Kasr El-Aini J. Clin. Oncol. Nucl. Med.
Vol.4, No.3-4, July-Oct. 2008:51-57

NEMROCK

Original Article

GREAT AURICULAR NERVE PRESERVATION IMPROVES OUTCOME OF SUPERFICIAL PAROTIDECTOMY

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ABSTRACT

Introduction: The present study aimed to evaluate the applicability and value of great auricular nerve (GAN) preservation on sensory recovery of supplied dermatomes after superficial parotidectomy.

Patients and Methods: The study included 35 patients; 23 males and 12 females with mean age of 5110.2±; range: 2962- years. All patients presented by unilateral swelling in the parotid region and underwent superficial parotidectomy. The GAN was identified at the point just beneath the lobule (for branches identification) and at the point on the sternoclienomastoid muscle beside the external jugular vein (for trunk identification). The anterior branch is usually sacrificed while the posterior superficial and deep branches were preserved. Touch sensation of ear lobule and the infraauricular area was evaluated using a cotton swab and represented on 100-point visual analogue scale (VAS) with 0=no sensation of the pinna and 100= no difference in sensation compared to that of the other side. The quality of life (QOL) after parotidectomy was evaluated using a similar VAS with 0=a feeling of severe discomfort; while 100=no discomfort or difficulties. VAS scores were evaluated 2-weeks, 1, 2, 3 and 6-months after surgery.

Results: Posterior branches of GAN could be preserved in 23 cases (65.7%) while the nerve was thin and could not be preserved in 8 cases and was adherent and could not be dissected in the remaining 4 cases, thus GAN was excised in 12 cases (34.3%). Mean VAS scores showed a significant increase at each time of examination compared to the previous records up to 3-months after surgery; but VAS scores recorded at 6-months after surgery were non-significantly higher compared to that recorded at 3-months. Recorded VAS scores at 2, 3 and 6 months after surgery were significantly higher in patients with preserved GAN compared to those with excised GAN. At 6-months after surgery, only 6 patients (26.5%) with preserved GAN had sensation score of <50, while the other 17 patients (73.5%) had sensation score of >50, whereas all patients with excised GAN had sensation score of <50. Number of patients with preserved GAN who had high sensation scores was significantly higher compared to those with excised GAN.

Conclusion: It could be concluded that preservation of posterior branches of GAN is feasible and improves the outcome of superficial parotidectomy with significant preservation of sensation of earlobe and the infraauricular area and improved quality of life.

Key Words: Superficial parotidectomy, great auricular nerve, outcome.

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INTRODUCTION

The great auricular nerve is a sensory nerve arising from fibers of the second and third cervical rami, bends around the posterior aspect of the sternocleinomastoid muscle and ascends to just posterior of the tail of the parotid gland, where it divides into anterior and posterior branches. The anterior branch supplies sensation to the facial skin over the parotid gland and the ascending rami of the mandible. The posterior branch supplies sensation to the skin overlying the mastoid process and the skin of the posteroinferior surface of the auricle, the lobule and the concha[1].

Parotidectomy is a relatively common surgical procedure for treatment of parotid neoplasms and is occasionally performed for inflammatory and autoimmune conditions. Potential complications include hemorrhage, infection, seroma formation, salivary fistula, keloid formation, facial nerve paralysis or paresis, auriculotemporal syndrome (gustatory sweating or frey syndrome) and great auricular nerve anesthesia[2].

Conventionally, surgeons have sacrificed the great auricular nerve during parotidectomy to facilitate access to the parotid gland. Studies have shown that GAN sensory loss can lead to anesthesia, paresthesia, discomfort, functional deficits, e.g., difficulties wearing earrings and handling the telephone, an increased risk of traumatic injury and an increase risk of neuromas[3]. However, the extent, timing and patients' perspectives of GAN morbidity and recovery after nerve sacrifice are not fully clear[4].

In recent years, there was an increasing concern not just in cure rates, but also in the functional results of all types of surgical treatment, including parotid surgery. Theoretically, the preservation of the GAN would avoid such complications. The idea of GAN preservation is not new[1] but it has not been widely accepted[5]. But to actually confirm the validity of the procedure, some questions had to be answered: First, whether preservation of the GAN is technically feasible during parotidectomy and second, whether the preservation is associated with any undesirable factor, such as prolonged surgical time, a higher tumor recurrence rate, or any other complication. Finally, is the preservation of the GAN really related to better functional results. Thus, the present study aimed to evaluate the applicability and value of GAN preservation on sensory recovery of supplied dermatomes after superficial parotidectomy.

PATIENTS AND METHODS

This study was conducted at General Surgery Department, Faculty of Medicine, Benha University from October 2003 till Jun 2006 and included 35 patients; 23 males and 12 females with a mean age of 5110.2±; range: 2962- years. All patients presented by unilateral swelling in the parotid region. All patients had thorough medical examinations and all had fine needle aspiration cytology and computed tomographic scanning was done (Fig.1).

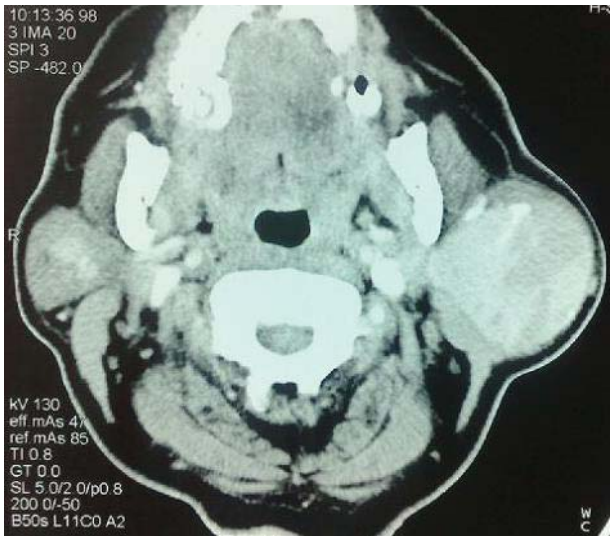

Fig. 1: Preoperative CT scanning showing left parotid mass.

All surgeries were performed under general inhalational anesthesia. A modified Blair incision is used (Fig. 2). The preauricular incision was made in the preauricular crease. The skin flap was raised to the superior, anterior and inferior borders of the gland. The skin flap was raised under the periparotid fascia which was included in the skin flap and the gland tissues were exposed. The periparotid fascia can then acts as a barrier to the parasympathetic fibres innervating the salivary and sweat glands, thereby, reducing the incidence of Frey's syndrome.

Fig. 2: A modified Blair incision.

The great auricular nerve was identified at two points (Fig. 3); at the point just beneath the lobule (for branches identification) and at the point on the sternocliedomastoid muscle beside the external jugular vein (for trunk identification). During elevation of the flap, the superficial branch of the great auricular nerve was dissected and visualized. Then, a blunt dissection was done at the posterior border of sternocleinomastoid muscle until the GAN trunk is identified. The nerve is dissected upward and usually 3 branches can be visualized: An anterior branch that goes to the parotid parenchyma and preauricular skin, a posterior superficial branch that goes to the auricle and a posterior deep branch that goes along the anterior border of the sternocleinomastoid muscle, (Fig. 4). The anterior branch is usually sacrificed. The last 2 branches can be technically preserved during surgery. Occasionally an inferior anterior branch is identified and it can be preserved. No major problem in preserving the posterior branches of the GAN, even in big tumors, since these branches do not go to the tumor but run vertically and can be preserved by careful dissection when the fascia connecting the parotid gland to the sternocleidomastoid muscle is cut. The main trunk and the posterior branches were protected and covered with saline-soaked gauze throughout the duration of surgery (Fig. 5). Thereafter, superficial parotidectomy was continued. Blunt dissection with a hemostat was used to expose the anterior border of the gland where the distal branches of the facial nerve emanate from the gland on to the masseter muscle, (Fig. 6). After removal of the superficial parotid gland and the tumor, the cut surface of the parotid remnant was sutured by absorbable sutures. The wound is irrigated with saline and the integrity of the facial nerve is checked. Closed suction drainage is inserted in all cases. The skin flap is replaced; the platysma muscle and subcutaneous tissues are closed with absorbable sutures. Finally, the skin incision is closed using 50- non-absorbable sutures. The excised specimens were sent for histopathological examination to verify the nature of lesion.

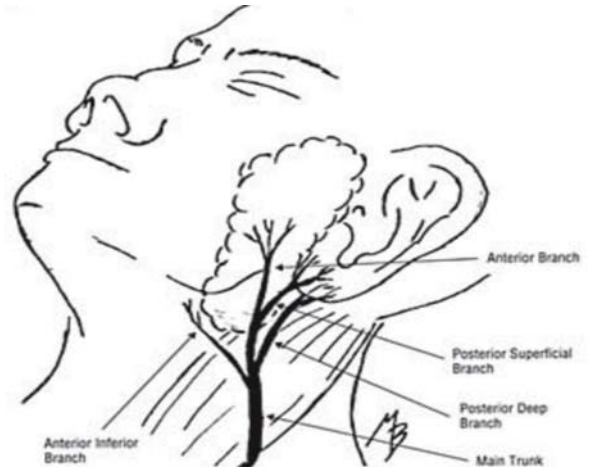

Fig. 3: Anatomical points for identification of GAN main trunk and its branches[1].

Fig. 4: GAN main trunk and its branches were identified and dissected.

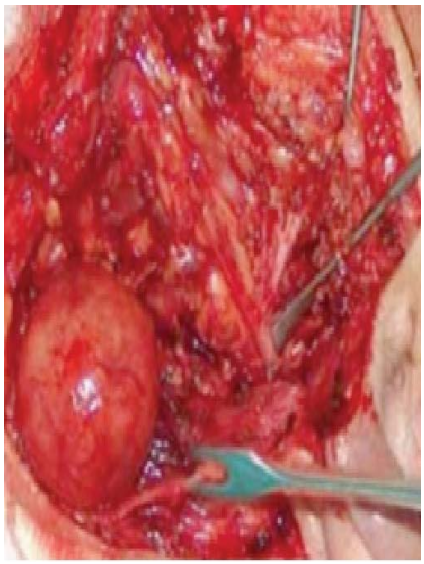

Fig. 5: The posterior branch of GAN was preserved and retracted.

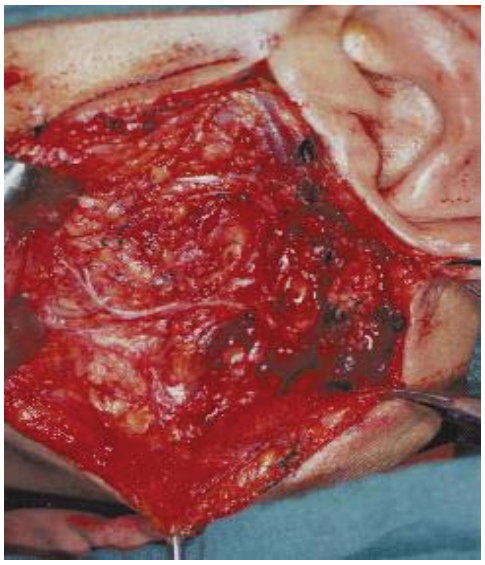

Fig. 6: Superficial parotidectomy completed and branches of the facial nerve preserved.

Touch sensation was assessed by placing a wisp of cotton on the surface of the earlobe and the infraauricular area on two separate occasions. With their eyes closed, patients were asked to indicate where they felt the wisp of cotton. Results were represented on 100-point visual analogue scale (VAS) with 0=no sensation of the pinna and 100= no difference in sensation compared to that of the other side. Touch sensation was evaluated 2-weeks, 1, 2, 3 and 6-months after surgery. Also, the quality of life (QOL) after parotidectomy was evaluated using a similar VAS with 0=a feeling of severe discomfort, difficulty in wearing earrings and/or unexpected traumatic lesions due to hyposensitivity of the pinna; while 100=no discomfort or difficulties.

Statistical analysis:

Scores of both sensation and QOL were presented as mean±SD and compared using Z-test. The frequency of patients was presented as numbers and percentages and compared using Chi-square (X^2) test. For all, P value of <0.05 was considered to be statistically significant.

RESULTS

All surgeries were completed with no intraoperative complications. Posterior branches of GAN could be preserved in 23 cases (65.7%) while the nerve was thin and could not be preserved in 8 cases and was adherent and could not be dissected in the remaining 4 cases, thus GAN was excised in 12 cases (34.3%), (Fig. 7). The mean operative time was 6910.1±; range: 5595- minutes. The mean duration of wound drainage was 53.411.5±; range: 2472- hours and the mean hospital stay was 59.811.8±; range: 4872- hours, (Table 1). There were 20 pleomorphic adenomas (57.1%), 8 Warthin's tumor (22.9%), 3 sialoadenitis (8.6%) and 4 (11.4%) were other begnin lesions, (Table 2).

Table 1: Operative and postoperative data.

	Mean±SD	Range
Operative time (minutes)	69±10.1	55-95
Wound drainage period (hours)	53.4±11.5	24-72
Hospital stay (hours)	59.8±11.8	48-72

Table 2: Patients> distribution according to result of histopathological examination of excised specimen.

	Number	%
Pleomorphic adenoma	20	57.1
Warthin's tumour	8	22.9
Sialadenitis	3	8.6
Other benign lesions	4	11.4

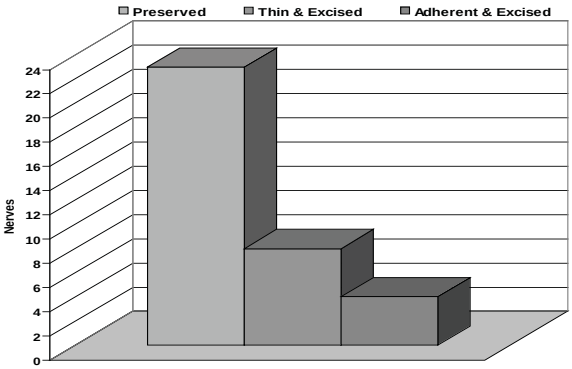

Fig. 7: Patients distrbution according to the fate of GAN during surgery.

During the immediate postoperative period no cases with facial weakness or salivary fistulae were reported. Mild cheek edema was noticed and resolved on conservative treatment with anti-edematous drugs. No wound infection or hematoma collection was noticed. Throughout the postoperative follow-up no patient developed Frey' syndrome or complained of retromandibular recess or wound dimpling.

Mean sensation VAS score showed a significant increase at each time of examination compared to the previous records up to 3-months after surgery; thereafter sensation scores recorded at 6-months after surgery were non-significantly higher compared to that recorded at 3-months in both Groups. Recorded touch sensation VAS scores at 2, 3 and 6 months after surgery were significantly higher (P_5=0.01, 0.005 and 0.002, respectively) in patients with preserved GAN compared to those with excised GAN, (Table 3, Fig. 8). At 6-months after surgery, only 6 patients (26.5%) with preserved GAN had sensation score of <50, while the other 17 patients (73.5%) had sensation score of >50, whereas all patients with excised GAN had sensation score of <50. Number of patients with preserved GAN had high sensation scores was significantly higher (X_2=15.266, p<0.001) compared to those with excised GAN, (Table 4, Fig. 9).

Table 4: Patients> distribution according to sensation scores.

Sensation score	Preserved GAN	Excised GAN
0-10	0	0
>10-20	0	1 (8.4%)
>20-30	1 (4.3%)	7 (58.3%)
>30-40	1 (4.3%)	4 (33.3%)
>40-50	4 (17.4%)	0
>50-60	3 (13%)	0
>60-70	5 (21.8%)	0
>70-80	6 (26.2%)	0
>80-90	3 (13%)	0

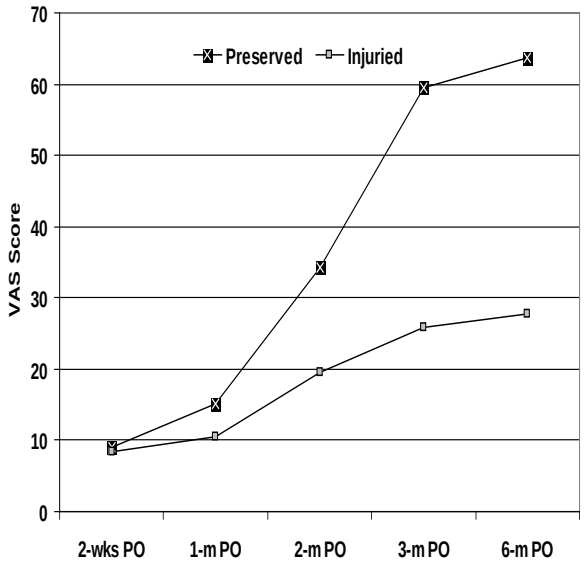

Fig. 8: Time course changes in VAS score of pain in patients with preserved and excised.

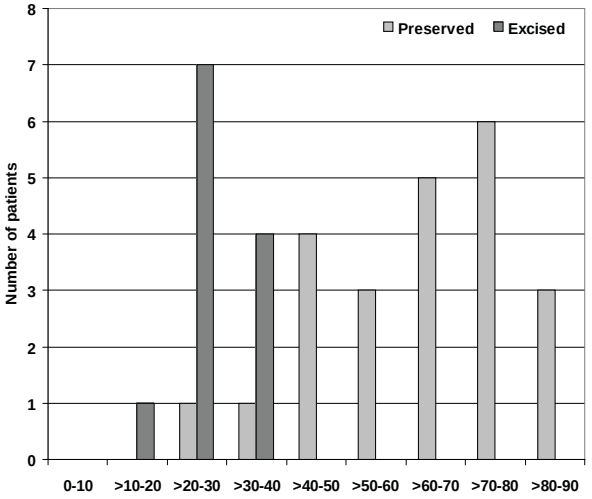

Fig. 9: Patients distribution within each se nsation score categoryin patients with preserved and excised GAN

Table 3: Mean (±SD) of VAS scores of touch sensation in patients with preserved and excised GAN.

Patients Time	GAN Excised (n=12)	Statistical Analysis Z	P	GAN preserved (n=23)	Statistical Analysis Z	p
2-weeks PO	8.3±4.4			9±2.3	0.09	P_5>0.05
1-month PO	10.6±6.6	1.473	P_1>0.05	15.1±6.8	2.993	P_1=0.003
					1.339	P_5>0.05
2-month PO		2.524	P_1=0.012		4.081	P_1<0.001
	19.5±11.6	2.524	P_2=0.012	34.3±16.9	3.192	P_2=0.001
					2.591	P_5=0.01
3-month PO		2.946	P_1=0.003		4.199	P_1<0.001
	25.8±14.4	2.940	P_2=0.003	59.5±20.5	4.021	P_2<0.001
		2.527	P_3=0.012		3.200	P_3=0.001
					2.825	P_5=0.005
6-month PO		3.069	P_1=0.002		4.199	P_1<0.001
		3.064	P_2=0.002		4.203	P_2<0.001
	27.7±14.8	2.677	P_3=0.007	63.7±16.4	3.422	P_3=0.001
		1.604	P_4>0.05		1.342	P_4>0.05
					3.059	P_5=0.002

P_1: significance versus VAS recorded at 2-wks.
P_2: significance versus VAS recorded at 1-m.
P_3: significance versus VAS recorded at 2-m.
P_4: significance versus VAS recorded at 3-m.
P_5: significance versus VAS recorded in patients with excised GAN.

Table 5: Mean (±SD) of VAS scores for the QOL recorded in patients with preserved and excised GAN.

Patients Time	GAN Excised (n=12)	Statistical Analysis Z	P	GAN preserved (n=23)	Statistical Analysis Z	p
2-weeks PO	11.2±3.9			12.8±4.7	0.09	P_5>0.05
1-month PO	18.8±11	2.805	P_1=0.005	26.9±13	3.722	P_1<0.001
					1.339	P_5>0.05
2-month PO		2.903	P_1=0.004		4.200	P_1<0.001
	30.5±17.8	2.040	P_2=0.041	51.8±15.5	3.881	P_2<0.001
					2.551	P_5=0.005
3-month PO		3.059	P_1=0.002		4.198	P_1<0.001
	40.9±21.8	3.062	P_2=0.002	63.5±14.1	4.201	P_2<0.001
		2.710	P_3=0.007		2.634	P_3=0.008
					2.824	P_5=0.005
6-month PO		3.061	P_1=0.002		4.198	P_1<0.001
		3.062	P_2=0.002		4.200	P_2<0.001
	47.9±25.2	3.065	P_3=0.002	72.5±14.9	3.299	P_3=0.001
		1.369	P_4>0.05		1.893	P_4>0.05
					3.065	P_5=0.002

P_1: significance versus VAS recorded at 2-wks.
P_2: significance versus VAS recorded at 1-m.
P_3: significance versus VAS recorded at 2-m.
P_4: significance versus VAS recorded at 3-m.
P_5: significance versus VAS recorded in patients with excised GAN.

Also, the mean VAS score for the QOL showed progressive significant time course increase in all patients with significantly higher scores on each evaluation compared to the previous one up to 3-months, but the increase was non-significant at 6-months compared to that at 3-months. Recorded QOL scores at 2, 3 and 6 months after surgery were significantly higher (P_5=0.005, 0.005 and 0.002, respectively) in patients with preserved GAN compared to those with excised GAN, (Table 5,Fig.10).

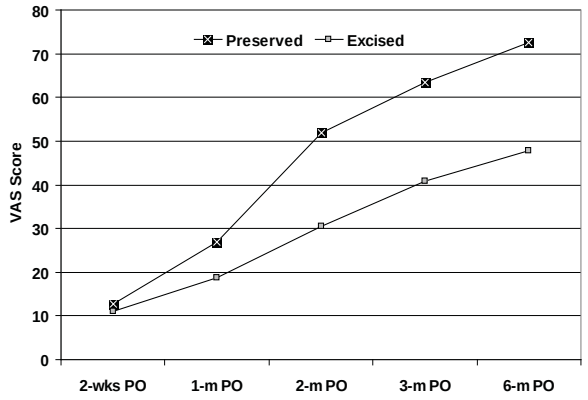

Fig. 10: Time course changes in QOL score recoded in patients with preserved and excisedGAN.

DISCUSSION

The unnecessary sacrifice of anatomic structures is not justified, mainly if it implies significant dysfunction. Besides the discomfort provoked, the post-parotidectomy hyposensitivity of the lobule has been associated with traumatic lesions secondary to deficiency in defense mechanisms mediated by pain. Another frequent complaint is the difficulty in wearing earrings[7].

The present study aimed to evaluate the applicability and value of GAN preservation on sensory recovery of supplied dermatomes after superficial parotidectomy. The Posterior branch of GAN could be preserved in 23 cases (65.7%) while the nerve was excised in 12 cases (34.3%). These findings go in hand with Christensen and Jacobsen[8] and Hui et al.[9] who reported that preservation and posterior retraction of the nerve trunk and posterior branch seem technically possible and achievable approximately 70% of the time.

Preservation of the posterior branch of GAN is not a time consuming procedure. In the present study, we did not need more than 15 minutes of surgery time to preserve the nerve. This is in agreement with Vieira et al.[11] and Biglioli et al.[12] who reported that the mean time consumed in preservation and posterior retraction of the nerve trunk and posterior branch was 10 and 12 minutes, respectively.

Mean sensation VAS score showed a significant increase at each time of examination compared to the previous records up to 3-months after surgery; thereafter sensation scores recorded at 6-months after surgery were non-significantly higher compared to that recorded at 3-months in both groups. Recorded touch sensation VAS scores at. 2, 3 and 6 months after surgery were significantly higher in patients with preserved compared to those with excised GAN. These data agreed with Biglioli et al.[10] and Vieira et al.[11] who reported that all patients who underwent preservation had no anesthesia by 6 months. Also, Ryan and Fee[4] who reported that half of the patients, at 6 months, on average, had a fifth of the amount of anesthesia they had at 3 months.

At 6-months after surgery, 6 patients (26.5%) with preserved GAN had sensation score of <50, this decreased sensation despite of nerve preservation could be attributed to intraoperative manipulation and devascularization of the posterior branch. Also, scar tissue associated with surgery may ultimately entrap the GAN and compromise or obliterate its function regardless of operative efforts.

On the other hand, all patients with excised GAN had sensation score of <50, this finding goes in hand with Vieira et al.[11] who found that patients who had undergone sacrifice of the GAN achieved a sensory recovery plateau by 6 months postoperatively and Hui et al.[9] who found that patients who had undergone sacrifice of the GAN had dysfunction up to 2 years. Furthermore, Biglioli et al.[10] reported that 90% of patients who had undergone sacrifice of the GAN still had anesthesia at a minimum of 8 years of follow-up.

The reported recovery of sensation in dermatomes supplied by GAN in patients with excised GAN may be explained by the regeneration of the GAN nerve fibers; collateral innervation by the lesser occipital nerve, auriculotemporal nerve, trigeminal nerve, and transverse cutaneous nerve; and the patient's own psychological adaptation to the sensory loss. Paresthesia and referred sensations may be the result of an abundant or immature reinnervation of the skin overlying the sectioned branch. The differences in the scope and severity of paresthesias and hypoesthesia found in the patients in this study are likely due to biologic vagaries of wound healing.

Mean QOL scores showed progressive significant time course increase in all patients with significantly higher scores on each evaluation compared to the previous one up to 3-months with significantly higher QOL scores in patients with preserved GAN compared to those with excised GAN. These findings agreed with Yokoshima et al.[12] who reported that score for the QOL was significantly higher in the group of patients whose GAN was preserved at 2 and 3 months as well as 6 months after parotidectomy compared to those with excised GAN. Also, Ryan and Fee[4] reported that despite the impact of GAN sacrifice morbidity on patient quality of life is tolerable and improves during the first postoperative year, GAN morbidity may be bothersome enough to warrant efforts to preserve the posterior branch of the GAN when possible and appropriate.

CONCLUSIONS

It could be concluded that preservation of posterior branch of GAN is feasible and improves the outcome of superficial parotidectomy with significant preservation of sensation of the pinna and improved quality of life.

REFERENCES

1. Berry M, Bannister LH, Standring SM. Nervous system. In: Gray H, Bannister LH, Berry MM, Williams PL, editors. Gray's anatomy: The anatomical basis of medicine and surgery. 38th ed.: Churchill Livingstone; 1995. p. 1264.
2. Guntinas Lichius O, Klussmann JP, Wittekindt C, Stennert E. Parotidectomy for benign parotid disease at a university teaching hospital: Outcome of 963 operations. Laryngoscope 2006 Apr;116(4):534-40.
3. Lim YC, Lee SY, Kim K, Lee JS, Koo BS, Shin HA, et al. Conservative parotidectomy for the treatment of parotid cancers. Oral Oncol. 2005 Nov;41(10):1021-7.
4. Ryan WR, Fee WE,Jr. Great auricular nerve morbidity after nerve sacrifice during parotidectomy. Arch.Otolaryngol.Head.Neck. Surg. 2006 Jun;132(6):642-9.
5. Brown JS, Ord RA. Preserving the great auricular nerve in parotid surgery. Br.J.Oral Maxillofac.Surg. 1989 Dec;27(6):459-66.
6. Witt RL. Minimally invasive surgery for parotid pleomorphic adenoma. Ear Nose Throat J. 2005 May;84(5):308, 310-1.
7. Zumeng Y, Zhi G, Gang Z, Jianhua W, Yinghui T. Modified superficial parotidectomy: Preserving both the great auricular nerve and the parotid gland fascia. Otolaryngol.Head.Neck.Surg. 2006 Sep;135(3):458-62.
8. Christensen NR, Jacobsen SD. Parotidectomy. Preserving the posterior branch of the great auricular nerve. J.Laryngol.Otol. 1997 Jun;111(6):556-9.
9. Hui Y, Wong DS, Wong LY, Ho WK, Wei WI. A prospective controlled double-blind trial of great auricular nerve preservation at parotidectomy. Am.J.Surg. 2003 Jun;185(6):574-9.
10. Biglioli F, D'Orto O, Bozzetti A, Brusati R. Function of the great auricular nerve following surgery for benign parotid disorders. J.Craniomaxillofac.Surg. 2002 Oct;30(5):308-17.
11. Vieira MB, Maia AF, Ribeiro JC. Randomized prospective study of the validity of the great auricular nerve preservation in parotidectomy. Arch.Otolaryngol.Head.Neck.Surg. 2002 Oct;128(10):1191-5.
12. Yokoshima K, Nakamizo M, Ozu C, Fukumoto A, Inai S, Baba S, et al. Significance of preserving the posterior branch of the great auricular nerve in parotidectomy. J.Nippon Med.Sch. 2004 Oct;71(5):323-7.