/Males	19/16	6/6
Age in years	50.34(12.73)	76.67(4.23)
ASA status	2(1)	2(1)
BMI, kg/m ²	28.44(5.19)	29.41(4.13)
Preoperative Pain Score	6(4)	5(3)
Intraoperative Opioids	27.82(14.25)	21.08(12.1)
PACU Discharge Pain Score	2(2)	1(1)
PACU Opioids	7.13(9.96)	2.53(4.38)

24 Hour Pain Score	4(2)	2(2)
24 Hour Postoperative Opioids	59.22(47.09)	23.97(34.91)*

Numbers expressed are arithmetic mean (SD).

Opioid doses calculated as mg intravenous morphine.

(* p < 0.05 by Student's t-test)

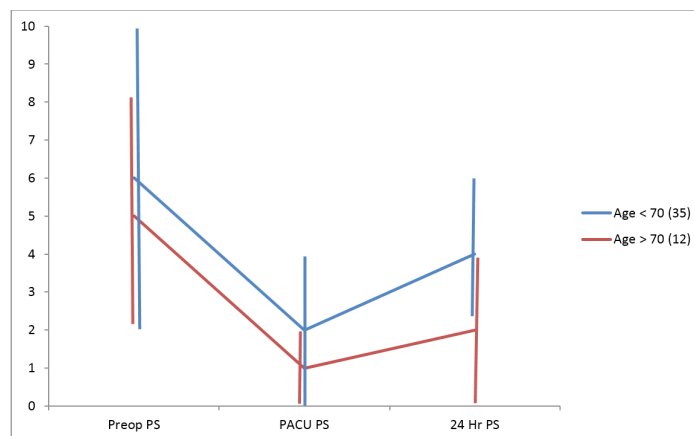


Figure 1: Mean Pain Score (PS) for patients at preoperative, post-anesthesia care unit discharge and 24 hour post-anesthesia care unit discharge times. Vertical lines represent standard deviation. Y-axis = Pain score.

The total mean opioid doses are presented in Figure 2. The elderly group intraoperative and PACU opioid doses trended lower compared to the non-elderly group but was not statistically significant. The elderly group mean intraoperative and PACU dosages of opioid were 21.08 (SD 12.1) mg and 2.53 (SD 4.98) mg compared to the non-elderly group opioid dosages of 27.82 (SD 14.25) mg in the intraoperative and 7.13 (SD 9.96) mg in the PACU time periods. At the 24 hour interval the cumulative opioid dose comparison between elderly and non-elderly patients was statistically significant (23.97 (SD 34.91) mg vs 59.22 (SD 47.09) mg, p < 0.05).

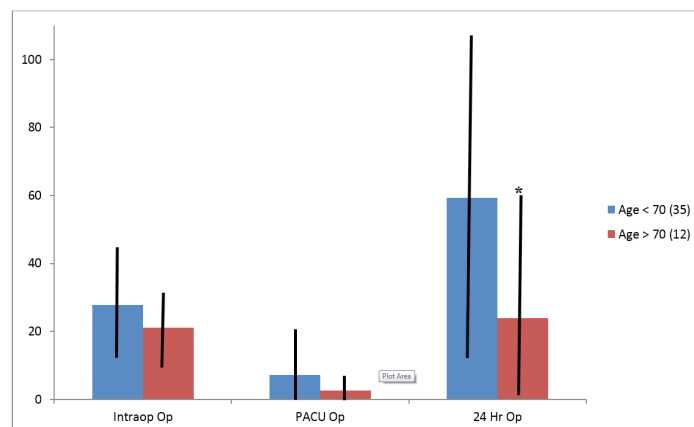


Figure 2: Mean total intraoperative, post-anesthesia care unit, and 24 hour ward unit opioid analgesic doses expressed as mg intravenous morphine sulphate. Vertical bars are standard deviations. * p < 0.05. Y axis = Pain score.

5. Discussion

The dose and volume of bupivacaine administered did not alter motor function in any patients after SNB. Elderly patients had lower pain scores and lower total opioid requirements than their non-elderly counterparts at 24 hours after surgery

following SNB although only the differing medication dose between the two categories of subjects was meaningfully significant. This observation supports the previous findings observed of prolonged duration of upper extremity nerve blockade in the elderly and demonstrates a similar phenomenon with SNB [7,8]. It is hypothesized that age related degenerative changes at the cellular level lead to an altered sensitivity of the nerve to local anesthetics causing decreased onset times and dosage requirements while simultaneously increasing their duration of action [3,4]. Prolonged nerve blockade in the elderly is also influenced by the attenuated clearance, redistribution and metabolism that are suggested to alter the pharmacodynamics and pharmacokinetics of local anesthetics at the tissue and systemic levels [1,2,5].

Attenuated pain perception in the elderly has been reported and this phenomenon could also explain the lower postoperative opioid requirements in this patient population [3]. The preoperative pain scores for the patients in this study were very similar between the elderly and non-elderly groups and contrasts with these reported observations.

Limitations of this study were the small number of elderly patients, the use of the pain score instead of the Visual Analog Scale (VAS), and the period of observation limited to 24 hours post-operatively. Standardization of intraoperative opioid dosing and recording of duration of action of nerve blockade would also have aided in supporting or refuting the notion of prolonged duration of action of local anesthetic at the nerve in the elderly.

Conclusion

Elderly patients over the age of 70 years have lower pain scores and cumulative postoperative opioid requirements 24 hours after SNB for elective foot and ankle surgery for degenerative joint disease and this may be due to prolonged duration of action or effects of local anesthetic upon the sciatic nerve in this age group. Further studies with high resolution ultrasound scanning to further investigate the sciatic nerve gross anatomy and greater patient enrollment will assist in determining the causes of this observation.

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