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Ambulatory Perineural Infusion: The Patients' Perspective

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Background and Objectives: Ambulatory perineural local anesthetic infusion is a relatively new method for providing postoperative analgesia, and many aspects of this technique remain in the domain of conjecture and speculation. This retrospective chart review and survey was undertaken to investigate patients' opinions on various aspects of their ambulatory perineural infusion experience.

Methods: Patients who had received an ambulatory perineural infusion from the University of Florida were identified via pharmacy records. Patients were contacted by phone and were asked various questions regarding their experiences and preferences during and after their perineural infusion.

Results: Of 217 patients identified, 215 charts were located and retrieved. Of these, 137 (64%) were successfully contacted and 131 (61%) consented to take part in the survey. More than 97% of patients reported that they felt "safe" during home infusion, that one physician telephone call each night was optimal contact, and that they were comfortable removing the catheter with instructions given over the phone. Only 4% would have preferred to return for catheter removal, and 43% felt that they would have been comfortable with only written instructions for catheter removal.

Conclusion: This investigation suggests that perineural local anesthetic infusion is generally well tolerated by ambulatory patients. *Reg Anesth Pain Med 2003;28:418-423.*

Key Words: Ambulatory surgery, Continuous nerve block, Continuous regional analgesia, Pain control. Perineural infusion, Postoperative analgesia

Although perineural local anesthetic infusions, or continuous nerve blocks, have been reported with more frequency in the past two decades, using this method of postoperative analgesia for patients at home was only first reported in 1998.[1] Since then, there have been as many editorials[2-7] commenting on this technique as there have been peer-reviewed controlled studies.[8-13] As a result of this relative lack of data, many aspects of ambulatory perineural infusion remain in the domain of conjecture and speculation. For example, although some practitioners have patients remove their catheters at home at the conclusion of their infusion,[10,11,13,14] others prefer removing the catheters themselves.[3] Some discharge patients with written instructions regarding catheter removal,[14] and others give verbal instructions over the phone during removal.[10,11,13] Some investigators have provided twice-daily home nursing visits,[12,15] whereas others have relied on daily telephone contact.[9-11,13] This retrospective chart review and survey was undertaken to investigate patients' opinions on various aspects of their ambulatory perineural infusion experience. Although this investigation will not provide definitive answers to the multitude of questions that ambulatory infusions raise, it will help guide health care providers and scientific investigators by providing insight into patients' experiences and preferences.

Methods

The University of Florida Institutional Review Board approved the study protocol. The pharmacy database was searched for local anesthetics sent to the ambulatory center. The charts for these patients were reviewed for telephone numbers, demographic data (e.g. age, tobacco use), surgical data

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Table 1. Survey Questionnaire

1. **Infusion experience.** Did you feel safe while you had the infusion of local anesthetic through the catheter following your surgery? *If not*, was there something specific that you were concerned about (yes/no and answer)? If you changed the infusion pump's programming with instructions given over the phone by the physician, did you feel comfortable doing this (yes/no)?
2. **Home contact.** Was it inconvenient that a physician contacted you by phone each night when you had your catheter in place (yes/no)? Would you have preferred to be called more or fewer times (more/fewer)? *If more*, how much more—twice/day, three times per day (#)? *If fewer*, would you have preferred not to be called at all, and had you call the physician if you had a problem (yes/no)?
3. **Catheter site.** Do you remember any clear fluid leaking from the catheter site (yes/no)? If yes, did you find a way to stop it (yes/no)? If yes, how did you stop it? Where the catheter entered your skin, did your skin look unusual more than a week after the catheter was removed (yes/no)? *If so*, how long before your skin went back to the way it was before your surgery (# days or never)? Did you experience any discomfort where the catheter entered your skin after the catheter was removed (yes/no)? *If so*, how would you describe the discomfort: minor, average or severe? How many days or weeks did the discomfort last after the catheter was removed (# days)?
4. **Catheter removal.** Did your catheter fall out accidentally (*if "yes," skip to next paragraph*). How would you describe the removal of your catheter: easy, average, or difficult? Did you feel comfortable having your catheter removed at home with instructions given over the phone by the physician (yes/no)? Do you think you would have been comfortable removing your catheter with written instructions, and without physician direction over the phone (yes/no)? Would you have preferred to return to the surgical center or your surgeon's office to have the catheter removed by a health care provider (yes/no)?

(e.g. procedure), and anesthetic data (e.g. catheter location, infusion pump type). Patients were contacted by telephone and asked if they would participate in this survey, and their answer recorded (informed consent). For those who answered in the affirmative, the responses to various questions regarding their perineural infusion experience (Table 1) were recorded. If a patient could not be reached by telephone after five attempts, the individual was considered lost to follow-up. If a patient had been younger than 18 years of age at the time of catheter placement,[16] his or her parent was queried and no direct contact with the patient was made.

After data collection, the information was transferred by keypunch entry into a computerized database (SPSS for Windows 11.5, Chicago, IL) for determination of descriptive and inferential statistical values. Categoric data was analyzed using the chi-square or Fisher exact test, as appropriate.

All catheters at our institution up to the time of the survey had been placed using a standard insertion procedure for patients expected to have moderate to severe postoperative pain. The majority of the patients had participated in previous clinical investigations that have subsequently been published.[10,11,13,17,18] The Contiplex system (B. Braun Medical, Bethlehem, PA) was used, and all surgical blocks were delivered via the needle, after which the 20 g polyamide multiport catheter was inserted through the needle. The surgical block consisted of 20-50 ml of mepivacaine 1.5%, sodium bicarbonate 2-5 mEq, and epinephrine 2.5 μg/ml. In all but 30 subjects (all receiving infraclavicular blocks/catheters during a study),[18] 100 μg of preservative-free clonidine was also added to the surgical block injectate. Catheters were secured with sterile liquid adhesive, sterile tape, and an occlusive dressing. Most popliteal catheters were further secured cephalad up the lateral aspect of the thigh with 1″ tape (Durapore, 3M Corporation, St. Paul, MN) to the level of the inguinal skin crease. Interscalene catheters of patients involved in one study[13] were tunneled toward the sternal notch using an 18 gauge angiocatheter, as previously described.[19] Postoperative infusions contained ropivacaine 0.2%, and in 15 subjects 1 μg/ml of clonidine was added.[18] Forty-four patients received an infusion of normal saline as part of randomized, double-blinded, placebo-controlled studies.[10,11,13] The patient and caretaker were given standard postoperative outpatient instructions and verbal and written instructions on the use of the pump and catheter. Specific attention was given to signs and symptoms of local anesthetic toxicity, catheter site infection, and catheter migration. Telephone and pager numbers for physicians available at all times were given to each patient. Patients were instructed to keep their operative limb well-protected in a sling or brace during the infusion period, unless instructed otherwise by their surgeon or physical therapist. Patients' caretakers were instructed on removal of the catheter using a pair of nonsterile gloves, with the physician in telephone contact throughout. On occasion, patients removed their own catheter if their caretaker preferred.

Results

Of 217 patients identified, 215 charts were located and retrieved. Of these, 137 (64%) patients were successfully contacted and 131 (61%) consented to take part in the survey (Table 2). Infusions occurred between March 14, 2000, and November 5, 2002. Seven different types of infusion pumps were used, but the majority were basal-and-bolus capable, reusable electronic Microject PCA (Sorenson Medical, West Jordan, UT) and disposable, elastomeric Accufuser Plus units (McKinley Medical, Wheat Ridge, CO). Fourteen percent of patients reported an accidental, premature catheter dis-

Table 2. Results of Chart Review and Initial Phone Contact

	Axillary	Femoral	Infraclavicular	Interscalene	ISCM	Popliteal	Psoas	Total
Patients/charts identified	5	1	102	41	2	46	18	215
Patients contacted	4	0	71	22	0	32	8	137
Patients consenting to survey	4	0	68	22	0	29	8	131
Age (mean in years)	37	23	37	51	45	51	28	47
Age (minimum, maximum)	12, 60	23, 23	12, 84	8, 78	45, 45	18, 68	14, 42	8, 84
Sex (female/male)	4/1	0/1	70/32	23/18	1/1	32/14	4/14	134/81
Weight (mean in kg)	77	80	79	84	75	78	78	80

Abbreviations: ISCM, intersternocleidomastoid; Psoas, psoas compartment (posterior lumbar plexus).

lodgement (Table 3). Overall, 98% of patients reported they were "comfortable" removing the catheter (Table 4). The majority (95%) of patients described the removal of their catheter as "easy," whereas 3% and 2% of patients described this as "average" and "difficult," respectively (see Table 3). Only 4% would have preferred to return to the ambulatory center for catheter removal (see Table 3), and these patients were all older than 40 years of age (see Table 4). Forty-three percent felt that they would have been comfortable with only written instructions for catheter removal (as opposed to verbal instructions over the telephone during removal by a physician), and this did not differ significantly by age.

After catheter removal, 3% of patients reported their skin at the site looked "unusual," but all of these had returned to "normal" by 2 weeks after catheter placement (see Table 3). There were no catheter infections in this cohort of patients. Nine percent of patients reported catheter site discomfort after removal, but these had all resolved by 2 weeks postoperatively. A great majority of patients (98%) "felt safe" with the perineural infusion at home (see Table 4). However, only 35% of those asked to change the infusion pump basal infusion rate programming at home "felt comfortable" doing so, and this did not change when stratified by age. No patient reported that the nightly follow-up phone call was inconvenient, and all patients felt that one call per day was the optimal number.

Discussion

This chart review and follow-up survey of patients who had undergone ambulatory perineural infusion reveals patients' experiences were generally positive during their infusions. Ninety-eight percent of respondents reported feeling "safe" during home infusion and felt comfortable removing their catheter at home. All patients and their caregivers were given verbal and written instructions

Table 3. Survey Results by Anatomic Catheter Location

	Axillary	Infraclavicular	Interscalene	Poplital	Psoas	Total
Patients consenting to survey	4	68	22	29	8	131 (61%)
Fluid leakage from site	3 (75%)	28 (41%)	4 (18%)	6 (13%)	0 (0%)	41 (31%)
Catheter dislodged	3 (75%)	11 (16%)	0 (0%)	4 (14%)	0 (0%)	18 (14%)
Catheter removal						
Easy	100%	95%	95%	100%	71%	95%
Average	0%	3%	0%	0%	29%	3%
Difficult	0%	2%	5%	0%	0%	2%
Prefer to return for removal*	1 (50%)	1 (1.5%)	2 (9%)	1 (5%)	0 (0%)	5 (4%)
Catheter site appearance†	0 (0%)	2 (3%)	2 (9%)	0 (0%)	0 (%)	4 (3%)
Days Until Skin Normal	NA	9-12	9-12	NA	NA	9-12
Catheter site discomfort?‡	0 (0%)	3 (4%)	4 (18%)	1 (3%)	4 (50%)	12 (9%)
Mild§	NA	100%	50%	100%	50%	70%
Average§	NA	0%	50%	0%	50%	30%
Severe§	NA	0%	0%	0%	0%	0%
Days to resolution (mean)	NA	4	7	14	2	6
Days to resolution (range)	NA	3-5	2-14	14	1-3	1-14

NOTE. Values represent the number of patients responding affirmatively (percentage of patients answering the question), unless otherwise noted.

NOTE. Not all patients answered every question; therefore, some rows or columns do not add up to 100%.

Abbreviations: ISCM, intersternocleidomastoid; Psoas, psoas compartment (posterior lumbar plexus); NA, not applicable.

*Patients who would have preferred to return to have a health care provider remove the catheter.

†Patients who reported that their skin at the catheter site had not returned to normal 1 week after catheter removal.

‡Patients who reported discomfort at the catheter site after catheter removal.

§Percentage of patients with this degree of discomfort as a percentage of those having any catheter site discomfort.

Table 4. Survey Results by Age

Age range in years	8-19	20-39	40-59	60+	Total
Patients consenting to survey	8	24	64	35	131
Feel safe during infusion?	8 (100%)	24 (100%)	62 (97%)	34 (97%)	128 (98%)
Comfortable changing pump program?	2 (25%)	10 (42%)	23 (36%)	11 (31%)	46 (35%)
Nightly phone contact inconvenient?	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Comfortable removing catheter?	7 (88%)	24 (100%)	62 (97%)	35 (100%)	128 (98%)
Easy catheter removal?	8 (100%)	21 (88%)	62 (97%)	34 (97%)	125 (95%)
Average catheter removal?	0 (0%)	3 (12%)	0 (0%)	1 (3%)	4 (3%)
Difficult catheter removal?	0 (0%)	0 (0%)	2 (3%)	0 (0%)	2 (2%)
Preferred to return for removal?*	0 (0%)	0 (0%)	4 (6%)	1 (3%)	5 (4%)
Comfortable with written instructions?†	4 (50%)	10 (42%)	25 (39%)	17 (49%)	56 (43%)

NOTE. Values represent the number of patients responding affirmatively (percentage of patients answering the question).
*Patients who would have preferred to return to have a health care provider remove the catheter.
†Patients who would have been comfortable with only written instructions for catheter removal instead of phone instructions.

regarding potential complications before discharge by the attending anesthesiologist or regional anesthesia fellow. In addition, patients were encouraged to call if they had questions or concerns regarding the infusion or degree of analgesia. How much influence these educational efforts had on patients' feeling of safety, if any, cannot be determined.

We have reported previously that the only complaint consistently noted by our patients with ambulatory perineural infusions was leakage of clear fluid from under the occlusive dressing,[10,11,13,18] and this is reflected in the 31% incidence reported here (see Table 3). The leakage is a cause of frustration for patients and also may increase the risk of accidental catheter dislodgement because the anchoring surgical tape and dressing are disrupted. Notable is the 41% incidence of leakage for infraclavicular catheters, which may be related to the type of catheter system used or our placement technique of not advancing the catheter past the needle tip after the brachial plexus is localized.[10,18] By threading the catheter tip 3-5 centimeters proximally along the brachial plexus, we have found a dramatic decrease in the incidence of this issue (Ilfeld, Morey, and Enneking, manuscript submitted, 2003). Whether the change in technique resulted in this perceived improvement can only be determined with a prospective study. Furthermore, the use of 2-octyl cyanoacrylate glue for the fixation of continuous peripheral nerve catheters has recently been reported and may decrease fluid leakage as well.[20]

Accidental catheter dislodgement is a problem noted by most investigators. Although the use of 2-octyl cyanoacrylate glue for the fixation of continuous peripheral nerve may prove helpful,[20] we have had a dramatic decrease in catheter dislodgments since we began tunneling[19] catheters and using a disposable device (StatLock, Venetec International, San Diego, CA) to affix the catheter hub to the patient (Ilfeld, Morey, and Enneking, manuscript submitted, 2003).

The optimal contact with ambulatory patients is currently unknown, and probably varies with many factors such as patient comorbidities and surgical procedure. We,[10,11,13] along with others investigators,[2,9] have suggested that, in addition to physician-availability at all times, patients be contacted daily by telephone. Other investigators have provided twice-daily home nursing visits in addition to telephone calls.[12,15] Although the current report does not provide evidence regarding the safety of any one technique, it does suggest that patients are comfortable with simple daily phone contact. No patients reported that the nightly phone call was inconvenient (see Table 4), and none responded that they would have preferred either more or fewer contacts.

Catheter removal has also been accomplished by various techniques: some discharge patients with written instructions[14] and others have insisted on a health care provider performing this procedure,[3] whereas we have patients' caretakers (or occasionally the patients themselves) remove the catheters.[10,11,13] Although the current report does not provide evidence regarding the safety of any one technique, it does suggest that the majority of patients are comfortable with the latter method. Ninety-eight percent of patients felt comfortable removing their catheter at home (Table 4), with 98% reporting this procedure was either "easy" or "average," and only 2% describing it as "difficult." Of note, only 4% would have preferred to return for a health care provider to remove the catheter, and 43% responded that they would have felt comfortable with exclusively written instructions.

During the 32-month period investigated, there was only one adverse event related to catheter removal when a knot developed in an infraclavicular catheter that was removed surgically via a <1 cm

incision after local anesthetic infiltration, as has been reported previously.[21] This was very early in our experience with perineural catheters placement, and the catheter had been threaded more than 10 cm past the needle tip. After this incident, we threaded catheters no more than 5 cm beyond the needle tip, although other experienced investigators have reported routine threading up to 10 cm without incident.[22]

Although seven different infusion pumps were used during the 2-year period investigated, 77% of patients used the electronic Microject PCA.[23] The programmable nature of this pump provides infusion flexibility, and we have found that allowing patients to vary their basal rate allows analgesia optimization.[10,11,17,18] This is always done with instructions provided by a physician via the telephone, and we have had only one experience in which the patient could not successfully reprogram her pump and had to return to the surgical center for assistance. It was therefore a surprising finding that only 35% of patients felt comfortable changing their pump programming, and this did not vary greatly when stratified by patient age (Table 4). We believe this is a result of the Microject PCA's controls, which are small and relatively difficult to adjust for the inexperienced user.[17] Various other reprogrammable, portable infusion pumps we have tested[24] and used clinically (Ilfeld, Morey, and Enneking, unpublished data, 2003) appear to be easier to reprogram. However, whether or not this practice ultimately proves beneficial remains to be determined.

The information contained in this article was collected by a retrospective chart review and patient telephone survey. By definition, this article does not provide as reliable data as prospective, randomized, controlled studies, and is not meant to replace such investigations. For example, patients were asked if they would "feel comfortable" having their catheter removed at home with instructions given over the phone by the physician. Because all of our patients remove their catheters with instructions provided by physicians in telephone contact throughout the procedure, patients in this study did not experience the alternative methods of catheter removal (e.g., with only written instructions). In keeping with evidence-based medical practice, we believe that the optimal techniques, equipment, and patient oversight should be determined by prospective, controlled trials, and not merely by institutional preference. However, because of the relatively recent evolution of these techniques, illuminating data are not yet available. Therefore, we wished to make the current report available to practitioners.

In conclusion, this chart review and survey of ambulatory patients who had received perineural infusion revealed that the majority felt "safe" during home treatment, were comfortable with once-daily telephone contact, and were comfortable removing their catheters with instructions given over the phone. However, only a third felt comfortable reprogramming their electronic pump at home.

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