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ORIGINAL ARTICLE

Evaluation of the Results of Preservation of Great Auricular Nerve during Parotid Surgery

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ABSTRACT

Background: Parotid surgery serves as a standard intervention for addressing various conditions, including both benign and malignant neoplasms and inflammatory and autoimmune conditions. This study aimed to assess the effectiveness of preservation of the Great auricular nerve in parotid surgery in improving sensory dysfunction. **Methods:** This prospective randomized clinical trial was conducted in the General Surgery Department at Zagazig University Hospitals. Thirty patients were included with parotid lesions, encompassing benign, malignant neoplasms, and inflammatory and autoimmune conditions. The surgical interventions involved either superficial or total parotidectomy, and all participants underwent Parotid Surgery with the preservation of the Great Auricular Nerve. After surgery, a facial nerve evaluation was conducted within the hospital, and neck US and CT scans were done. **Results:** Superficial parotidectomy was performed on 93.33%, while 6.67% underwent total parotidectomy. The mean parotidectomy incision width was 5.06 ± 1.02. Neck dissection due to LN affection occurred in 10% of cases, with a mean incision width of 5.9 ± 0.22. Intraoperative facial affection occurred in 3.33%. Preservation rates for both branches of the GAN were 56.67% for both branches and 43.33% for the posterior branch. In only one case, the posterior branch of GAN was preserved as a branch for the facial nerve. GAN recovery showed 83.33% experiencing near-total rapid recovery and 13.33% experiencing delayed recovery after 3 months. Complications among the subjects revealed no hematoma occurrences, 16.67% experiencing a concussion, 23.33% suffering temple anesthesia, and 100% facing disfigurement. 60% of subjects expressed satisfaction, and 40% reported dissatisfaction. **Conclusion:** This study underscores the effectiveness of preserving the Great Auricular Nerve during parotid surgery, offering valuable insights into enhancing surgical outcomes and patient well-being.

Keywords: Great Auricular Nerve, Parotid Surgery, Surgery.

INTRODCUTION

Common reasons for parotid surgery include benign and malignant neoplasms, as well as inflammatory and autoimmune disorders. While the surgeon's primary priority is protecting the facial nerve, patients often report sensory disruption in the post-auricular, pre-auricular, and lobular areas as a postoperative complaint. Research has demonstrated that when the greater auricular nerve (GAN) is sacrificed during a parotidectomy for benign disease, it can result in sensory and functional abnormalities, an increased risk of neuromas, and severe injury, among other long-term complications [1].

Of the four cutaneous nerves in the neck, the greatest is the great auricular nerve (GAN). Auricle skin, the parotid gland, the skin above the parotid gland, and the mandibular angle are its destinations once it emerges, starting at the back of the sternocleidomastoid muscle, which is attached to the superficial cervical fascia. It is important to note that there are significant consequences that can arise from iatrogenic or inevitable GAN amputation during rhytidectomy or parotidectomy. These include dysesthesia or allodynia in the affected skin area, otalgia, discomfort when exposed to cold, and traumatic neuroma [2].

In parotid surgery, the facial nerve is preserved, while a cuff of healthy tissue is used to remove the lesion. The probable morbidity associated with the sacrifice of the great auricular nerve and its care receive little attention. Anesthesia, paresthesia, pain, increased neuroma risk, severe injuries, and functional impairments are all possible side effects (e.g., difficulties in using the telephone or wearing earrings). It is not yet known how patients' quality of life is affected by the decision to sacrifice or preserve GAN [3].

Restoring facial nerves with a tremendous auricular nerve (GAN) transplant was something Alberti speculated about in 1962. At that time, most surgeons used a nerve from the lower extremities, like the sural or lateral femoral cutaneous nerve. Still, Alberti suggested the GAN because of how close it was to the operation site. Numerous publications have since detailed the effective regrowth of face nerves following GAN transplants [3].

While protecting the facial nerve is the surgeon's prime priority, patients often report postoperative sensory disruption in the lobular, pre-auricular, and post-auricular regions as their primary complaint. This is the first study in Zagazig University Hospital to show the clinical value of preservation of great auricular nerves during parotid surgery among patients of Zagazig University. So, this study aimed to assess the effectiveness of the conservation of the Great auricular nerve in parotid surgery in improving sensory dysfunction.

PATIENTS AND METHODS

This study included thirty patients with parotid lesions, encompassing benign, malignant neoplasms, and inflammatory and autoimmune disorders in the General Surgery Department, Faculty of Medicine, Zagazig University from March 2023 to December 2023. Approval was obtained from the Zagazig University Institutional Review Board (IRB #10654-4-2023)—and consent was obtained from all patients participating in the study. The Declaration of Helsinki, the International Medical Association's guideline of ethics for studies involving humans, was followed in the conduct of this study.

The inclusion criteria: all patients who presented parotid lesions, either benign, malignant neoplasms, inflammatory and autoimmune conditions, either superficial or total parotidectomy. The exclusion criteria included Patients with any sensory disturbance of the pinna preoperatively, injury of the nerve during previous parotid surgery, or any head and neck surgery.

Preoperative Phase

Patients underwent a thorough history-taking and a detailed general and local examination. This included the evaluation of facial nerve functions, where patients were instructed to perform various facial movements, such as looking up, wrinkling the forehead, closing eyes tightly, and smiling to assess different aspects. Additionally, the examination covered great auricular nerve functions, involving the evaluation of touch sensation in the ear lobule and infraauricular area using a cotton swab.

Routine lab investigations involved a complete blood picture, prothrombin time (PT), INR, and serum creatinine levels, which were measured using the ELISA technique and liver function test. Radiological investigations, including neck ultrasonography, were performed with an ultrasound scanner equipped with a 7–12 MHz linear transducer was used. Images were obtained in the transverse and longitudinal (sagittal) axes. CT examination sagittal, coronal, and axial images were acquired. The third cervical (C3) vertebra was chosen as the reference point in the head and neck CT.

Surgical technique

During the operative phase under general anesthesia, a standard lazy S incision (Blair's incision) was made, with potential extensions below the ear lobe and into a crease in the neck below the jawline (Figure 1A). There were two spots where the great auricular nerve was found: on the sternocleidomastoid muscle next to the external jugular vein and right under the lobule. Flap elevation allowed for visualization of the superficial layer of the great auricular nerve (Figure 1A, B). Both anterior and posterior branches of the nerve were preserved through fine dissection unless adhesions between the nerve and the tumor required excision to prevent tumor cell dissemination, particularly in cases of malignancy. The great auricular nerve, known for its anatomical variations, was isolated before proceeding with either superficial parotidectomy or total parotidectomy (Figure 1D). While the tumor was being removed, the preserved nerve was wrapped with moist gauze that had been soaked in saline. On the plane beneath the parotid fascia, near the parotid gland's anterior edge, the skin flap was raised. The sternocleidomastoid muscle was used to identify the external jugular vein. The tympanomastoid suture and tragal pointer were exposed to reveal the facial nerve's main trunk (Figure 1E). To separate the nerve into its upper and lower branches, the parotid tissue that was above it was gradually removed. The location and size of the parotid tumor dictated the cautious dissection of subsequent nerve branches. With great caution to prevent capsular rupture or nerve damage, the tumor was surgically excised in its entirety, leaving tumor-free margins of roughly 0.5-1 cm. Careful dissection of the facial nerve trunk and branches above a tumor in the deep lobe of the parotid gland allowed for its complete removal, while normal parotid tissues and the nerve were preserved (Figure 1F).

Careful dissection of the tumor's branches was used to liberate it if it was pressing on the facial nerve; the capsular rupture was avoided at all costs, and the deep parotid tissue surrounding the tumor was removed independently. None of the tumor-free parotid parenchyma or covering parotid fascia was removed, and the facial branches that were not directly affected by the tumor were not severely dissected either. Preservation of the remaining parotid tissues and fascia indicated that primary closure was feasible; covering the parotid with a superior-based sternocleidomastoid muscle flap was necessary for more significant defects.

Total parotidectomy

Similar to the partial parotidectomy, dissection was performed after flap elevation. After meticulously dissecting all branches of the facial nerves, the tumor and the superficial parotid tissues were removed. Care was taken to preserve the facial nerve when removing the entire parotid gland when the tumor was in either the deep lobe or both the deep and superficial lobes. To cover the exposed parotid tissues, a sternocleidomastoid muscle flap was rotated from the superior side. The preserved nerve was wrapped with moist gauze that had been soaked in saline throughout the operation. The ear lobule is delicately drawn back as the face nerve's main trunk is located. The facial nerve's integrity was verified prior to closure. It was necessary to place a drain after both procedures. When the output is less than 15 to 50 cc in 24 hours, the drain is often removed 2 or 3 days after surgery. Interrupted dermal buried suturing with size 2/0 polyglactin-90 sutures was used for skin closure. (Figure 1G).

Postoperative and follow-up

After surgery, a facial nerve evaluation was conducted within the hospital. Tactile sensitivity was blindly assessed using a cotton swab, gently pressing the center of each area of the greater auricular nerve's sensory distribution on the face and neck. Patients were evaluated at 2-week intervals and 1, 2, and 3 months after surgery. All patients were discharged, and subsequent follow-ups were scheduled every 2 weeks at the outpatient clinic for dressing changes and continued monitoring. Ethics approval

STATISTICAL ANALYSIS

Statistical Package for the Social Sciences, version 29.0, was used to process, input, and analyze the data. The qualitative data is presented as numbers and percentages, while the quantitative data is presented as the mean ± SD of each group. To compare the means of two separate groups, the student "t" test is used. The quantitative variables in the two sets of non-normally distributed data were compared using the Mann-Whitney test. In contrast, the qualitative variables were compared using the Chi-square test for association and difference (X2). The 5% level (P-value) was set as the threshold of significance, with results being considered significant when the p-value is less than 0.05.

RESULTS

Table 1 presented demographic data for 30 subjects, with an average age of 38.43 ± 6.33 years. Gender distribution included 17 males (56.67%) and 13 females (43.33%). The distribution between the right and left sides was equal, with 15 subjects (50%) for each side.

In Table 2, the pathological characteristics and preoperative status of the facial nerve in the included subjects (N = 30) are presented. Among the observed pathologies, 70% were benign, with 30% identified as pleomorphic adenoma and 40% as Warthin's tumor. Malignant pathologies constituted 30%, with mucoepidermoid carcinoma accounting for 26.67% and posterior scalp squamous cell carcinoma at 3.33%. Lymph node (LN) affection was observed in 10% of cases. Notably, none of the subjects exhibited facial nerve involvement before surgery, indicating a 0% occurrence in this regard.

Table 3 outlined surgery data, including parotidectomy types and incision widths, for all 30 subjects. Superficial parotidectomy was performed on 93.33%, while 6.67% underwent total parotidectomy. The mean parotidectomy incision width was 5.06 ± 1.02. Neck dissection due to LN affection occurred in 10% of cases, with a mean incision width of 5.9 ± 0.22. Intraoperative facial affection occurred in 3.33%.

Table 4 detailed GAN evaluative data for the subjects, indicating preservation rates of 56.67% for both branches and 43.33% for the posterior branch. In only one case, the posterior branch of GAN was preserved as a branch for the facial nerve. GAN recovery showed 83.33% experiencing near-total rapid recovery and 13.33% experiencing delayed recovery after 3 months.

Table 5 explored complications among the subjects, revealing no hematoma occurrences, 16.67% experiencing a concussion, 23.33% suffering temple anesthesia, and 100% facing disfigurement.

Table 6 focused on satisfaction levels, with 60% of subjects expressing satisfaction and 40% reporting dissatisfaction.

Table (1): Demographic data of included subjects

	Value (N = 30)
Age (Years)	38.43 ± 6.33
Male	17 (56.67%)
Female	13 (43.33%)
Side	
Right	15 (50%)
Left	15 (50%)

Table (2): Pathology and Affected facial nerve before surgery among included subjects

	Value (N = 30)
Pathology	
Benign	21 (70%)
Type of pathology	
Pleomorphic adenoma	9 (30%)
Warthin's tumor	12 (40%)
Malignant	9 (30%)

Type of pathology	
Mucoepidermoid carcinoma	8 (26.67%)
Posterior Scalp Squamous Cell Carcinoma	1 (3.33%)
LN Affection	3 (10%)
Affected facial nerve before surgery	0 (0%)

Table (3): Surgery data among included subjects

	Value (N = 30)
Type of parotidectomy	
Superficial	28 (93.33%)
Total	2 (6.67%)
Parotidectomy Incision width (Cm.)	5.06 ± 1.02
Neck dissection due to LN affection	3 (10%)
Neck dissection Incision width (Cm.)	5.9 ± 0.22
Intraoperative facial Affection	1 (3.33%)

Table (4): GAN evaluative data among included subjects

	Value (N = 30)
Preservation	
Both Branches	17 (56.67%)
Posterior Branch	13 (43.33%)
Preserved as graft for facial nerve	1 (3.33%)
GAN recovery	
Near total rapid recovery	25 (83.33%)
Delay recovery (3 months)	4 (13.33%)

Table (5): Complications occurrence among included subjects

	Value (N = 30)
Hematoma	0 (0%)
Concussion	5 (16.67%)
Anesthesia of Temple	7 (23.33%)
Disfigurement	30 (100%)

Table (6): Satisfaction among included subjects

	Value (N = 30)
Satisfied	18 (60%)
Not Satisfied	12 (40%)

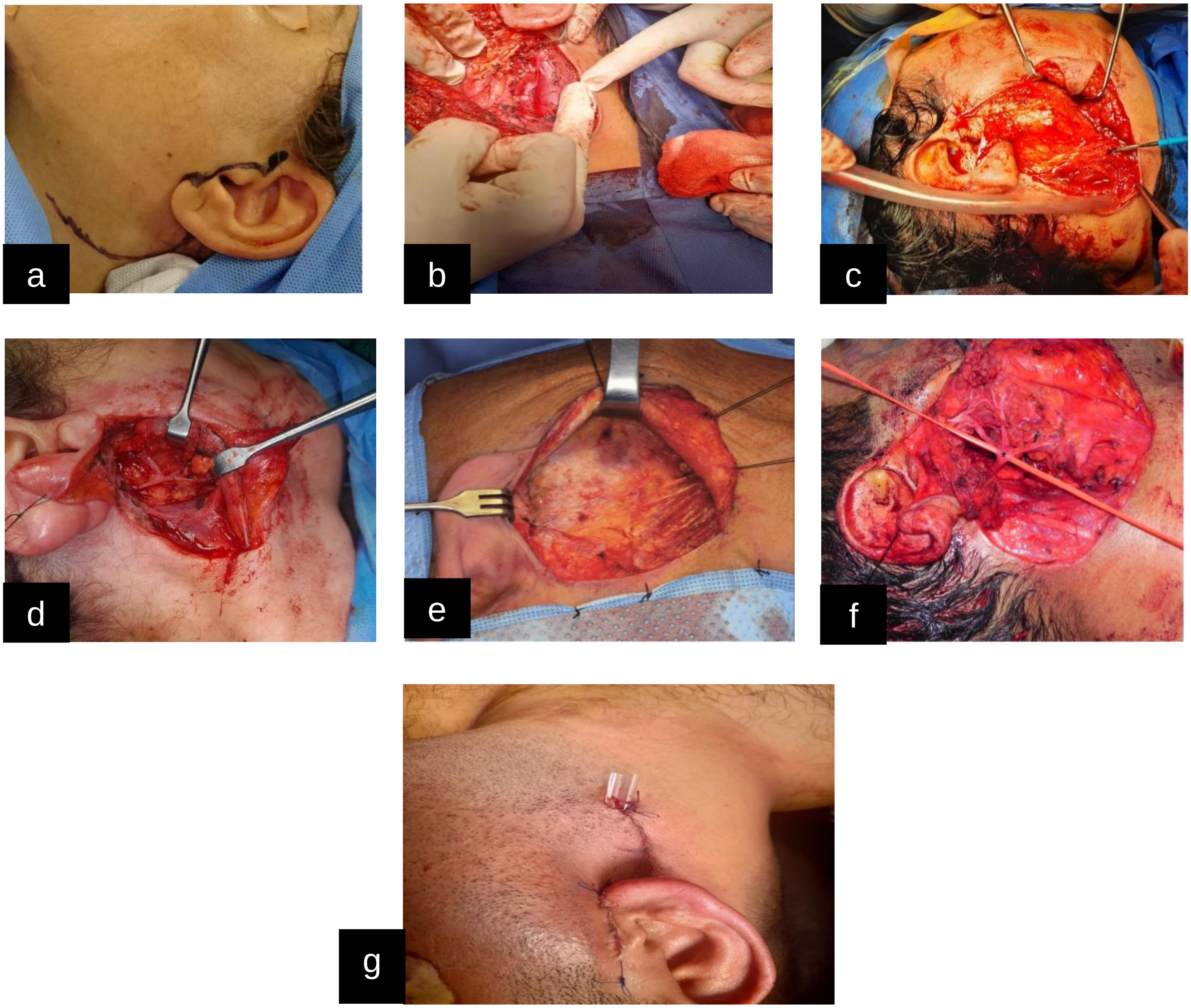

Figure (1): (a) Blair Incision (also known as a lazy S incision). Starts in front of the ear with extension underneath the earlobe and down into a cervical crease to get access to the left parotid area. **(b)** The great auricular nerve during parotidectomy. **(c)** Great auricular nerve preservation during parotidectomy. **(d)** Facial nerve during parotidectomy. **(e)** After a skin incision, the skin flap is elevated anteriorly, superficial to the parotid fascia. **(F)** main trunk of the facial nerve and its branches dissected free from the deep lobe before the excision. **(g)** Skin closure after parotidectomy.

DISCUSSION

When considering sensory disruption and patients' quality of life in the long run, it is crucial to understand the long-term clinical implications of preserving or sacrificing GAN during parotid surgery. To improve surgical decision-making, patient care, and the overall success of parotid procedures, additional study and thorough exploration of these outcomes are necessary [4].

As regards demographic data, we found that the mean age was 38.43 ± 6.33 years. Gender distribution showed male predominance (56.67% male and 43.33% female). The distribution between the right and left sides was equal, with 50% of subjects for each side.

Our results agreed with those who reported that the mean age at intervention was slightly higher at 45.5 (SD 13.5) years for the preserved GAN group and 45.3 (SD 14) years for the sacrificed GAN group. Among the 28 patients with preserved GAN, 53.5% were males, and among the 22 patients with sacrificed GAN, 59% were males, revealing an overall male predominance in both GAN preservation and sacrifice groups.

However, the present study results disagreed with those who reported that the mean age was 55.3 ± 13.3 years (ranging from 28 to 86 years). The gender distribution revealed a significant female predominance, with 70.1% of the total subjects being female. The discrepancy in demographic data compared to our study may be attributed to methodological differences such as randomization.

In the present study, the pathology and preoperative status of the facial nerve among the subjects indicated that most cases (70%) presented with benign pathologies, with pleomorphic adenoma (30%) and Warthin's tumor (40%) being the most common. Malignant cases constituted 30%, primarily identified as mucoepidermoid carcinoma (26.67%). Notably, none of the subjects exhibited facial nerve involvement before surgery, indicating a 0% occurrence in this regard.

The higher occurrence of pleomorphic adenoma and Warthin's tumor in parotidectomy cases can be elucidated by their respective high incidence rates, characteristic slow growth, and preference for the parotid gland. Pleomorphic adenoma, the most common benign salivary gland tumor, typically presents in the parotid gland's superficial lobe, necessitating surgical intervention due to noticeable symptoms. Meanwhile, Warthin's tumor, the second most prevalent benign tumor, also frequently affects the parotid gland and is associated with specific demographic factors, mainly occurring more often in older males. The challenges of detecting these tumors until they reach a noticeable size contribute to their prevalence in cases requiring parotid surgery **[6-9]**

The present study findings were in agreement with Alghamdi [10] as most cases, 84.4%, were identified as pleomorphic adenomas, totaling 38 instances. The distribution of cases included 8.8% for Warthin's tumors, 4.4% for oncocytoma, and 2.2% for chronic proctitis.

Also, the results of the present study agreed with Bulut et al. [3], who reported that pleomorphic adenoma accounted for 55.5%, with 76 cases in total. Warthin's tumor constituted 32.1%, with a total of 44 cases. Cysts and lymphadenitis represented 4.4% (6 cases) and 3.6% (5 cases), respectively. Hemangioma, oncocytoma, and lipoma collectively comprised 4.4% of the total cases, with 3 cases in total. Similarly, the tumor pathology distribution includes 14.9% (10 cases) of pleomorphic adenoma, 14.9% (10 cases) of Warthin tumor, 4.5% (3 cases) of the cyst, and 19.4% (13 cases) of chronic sialadenitis.

In the present study, the majority underwent superficial parotidectomy (93.33%), while a smaller percentage underwent total parotidectomy (6.67%). The mean incision width for parotidectomy was 5.06 ± 1.02 cm. Neck dissection due to lymph node (LN) affection occurred in 10% of cases, with a mean incision width of 5.9 ± 0.22 cm. Intraoperative facial affection occurred in 3.33%.

The results of the present study aligned with the findings reported by, where a total of 83 patients were included. In their study, 17 patients underwent total parotidectomy, while the remaining patients opted for superficial parotidectomy. The mean diameter of the lesions in their cohort was reported as 2.5 cm, ranging from 0.7 to 4.2 cm. Also, the present study results agreed with, as the surgical procedures encompassed 61 cases (68.5%) of superficial parotidectomies, 14 cases (15.7%) of extracapsular dissections, and an additional 14 cases (15.7%) of total parotidectomies.

In the present study, we had a preservation rate of 56.67% for both branches and 43.33% for the posterior branch. In only one case, the posterior branch of GAN was preserved as a branch for the facial nerve. The results of the present study were in agreement with Grosheva et al. [12], who found a higher preservation rate, with the dissection and preservation of the posterior GAN branch being feasible in 61% of patients.

Also, Iwai and Konishi [13] achieved a significantly higher preservation rate, with a success rate of 95.9% for preserving the trunk of the GAN to the lobular branch in their study involving 74 cases. This success rate is notably higher than our study's overall preservation rate of 56.67%. The differences could be attributed to variations in surgical techniques, patient populations, or lesion characteristics.

The present study findings were in disagreement with Moretti et al. [14], who reported a lower preservation rate, with GAN sacrifice occurring in 33.06% of cases. Preservation rates for the posterior branch, both posterior and lobular branches, and total GAN section were documented. The preservation rate in our study for both branches is higher than the sacrifice rate reported by Moretti et al., suggesting a relatively better outcome in terms of GAN preservation in our research. On the other hand, Bulut et al. [3] employed a more selective approach, resulting in a lower preservation rate. They preserved only the posterior branches of the GAN, specific to the pinna innervation. This approach contrasts with our study, which aimed for the preservation of both branches. While Bulut et al. focused on a particular subset of branches, our study aimed for broader preservation, potentially contributing to the differences in preservation rates.

In the present study, GAN recovery showed 83.33% experiencing near-total rapid recovery and 13.33% experiencing delayed recovery after 3 months. The present study findings agreed with those who provided evidence that the preservation of the Great Auricular Nerve (GAN) significantly rapid recovery and retained sensation in the lobular region during the immediate postoperative period.

Also, the results of the present study agreed with Sagalow et al. [15], who reported that individuals who experienced sensory problems did not show a substantially correlated relationship between GAN preservation and the likelihood of spontaneous recovery ($p > 0.05$). Nine patients (8.1%) out of 111 patients who reported sensory problems had GAN sacrifice, compared to nine patients (4.6%) who had no such symptoms ($p > 0.05$). At their most recent follow-up, twenty-five patients (32.5 percent) reported that their symptoms had resolved on their own, which occurred an average of 6.2 months following the start of symptoms. Similarly, Hui et al. [16] advocated that the rapid recovery of sensation in cases where the posterior branch of the GAN was preserved. Moreover, the research demonstrated that tactile sensation in the held group was fully restored within three months post-surgery. However, the group where the GAN was sacrificed exhibited persistent sensory deficits even two years after undergoing parotid surgery.

In the present study, exploration of complications among the subjects revealed that Concussion was observed in 16.67% of cases, anesthesia of the temple in 23.33%, and disfigurement was present in 100% of cases. However, no occurrences of hematoma were observed. The current study results were in agreement with Ryan and Fee [17], who reported that the lobule and mandibular angle both experience anesthesia in 26% of individuals undergoing GAN preservation.

Also, we agreed with the idea that they preserved the posterior branch of the Great Auricular Nerve (GAN) in 42 patients (group A) and sacrificed it in 13 patients (group B). Both groups experienced varying degrees of tactile and thermal anesthesia. In group A, the most affected areas were retro auricular (area 6) and the angle of the mandible (area 3), while in group B, the predominantly involved areas were the angle of the mandible (area 3), helix/concha (area 4), lobule (area 5), and mastoid/lateral neck (area 7).

The present study findings aligned with Al-Aroomi et al. [4] as a significant proportion of patients (77%) experienced postoperative auricular numbness, with a stark contrast between the preserved and sacrificed groups (57.1% vs. 100%, respectively). The tactile sensitivity differences between the two groups were particularly notable in the mandibular body and lobule regions during the first postoperative month, with sustained significance observed in the mandibular body in subsequent months. The areas most frequently affected in the preserved group were the mandibular body, preauricular, and lobule during the initial postoperative month, while the sacrificed group exhibited higher numbness frequency in the mandibular body, lobule, and preauricular regions during the same period. Over time, numbness areas gradually reduced within each region. Both groups demonstrated minor effects on the superior helix and concha at one month postoperatively, followed by significant recovery at six months. Twelve months after surgery, there was no statistically significant difference in abnormal sensations between the preserved and sacrificed groups. Furthermore, patients in both groups did not report traumatic injury or damage to any region innervated by the Great Auricular Nerve during clinical follow-up.

Similarly, Grosheva et al. [12] reported that Thirty percent of their patients still had hypoesthesia two years after the surgery. Nevertheless, after two years, individuals with preserved GAN reported considerably enhanced tactile feeling of the lobule and anti-tragus, as well as dysesthesia, in comparison to those with transected GAN. The present study results were in disagreement with Biglioli et al.[19] who reported a significantly higher anesthesia rate compared to ours, as 90% of patients with GAN resection reported anesthesia at the angle of the mandible.

In the current study, satisfaction levels among the subjects showed that 60% expressed satisfaction, while 40% reported dissatisfaction. The results of the present study were inconsistent with those of Al-Aroomi et al. [4], who reported that overall Quality of Life (QoL) and satisfaction ratings appeared to be unaffected by either GAN preservation or sacrifice.

Also, the results of the present study were in disagreement with Bulut et al. [3]. Despite the feasibility of Great Auricular Nerve (GAN) preservation, the observed improvement in sensation was limited to the short term. The reported findings present a negative result, indicating that GAN preservation did not significantly enhance sensation in the long term. Moreover, there was no notable increase in health-related quality of life (QOL) postoperatively when compared to GAN sacrifice. Overall, the results from the study were not satisfactory in terms of the anticipated long-term sensory and QOL benefits associated with GAN preservation.

CONCLUSION

In conclusion, the preservation of the Great Auricular Nerve during parotid surgery demonstrated favorable outcomes across various parameters. The evaluation of the Great Auricular Nerve showcased significant preservation rates and high recovery rates, affirming the feasibility and success of this approach. Despite the occurrence of some complications, particularly disfigurement, patient satisfaction remained at a commendable 60%. Overall, our study underscores the effectiveness of preserving the Great Auricular Nerve during parotid surgery, offering valuable insights into enhancing surgical outcomes and patient well-being.

CONFLICTS OF INTEREST

No potential conflict of interest was reported by the authors.

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