Austin Journal of Anesthesia and Analgesia

Open Access

Austin Publishing Group

Research Article

Post-Operative Pain Scores and Level of Regional Anesthesia Expertise: Using Clinical Outcomes to Assess Procedural Proficiency

Lollo L* and Stogicza A
Department of Anesthesiology and Pain Medicine, University of Washington, USA

***Corresponding author:** Lollo L, Department of Anesthesiology and Pain Medicine, University of Washington, Box 356540, 1959 NE Pacific St, BB-1469, Seattle, WA 98195-6540, USA, Tel: 206-744-2881; Fax: 206-7446240; Email: lollomd@uw.edu

Received: October 30, 2014; **Accepted:** December 02, 2014; **Published:** December 03, 2014

Abstract

Background and Objectives: Peripheral nerve blockade requires regional anesthesia skills that trainees learn in several formats. Technical proficiency has shifted from a quota to comprehensive procedural evaluation. Successful nerve blockade is the clinical endpoint validating proficiency but patient, technical and procedural factors influence this result. The purpose of this study was to determine if procedural expertise for sciatic nerve blockade influenced postoperative pain scores and opioid requirements and if patient factors, technique and repetition influenced this outcome.

Method: Sciatic nerve blockade by nerve stimulation and ultrasound guidance and training level of the resident performing the procedure were recorded. Patient obesity, trauma, chronic pain, opioid use and preoperative pain scores were compared to post-procedure pain scores and opioid analgesic requirements.

Results: 102 patients received sciatic nerve blockade from 47 trainees over a 36 month interval. A significant relation between training level and improved pain scores was not demonstrated but transition from nerve stimulation to ultrasound guidance lowered scores in all groups. Nerve blockade failure was frequent with chronic opioid use and trauma.

Conclusion: Analgesic outcomes should be an integral part of assessment of proficiency in regional anesthesia techniques. Evaluating outcomes of procedures throughout training will longitudinally assess technical expertise.

Keywords: Regional anesthesia; Body mass index; Opioid; SNB

Introduction

Proficiency in Regional Anesthesia (RA) techniques is a vital part of the practice of anesthesiology and it is known that trainees completing a minimal quota of procedures does not equate with acquisition of all the skill sets necessary to perform an appropriately selected, timely, safe and successful nerve block [1]. Regional anesthesia rotations with expert faculty and use of adjunctive teaching methods including simulation, cadaver dissection, robotics and web-enhanced didactics improved the learning experience and the overall competency for residents performing these techniques and particularly the visuospatial coordination required for Ultrasound Guided (USG) procedures [2-4]. Global procedural scores and performance times for axillary and inter-scalene brachial plexus nerve blockade for both trainees and practitioners demonstrated improvement in these parameters that was related to the number of procedures completed and weeks in training [5,6]. Clinical outcomes monitored by Cumulative Summation (CUSUM) statistical methods demonstrate resident variability in the number of repetitions necessary to acquire the minimal standard of technical proficiency for any given procedure [7]. Sciatic popliteal Nerve Blockade (SNB) placed by podiatry residents had an overall success rate of 72.4% with no difference in this proportion with respect to months of training [8]. The consensus for a successful nerve block is one that requires no further analgesia or intervention for pain relief [9]. The objective quantification of a subjective pain score is influenced by many patient variables but this critical parameter assesses successful nerve blockade and is an important marker of clinical proficiency. The purpose of this study was to determine if the success rate of postoperative SNB for analgesia measured by postoperative pain scores and opioid requirements is influenced by the level of RA expertise. Further objectives of this study were to determine if specific preoperative patient factors, procedural technique and repetition of SNB by trainees influenced this outcome.

Method

After receiving institutional review board approval from the University of Washington Human Subjects Division, patients provided written informed consent prior to undergoing foot and ankle surgery and were enrolled for participation in this prospective study of the perioperative analgesic effects of popliteal sciatic nerve blockade. All procedures were performed at Harborview Medical Center, Seattle between October 2009 and November 2012. The preoperative data collected were age, gender, ASA physical status, height, weight, calculated body mass index (BMI), recent traumatic lower extremity injury, pre-existing lower extremity neuropathy

Citation: Lollo L and Stogicza A. Post-Operative Pain Scores and Level of Regional Anesthesia Expertise: Using Clinical Outcomes to Assess Procedural Proficiency. Austin J Anesthesia and Analgesia. 2014;2(7): 1039.

Table 1: Patient demographics categorized by level of trainee performing sciatic nerve blockade.

Academic Year of Training				
Male Patients(59)	R1	R2	R3	R4
Number of Patients (n)	4	12	22	21
Mean Age(yrs)	58.3 (11.6)	54.6 (15.2)	48.2 (13.7)	56.7 (13.3)
Mean ASA Physical Status	2 (1)	2 (1)	2 (1)	2 (1)
Mean BMI (kg/m2)	30.2 (5.3)	28.2 (4.1)	31.6 (17.2)	32 (14.5)
Mean Pre-op Pain score	2 (3)	5 (2)	5 (2)	5 (4)
Obesity(n)	2	4	11	9
Chronic Opioid Use (n)	2	5	11	7
Trauma (n)	1	7	8	10
Mean Intraoperative Opioid Dose	25.5 (14.6)	46.6 (26.04)	31.23 (15.57)	34.44 (13.4)
Female Patients(43)				
Number of Patients (n)	3	13	17	10
Mean Age(yrs)	59.3 (17.9)	55.2 (14)	50.9 (15.2)	57 (6.9)
Mean ASA Physical Status	2 (2)	2 (2)	2 (2)	2 (2)
Mean BMI (kg/m2)	25.5 (25.9)	25.7 (26.1)	29.8 (30.2)	32.9 (31.8)
Mean Pre-op Pain Score	7 (4)	3 (4)	4 (5)	7 (6)
Obesity (n)	1	2	7	8
Chronic Opioid Use (n)	1	3	6	6
Trauma (n)	1	2	2	3
Mean Intraoperative Opioid Dose	36.7 (6)	24.64 (19.02)	30.39 (19.93)	44.63 (30.57)

(Obesity = BMI > 30kg/m2. Opioid dose converted to mg intravenous morphine. Numbers in parentheses are SD.)

Table 2: Trainee and Procedure Characteristics.

Academic Year of Residency Training	R1	R2	R3	R4
Trainees	7	16	25	19
Patients (Procedures)	7	25	39	31
SNB by Nerve Stimulation	3	5	16	9
SNB by Ultrasound Guidance	4	20	23	21
Repeat SNB Placement	0	5	8	8

Abbreviations: SNB: Sciatic Nerve Block

Figures represent actual numbers (n). Repeat refers to trainees repeating SNB on different patients during the same rotation.

or chronic pain, worst pain score in the preceding 24 hour interval and maintenance preoperative 24 hour opioid dosage converted to mg of intravenous Morphine Sulfate (MS). All patients received general inhalational endotracheal anesthesia with sevoflurane and intraoperative analgesia in the form of intravenous fentanyl, morphine and/or hydromorphone for their surgery. Postoperative analgesia in those patients with inadequate pain relief following sciatic nerve blockade was administered as intravenous fentanyl, morphine and/or hydromorphone and oral oxycodone in bolus doses in the immediate postoperative period and as patient controlled analgesic infusions in the 24 hour period following surgery. In order to quantify the opioids administered to patients in equivalent dosing units and to compare the opioid usage between patients as a result of the variety of analgesic narcotic medications administered peri-operatively due to both patient and prescribing practitioner preferences, all dosages were converted to equipotent values in mg of intravenous morphine sulphate using standardized opioid conversion formulae. The dose of intraoperative opioid administered was recorded for each patient. Postoperative popliteal sciatic nerve blockade by the lateral approach at a point 10 cm proximal to the popliteal crease was performed in the post anesthesia care unit. All patients were administered 25 ml 0.375% (93.7 mg) bupivacaine for the SNB using a Life-Tech ProBloc II 20 Gauge 100mm 30 degree bevel needle. The procedure was performed in the first 18 months of the study with the use a Life-Tech Tracer III Nerve Stimulator (NS) and the dose of local anesthetic was injected when toe plantar flexion was observed at a current of less than 0.6 mA. In the second 18 month interval the procedure was performed under Ultrasound Guidance (USG) using a Sono Site M Turbo with a linear 38mm probe to locate the sciatic nerve in the short axis view proximal to its branch point and the local anesthetic was injected when the needle tip was observed to be within close proximity to the nerve. The academic year of training for the resident performing the procedure was noted and these groups were categorized as first year (R1) through fourth year (R4). All procedures were supervised by regional anesthesia faculty with added expertise in ultrasound guided imaging. The patient self-reported pain score on discharge from the Post Anesthesia Care Unit (PACU), observation of toe plantar flexion and the total postoperative opioid dose at the same time of discharge converted to mg of intravenous MS were also recorded.

Results

102 patients were enrolled and received a SNB from 47 anesthesiology resident trainees over a 48 month interval. The preoperative demographics for the enrolled patients for gender, age, American Society of Anesthesiologists (ASA) physical status, Body Mass Index (BMI) and intraoperative opioid doses in mg of intravenous MS and the academic level of resident trainees that performed the nerve block are summarized in Table1. No significant differences were observed between patient groups receiving nerve blockade for each class of resident trainees. Trainee and nerve block procedure characteristics with respect to number of trainees in each cohort and number and type of nerve stimulator and ultrasound guided techniques and number of repeat observations on unique patients are listed in Table 2. Reduced postoperative opioid requirements following ultrasound guided compared to nerve stimulator directed procedures was observed for all trainee groups but the differences did not reach statistical significance. Table 3 is the summary of these procedural outcomes with respect to postoperative pain scores and

Table 3: Procedure Outcome by Training Level and Technique Performed for Sciatic Nerve Blockade.

Trainee Level (n)	Procedures (n)	BMI (kg/m2)	Preoperative Pain Score	Preoperative Opioids	Intraoperative Opioids	Postoperative Opioids	Postoperative Pain Score
		Nerve Stimulator					
R1(3)	3	24.77(2.95)	4(4)	23.49(29.89)	31.23(6.01)	40.83(35.83)	3(1)
R2(5)	5	24.56(2.66)	2(2)	14.27(23.19)	30.4(31.43)	5.81(8.6)	2(2)
R3(10)	16	30.38(7.59)	5(4)	11.4(21.04)	30.67(20.36)	18.98(15.39)	3(3)
R4(8)	9	29.67(5.48)	6(2)	13.25(23.81)	43.52(10.65)	16.57(20.52)	3(2)
		Ultrasound					
R1(4)	4	30.75(6.68)	5(4)	1.25(2.5)	29.58(16.84)	6.04(6.54)	2(2)
R2(11)	20	27.46(4.52)	4(4)	12.25(29.77)	36.38(23.75)	7.46(8.51)	2(2)
R3(18)	23	31.12(7.09)	5(2)	9.29(25.08)	30.99(15.44)	14.02(19.32)	2(2)
R4(12)	21	33.4(14.12)	6(4)	14.17(26.08)	34.94(23.13)	8.41(14.6)	3(3)

Data reported are mean (SD). Opioids are converted to and expressed in mg intravenous Morphine sulphate. Postoperative refers to time of discharge from the post anesthesia care unit.

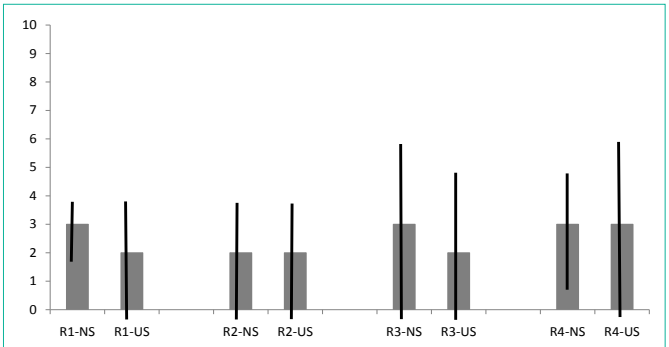

Figure 1: Post Anesthesia Mean Pain Score for Training Level and Sciatic Nerve Block Technique. R1 to R4 – Academic year of trainee, NS – Nerve Stimulator, US – Ultrasound Guided, Y axis – Pain Score, Vertical bars are SD.

perioperative opioid requirements by level of training and these are graphically represented in Figures 1 and 2. There were 25 trainees that performed repeat procedures through a 3 month rotation and the postoperative pain scores are presented in figure3. The small sample size of both patients and trainees did not allow detailed analysis but a downward trend in postoperative pain scores was observed in more senior level trainees with repetition of nerve blockade for both nerve stimulator and ultrasound guided techniques. All patients had intact motor function of the foot after SNB.

Discussion

The patient characteristics were comparable in all trainee procedure groups for gender, age, ASA physical status, BMI and intraoperative opioid doses. The technique for performing SNB varied because the group practice changed from NS to USG for SNB at month 19. Postoperative pain scores varied in the USG groups compared to the NS cohorts for all training levels but this did not reach statistical significance. Improvement in pain control with USG SNB has been reported by others and the observed lower postoperative opioid requirement for analgesia in the USG groups compared to the NS groups supports this finding. A relation between level of RA expertise and improved pain scores was not demonstrated but there was slight improvement in this parameter with the transition from NS to USG SNB in all groups.

Table 4 is a summary of the patient subgroups with respect to preoperative chronic maintenance opioid therapy, trauma and obesity for each cohort of resident trainees and their respective outcomes for postoperative pain scores and opioid requirements. These categories of patients have been reported elsewhere to be challenging for the success of peripheral nerve blockade for postoperative analgesia. Patients with preceding trauma had higher postoperative opioid requirements than other patient categories even though pain scores for each training level were within one point above or below the non-trauma related procedures. All chronic opioid using patient groups reported higher postoperative pain scores and had higher postoperative opioid usage compared to the non-trauma related procedure groups for every training level. Obesity was variable with respect to postoperative opioid requirement and the doses administered were lower than the non-trauma related procedures in the R1 and R4 training groups and higher in the R2 and R3 trainee groups. Statistical analysis could not be performed due to the small sample sizes for each group of patients and trainees.

Resident trainees repeating SNB over the course of a 3 month rotation demonstrated varying results with respect to postoperative pain scores. Failure of nerve blockade appears to be related to chronic opioid use and trauma while obesity had a variable outcome in postoperative pain scores.

The regional anesthesia curriculum for all trainees was maintained constant through the course of their specialty training and for this study and is summarized in Table 5. Although the numbers of patients and residents were small there is a downward trend in pain scores as the senior level trainees repeated the procedure on different patients as demonstrated in Figure 3. Decrease in pain scores with repetition and consistently successful SNB outcomes would support the notion that the trainee is advancing in clinical proficiency for this technique.

Limitations of this study include that not every SNB performed by the trainee was assessed and therefore patient selection bias prevents generalizations concerning clinical proficiency and regional anesthesia expertise with respect to successful nerve blockade. The small number of patients in each group and the trauma, obesity, and opioid usage subgroups for each training level lead to inferences that one of these criteria might impact clinical outcomes but all were observed to play a role in pain scores. Selection of the 10 point pain score was not the best assessment tool for analgesic control because its discrete finite numbering system does not allow the more precise recording of data permitted by the continuous Visual Analog Scale (VAS). Using pain as a subjective clinical variable to objectively quantify a procedure outcome is challenging due to the many patient

Table 4: Procedural outcomes for patient subgroups by level of resident training.

R1 (n=7)	Patients (n)	Preoperative Pain Score	Preoperative Opioid Dose	Postoperative Pain Score	Postoperative Opioid Dose
Non-traumatic	5	4	1	2	7.34
Trauma	2	6	35.24	3	55
Obesity	3	6	1.67	3	5.89
Chronic Opioid	3	6	25.16	3	34.22
R2 (n=16)					
Non-traumatic	16	3	2.03	2	5.22
Trauma	9	3	31.54	2	10.51
Obesity	6	2	19.58	1	10.97
Chronic Opioid	8	4	38.92	3	14.7
R3 (n=25)					
Non-traumatic	29	5	5.49	2	12.43
Trauma	10	6	23.26	2	24.31
Obesity	18	5	12.95	3	14.37
Chronic Opioid	17	6	21.18	3	20.43
R4 (n=19)					
Non-traumatic	17	6	13.97	3	9.15
Trauma	13	6	14.81	2	14.36
Obesity	17	6	9.34	3	7.33
Chronic Opioid	13	7	33.08	3	14.73

(Numbers expressed as arithmetic mean. Opioid doses are in mg intravenous morphine sulphate.)

Table 5: Anesthesiology Residency Regional Anesthesia Training Curriculum.

Academic Year	Curricular Intervention
First (R1)	4 week acute pain service (APS) rotation Pain related didactic lectures
Second (R2)	4 week regional anesthesia didactic block including problem based learning (PBLD)
Third (R3)	4 week acute pain service (APS) rotation One day cadaver based regional anesthesia workshop
Fourth (R4)	One day cadaver based regional anesthesia workshop One day ultrasound phantom based training workshop One day intensive regional anesthesia board review didactic workshop

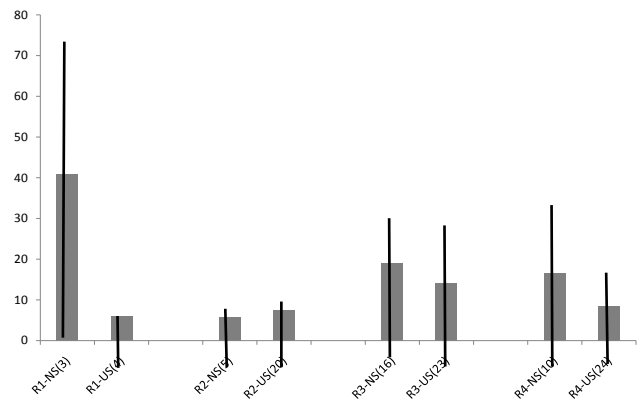

Figure 2: Mean Post Anesthesia mg IV Morphine for Training Level and Sciatic Nerve Block Technique. R1 to R4 – Academic year of trainee, NS – Nerve Stimulator, US – Ultrasound Guided Y axis – Pain Score, vertical bars represent SD.

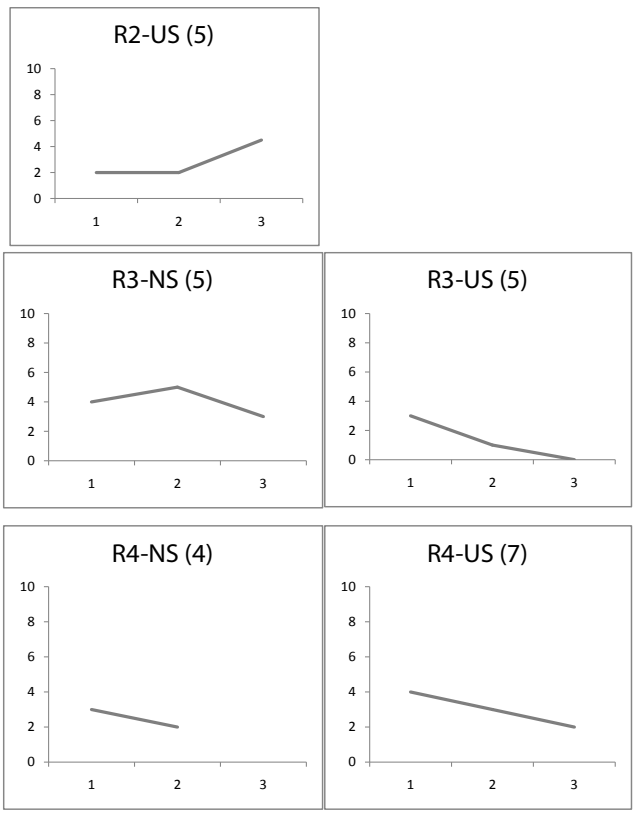

Figure 3: Mean pain score for resident trainees repeating sciatic nerve blockade on different patients. X axis - Numerical order of repeat procedures. Y axis – Mean pain score on discharge from post anesthesia care unit. NS – Nerve stimulator technique. US – Ultrasound guided technique. Numbers in parentheses are the number of trainees in each cohort repeating the procedure during the rotation.

factors that contribute to its perception. This study demonstrates this phenomenon with cohorts with lower average pain scores having greater opioid requirements than groups with higher scores both in the preoperative and postoperative phases of their surgery.

Conclusion

There is no overall direct relation between level of RA expertise and improved pain scores but there was observed improvement with the transition from NS to USG SNB in all groups. Patient

factors including trauma, chronic opioid use and subjective pain quantification influence the desired clinical outcome of successful nerve blockade but the observed trend is for improvement as trainees repeat SNB. Adequate analgesia is an important parameter for assessment of proficiency in RA techniques and should be included in trainee procedure logs. Future studies need to address the limitations of this study which include using the VAS continuum instead of the discrete pain score and recording outcomes for all RA procedures through the entire training curriculum instead of sporadic periodic observations of performance which can lead to inaccuracies for assessment of RA technical expertise. The authors report no external funding source for this study and also report no declarations of interest.

Essentials

Patient outcomes of clinical procedures performed by resident trainees are an important component of the overall assessment of adequate proficiency in these technical skills.

o Pain relief following regional anesthetic procedures is the vital clinical endpoint but this is challenging to achieve due to subjective patient variables that influence pain scores.

o The transition from nerve stimulator to ultrasound guided procedures demonstrated improvement in pain scores and reduced postoperative opioid use for pain control.

o Repetition of the procedure during a rotation yielded lower pain scores in patients for some trainee cohorts.

o Universal documentation of patient outcomes from regional anesthetic procedures is proposed as a critical aspect of assessing proficiency in technical expertise for trainees.

References

1. Neal JM. Education in regional anesthesia: caseloads, simulation, journals, and politics: 2011 Carl Koller Lecture. Reg Anesth Pain Med. 2012; 37: 647-651.
2. Woodworth GE, Chen EM, Horn JL, Aziz MF. Efficacy of computer-based video and simulation in ultrasound-guided regional anesthesia training. J Clin Anesth. 2014; 26: 212-221.
3. Slater RJ, Castanelli DJ, Barrington MJ. Learning and teaching motor skills in regional anesthesia: a different perspective. Reg Anesth Pain Med. 2014; 39: 230-239.
4. Morse J. Comparison of success rates, learning curves, and inter-subject performance variability of robot-assisted and manual ultrasound-guided nerve block needle guidance in simulation. Br J Anaesth. 2014; 112: 1092 – 1097.
5. Morros C, Pérez-Cuenca MD, Sala-Blanch X, Cedó F. [Ultrasound-guided axillary brachial plexus block: learning curve and results]. Rev Esp Anestesiol Reanim. 2011; 58: 74-79.
6. Orebaugh SL, Williams BA, Kentor ML, Bolland MA, Mosier SK, Nowak TP. Interscalene block using ultrasound guidance: impact of experience on resident performance. Acta Anaesthesiol Scand. 2009; 53: 1268-1274.
7. Starkie T, Drake EJ. Assessment of procedural skills training and performance in anesthesia using cumulative sum analysis (cusum). Can J Anaesth. 2013; 60: 1228-1239.
8. Hegewald K, McCann K, Elizaga A, Hutchinson BL. Popliteal blocks for foot and ankle surgery: success rate and contributing factors. J Foot Ankle Surg. 2014; 53: 176-178.
9. Fischer B. Benefits, risks, and best practice in regional anesthesia: do we have the evidence we need? Reg Anesth Pain Med. 2010; 35: 545-548.

Austin J Anesthesia and Analgesia - Volume 2 Issue 7 - 2014
ISSN : 2381-893X | www.austinpublishinggroup.com

Citation: Lollo L and Stogicza A. Post-Operative Pain Scores and Level of Regional Anesthesia Expertise: Using Clinical Outcomes to Assess Procedural Proficiency. Austin J Anesthesia and Analgesia. 2014;2(7): 1039.