TÜBİTAK

Turkish Journal of Medical Sciences

http://journals.tubitak.gov.tr/medical/

Research Article

Turk J Med Sci
(2015) 45: 694-699

doi:10.3906/sag-1312-24

Comparison of local infiltration anesthesia and peripheral nerve block: a randomized prospective study in hand lacerations

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Received: 04.12.2013 • **Accepted/Published Online:** 19.11.2014 • **Printed:** 30.06.2015

Background/aim: To compare local infiltration anesthesia (LIA) and peripheral nerve block (PNB) in repairing hand lacerations.

Materials and methods: This prospective study was designed as a randomized, controlled, unblinded trial. Fifty four patients with hand lacerations were included in the study. While 23 of these patients had LIA, PNB was performed in the remaining 31 patients. Lidocaine hydrochloride 2% and 27 gauge needles were used. Onset time of the anesthesia, response to the injection and suturing procedures, need for additional anesthetic, and patient satisfaction were compared.

Results: No significant differences were noted between the groups in terms of response to injection pain and suture pain (Mann–Whitney U; P = 0.220/P = 0.316). There were also no significant differences between the groups when patient satisfaction (chi-square; P = 0.785) and need for additional local anesthetics (Fisher's exact; P = 0.628) were evaluated. The time to loss of pinprick sensation in the local infiltration group was 1.3 min, whereas in the nerve block group it was 2.2 min. The difference was statistically significant (Mann–Whitney U; P < 0.001).

Conclusion: Despite the fact that performing PNB in emergency departments requires some experience, it still counts as a convenient method comparable to LIA.

Key words: Peripheral nerve block, local infiltration anesthesia, hand lacerations, pain, satisfaction

1. Introduction

One of the most commonly observed complaints of patients presenting to emergency departments (EDs) is skin lacerations. According to data compiled in the USA, eight million patients present to EDs every year with the complaint of traumatic skin injuries. This particular group accounts for 7% of all the patients presenting to EDs in a year. The most frequent types are facial, scalp, finger, and hand injuries (1).

Local infiltration anesthesia (LIA) is a simple, convenient, and highly preferred anesthetic technique in EDs for repairing lacerations. Its advantages include physicians being familiar with the technique, it is learnt easily, it has a short onset time of effect, and it is reliable. On the other hand, it requires multiple needle entries, and there is possible contamination risk of the injury, difficulty in putting together wound edges due to increasing tension, likelihood of requiring additional anesthetic substances, and distortion of tissue perfusion; all count against it as primary disadvantages (2). As an alternative technique peripheral nerve block (PNB) may be used (3). Although it is an old technique, it is not commonly preferred by physicians. Its favorable aspects can be listed as its requirement for a single injection most of the time and allowing completion of the procedure with less anesthetic substances in major wounds (2). Pain caused by these anesthetic techniques and repairing procedures is one of the most significant factors in determining patient satisfaction (4).

In the present study, LIA and PNB techniques, which are used prior to suturing in patients presenting to the emergency unit with traumatic hand lacerations, are compared in terms of patient satisfaction. Comparison criteria were set as pain scores for the anesthetic injection and suturing procedures, necessity for additional anesthesia, and starting time of anesthesia.

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2. Materials and methods

Fifty-four patients presenting to the Emergency Department of Gazi University Hospital between 17 August 2009 and 30 September 2009 were included in the study. Ethical committee approval was obtained from Yıldırım Beyazıt University School of Medicine. Having agreed to participate in the study, patients older than 18 who presented to the hospital within 6 h following the incident and had lacerations at proper dermatomes were selected. The exclusion criteria were lidocaine and latex allergies; mental and conscious instability presenting vital risks; alcohol, analgesics, and sedative-hypnotic drug consumption; complex lacerations; neuropathies and pain syndromes; histories of atrioventricular block, diabetes mellitus, and chronic kidney failure; pregnancy; and lactation. This randomized prospective study was designed as controlled and unblinded.

In the study, physicians performing anesthesia techniques were selected from among specialists in the Emergency Department of Gazi University Hospital and residents with at least three years of experience.

Patients were randomized through selection of closed envelopes; 23 received LIA and 31 had PNB. For both techniques, lidocaine hydrochloride 2% at room temperature and 27 gauge needles (size 4 cm) were used. Due to the study protocol, the physicians and patients were unblinded. Demographic features of patients, types of injuries, incident types, and examination findings were prospectively recorded on patient survey forms. The patients received standard care techniques for injuries (2).

LIA was performed by inserting a needle at the interior part of the wound edges and applying the injection at the withdrawal stage while proceeding parallel to the sides. In the median nerve block, an injection was made to the lateral margin of the palmaris longus tendon at the level of the proximal skin crease. In the radial nerve block, an injection was performed on dorsal and palmar parts starting from the lateral margin of the proximal skin crease. In the digital nerve block, two injections were performed at the medial and lateral web space of the finger just distal to the metacarpal-phalangeal joint; 5 mL of lidocaine hydrochloride 2% was injected percutaneously into the radial and median nerves and 4 mL into the digital nerves.

After the anesthetic procedure, pain response to the injection was measured via a 100-mm visual analogue scale (VAS). Following that, pain testing was performed at the wound edges every 30 s through a pinprick test and the time of sensory loss was assumed as the exact onset time of anesthesia and then recorded. In cases where no sensory loss was observed within the first 10 min, additional (rescue) local anesthesia was performed and these cases were also noted. Afterwards, the injury was sutured with nonabsorbable suture material and it was recorded after the suture pain had been measured again on a 100-mm VAS. Finally, the whole procedure was concluded by assessing patient satisfaction (Table 1). The relation between the onset time of anesthesia and patient satisfaction was also evaluated.

SPSS 15.0 for Windows (SPSS, Inc., Chicago, IL, USA) was used for the analysis of data. First, the evaluation was performed in all patients. Then lacerations were categorized into two subgroups as finger lacerations and hand lacerations other than finger lacerations (all patients in which radial and median nerve blocks were used). After that the data obtained were analyzed statistically.

3. Results

Fifty-four patients between 18 and 65 years old were included in the study. While 23 of these patients had LIA, PNB was performed in the remaining 31 patients. Within the groups, it was found that vital findings and demographic features of patients displayed a homogeneous distribution (Tables 2 and 3). Dermatomes of lacerations are shown in Table 4. Mean length of lacerations was 2.42 cm.

No significant difference was found between the two techniques regarding pain response to injection (for LIA: 24.5 and for PNB: 29.7; difference: 5.2; P = 0.220). There was also no statistically significant difference within the groups regarding suturing procedure pain (for LIA: 5.6 and for PSB: 9.2; difference: 1.2; P = 0.316). When the need for rescue anesthesia was evaluated, no significant difference was seen (in LIA group: 1 patient, in PNB group: 3 patients; P = 0.628). The time to loss of pinprick sensation was 1.3 min in the LIA group and 2.2 min in the PNB group and the difference between the groups was statistically significant (P < 0.001). In the satisfaction evaluation, 15 (65.2%) patients in the LIA group and 18 (58.1%) patients in the PNB group stated that they were quite satisfied. The difference was statistically insignificant (P = 0.785) (Table 5). When lacerations were categorized into subgroups as finger lacerations and hand lacerations other than finger lacerations, similar results were found as the results in all patients. In the finger lacerations group (33 patients), no difference was observed between LIA and PNB in terms of pain response to injection (21.9/25.0; P =

Table 1. Satisfaction scale.

Satisfaction level	Score
Not at all satisfied	1 points
Not satisfied	2 points
Neutral (neither satisfied nor dissatisfied)	3 points
Satisfied	4 points
Very satisfied	5 points

Table 2. Sex.

		Type of anesthesia			Pearson chi-square
		LIA (%)	PNB (%)	Total (%)	P
Sex	Male	18 (78.2)	21 (67.8)	39 (72.2)	0.393
	Female	5 (21.8)	10 (32.2)	15 (27.8)	
Total		23 (100)	31 (100)	54 (100)	

Table 3. Vital findings and demographic features.

		Type of anesthesia						Mann–Whitney U
		n	Mean	Median	Min	Max	SD	P
Age (year)	LIA	23	32.0	29	21	63	10.3	0.257
	PNB	31	35.6	33	20	65	12.2	
	Total	54	34.0	30	20	65	11.4	
Systolic blood pressure (mmHg)	LIA	23	117.4	120.0	90.0	165.0	17.2	0.986
	PNB	31	117.2	120.0	90.0	140.0	12.3	
	Total	54	117.3	120.0	90.0	165.0	14.9	
Diastolic blood pressure (mmHg)	LIA	23	74.6	80.0	60.0	90.0	9.5	0.455
	PNB	31	77.2	80.0	60.0	100.0	13.0	
	Total	54	75.9	80.0	60.0	100.0	11.4	
Heart rate (beat/min)	LIA	23	84.7	82.0	62.0	117.0	14.1	0.664
	PNB	31	82.8	80.5	59.0	115.0	12.0	
	Total	54	83.8	81.5	59.0	117.0	13.0	
Body temperature (°C)	LIA	23	36.2	36.0	35.4	37.9	0.4	0.057
	PNB	31	36.0	36.0	35.0	36.7	0.3	
	Total	54	36.1	36.0	35.0	37.9	0.4	
Laceration length (cm)	LIA	23	2.5	2.0	1.0	11.0	1.9	0.191
	PNB	31	2.3	2.0	1.0	10.0	1.8	
	Total	54	2.4	2.0	1.0	11.0	1.8	

Table 4. Dermatomes of lacerations and type of anesthesia.

	LIA	PNB	Total
Radial nerve block	10	5	15
Median nerve block	3	3	6
Digital nerve block	10	23	33
Total	23	31	54

Table 5. Satisfaction, need for extra local anesthetics, pain response to injection, pain response to suturing, and time to loss of pinprick sensation parameters.

	LIA		PNB		P-value
Satisfaction (very satisfied/satisfied/other categories)	15 (65.2%)/8 (34.8%)/0(0%)		18 (58.1%)/13 (41.9%)/0(0%)		0.785
Need for extra local anesthetics	1 (4.3%)		3 (9.7%)		0.628
	Mean ± sd	Median (min–max)	Mean ± sd	Median (min–max)	
Pain response to injection (VAS)	24.5 ± 18.55	10.0 (5–100)	29.7 ± 17.25	20.0 (10–80)	0.220
Pain response to suturing (VAS)	5.6 ± 8.95	0.0 (0–30)	9.2 ± 12.91	0.0 (0–40)	0.316
Time to loss of pinprick sensation (min)	1.3	1.0	2.2	1.5	<0.001

0.490) and pain response to suturing (6.0/5.7; P = 0.820). In the hand lacerations other than finger lacerations group (21 patients), no difference was observed between LIA and PNB in terms of pain response to injection (29.5/30.0; P = 0.679). On the other hand, there was a statistically significant difference regarding pain response to suturing (8.8/14.50; P = 0.045). Additionally, the difference in the onset time of the anesthesia that was determined in the main group was statistically insignificant in the finger lacerations group (1.7 min in PNB group and 1.3 min in LIA group) (P = 0.382).

In the group with higher levels of satisfaction, the onset time of anesthesia was significantly lower (P = 0.046).

During ED follow-ups of the patients, no complications such as intractable pain, paresthesia, or anesthesia were observed.

4. Discussion

In this study we compared LIA and PNB in repairing hand lacerations. We found no difference between them regarding pain response to injection and suturing, the need for rescue anesthesia, the time to loss of pinprick sensation, or patient satisfaction.

In the literature, we have identified no other studies with methodology similar to this study that compares radial and median nerve blocks with LIA. In one study, it was indicated that in minor lacerations local infiltration was more suitable for hand and foot lacerations, whereas nerve blocks were more convenient for removal of foreign bodies, debridement, and suture of large and contaminated lacerations (5). In our study for the hand lacerations other than finger lacerations group, pain response to suturing in the PNB group was significantly higher than it was in the LIA group (14.5/8.8; P = 0.045). Yet, some studies that claim that differences less than 13 on VAS are not statistically significant are seen in the literature (6). Moreover, in our study we required additional anesthesia for 1 patient in the PNB group and for 1 patient in the LIA group.

In one particular study on finger lacerations, it was found that digital block resulted in less pain during anesthetic injection and suturing compared to local infiltration anesthesia (7). In another similar study, which mentioned topical anesthesia prior to the actual anesthesia, no differences were observed between digital block and infiltration anesthesia in terms of needle entry, infiltration of medication, or suture pain. In one patient extra anesthesia was required (8).

In the finger lacerations group involving 33 patients in this study, no difference was observed between LIA and PNB in terms of pain scores; however, extra anesthesia was needed in two of the cases in which block was performed. This difference was considered insignificant.

In previous digital block studies conducted using lidocaine hydrochloride, the time to loss of pinprick sensation via PNB technique was between 1.3 and 2.5 min (9,10). In the finger lacerations group in our study, the time to loss of pinprick sensation was 1.7 min in the PNB group and 1.3 min in the LIA group. This difference between the groups was not statistically significant (P = 0.382). However, the difference in the time to loss of pinprick sensation in hand lacerations other than finger lacerations was 2.4 min (P = 0.003) and this difference was statistically significant. In the overall evaluation of all patients, a difference of 1 min on average was measured (P = 0.001). This difference may be regarded as significant as it shows that local infiltration anesthesia can provide an anesthetic effect in a shorter period of time. Furthermore, when time to loss of pinprick sensation was compared with patient satisfaction, it was also found that starting time of anesthesia was significantly low in the patient group with more satisfaction (P = 0.046). At this point, it may be concluded that patients are well aware of the short time to loss of pinprick sensation during local infiltration anesthesia and it is reflected in patient satisfaction.

In our study, when we reviewed the evaluation of all patients in terms of pain scores and need for extra

anesthesia, we may state that there was not a statistically significant difference between the PNB and LIA groups regarding anesthetic injection pain and suture pain. In the PNB group 3 patients and in the LIA group only 1 patient required a rescue analgesic injection and this difference cannot be considered statistically significant.

Patient satisfaction in laceration approaches depends on several factors. These factors generally focus on pain and comfort during the procedure, injury recovery, and cosmetic outcomes. It has been reported in the literature that patients care primarily about cosmetic results in traumatic laceration repairs (11). In a study on patient satisfaction, in which the Iowa Satisfaction with Anesthesia Scale (ISAS) was used, local infiltration anesthesia and regional nerve block were compared in ptosis surgery and no difference was found between the two techniques in terms of patient satisfaction (12). In another study, where ultrasonography was used, patient satisfaction with radial, median, and ulnar nerve blocks was evaluated and the patients indicated their satisfaction as 92% (13). In our study, 65.2% (n = 15) of the patients in the LIA group (n = 23) marked the 'I am very satisfied' option on the satisfaction scale; on the other hand, 58.1% (n = 18) of the patients in the PNB group (n = 31) checked the 'I am very satisfied' option. This difference was not significant (P = 0.785) (Table 5). Since studies in the literature vary in terms of methods, it would be unreasonable to compare them. Nevertheless, results reveal that both techniques yield positive effects on patient satisfaction.

The amount of local anesthetics that we used in this study was significantly higher in the PNB group as expected (P = 0.001). However, the injection number was lower than expected in the PNB group (P = 0.008). In order to make this finding more objective in our study, we formed two groups regarding laceration sizes: ≤2.5 cm and >2.5 cm. No significant difference was found in these groups in terms of pain scores, satisfaction, or additional anesthesia need. As the average laceration size was 2.5 cm, the advantage of providing less anesthetic substance volume in PNB did not occur. In further similar studies where laceration size is 5 cm and larger, this advantage of PNB technique may become prominent.

Limitations of this study include its unblinded design both for the patient and the physician and the physician who performed anesthesia technique was at the same time the person asking survey questions to the patient. This drawback may have affected patient responses. Since laceration dermatomes, where two anesthesia techniques were performed, were not equally distributed and the number of doctors enrolled in the study was quite high, these factors may have affected the standardization as well. Reliability of patients' evaluating VAS score in the study may also be questioned. Additional objective evaluation methods may need to be incorporated.

Anatomic variations of hand nerves may be listed among the limitations of this study. It should also be remembered that anastomoses can occur particularly between the radial and ulnar nerves and this situation may well be observed in other nerves in the hand (14). It is also assumed that these anastomoses are likely to play a role in the failure of peripheral nerve block.

In conclusion, LIA or PNB for hand laceration surgery is convenient and predictable.

Acknowledgment

We would like to express our special thanks to the physicians of Gazi University Hospital Emergency Department for their extensive support during the data gathering process.

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