INTRODUCTION

Soft tissues of the face are innervated by the branches of trigeminal nerve [1 - 4], as well as by the branches of superficial cervical plexus – great auricular nerve and transverse cervical nerve [5 - 7]. These nerves closely connect with each other by the anastomoses, so there are no distinct borders in the partition of innervation zones on the face. The branching of these nerves varies in every patient [8, 9]. The most common method of local anesthesia of maxillofacial region in the modern surgical practice is conductive anesthesia of the peripheral branches of trigeminal nerve. In order to reach the total anesthesia of the lateral facial region it is necessary to block not only auriculo-temporal and buccal nerves, but also facial branches of great auricular nerve taking part in the innervation of parotid-masticatory area and the part of the cheek. Topographic-anatomical investigations of corpses revealed the anatomical variability of the branching of great auricular nerve on the neck and the head. Taking into account the topographic-anatomical aspects of variability of innervation of the lateral facial region, we developed the method of conductive anesthesia of the facial branches of great auricular nerve.

To evaluate the clinical effectiveness of the developed method of conductive anesthesia of the facial branches of great auricular nerve taking into account individual anatomical peculiarities of its branching in patients with the different forms of the skull.

Materials and methods: Clinical observations were conducted on 69 patients of different age (from 18 to 70) and sex (43 males and 26 females). Under the local anesthesia we conducted surgery in the parotid-masticatory region including: disclosure of the abscesses, excision of migrating granulomas or lymph nodes (in the cases of chronic hyperplastic lymphadenitis); excision of the benign tumors of the soft tissues (atheromas, lipomas, fibromas and keratoacanthomas), excision of the salivary fistulas and keloid scars. Depending on the used methods of local anesthesia of the soft tissues of the parotid-masticatory region the patients were divided into two clinical groups. The first group (30 patients) was exposed to conductive anesthesia of great auricular nerve by the method of P. Raj (2002), according to which the blockade of the nerve is conducted ahead the apex of mastoid process of the temporal bone. 39 patients after the signing of the written agreement were exposed to the developed method of conductive anesthesia of the facial branches of great auricular nerve. In order to detect the individual anatomical features of the facial part of the head in patients, the facial index was determined by the Garson’s formula. Pain sensitivity and perception in patients were studied using subjective and objective methods. The data were analysed by means of the Pearson’s chi-square tests.

Results: It is revealed that total anesthesia of the soft tissues of the parotid-masticatory region in all cases was reached in patients with euriprosopic face shape (broad-faced) – in 8 patients of the first clinical group and 10 patients of the second. The least effective was the anesthesia of the anterior branch of great auricular nerve conducted according to P. Raj’s method (2002) in patients with leptoprosopic face shape. In patients with leptoprosopic face shape of the second clinical group after administering anesthesia according to the developed method in 9 cases total anesthesia was reached, in 2 cases pain sensitivity in the inferior-anterior quadrant remained ($\chi^2 = 5,70; p < 0,05$). Generally, in patients of the first clinical group the method of conducted anesthesia by P. Raj was effective in 19 cases (63,3 %), and the developed method of conductive anesthesia of the facial branches of great auricular nerve – in 36 cases (92,3 %) – $\chi^2 = 8.85$, $p < 0,01$.

Conclusions: The results of the research confirm that the developed method of conductive anesthesia of the facial branches of great auricular nerve is more effective in comparison to methods of anesthesia commonly used in today dentistry surgical practice. It allows to reach the total anesthesia of the soft tissues of the parotid-masticatory region in 92,3 % patients with different face shapes.

KEY WORDS: great auricular nerve, face shape, conductive anesthesia, pain perception
auricular nerve on the neck and the head (fig. 1) [16]. Its anterior ramus branches in the skin of parotid-masticatory region, lobular ramus – in the lap and auricle (on its concave surface). The posterior ramus of great auricular nerve innervates the skin of the convex surface of auricle and a small area of skin behind the auricle [18]. The anterior ramus of the nerve crosses the anterior edge of the sternocleidomastoid muscle at the distance of 29.1 ± 3.4 mm from the apex of mastoid process of the temporal bone and 27.5 ± 4.5 mm to the angle of the mandible. It is detected that great auricular nerve in the majority of cases is localized in the middle third of the imaginary line connecting the noted topographic anatomical points on the bones [17].

Infiltration anesthesia is the most common method of blockade of the branches of great auricular nerve in the modern surgical practice. However, this method has a number of disadvantages: the introduction of local anesthetic causes the deformation of soft tissues that complicates the carrying out of local plastic surgery; repeated injections into the soft tissues intensify the pain in the emotionally labile patients causing stress reactions [18, 19]. According to classic Brown’s method great auricular nerve is blocked at Erb’s point on the neck [20] (fig. 2). It is also blocked when the whole superficial cervical plexus is blocked along the posterior edge of the sternocleidomastoid muscle [21, 22]. These methods are risky to damage external jugular vein passing through the area of injection [15]. Due to the risks of local complications the noted methods of local anesthesia are not currently used in the surgical dentistry practice. P. Raj (2002) proposed to block the anterior branch of great auricular nerve ahead the apex of mastoid process of the temporal bone [23].

We used this method to anesthetise the soft tissues of the parotid-masticatory region during surgical procedures. Total anesthesia was reached in 63 % of the patients. In the rest occurred only partial anesthesia of the lap, auricle (concave surface) and the upper part of the parotid-masticatory region. In our opinion, insufficient effectiveness of the method is associated with the anatomical variability of the localization of great auricular nerve on the face in patients with different forms of the facial part of the skull. According to classification by V. Sharma et al. [16], in patients with the 3rd or 4th type of branching of great auricular nerve its anterior branch is much remote from the lap, that’s why it can’t be blocked by the anesthetic, depot of which is localized ahead the apex of mastoid process of the temporal bone. Taking into account the topographic-anatomical aspects of variability of innervation of the lateral facial region, we developed the method of conductive anesthesia of the facial branches of great auricular nerve.

**THE AIM**

The purpose of the study: to evaluate the clinical effectiveness of the developed method of conductive anesthesia of the facial branches of great auricular nerve taking into account individual anatomical peculiarities of its branching in patients with the different forms of the skull.


**MATERIALS AND METHODS**

Clinical observations were conducted on 69 patients of different age (from 18 to 70) and sex (43 males and 26 females). This number consisted of the patients hospitalized in the department of surgical dentistry and maxillofacial surgery of Lviv Regional Hospital and the patients treated at the Dental Medical Centre of Danylo Halytsky Lviv National Medical University. Under the local anesthesia we conducted surgery in the parotid-masticatory region including: disclosure of the abscesses, excision of migrating granulomas or lymph nodes (in the cases of chronic hyperplastic lymphadenitis); excision of the benign tumors of the soft tissues (atheromas, lipomas, fibromas and keratoacanthomas), excision of the salivary fistulas and keloid scars. Depending on the used methods of local anesthesia of the soft tissues of the parotid-masticatory region the patients were divided into two clinical groups. The first group (30 patients) was exposed to conductive anesthesia of great auricular nerve by the method of P. Raj (2002), according to which the blockade of the nerve is conducted ahead the apex of mastoid process of the temporal bone [23]. 39 patients after the signing of the written agreement were exposed to the developed method of conductive anesthesia of the facial branches of great auricular nerve: at the beginning the skin of the parotid-masticatory region is covered with antiseptic. After that the doctor should palpate the posterior edge of the mandibular ramus: the thumb of the left hand should be placed at the projection of the mandibular angle, the forefinger – at the projection of the base of collum of the articular process located 1 cm lower the lap. The skin between two fingers gets pulled in order to better see the contours of the posterior edge of mandibular ramus. The syringe with needle is held in the right hand. The injection is done into the subcutaneous tissue next to the mandibular angle. The direction of needle goes from the bottom to the top, in parallel to the posterior edge of mandibular ramus, and then it ascends from the mandibular angle to the base of collum of the articular process. On this way the local anesthetic infiltrates the subcutaneous tissue and the superficial fascia of the face along the posterior edge of the mandibular ramus [24].

Pain sensitivity and perception in patients were studied using subjective and objective methods. Pain sensitivity was determined by injection of a needle (pinprick) into the epidermis. The assessment of pain sensitivity was performed on a four-point scale in each quadrant: 0 points – no sensitivity, 1 point – sensitivity is sharply reduced, 2 points – sensitivity is moderately reduced, 3 points – tactile and pain sensitivity is completely preserved [26].

Autonomic reaction of the cardiovascular system to pain was evaluated by the perfusion index (PI) monitored with the pulse oximeter ELERA SH-K3 (Hong Kong). The normal PI range is 5–6 %. It decreases with the narrowing of the lumen of the peripheral blood vessels caused by the pain triggers [28].

The protocol used in this study conformed to the tenets of the Declaration of Helsinki and was approved by the Ethics Committee of the Danylo Halytsky Lviv National Medical University.

The reliability of the obtained results was evaluated according to the reliability criterion of the Student by statistically computing the data using the commonly used methods of variation statistics from the package «Statistica-7». The data were analysed by means of the Pearson's chi-square tests.

**RESULTS AND DISCUSSION**

It is revealed that total anesthesia of the soft tissues of the parotid-masticatory region in all cases was reached in patients with euriprosopic face shape (broad-faced) – in 8 patients of the...
first clinical group and 10 patients of the second. Pain sensitivity was absent (0 points). During surgery the stress reactions of the autonomic nervous system did not occur (PI = 5.5 ± 0.5 %) as well as the behavioral disorders according to SEM scale were not noticed. In patients with mesoprosopic face shape of the first group the total anesthesia of the parotid-masticatory region was reached in 8 cases, and in 4 cases only a partial loss of the tactile and pain sensitivity in the parotid-masticatory region was noticed. Total anesthesia occurred only in the upper quadrants of the parotid-masticatory region, the lap and auricle. This meant that only the lobular branches of great auricular nerve were blocked. The pain sensitivity in the lower quadrants was evaluated in 2.5 ± 0.5 points. With the attempt to begin the surgery in such patients manifested pronounced motor (discomfort according to SEM scale) and autonomic (PI = 2.5 ± 0.5 %) reactions to pain triggers. After additional infiltration anesthesia the total anesthesia was reached. In patients with the mesoprosopic face shape (medium-headed) of the second clinical group total anesthesia of the parotid-masticatory region was reached in 17 cases (χ² = 3.97; p < 0.05). Only in 1 patient the developed method of anesthesia had an insufficient effect – pain sensitivity in the superior-anterior quadrant of the parotid-masticatory region didn’t decrease. The least effective was the anesthesia of the anterior branch of great auricular nerve conducted according to P. Raj’s method (2002) in patients with leptoprosopic face shape. Total anesthesia of the parotid-masticatory region occurred in 3 patients, in 7 patients the method was not effective: the tactile and pain sensitivity were not lost (3 points) in the lower quadrants of the parotid-masticatory region. In patients with leptoprosopic face shape of the second clinical group after administering anesthesia according to the developed method in 9 cases total anesthesia was reached, in 2 cases pain sensitivity in the inferior-anterior quadrant remained (χ² = 5.70; p < 0.05). We noticed that in patients with leptoprosopic face shape in the sensitive innervation of inferior-anterior quadrants of the parotid-masticatory region can take part buccal nerve. The confirmation of this is the loss of pain sensitivity in the region of innervation after the conductive anesthesia of this nerve. Generally, in patients of the first clinical group the method of conducted anesthesia by P. Raj was effective in 19 cases (63.3 %), and the developed method of conductive anesthesia of the facial branches of great auricular nerve – in 36 cases (92.3 %) – χ² = 8.85, p < 0.01 (Table II).

Table I. The Sounds, Eyes, and Motor (SEM) scale for measuring the comfort or discomfort

<table>
<thead>
<tr>
<th>Observations</th>
<th>Sounds</th>
<th>Eyes</th>
<th>Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No sounds indicating pain</td>
<td>No eye signs indicating discomfort</td>
<td>Hands relaxed; no apparent body tension</td>
</tr>
<tr>
<td>Comfort</td>
<td>Nonspecific sounds; possible pain indication</td>
<td>Eyes wide, show of concern, no tears</td>
<td>Hands show some distress or tension, grasps chair due to discomfort, muscular tension</td>
</tr>
<tr>
<td>Discomfort</td>
<td>Specific verbal complaints, e.g., “Ouch”, raises Voice</td>
<td>Watery eyes, eyes flinching</td>
<td>Random movement of arms or body without aggressive intention of physical contact, grimace, twitch</td>
</tr>
<tr>
<td></td>
<td>Verbal complaint indicates intense pain, e.g., scream, sobbing</td>
<td>Crying, tears running down face</td>
<td>Movement of hands to make aggressive physical contact, pulling head away</td>
</tr>
</tbody>
</table>

Table II. The clinical effectiveness of used methods of conductive anesthesia of the facial branches of great auricular nerve

<table>
<thead>
<tr>
<th>Form of the face (facial index)</th>
<th>Method of conductive anesthesia of the facial branches of great auricular nerve (according to P. Raj, 2002) (n = 30)</th>
<th>Developed method of conductive anesthesia of the facial branches of great auricular nerve (n = 39)</th>
<th>Pearson’s correlation coefficient χ² (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euriprosopic (&lt; 79.9 %)</td>
<td>Total anesthesia of the parotid-masticatory area: 8 cases</td>
<td>Partial anesthesia of the parotid-masticatory area: 0 cases</td>
<td>3.97 (p &lt; 0.05)</td>
</tr>
<tr>
<td>Mesoprosopic (80.0 - 89.9 %)</td>
<td>Total anesthesia of the parotid-masticatory area: 17 cases</td>
<td>Partial anesthesia of the parotid-masticatory area: 1 case</td>
<td></td>
</tr>
<tr>
<td>Leptoprosopic (90.0 - 94.9 %)</td>
<td>Total anesthesia of the parotid-masticatory area: 9 cases</td>
<td>Partial anesthesia of the parotid-masticatory area: 2 cases</td>
<td>5.70 (p &lt; 0.05)</td>
</tr>
<tr>
<td>Totally n - cases (%)</td>
<td>19 cases (63.3%)</td>
<td>36 cases (92.3 %)</td>
<td>8.85 (p &lt; 0.01)</td>
</tr>
<tr>
<td></td>
<td>11 cases (36.7 %)</td>
<td>3 cases (7.7 %)</td>
<td></td>
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</tbody>
</table>
CONCLUSIONS
The results of the research confirm that the developed method of conductive anesthesia of the facial branches of great auricular nerve is more effective in comparison to methods of anesthesia commonly used in today dentistry surgical practice. It allows to reach the total anesthesia of the soft tissues of the parotid-masticatory region in 92.3% patients with different face shapes.

REFERENCES
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