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Comparison between landmark and ultrasound-guided percutaneous peristyloid glossopharyngeal nerve block for post-tonsillectomy pain relief in children: a randomized controlled clinical trial

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ABSTRACT

Background: Glossopharyngeal nerve (GPN) block is a useful treatment option for acute post-tonsillectomy pain. This study aimed to assess safety and efficacy of the landmark (LM) technique versus the ultrasound (US)-guided technique for GPN block in children undergoing tonsillectomy.

Methods: This double-blinded, parallel-group, randomized trial enrolled 54 children of both genders who were American Society of Anesthesiologists physical status grade I–II and were scheduled for tonsillectomy under general anesthesia. All patients underwent percutaneous peristyloid GPN block. In the LM group, 27 patients were managed by insertion of the needle at midpoint of the line between the mastoid process and angle of the mandible. In the US group, 27 patients were managed with the US-guided technique to locate the styloid process. The outcomes were time to first analgesic requirement, pain in rest and during swallowing, easiness of the technique, time required for the technique performance, recovery time from anesthesia, and anesthetist, surgeon, parent, and staff satisfaction.

Results: The post-tonsillectomy pain score during rest and swallowing, rescue analgesic request, recovery time from general anesthesia, anesthetist', surgeon', staff nurses', and parents' satisfactions were comparable between the LM technique and US-guided percutaneous peristyloid GPN block (all $p > 0.05$). However, the LM technique was significantly easier and required shorter duration than the US-guided technique ($p < 0.05$).

Conclusion: In tonsillectomy surgery, both the LM technique and the percutaneous peristyloid US-guided GPN block were safe and effective in reducing postoperative pain. Furthermore, the LM technique was easier and had shorter duration to perform than the US-guided technique.

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Landmark; ultrasound-guided; tonsillectomy; glossopharyngeal nerve block; pain relief

1. Introduction

Tonsillectomy is one of the most common operations in general otolaryngology. Pain following a tonsillectomy contributes significantly to patient morbidity. Poor oral intake and the potential risk of hemorrhage are the two effects of postoperative discomfort. Additionally, the rise in day-case tonsillectomy has raised the need for better postoperative analgesia [1].

Tonsillectomy pain is produced by peripheral tissue damage that releases a variety of inflammatory mediators during the inflammatory process. Bradykinin, serotonin, and prostaglandins alter neuronal excitability, lowers pain thresholds, and increase sensitivity to nociceptive stimuli. Consequently, greater inflammation is linked to more pain and discomfort following surgery, especially on the first postoperative day [2].

To reduce pain after tonsillectomy surgery, the use of corticosteroids, alterations to anesthesia and surgical technique, and local anesthetic agents have been combined with general anesthetic to lessen post-tonsillectomy discomfort. However, the outcomes are ambiguous and debatable [3,4]. A systematic review by Grainger and Saravanappa [5] determined that local anesthetic procedures were efficient in reducing post-operative analgesic usage, and raised satisfaction following tonsillectomy [3,6]. Local anesthetics decreased the central nervous system sensitization and blocked the peripheral nociceptor transmission after tissue damage. The local anesthetic drugs are applied either by topical application into the tonsillar fossa or via infiltration either before or after tonsillectomy [7]. Where, the glossopharyngeal nerve (GPN) supplies the tonsillar and peritonsillar regions especially, the sensory fibers. Thereby, GPN block reduced postoperative discomfort during tonsillectomy and analgesic use [8].

Several studies have described glossopharyngeal nerve block in pain therapy or post-operative analgesia using different techniques; however, the current trial is novel in comparing the landmark techniques against ultrasound techniques in pediatric age group undergoing tonsillectomy with a primary outcome of time to first analgesic requirement and secondary

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outcomes giving a spotlight on easiness and anesthetist satisfaction. Earlier trials of glossopharyngeal nerve block used the intraoral technique [8], and some performed the para-pharyngeal not the peristyloid technique in cadaver and volunteer sonoanatomy study [9]. Some studies compared the extraoral and intraoral routes of glossopharyngeal nerve block for pain relief in patients with carcinoma of the tongue, and some trials used extra oral glossopharyngeal nerve block in glossopharyngeal neuralgia [9–11].

The mastoid process and the mandible are where the styloid is placed, hence the acoustic window is quite narrow and the styloid is readily covered by bones. Anesthesiologists are increasingly using ultrasonography to guide nerve blocks, and certain cases of ultrasound (US)-guided GPN blocks have also been documented [12]. Real-time imaging with peristyloid US-guided GPN block allows for the direct observation of drug diffusion as well as the real-time visualization of bone, soft tissue, and peripheral blood arteries [9]. This helps anesthetists to lower the risk of vital structures injury. In the current study, we investigated the efficacy and safety of US-guided GPN block via the styloid process versus LM technique in children undergoing tonsillectomy.

2. Methods

2.1. Ethical considerations

The study was carried out following approval by the Ethics Committee of the Faculty of Medicine, Suez Canal University, Egypt. This trial was registered at the ClinicalTrials.gov (Trial ID: NCT04970680). After explanation of the purpose and procedures of the study, written informed consents were obtained from the guardians of all participants. The participants' data were kept confidential.

2.2. Study design, setting, and date

This double-blinded, parallel-group, randomized trial was conducted in the day case surgical theatres at Suez Canal University Hospital, Egypt between February 2019 and April 2022.

2.3. Eligibility criteria

The present study included 54 children (3–7 year-old) of both genders, who were American Society of Anesthesiologists physical status I or II and were scheduled for tonsillectomy. We excluded patients for combined adeno-tonsillectomy, patients who had infection, scar or deformity at the injection site, or severe coagulation disorders. Patients who had hypersensitivity to any of the used drugs were also excluded.

2.4. Randomization, allocation concealment, and blinding

Randomization was done by a computer software program, and allocation concealment was performed using the sequentially numbered, opaque, sealed envelopes method [13]. The allocation sequence was concealed from the physician assessing and enrolling participants.

The GPN block for all patients was performed by two anesthesiologists with the same level of experience in performing the technique either using the landmark or with ultrasound guidance. Data of outcomes were obtained by the principle investigator, who was blinded to the technique done.

2.5. Interventions

Fifty-four patients were randomly allocated into two groups (27 patients each). All patients received percutaneous peristyloid GPN block. Patients in the landmark (LM) group were managed through insertion of the needle at the midpoint of the line between the mastoid process and the angle of the mandible [11]. Patients in the US-guided group were managed with SonoSite M-Turbo® (Fujifilm SonoSite, USA) ultrasound machine to locate the styloid process. The low-frequency linear probe was used, and the injection was within real-time guidance posterior to the styloid process [9].

All patients were subjected to full history taking, clinical examination, and routine laboratory investigations including the coagulation profile. Details of the anesthetic technique were explained to the guardians of the children on the preoperative visit.

Patients were fasting for at least 6 h preoperatively. Routine monitoring was done in the form of automated noninvasive blood pressure, pulse oximetry, and ECG. All the baseline parameters were observed and recorded in the morning of the day of surgery. A good venous access was secured, oxygen (2 L/min) was administered for 3 min. All patients were anesthetized with 1 µg/kg of fentanyl and 2.5 mg/kg of propofol.

A proper sized cuffed endotracheal tube was inserted and fixed at a level of bilateral equal air entrance evidenced by auscultation. The patients were attached to the mechanical ventilator. Maintenance of anesthesia was carried out by end-tidal sevoflurane (1.2%) with oxygen (2 L/min) in a semi-closed circuit with a CO_2 absorbent. Upon completion of the surgical procedure, according to the randomization, a bilateral GPN block was performed.

2.5.1. Ultrasound-guided glossopharyngeal nerve block

Once the patient's head was in the lateral position, the mastoid and mandibular angle were identified via

high-frequency linear probe scanning. An imagined line was drawn connecting these two landmarks (first line). A second imaginary line was created starting 1.5 cm beyond the posterior margin of the mandibular angle and extending to the mastoid. To view the styloid process, the linear array probe was fitted on the second line. The arteries beneath or behind the styloid process were identified using the color flow Doppler technique. The mandible was punctured using 22-gauge 3.5-inch needle with an ultrasound-guided. The needle path was seen when the needle tip entered the styloid process and slid through it to the back of the styloid process. When no blood or cerebrospinal fluid appeared after careful withdrawal of the needle, 1 ml of lidocaine 2% on each side was injected using a 1 ml syringe under real-time US guidance.

2.5.2. The landmark technique

An imaginary line was drawn from the mastoid process to the angle of the jaw while the patient was lying supine. Just below the line's center, the styloid process should be located. Antiseptic solution was used to prepare the skin. In the plane perpendicular to the skin, a 22 gauge, 1.5-inch needle was inserted at this midpoint. Within 3 cm of making contact, the styloid process was encountered. The needle was then withdrawn, and the styloid process was "walked off" posteriorly. The local anesthetic was given as soon as bone contact was broken and if meticulous aspiration showed no signs of blood or cerebrospinal fluid.

After the bilateral GPN block was completed, sevoflurane was discontinued, and the inspired oxygen flow rate was increased to 5 L/min. Patients were transferred to the post-anesthesia care unit with a nonrebreathing oxygen mask attached to an oxygen cylinder (5 L/m) and a portable monitor.

At rest and during swallowing, postoperative face, legs, activity, cry, consolability (FLACC) scale were assessed at 0, 2, and 4 h after surgery [14]. Additionally, the time to the first paracetamol analgesic dose requirement was recorded during the recovery period and 4 h after surgery.

The duration for performing the block is defined as the time from sterilizing the area for injection till putting a gauze after injection. The recovery time from general anesthesia was defined as the time from the discontinuation of the inhalational anesthesia till shifting the patient to the post-anesthesia care unit. In both techniques, the easiness of the technique was assessed by asking the anesthetists at the end of the block performance (0 [so difficult] to 10 [extremely easy]). The anesthetists' satisfaction was assessed by asking the anesthetists at the end of the block performance (0 [complete dissatisfaction] to 10 [complete satisfaction]). The parent's satisfaction was assessed by asking the parents at the discharge time from the day case department (0 [complete dissatisfaction] to 10 [complete satisfaction]). The surgeon's satisfaction (blinded to group allocation) was assessed by asking the surgeons in the recovery room (0 [complete dissatisfaction] to 10 [complete satisfaction]). The staff nurses' satisfaction was assessed by asking the staff nurses at the discharge time from the day case department (0 [complete dissatisfaction] to 10 [complete satisfaction]).

2.6. Outcomes

The primary outcome was the time to first analgesic requirement. The secondary outcomes included the FLACC scale at 0, 2, and 4 h at rest and during swallowing, the easiness of the technique, the time required for the technique performance, the recovery time from general anesthesia, and the anesthetists', the surgeon's, the parents', and the staff nurses' satisfactions.

2.7. Sample size

The sample size was calculated using the G power 3.1.9.2 software after setting the used statistical test to t-test- difference between two independent means, with α error probability to 0.05, power to 0.95, and the allocation ratio to 1:1. According to Ahmed and Omara [8], a Cohen's effect size of (0.98) was calculated regarding the time to first analgesic request between the control and the glossopharyngeal nerve block groups. The calculated sample size was 24 patients per group. We added 10% to account for the loss to follow-up. The final sample size was then 27 subjects per group (the total sample size was 54 patients).

2.8. Statistical analysis

Data were analyzed using the Statistical Package for Social Sciences for Windows, version 24 (IBM© Corp., Armonk, N.Y., USA). The distribution of the numerical data was tested using the Shapiro-Wilk test for normality. All data were normally distributed and were summarized as mean ± standard deviation (SD). Comparisons between the two groups were done using the student t-test. Categorical data were summarized as frequencies (counts and percentages), and the associations between the studied groups were tested using the Pearson's Chi-square test. A p-value <0.05 was adopted to indicate statistical significance.

3. Results

Sixty patients were recruited, 3 patients were excluded due to development of acute upper respiratory tract infection with fever and so the surgery was cancelled, and 3 patients' guardians declined participation. Fifty-four patients received percutaneous peristyloid GPN

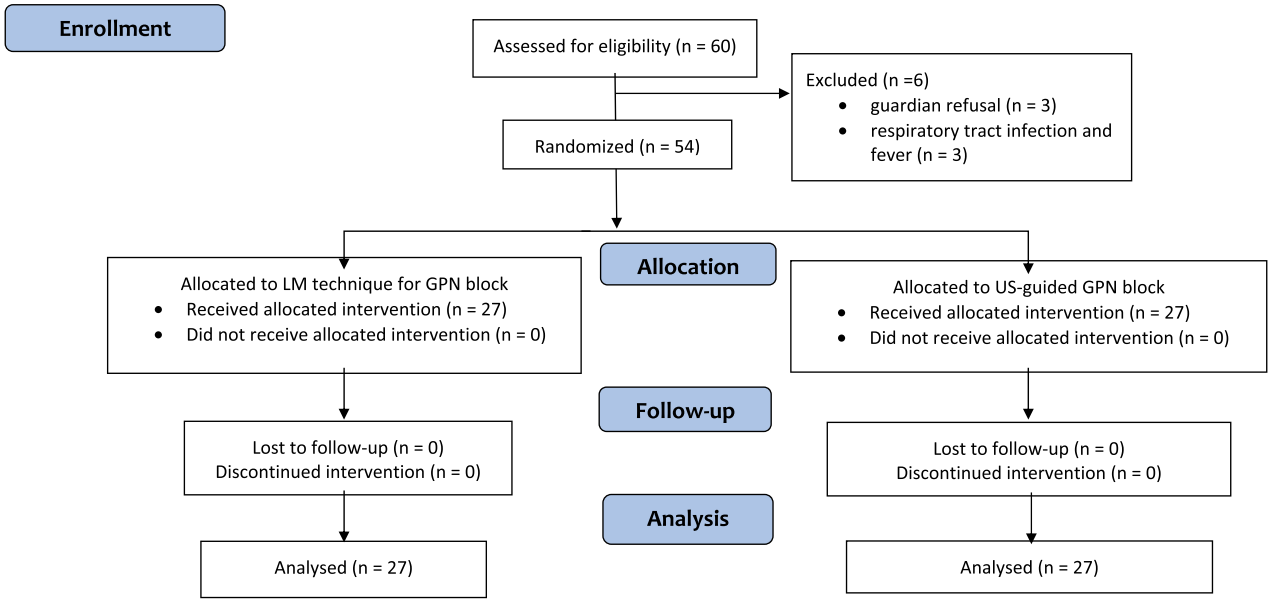

Figure 1. The trial flow chart.

block during tonsillectomy and were randomly allocated into two groups (27 patients each) with a 1:1 allocation ratio. The LM group were managed through insertion of the needle at the midpoint of the line between the mastoid process and the angle of the mandible. The US group were managed through insertion of the needle within real-time US guidance posterior to the styloid process (Figure 1).

The mean age of the enrolled patients was 4.89 ± 1.1 years in the LM group and 4.7 ± 1.2 in the US group. The mean duration of surgery was not statistically significant between both techniques ($p > 0.05$; Table 1).

The time to the first analgesic request was not significantly different between both groups. The postoperative pain scores during rest (FLACC score) were comparable between the two groups immediately after surgery and at 2 and 4 h after surgery ($P = 0.523$, 0.372, and 0.854, respectively). In addition, the FLACC scores during swallowing were insignificantly different between the two groups at the same time points of evaluation ($P = 0313$, 0.438, and 0.342, respectively). However, the LM group had a significantly easier technique compared to the US group ($p < 0.001$). Meanwhile, the mean duration of technique performance was significantly longer in the US group than in the LM group (6.56 ± 1.1 min, vs. 1.22 ± 0.4 min, respectively; $p < 0.001$). The recovery time from general anesthesia was not different between both groups ($p > 0.734$). The anesthetists, the surgeons, the staff nurses, and the parents expressed complete satisfaction in both groups with no significant differences (all $p > 0.05$; Table 2).

4. Discussion

Acute post-tonsillectomy pain is the commonest morbidity that affect child activity. The effectiveness of GPN block in reducing acute post-tonsillectomy pain is somewhat debatable. In addition, the technique of the block was not standardized in the literature [15]. Therefore, the aim of our study was to compare the safety and efficacy of LM technique with the US-guided GPN block among children underwent tonsillectomy.

Our findings showed that time to first analgesic request, the FLACC score during rest and swallowing, recovery time from general anesthesia, and satisfactions of the anesthetists, surgeons, staff nurses, and parents were comparable in both the LM and the US-guided GPN block techniques. According to earlier studies [16–20], GPN block was beneficial for treating acute post-tonsillectomy pain.

In children who underwent adeno-tonsillectomy, Ahmed and Omara [8] compared GPN block with 5 ml of 0.5% bupivacaine versus no block technique, and they reported effective bilateral GPN block for postoperative analgesia. Moreover, Mohamed et al. [21] studied the effect of combined pre-surgical administration of dexamethasone and intraoral GPN block using 3 ml of 0.5%

Table 1. Baseline characteristics (total n = 54).

Variable	Landmark Group (n = 27)	Ultrasound Group (n = 27)	P value
Age (year)	4.89 ± 1.1	4.70 ± 1.2	0.543
Duration of surgery (min)	28.07 ± 4.2	28.19 ± 4.4	0.925

Data are presented as mean ± standard deviation.
n: numbers; min: minute.

Table 2. Face, legs activity, cry, consolability scale, the rescue analgesic, the easiness, the time consumption, and the anesthetists', the surgeons, the parents, and the staff nurses' satisfactions (total n = 54).

			Landmark Group (n = 27)	Ultrasound Group (n = 27)	P value
Paracetamol request by Parents, n (%)	None		11 (40.7%)	10 (37%)	0.342
	Yes		16 (59.3%)	17 (63%)	
FLACC 0, n (%)	Rest	0	1 (3.7%)	1 (3.7%)	0.523
		1	2 (7.4%)	4 (14.8%)	
		2	10 (37%)	5 (18.5%)	
		3	3 (11.1%)	7 (25.9%)	
		4	5 (18.5%)	3 (11.1%)	
		5	4 (14.8%)	6 (22.2%)	
		6	2 (7.4%)	1 (3.7%)	
	Swallow	0	0	0	0.313
		1	0	0	
		2	1 (3.7%)	2 (7.4%)	
		3	3 (11.1%)	9 (33.3%)	
		4	6 (22.2%)	3 (11.1%)	
		5	10 (37%)	6 (22.2%)	
		6	7 (25.9%)	7 (25.9%)	
FLACC 2, n (%)	Rest	0	1 (3.7%)	5 (18.5%)	0.372
		1	8 (29.6%)	7 (25.9%)	
		2	6 (22.2%)	4 (14.8%)	
		3	3 (11.1%)	4 (14.8%)	
		4	6 (22.2%)	3 (11.1%)	
		5	3 (11.1%)	2 (7.4%)	
		6	0	2 (7.4%)	
	Swallow	0	0	0	0.438
		1	1 (3.7%)	0	
		2	8 (29.6%)	7 (25.9%)	
		3	12 (44.4%)	9 (33.3%)	
		4	3 (11.1%)	3 (11.1%)	
		5	3 (11.1%)	8 (29.6%)	
		6	0	0	
FLACC 4, n (%)	Rest	0	8 (29.6%)	11 (40.7%)	0.854
		1	6 (22.2%)	6 (22.2%)	
		2	7 (25.9%)	4 (14.8%)	
		3	3 (11.1%)	3 (11.1%)	
		4	1 (3.7%)	1 (3.7%)	
		5	2 (7.4%)	1 (3.7%)	
		6	0	1 (3.7%)	
	Swallow	0	2 (7.4%)	4 (14.8%)	0.342
		1	7 (25.9%)	2 (7.4%)	
		2	12 (44.4%)	10 (37%)	
		3	4 (14.8%)	7 (25.9%)	
		4	2 (7.4%)	3 (11.1%)	
		5	0	1 (3.7%)	
		6	0	0	
FLACC 0, mean ± SD	Rest		3.07 ± 1.6	3.07 ± 1.6	1
	Swallow		4.81 ± 1.3	4.26 ± 1.4	0.129
FLACC 2, mean ± SD	Rest		2.52 ± 1.5	2.26 ± 1.9	0.577
	Swallow		2.96 ± 1.0	3.44 ± 1.2	0.116
FLACC 4, mean ± SD	Rest		1.59 ± 1.5	1.41 ± 1.7	0.670
	Swallow		1.89 ± 1.0	2.22 ± 1.3	0.301
Easiness, n (%)	Easy		27 (100%)	5 (18.5%)	0.000*
	Difficult		0	22 (81.5%)	
Duration of technique performance (min), mean ± SD			1.22 ± 0.4	6.56 ± 1.1	0.000*
Recovery time from general anesthesia (min), mean ± SD			5.30 ± 1.3	5.41 ± 1.1	0.734
Anesthetists' satisfaction, mean ± SD			7.33 ± 1.3	7.26 ± 1.0	0.817
Surgeon's satisfaction, mean ± SD			7.33 ± 1.2	7.81 ± 0.8	0.089
Parents' satisfaction, mean ± SD			6.96 ± 1.1	7.26 ± 1.0	0.308
Staff nurses' satisfaction, mean ± SD			7.74 ± 1.1	7.59 ± 0.8	0.572

Data are presented as mean± standard deviation or number (%).
SD: standard deviation; n: number; min: minute; FLACC: face, legs activity, cry, consolability scale; *: significant at $p < 0.05$.

bupivacaine in children who underwent tonsillectomy. The two studies concluded that the GPN block were effective for post-tonsillectomy pain in children.

Moreover, in adult patients, Al katatbeh et al. [22] evaluated the efficacy of US-guided GPN block versus no block technique in 400 adult patients that were randomly allocated to oropharyngeal surgery. [22] found that GPN block was effective in controlling the postoperative pain after tonsillectomy. Moreover, Park et al. [23] reported the efficacy of GPN block with the ropivacaine and bupivacaine versus no block technique for the control of post-tonsillectomy pain. Both Al katatbeh et al. and Park et al. noticed that the magnitude of an obtunded response to gag reflex was correlated to the degree of postoperative pain control. Therefore, the obtunded gag reflex response was considered a clinical predictor for successful GPN block.

Furthermore, the LM technique was easier and consumed short duration than the US-guided GPN block. Barton and Williams [24] found it is easy and

recommended to use intraoral lidocaine GPN block among awake patients with nasotracheal intubation, local tonsillectomies, and in combination with superior laryngeal nerve blocks. The lidocaine administration easily and quickly blocked the GPN; hence, completely abolished the gag reflex. Furthermore, it was noted that to completely eliminate the gag reflex, bilateral GPN blocks were required due to the likelihood of some innervations overlap or the near impossibility of applying pressure to the posterior portion of the tongue unilaterally. The gagging might persist in case of unilateral tonsillectomy until the unoperated pharyngeal wall was blocked. In patients scheduled for upper gastrointestinal endoscopy, Ortega Ramírez et al. [25] studied the effect of intraoral GPN block versus lidocaine local spray. Patients with intraoral GPN block had greater comfort and tolerance with more significant reduction of the need for sedation.

Moreover, Singh et al. [11] compared the safety and efficacy of medical therapy alone versus the combined medical therapy with extraoral fluoroscopy-guided GPN block in patients with glossopharyngeal neuralgia. Singh et al. discontinued the GPN block via fluoroscopy as it was difficult to visualize the styloid process, and they continued the GPN block by the easy LM technique. In additions, blind GPN block via LM technique was safe and well tolerated with no adverse effects.

Some authors recommended the US-guided GPN block rather than other GPN approaches. Effective pain control of tongue cancer was reported by Sirohiya et al. [26]. The linear transducer probe was used for US-guided GPN block via parapharyngeal technique, which was similar to the used probe in our study. The linear transduser probe is high frequency that is effective in clarifing the superficial structures, whereas the convex probe is of low frequency that could clarify the deepest structure. Al Katatbeh et al. [22] and Liu et al. [12] used the convex probe in their research and reported effective GPN blockage.

Additionally, Ažman et al. [9] assessed the technical feasibility of a distal GPN block via the parapharyngeal space in the cadavers and healthy volunteers. An US-guided block of the distal GPN was technically feasible, successful, and safe via the pharyngeal wall level. Also for primary GP neuralgia, Liu et al. [12] evaluated the efficacy and safety of US-guided GPN block. After 18 months follow-up, GPN block via post-styloid process approach was considered a safe, radiation-free, repeatable, convenient, and effective treatment. However, Liu et al. studied only 12 patients retrospectively with no randomization. Furthermore, Fukui [27] did not recommend blind insertion of the needle or changing its position. This was due to the vital structures located around the styloid process, such as the vagus nerve, accessory nerve, hypoglossal nerve, facial nerve, sympathetic nerve, and internal carotid vessels. Hence, the US-guided GPN block was preferred to clarify these structures. However, it was difficult to confirm the styloid process under US guidance. The styloid process was located in a shallower area than expected in some patients. However, in the present study both US-guided and the LM techniques of GPN block were safe. We inserted the needle posteriorly to the styloid process during the US-guided approach, while Fukui inserted the needle through the ventral aspect of the styloid process.

Safety was another aim of our study. Aldamluji et al. [15] reported that GPN block was considered a relatively safe procedure in children with rare complication for controlling post-tonsillectomy pain. Al katatbeh et al. [22] documented that using the proper dose and dilution of the local anesthetic was essential to prevent any adverse effects. Singh et al. [10] compared the intraoral versus extraoral approach of GPN block in tongue cancer patients, where the rate of complication and number of attempts were lower in the extraoral approach of GPN block compared to the intraoral approach.

Contrary to our study, earlier studies showed that GNB with 0.5% bupivacaine or ropivacaine was unsuccessful for treating adult and pediatric patients' early post-tonsillectomy pain [28–31]. Bean-Lijewski [28] reported that GPN block after tonsillectomy might be associated with life-threatening upper airway obstruction and tachycardia with hypertension. These complications were secondary to inadvertent neural blockade of the vagus or hypoglossal nerves located near the GPN. However, the researcher included retrospective duration and interrupted randomized trial. During the retrospective study, the rate of complications among patients with GPN block was 4.2% with no significant difference compared with the no-block technique. After starting the randomized trial, two out of four patients developed upper airway obstruction after GPN block; hence, the trial was interrupted. Bean-Lijewski used a large dose of 5 mL per tonsil of 0.25% bupivacaine via intraoral approach, while we used a smaller dose of 1 ml of 2% lidocaine through extraoral approach. From all these studies, both US-guided and LM approaches were effective and safe, but the US-guided approach was more difficult and time consuming compared to the LM technique.

4.1. Limitation

The current research was a single-center study with a small sample size. Hence, larger, multicenter, randomized, controlled trials are needed.

5. Conclusions

In conclusion, the landmark and US-guided GPN block through percutaneous styloid approach are safe and effective postoperative analgesia for children undergoing tonsillectomy. Moreover, the LM technique is easier and needs less time to perform than the US-guided technique.

Disclosure statement

No potential conflict of interest was reported by the author(s).

References

[1] Šumilo D, Nichols L, Ryan R, et al. Incidence of indications for tonsillectomy and frequency of evidence-based surgery: a 12-year retrospective cohort study of primary care electronic records. Br J Gen Pract. 2019;69:e33–e41.

[2] Toma AG, Blanshard J, Eynon-Lewis N, et al. Post-tonsillectomy pain: the first ten days. J Laryngol Otol. 1995;109:963–964.

[3] Arbin L, Enlund M, Knutsson J. Post-tonsillectomy pain after using bipolar diathermy scissors or the harmonic scalpel: a randomised blinded study. Europ Archiv oto-rhino-laryngol. 2017;274:2281–2285.

[4] Titirungruang C, Seresirikachorn K, Kasemsuwan P, et al. The use of steroids to reduce complications after tonsillectomy: a systematic review and meta-analysis of randomized controlled studies. Europ Archiv oto-rhino-laryngol. 2019;276:585–604.

[5] Grainger J, Saravanappa N. Local anaesthetic for post-tonsillectomy pain: a systematic review and meta-analysis. Clin Otolaryngol. 2008;33:411–419.

[6] Naja MZ, El-Rajab M, Sidani H, et al. Modified infiltration technique in tonsillectomy: expanded case report of 25 children. Int J Pediatr Otorhinolaryngol. 2005a;69:35–41.

[7] Singh N, Singh S, Mishra N, et al. Comparison of extra-oral and intraoral routes of glossopharyngeal nerve block for pain relief in patient with carcinoma tongue: a prospective randomized study. J Cancer Res Ther. 2020a;16:534–538. 2020

[8] Ahmed SA, Omara AF. The effect of glossopharyngeal nerve block on post-tonsillectomy pain of children. Randomized Controlled Trial. 2019;9:e90854.

[9] Ažman J, Stopar Pintaric T, Cvetko E, et al. Ultrasound-guided glossopharyngeal nerve block: a cadaver and a volunteer sonoanatomy study. Reg Anesth Pain Med. 2017;42:252.

[10] Singh N, Singh S, Mishra NK, et al. Comparison of extraoral and intraoral routes of glossopharyngeal nerve block for pain relief in patient with carcinoma tongue: a prospective randomized study. J Cancer Res Ther. 2020b;16:534–538.

[11] Singh PM, Dehran M, Mohan VK, et al. Analgesic efficacy and safety of medical therapy alone vs combined medical therapy and extraoral glossopharyngeal nerve block in glossopharyngeal neuralgia. Pain Medicine (Malden, Mass.). 2013;14:93–102. Pain medicine (Malden, Mass.

[12] Liu Q, Zhong Q, Tang G, et al. Ultrasound-guided glossopharyngeal nerve block via the styloid process for glossopharyngeal neuralgia: a retrospective study. J Pain Res. 2019;12:2503–2510.

[13] Doig GS, Simpson F, Delaney A. A review of the true methodological quality of nutritional support trials conducted in the critically ill: time for improvement. Anesth Analg. 2005;100:527–533.

[14] Merkel SI, Voepel-Lewis T, Shayevitz JR, et al. The FLACC: a behavioral scale for scoring postoperative pain in young children. Pediatr Nurs. 1997;23:293–297.

[15] Aldamluji N, Burgess A, Pogatzki-Zahn E, et al. PROSPECT guideline for tonsillectomy: systematic review and procedure-specific postoperative pain management recommendations. Anaesthesia. 2021;76:947–961.

[16] Bruin G. Glossopharyngeal nerve block for tonsillectomy or uvulopalatopharyngoplasty. Can J Anaesth. 1994;41:1236.

[17] Giannoni C, White S, Enneking FK, et al. Ropivacaine with or without clonidine improves pediatric tonsillectomy pain. Arch Otolaryngology Head Neck Surg. 2001;127:1265–1270.

[18] Kaygusuz I, Susaman N. The effects of dexamethasone, bupivacaine and topical lidocaine spray on pain after tonsillectomy. Int J Pediatr Otorhinolaryngol. 2003;67:737–742.

[19] Naja MZ, El-Rajab M, Sidani H, et al. Modified infiltration technique in tonsillectomy: expanded case report of 25 children. Int J Pediatr Otorhinolaryngol. 2005b;69:35–41.

[20] Spence AG. Single injection field block of tonsillar fossa. Anaesth Intensive Care. 1996;24:621–623.

[21] Mohamed SK, Ibraheem AS, Abdelraheem MG. Preoperative intravenous dexamethasone combined with glossopharyngeal nerve block: role in pediatric postoperative analgesia following tonsillectomy. Europ Archiv oto-rhino-laryngol. 2009;266:1815–1819.

[22] Al Katatbeh M, Khasawneh L, Al-Mashakbeh Y, et al. Role of pre-incisional external bilateral ultrasound guide glossopharyngeal nerve block with diluted bupivacaine mixture in pain management in oropharyngeal surgery: a randomized control trial. Am J Otolaryngol. 2022;43:103468.

[23] Park HP, Hwang JW, Park SH, et al. The effects of glossopharyngeal nerve block on postoperative pain relief after tonsillectomy: the importance of the extent of obtunded gag reflex as a clinical indicator. Anesth Analg. 2007;105:267–271.

[24] Barton S, Williams JD. Glossopharyngeal nerve block. Arch Otolaryngology. 1971;93:186–188.

[25] Ortega Ramírez M, Linares Segovia B, García Cuevas MA, et al. Glossopharyngeal nerve block versus lidocaine spray to improve tolerance in upper gastrointestinal endoscopy. Gastroenterol Res Pract. 2013;2013:264509.

[26] Sirohiya P, Kumar V, Yadav P, et al. Ultrasound-Guided glossopharyngeal nerve block at pharyngeal wall level in a patient with carcinoma tongue. Indian J Palliat Care. 2020;26:140–141.

[27] Fukui H. Glossopharyngeal nerve block. In: Kuhih O, editor. Nerve blockade and interventional therapy. 1st ed. Japan: Tokyo: Springer Japan; 2019. p. 65–67.

[28] Bean-Lijewski JD. Glossopharyngeal nerve block for pain relief after pediatric tonsillectomy: retrospective analysis and two cases of life-threatening upper airway obstruction from an interrupted trial. Anesth Analg. 1997;84:1232–1238.

[29] Bell KR, Cyna AM, Lawler KM, et al. The effect of glossopharyngeal nerve block on pain after elective adult tonsillectomy and uvulopalatoplasty. Anaesthesia. 1997;52:597–602.

[30] El-Hakim H, Nunez DA, Saleh HA, et al. A randomised controlled trial of the effect of regional nerve blocks on immediate post-tonsillectomy pain in adult patients. Clin otolaryngology allied sci. 2000;25:413–417.

[31] Park AH, Pappas AL, Fluder E, et al. Effect of perioperative administration of ropivacaine with epinephrine on postoperative pediatric adenotonsillectomy recovery. Arch Otolaryngology Head Neck Surg. 2004;130:459–464.