The Influence of Spinal Needle Orientation During Administration of Subarachnoid Blocks on Discharge Criteria in Same-Day Surgical Patients

Doddi Brewer, CRNA, MS
Sarah Baxter, CRNA, MS
Debra Marsh, CRNA, MS
David Saraceno, CRNA, MS
Kimberly R. Barber, PhD
Lynn L. Lebeck, CRNA, PhD

Cost containment is a critical factor in today's healthcare industry, so finding ways to decrease length of stay is essential in anesthesia practice. We rely on rapid induction, recovery, and discharge to control cost in outpatient surgery. Subarachnoid block (SAB) is an acceptable anesthetic choice for many outpatient procedures. It is often underused because it may result in delayed discharge. The purpose of this study was to determine if orientation of the spinal needle during administration of SAB affects the time required to meet discharge criteria in a same-day surgical unit.

Patients undergoing surgical procedures deemed appropriate for short-acting lidocaine spinal anesthetic were recruited for this randomized, posttest, prospective study. All patients received a hyperbaric lidocaine spinal administered using a 25-gauge Whitacre needle. The needle was oriented in a cephalad (group A) or a lateral (group B) direction. Time to discharge was determined by calculating time elapsed between administration of the SAB and the time when the patient met discharge criteria.

The statistical analysis included 50 patients (group A, n = 30; group B, n = 20). Demographics (except weight) were not statistically different between the groups. Total hospital time did not differ between the groups. Regardless of needle orientation, patients in both study groups achieved discharge criteria in similar amounts of time.

Keywords: Bevel orientation, lidocaine, spinal anesthesia, Whitacre needle.

Cost containment is a critical factor in today's healthcare industry, and finding ways of decreasing length of stay has become essential in anesthesia practice. Although subarachnoid block (SAB) is an acceptable anesthetic choice for certain outpatient procedures, it is often underused because it potentially delays meeting discharge criteria.[1] If time to discharge is significantly less for 1 technique over another without compromising patient outcomes, encouragement of that technique to decrease anesthesia care costs would be worthwhile.

After reviewing several published studies regarding orientation of needle orifice during spinal anesthesia, we concluded that further study of this variable as it relates to recovery time and time of discharge is warranted. The purpose of this study was to determine if the orifice orientation, cephalad or lateral, with a 25-gauge Whitacre spinal needle (BD Medical Systems, Franklin Lakes, New Jersey), using a hyperbaric lidocaine solution, affects the length of time required to meet discharge criteria in a same-day surgical unit (SDSU) (Figure 1).

• *Null Hypothesis.* The orientation of the orifice, cephalad vs lateral, of the 25-gauge Whitacre spinal needle during injection of a hyperbaric 5% lidocaine solution premixed with 7.5% dextrose will have no impact on the length of time required for an outpatient to meet SDSU discharge criteria, as measured by the Aldrete score (Table 1).

Figure 1. Placement of a Subarachnoid Block Using a Whitacre Needle
(BD Medical Systems, Franklin Lakes, New Jersey.)

• *Alternative Hypothesis.* The orientation of the orifice of the 25-gauge Whitacre spinal needle in the cephalad position, rather than lateral, during injection of a hyperbaric 5% lidocaine solution, premixed with 7.5% dextrose, will decrease the length of time required for patients to meet SDSU discharge criteria as measured by the Aldrete score (Table 1).

Methods

Patients scheduled for surgery who had consented for SAB were recruited for this prospective, randomized, posttest, internal review board-approved study. Eligibility criteria included patient age from 18 to 65, height from 5 ft 2 in to 6 ft 2 in, and American Society of Anesthesiologists (ASA) I or II status. Exclusion criteria included pregnancy, allergy to lidocaine, history of chronic back pain, and abnormal curvatures of the spine.

Investigators obtained informed consent from patients meeting eligibility criteria. On enrollment in the study, patients were assigned randomly to 2 groups (group A, needle orifice cephalad; or group B, needle orifice lateral) using a computer-generated, random numbers list. Patients also received at least 500 mL of an isotonic crystalloid solution (lactated Ringer's solution or 0.9% normal saline) 20 minutes before the SAB was administered.

Standard monitoring equipment (eg, continuous electrocardiography, noninvasive blood pressure cuff, and continuous pulse oximetry) was used. Baseline vital signs were obtained and recorded on the anesthesia record. Patients received 0 mg to 5 mg of midazolam and/or 0 µg to 150 µg of fentanyl to attenuate anxiety and discomfort before the SAB at the discretion of the anesthesia provider. Patients were seated for administration of the SAB and were prepared and draped according to standard hospital policy.

The site of injection was localized with 2 mL to 3 mL of a 1% lidocaine solution. An 18-gauge introducer needle was inserted into the selected interspace. A 25-gauge Whitacre spinal needle was passed through the introducer and advanced until a free flow of clear cerebral spinal fluid was observed. Participants were instructed to inform the anesthesia provider of any parasthesia. The anesthesia provider ensured that the orifice of the spinal needle was oriented in the proper position before injection of local anesthesia into the subarachnoid space. An amount of hyperbaric lidocaine solution sufficient to obtain a T6 to T12 level appropriate for the scheduled surgical procedure was administered. The patient was then immediately placed in a supine position on the operating room table.

Time of injection and total dose were recorded. Height of block was documented 5 minutes postinjection. Sensory level was assessed using the cool alcohol wipe technique. Vital signs were obtained every 1 to 2 minutes until stabilized, and they were documented on the anesthesia record according to institutional guidelines. Participants were evaluated and treated for nausea, hypotension, anxiety, and pain throughout the procedure at the discretion of the anesthesia provider. All intraoperative sedation and analgesic medications were documented on the data collection sheet.

Following surgery, most of the patients were transferred to the postanesthesia care unit (PACU), but 4 patients bypassed the PACU and were transferred directly to the SDSU. Sensory block was assessed using the cool alcohol wipe technique and a standard dermatome chart. Motor blockade was determined using the Bromage scale

Activity	
Able to move 4 extremities voluntarily on command	2
Able to move 2 extremities voluntarily on command	1
Unable to move extremities voluntarily on command	0
Respiration	
Able to breathe deeply and cough freely	2
Dyspnea, limited breathing or tachypnea	1
Apneic or on mechanical ventilator	0
Circulation	
Blood pressure ± 20% of preanesthetic level	2
Blood pressure ± 21%-49% of preanesthetic level	1
Blood pressure ± 50% of preanesthetic level	0
Consciousness	
Fully awake	2
Arousable on calling	1
Not responding	0
Oxygen saturation	
Able to maintain oxygen saturation > 95% on room air	2
Needs oxygen inhalation to maintain oxygen saturation > 90%	1
Oxygen saturation < 90% even with oxygen supplement	0
Dressing	
Dry and clean/no dressing	2
Wet but stationary or marked	1
Growing areas of wetness	0
Pain	
Pain free	2
Mild pain handled by oral medication	1
Severe pain requiring parenteral medication	0
Ambulation	
Able to stand up and walk straight	2
Vertigo when erect	1
Nausea and vomiting	0
Urine output	
Has voided	2
Unable to void but comfortable	1
Unable to void and uncomfortable	0

Table 1. Aldrete Scoring System

Grade	Criteria	Degree of block (%)
1	Free movement of legs and feet	0
2	Just able to flex knees with free movement of feet	33
3	Unable to flex knees, but with free movement of feet	66
4	Unable to move legs or feet	100

Table 2. Bromage Scale

	Group A (cephalad) n = 35	Group B (lateral) n = 28	*P* value
Age, mean (SD), y	47.4 (11.1)	45.8 (12.6)	.60
Weight, mean (SD), kg	84.9 (19.7)	97.8 (25.3)	.03*
Height, mean (SD), in	67.5 (3.7)	67.5 (3.2)	.93
Gender			
Male/Female	15/20	18/10	

Table 3. Demographics (significance $P < .05$)
*Demonstrates significance.

	Group A (cephalad) n = 35	Group B (lateral) n = 28	*P* value
Spinal lidocaine dose, mean (SD), mg	65.3 (8.0)	66.4 (9.6)	.61
Level of subarachnoid block at 5 minutes, mean (SD), min	T8 (1.7)	T8 (1.8)	.91
Medications given			
Fentanyl, mean (SD), µg	100.0 (21.3)	119.4 (58.0)	.08
Propofol, mean (SD), mg	53.3 (35.0)	61.3 (33.0)	.69

Table 4. Intraoperative Data (significance $P < .05$)

(Table 2). Once participants met criteria, they were transferred to the SDSU and, again, sensory and motor blockade were assessed. An Aldrete score of 18 or above with a score of 2 in the areas of ambulation and voiding were the criteria for discharge from SDSU. Table 1 details the Aldrete score assessment used per hospital protocol. Time to discharge was the time in minutes from injection of hyperbaric lidocaine into the subarachnoid space to the time the patient met SDSU discharge criteria.

Results

A total of 83 participants were enrolled in this study. Because of protocol violation or missing data, 20 participants were excluded from data analysis. Examples of protocol violations included the placement of opioids in the local anesthetic solution, using a local anesthetic other than lidocaine, and local anesthesia injection with orifice orientation different than directed by study. Analysis of the remaining participants (group A, n = 35; group B, n = 28) was performed using the student *t* test for equality of means. There was no statistical demographic difference between the 2 groups, with the exception of patient weight (Table 3). Group A had an average weight of 84.9 kg ± 19.7 kg, and group B had an average weight of 97.8 kg ± 25.3 kg ($P < .03$). There was little difference between groups in regard to intraoperative lidocaine dose, level of the SAB, and intraoperative sedative medications (Table 4). No statistical significance was demonstrated between the 2 groups in total hospital time, return of full motor function, time to first void, or time in PACU (Figure 2).

Discussion

Researchers have investigated the subject of spinal anesthesia. Areas of interest include preferred methods, medications administered, factors affecting distribution of local anesthetic, time for recovery, advantages and disadvantages of methods, comparisons of equipment used, patient positions during and after administration of blocks, and cost-containment issues between SAB and general anesthesia. Many questions on the subject of spinal anesthesia have surfaced, such as (1) What are the factors that determine distribution of local anesthetic solutions in the cerebral spinal fluid? (2) How does the orifice direction of a pencil point spinal needle influence the level of sensory blockade? (3) Does the insertion angle of a spinal needle affect the cephalad spread of the

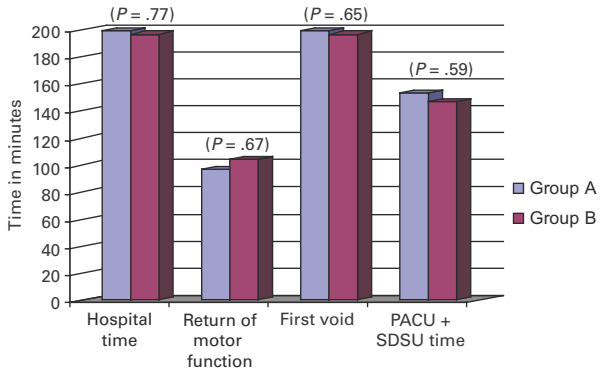

Figure 2. A Comparison of Discharge Criteria for Groups A and B

PACU indicates postanesthesia care unit; SDSU, same-day surgical unit.

local anesthetic solution? (4) In what ways does the type of spinal needle, pencil point or standard, differ in the distribution of the local anesthetic solution?[1-5] These questions have prompted a variety of clinical research investigations.

For most studies, the researchers used prospective methods with convenience sampling and relatively small sample population sizes.[1,3,4,5] Anesthesia providers, PACU staff, or even the patients were included in the continuum of evaluators. Spinal blockade and regression of the block were assessed in a variety of ways. Methods such as pinprick and cold sensation with a cool bottle were typically used to assess sensory block, while motor block was usually assessed using the Bromage score.

Wofford et al[1] assessed the effects of orifice direction on the time required to meet discharge criteria. Time to discharge was limited to the time of injection of spinal local anesthetic solution to the time that the patient met discharge criteria.[1,6] Conclusions of the various studies have shown that there were no statistically significant differences in time of block setup, level of block, duration of motor blockade, number of attempts to perform block, pain scores, and side effects among patients who received spinal blockade with cephalad, lateral, or caudad oriface orientation.[1] Also, in previous work there were no significant differences in time to discharge from PACU to the SDSU between groups. However, when total time in the hospital was analyzed, significant differences were found among the groups. Patients receiving spinal blockade with the orifice directed laterally met discharge criteria earliest, followed by caudad, then cephalad direction.[1] Contrary to this finding, another study found that patients with the spinal anesthetic injected cephalad met discharge criteria sooner than those injected caudad.[6] Unfortunately, the results of the many studies may have limited generalizability because of the inconsistencies of techniques used and variations in sample size.

Despite findings of these previous studies, this current study failed to demonstrate a significant difference in discharge times between the 2 groups (cephalad or lateral); however, this study had some limitations including high attrition rate due to failure of practitioners to adhere to protocol, missing data collection sheets, and failure to meet the number of participants to attain calculated power. Although much education was provided to the caregivers participating in this study, perhaps additional education throughout the data collection period would be warranted.

Future studies could use methodology similar to the current study, while enrolling enough participants to reach power. In addition to the limitations addressed in this study, past studies have included recommendations for additional research to further improve patient outcomes and help contain the ever-rising costs of care in anesthesia practice. The recommendations include studying the use of 2 different pencil point needles and using an isobaric solution while looking at the effects of needle orientation on spinal anesthesia.[1] Future investigations assessing factors that affect the level of sensory blockade should be performed. These investigations could be performed while maintaining consistent technique and using larger sample populations. Such endeavors may improve generalizability of study results and provide contributions to improve the use of spinal anesthesia for ambulatory surgery.

REFERENCES

1. Wofford K, Kase S, Moore J, Kelly J, Pellegrini JE. The effect of Pencan needle orientation on spinal anesthesia outcomes. *AANA J.* 2005;73(2):121-127.
2. Greene N. Distribution of local anesthetic solutions within the subarachnoid space. *Anesth Analg.* 1985:64(7):715-730.
3. Stienstra R, van Poorten F, Kroon J. Needle direction affects the sensory level of spinal anesthesia. *Anesth Analg.* 1989;68(4):497-500.
4. McShane FJ, Burgos N, Kapp M, Wieczorek C. Influence of Whitacre spinal needle orifice direction on the level of sensory blockade. *AANA J.* 2000;68(1):67-72.
5. Casati A, Fanelli G, Cappelleri G, et al. Effects of spinal needle type on lateral distribution of 0.5% hyperbaric bupivacaine. *Anesth Analg.* 1998;87(2):355-359.
6. Urmey WF, Stanton J, Bassin P, Sharrock NE. The direction of the Whitacre needle aperture affects the extent and duration of isobaric spinal anesthesia. *Anesth Analg.* 1997;84(2):337-341.

AUTHORS*

Doddi Brewer, CRNA, MS, is a staff nurse anesthetist at Genesys Regional Medical Center, Grand Blanc, Michigan.

Sarah Baxter, CRNA, MS, is a staff nurse anesthetist at Genesys Regional Medical Center, Grand Blanc, Michigan.

Debra Marsh, CRNA, MS, is a staff nurse anesthetist at McLaren Regional Medical Center, Flint, Michigan.

David Saraceno, CRNA, MS, is a staff nurse anesthetist at Genesys Regional Medical Center, Grand Blanc, Michigan.

Kimberly R. Barber, PhD, MS, is the director of clinical research at Genesys Regional Medical Center, Grand Blanc, Michigan.

Lynn L. Lebeck, CRNA, PhD, is clinical assistant professor and pro-

gram director, University of Michigan–Flint/Hurley Medical Center Anesthesia Program, Flint, Michigan.

*The clinical research was performed and subsequent manuscript was written while D. Brewer, S. Baxter, D. Marsh, and D. Saraceno attended the University of Michigan–Flint/Hurley Medical Center Master of Science Anesthesia Program.

ACKNOWLEDGMENTS

The authors wish to acknowledge Ravi Hedni, MD, and David Millon, CRNA, MS, for their contributions and support to this study.

Grant support for this study was received from the Gerald and Sharon Schreiber Research Fund, The Nick S. and Sharon G. George Research Fund, and the M-Club of Greater Flint, Flint, Michigan.