# Functional outcomes of superficial and conservative total parotidectomy: a 4-year experience from Benha, Egypt

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**Purposes**
The aim of this study was to find out the frequency of the functional outcomes related to superficial and conservative total parotidectomy.

**Background**
Functional outcomes especially facial nerve injury and Frey's syndrome during parotid surgery represent annoying problem, as it is associated with cosmetic problems and multiple physician visits; 'to minimize these outcomes' remains in question.

**Patients and methods**
The study included 52 patients; 6 (11.5%) were below 35 years of age, 28 (53.8%) were between 35 and 50 years of age, and 18 (34.7%) were above 50 years of age. All patients underwent clinical evaluation, laboratory assessment, ultrasound, computed tomography scan, and MRI examination. All patients underwent either superficial or conservative total parotidectomy.

**Results**
In this study, immediately postoperatively, facial nerve injury was observed in 20 patients; in this series, 14 (70%) developed temporary facial palsy, whereas 6 (30%) developed permanent facial paralysis. Cervical branch was the most commonly injured nerve 8 (40%). Symptomatic Frey's syndrome was observed in 5 (9.6%), and parotid leak was observed in 11 (27.5%); all were observed in superficial parotidectomy as sialocele in 5 (12.5%), glandular fistula in 4 (10%), and ductal fistula in 2 (5%).

**Conclusion**
Facial nerve injury is more common in total conservative parotidectomy than in superficial parotidectomy. Early detection of nerve injury is quite helpful to reduce the facial deformity by early reconstruction and other procedures. However, parotid leak is only observed in superficial parotidectomy; most of this leak can be managed conservatively except ductal fistula. Symptomatic Frey's syndrome is more common in superficial parotidectomy.

**Keywords:**
facial nerve, functional morbidity, parotidectomy, parotid gland tumors

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## Introduction

The parotid gland is the most common site for salivary tumors. Most tumors arise in the superficial lobe and present as slow-growing, painless swellings below the ear, in front of the ear, or in the upper aspect of the neck. Less commonly, tumors may arise from the accessory lobe and present as persistent swellings within the cheek. Rarely, tumors may arise from the deep lobe of the gland and present as parapharyngeal masses [1–3].

Symptoms include difficulty in swallowing and snoring. Clinical examination reveals a diffuse firm swelling in the soft palate and tonsil. Some 80–90% of tumors of the parotid gland are benign, the most common being pleomorphic adenoma [4–6].

All tumors of the superficial lobe of the parotid gland should be managed by superficial parotidectomy. There is no role for enucleation, although a benign lesion is suspected. The aim of superficial parotidectomy is to remove the tumor with a cuff of normal surrounding tissue [7–9].

Superficial parotidectomy is the commonest procedure for parotid gland pathology, but total conservative parotidectomy is performed if the mass involves the deep lobe or with low-grade carcinoma. Surgery is performed under endotracheal general anesthesia, which may or may not be accompanied by hypotensive anesthesia to facilitate dissection, improve the visual surgical field, and reduce blood loss [10–12].

Conservative parotidectomy is an effective and well-established technique for the treatment of parotid gland pathology, but there are many complications such as visible scars, bleeding, parotid leak, retromandibular depression, Frey's syndrome, and facial nerve injury, which is the most annoying complication [13].

Parotid surgery has always been engaged with facial nerve dissection, trauma, and reconstruction. Around

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5–7% of the parotid masses are malignant and some of them have the possibility of perineural invasion [14].

The facial nerve is a very important nerve that exits through the skull base below the ear lobule and travels through the parotid gland, separating it into superficial and deep lobes. The hazardous course of the facial nerve through the parotid has evoked considerable risk for nerve injury [15].

The incidence of symptomatic Frey's syndrome after superficial parotidectomy is 10–48% [16]. Many techniques have been tried to reduce the incidence of Frey's syndrome. In all the surgical methods, the aim is based on forming a barrier between the sweat glands in the skin and the postganglionic nerve fibers lying open – that is, the sternocleidomastoid muscle flap [17], the temporoparietal fascia flap [18], and politetrafloroetilen [19].

Parotid leak includes fistula or sialocele; parotid fistula is a communication between the skin and a salivary duct or gland, through which saliva is discharged. In glandular fistulas, discharge is less and tends to heal spontaneously with conservative treatment, whereas ductal fistulas continuously discharge saliva and spontaneous healing is very rare [20].

However, sialocele is a collection of saliva beneath the skin that may lead to swelling over or adjacent to the parotid gland and may occur if the duct leaks but no fistula forms. This may also result when the glandular substance of the parotid is disrupted but the parotid duct is intact. This condition usually resolves with intermittent aspiration and compression and rarely requires drain placement [21].

## Patients and methods

After local ethical committee of Benha university approval and obtaining written fully informed patients consent, the current study was conducted at General surgery Department, Benha University Hospital from January 2010 to December 2013 so as to allow 6 months follow-up period for the last case operated on. This prospective randomized controlled study was conducted on 52 patients diagnosed with parotid gland swelling, 32 (61.5%) women and 20 (38.5%) men with age strata; most patients were aged between 35 and 50 years.

All patients presenting were subjected to detailed clinical evaluation, laboratory assessment, ultrasound, computed tomography scan, and MRI examination.

Inclusion criteria in this study included patients fit for general anesthesia. Exclusion criteria in this study included previous parotid gland surgery, facial nerve palsy, or irresectable parotid gland swelling.

All patients underwent either superficial or conservative total parotidectomy. Postoperative follow-up was 6 months.

### Operative procedure

Oral endotracheal anesthesia is essential; the patient is placed in the supine position. The head is extended by elevating the shoulders and rotated to the contralateral side, draping the head separately from the body. Exposure (and protection) of the eye, cheek, and mouth in the operative field, as well as the endotracheal tube and its connections is ensured. Muscle relaxants are not appropriate, such that nerve stimulation may be conducted intraoperatively.

Skin incision is initiated anterior to the ear just above the tragus. It is carried inferiorly to the level of the lobule and then angled posteriorly under the lobule and directed anteriorly for a suitable distance in the upper neck.

The incision is carried out through skin and subcutaneous tissue, developing the plane between the cartilaginous external canal and the posterior aspect of the gland. Allis clamps on subcutaneous tissues provide traction of the flaps. The sternomastoid muscle is identified and its anterior border exposed as the tail of the gland is dissected and reflected away from the muscle. Sacrifice of the greater auricular nerve is expected unless its course meanders to the mastoid process. Dissection is continued in this plane, incising attachments to the mastoid, until the posterior belly of the digastric muscle is visualized below the digastric groove. The anterior flap is elevated in the plane of the parotid capsule; with the concern that terminal branches of the facial nerve are at risk, the dissection should continue beyond the anterior margin of the gland. The facial nerve must be thereafter identified just distal to its emergence from the stylomastoid foramen. A variety of landmarks have been described that facilitate the exposure of the main trunk, such as the cartilaginous part of the external canal and the tympanomastoid sulcus. When the volar aspect of the fifth finger is placed deeply on the junction of cartilaginous and bony external auditory canal and wedged against the bone cephalad, the main trunk is found below the inferior border of the finger, a few millimeters above the exposed superior border of the posterior belly of the digastric muscle as it enters its groove in the mastoid bone.

Good traction on the reflected parotid tissue is essential, as a clamp (first curved but after exposure of the facial nerve, straight clamp) is used to elevate and incise the

overlying tissue in layers. Meticulous hemostasis and good illumination are essential. A small arterial branch often located just lateral to the nerve must be identified and ligated. With careful layer-by-layer dissection and knowledge of the anatomy, a nerve stimulator is often unnecessary. Minor twitching of the facial muscles due to mechanical stimulation of the facial nerve is likely in nonparalyzed patient, which can be of assistance in the dissection. Neurologic injury to CN VII can result from desiccation, as well as from mechanical trauma; the former is easily avoided if moist sponges are applied during the dissection.

A single closed suction drain is brought out by a separate stab wound; fine sutures are used for a layered closure. A pressure dressing is not needed. The suction drain can often be removed by day 3–5 postoperatively. Bedside assessment of facial nerve function after the patient awakens from anesthesia is appropriate.

The conduct of a routine conservative total parotidectomy, tumor extension deep to the main trunk or one of its branches, may require a major intraoperative decision. All major nerve branches should be fully exposed before tumor removal is attempted. This maneuver is accomplished by elevation and gentle retraction of the overlying nerves. With presentations of abutment below the main trunk or smaller distal branches, nerve displacement inferiorly and superiorly abets tumor resection. When a deep tumor involves the isthmus, excision is usually achieved by retracting the upper CN VII division superiorly and the lower division inferiorly. Apraxia of CN VII due to stretching is common in this situation [22–24].

### Outcome items

Postoperative follow-up was performed for functional outcomes of the parotid gland surgery, which included facial nerve injury (i.e., by asking patient to raise his eyebrow by frontalis muscle, close his eye by orbicularis oculi muscle, blow his cheek by buccinator muscle, show his teeth by retractor anguli oris muscle, and whistle by orbicularis oris muscle), symptomatic Frey's syndrome (i.e., gustatory sweating, during meals the cheek becomes sweaty, red, and hot), and parotid leak (i.e. sialocele or fistula) that was classified by the injury classification system into three regions: (a) posterior to the masseter or intraglandular (site A), (b) overlying the masseter (site B), and (c) anterior to the masseter (site C) [25].

None of the patients were lost to follow-up, and data collection was complete.

### Statistical analysis

Analysis of data was performed using SPSS, version 16 (Bristol University, Bristol, UK). Quantitative data were presented as mean and SD and were analyzed using one-way analysis of variance test. Qualitative data were presented as numbers and percentages and were analyzed using the $\chi^2$ and Fisher exact tests. *P*-value less than 0.05 was considered significant, whereas *P*-value less than 0.01 was considered highly significant. However, *P*-value greater than 0.05 was considered insignificant.

All data were recorded in Fig. 1.

## Results

The study included 52 patients, 32 (61.5%) women and 20 (38.5%) men with age strata; most patients were aged between 35 and 50 years. They were diagnosed with parotid gland swelling located in superficial lobe in 46 (88.5%) patients and in deep lobe in 6 (11.5%) patients. All patients were fit for surgery confirmed by American Society of Anesthesiologists grade (ASA): ASAI [*n* = 36 (69.2%)], ASAII [*n* = 10 (19.3%)], and ASAIII [*n* = 6 (11.5%)] (Table 1).

Patients underwent either superficial parotidectomy in 40 (76.9%) cases with a mean operative time of 1.2 ± 0.3 h or total conservative parotidectomy in 12 (23.1%) cases with a mean operative time of 2 ± 0.2 h (Table 2). No intraoperative complications or mortality were recorded.

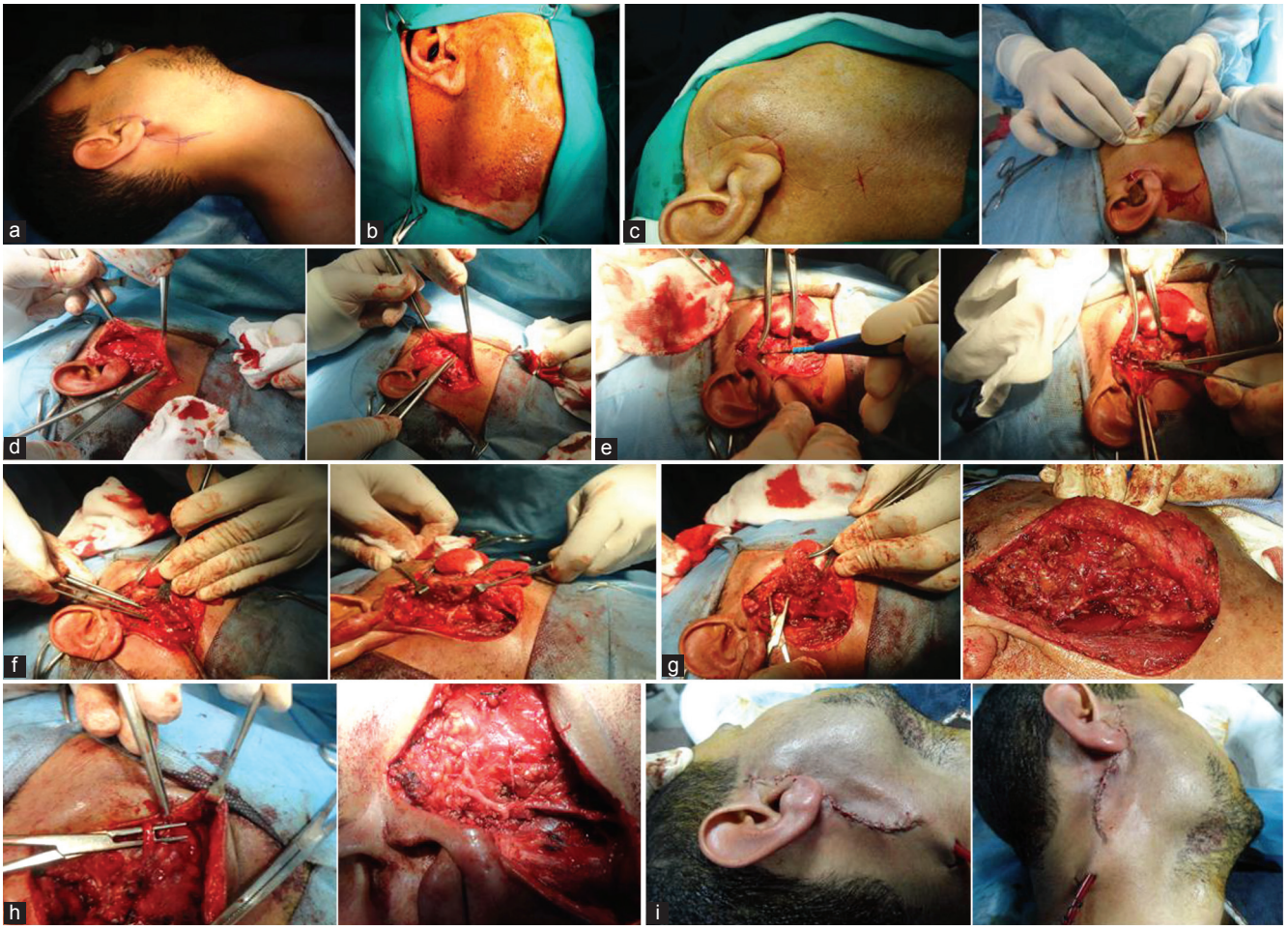
The site of tumor origin was in the lower pole, 34 (65.3%); middle of the gland, 12 (23.2%); or the upper pole, 6 (11.5%). The mean tumor diameter was 3.6 ± 0.7 cm. Thirty-two patients had pleomorphic

**Table 1 Preoperative data**

| Data | Findings [*n* (%)] |
|---|---|
| Age (years) | |
| Below 35 | 6 (11.5) |
| Between 35 and 50 | 28 (53.8) |
| Above 50 | 18 (34.7) |
| Sex | |
| Female | 32 (61.5) |
| Male | 20 (38.5) |
| American Society of Anesthesiologists grade (ASA) | |
| $ASA_I$ | 36 (69.2) |
| $ASA_{II}$ | 10 (19.3) |
| $ASA_{III}$ | 6 (11.5) |
| Location | |
| Superficial lobe | 46 (88.5) |
| Deep lobe | 6 (11.5) |

Data are presented as number; ranges and percentages are in parentheses.

**Figure 1**




(a) Skin incision marking, (b) drapes, (c) incision, (d) the skin flap dissection until the anterior border of parotid, (e) parotid is dissected from the external auditory canal and anterior border of SM muscle, (f) identification of facial nerve trunk, (g) straight mosquito forceps is used to separate facial nerve branches, (h) parotid duct identification and ligation, (i) skin closed and a drain is left behind. SM, sternomastoid.

**Table 2 Operative data**

| Types of parotid surgery | Procedure in | Operative time (h) |
|---|---|---|
| Superficial parotidectomy | 40 (76.9) | 1.2 ± 0.3 |
| Total conservative parotidectomy | 12 (23.1) | 2 ± 0.2 |

Data are presented as mean+SD and number; ranges and percentages are in parentheses.

adenoma; surgical margin showed microscopic infiltration in 2 (3.9%) patients. Three patients (5.7%) showed perineural invasion and six patients (11.5%) showed vascular invasion. Seven patients (13.4%) had histologically positive lymph node metastases in the resection specimen (Table 3).

The frequency of postoperative functional outcomes — that is, facial nerve injury ($N = 20$) was: 14 patients had temporary facial palsy – 8/40 (20%) patients in superficial parotidectomy and 6/12 (50%) patients in total conservative parotidectomy ($P = 0.004$) — and six patients had permanent facial paralysis after 6 months follow-up that was in need for grafting: 2/40 (5%) patients in superficial parotidectomy and 4/12 (33.3%) patients in total conservative parotidectomy ($P = 0.002$). However, symptomatic Frey's syndrome was observed in five patients: 4/40 (10%) patients in superficial parotidectomy and 1/12 (0.8%) patients in total conservative parotidectomy ($P = 0.125$) (Table 4).

The distribution of diseases with respect to facial nerve injury was: epidermoid carcinoma was associated with the highest percentage of facial nerve injury, 2/2 (100%), followed by mucoepidermoid carcinoma, 4/6 (66.6%); however, chronic sialadenitis was not associated with facial nerve injury (Table 5).

With respect to the frequency of postoperative different branches of facial nerve injury following surgery, cervical branch was the most common injured, 8/20 (40%), and the main trunk injury was observed in 2/20 (10%); however, no injury was observed in the temporal and zygomatic branches (Table 6).

The incidence of postoperative functional outcomes — that is, parotid leak [*N* = 11 (27.5%)]: all cases were observed in superficial parotidectomy only as sialocele in 5 (12.5%) patients and as parotid fistula — glandular type in 4 (10%) patients and ductal type in 2 (5%) patients (Table 7).

Parotid leak (i.e. sialocele or fistula) was classified by the injury classification system into three regions: posterior to the masseter or intraglandular (site A), 7 (17.5%) patients; overlying the masseter 'site B', 3 (7.5%) patients; anterior to the masseter 'site C', 1 (2.5%) patient [25] (Table 8).

**Table 3 Pathological data of excised specimens**

| Data | Findings |
|---|---|
| Site | |
| Lower pole | 34 (65.3) |
| Middle of the gland | 12 (23.2) |
| Upper pole | 6 (11.5) |
| Size (cm) | |
| Diameter in its longest axis | 3.6 ± 0.7 |
| Histological types | |
| Pleomorphic adenoma | 32 (61.5) |
| Mucoepidermoid carcinoma | 6 (11.5) |
| Warthin's tumor | 6 (11.5) |
| Acinic cell tumor | 4 (7.7) |
| Epidermoid carcinoma | 2 (3.9) |
| Chronic sialadenitis | 2 (3.9) |
| Surgical margin invasion | |
| Yes | 2 (3.9) |
| No | 50 (96.1) |
| Perineural invasion | |
| Yes | 3 (5.7) |
| No | 49 (94.3) |
| Perivascular invasion | |
| Yes | 6 (11.5) |
| No | 46 (88.5) |
| Lymph node status | |
| Positive | 7 (13.4) |
| Negative | 45 (86.6) |

Data are presented as mean+SD and number; ranges and percentages are in parentheses.

**Table 4 Types of nerve injury, facial (*N* = 20) or auriculotemporal (*N* = 5)**

| Type of nerve injury | *n* (%) | | *P*-value |
|---|---|---|---|
| | Superficial parotidectomy (*N* = 40) | Total conservative parotidectomy (*N* = 12) | |
| Temporary facial palsy | 8 (20) | 6 (50) | 0.004 |
| Permanent facial paralysis after 6 months (for grafting) | 2 (5) | 4 (33.3) | 0.002 |
| Symptomatic Frey's syndrome | 4 (10) | 1 (0.8) | 0.125 |

Finally, patients with parotid leak were treated conservatively, except ductal parotid fistula in 2 (5%) patients, which was treated by surgical reconstruction.

## Discussion

Parotidectomy has been classically performed through a bayonet-shaped incision without parotid bed

**Table 5 Distribution of diseases with respect to facial nerve injury (*N* = 52)**

| Nature of the disease | Patients | Facial nerve injury |
|---|---|---|
| Pleomorphic adenoma | 32 (61.5) | 10 (31.2) |
| Mucoepidermoid carcinoma | 6 (11.5) | 4 (66.6) |
| Warthin's tumor | 6 (11.5) | 2 (33.3) |
| Acinic cell tumor | 4 (7.7) | 2 (50) |
| Epidermoid carcinoma | 2 (3.9) | 2 (100) |
| Chronic sialadenitis | 2 (3.9) | 0 (0) |
| Total | 52 (100) | 20 (38.4) |

Data are presented as number; ranges and percentages are in parentheses.

**Table 6 Different branches of facial nerve injury following surgery (*N* = 20)**

| Types | Branches | *N* (%) |
|---|---|---|
| Single branch | Temporal | 0 (0) |
| | Zygomatic | 0 (0) |
| | Buccal | 2 (10) |
| | Mandibular | 4 (20) |
| | Cervical | 8 (40) |
| Multiple branches | Zygomatic and buccal | 2 (10) |
| | Mandibular and cervical | 2 (10) |
| Main trunk | All | 2 (10) |

Data are presented as number; ranges and percentages are in parentheses.

**Table 7 Incidence of parotid leak (*N* = 11)**

| Parotid leak | Superficial parotidectomy (*N* = 40) | Total conservative parotidectomy (*N* = 12) |
|---|---|---|
| Sialocele | 5 (12.5) | 0 (0) |
| Parotid fistula | | |
| Glandular | 4 (10) | 0 (0) |
| Ductal | 2 (5) | 0 (0) |

Data are presented as number; ranges and percentages are in parentheses.

**Table 8 Distribution of parotid leak by the injury classification system (*N* = 11)**

| Parotid leak | Superficial parotidectomy (*N* = 40) |
|---|---|
| Site A: posterior to masseter or intraglandular | 7 (17.5) |
| Site B: overlying the masseter | 3 (7.5) |
| Site C: anterior to the masseter | 1 (2.5) |

Data are presented as number; ranges and percentages are in parentheses.

reconstruction. This approach allows quick and wide access for dissection of the facial nerve and eases parotid gland removal [26].

To find the facial nerve in parotid surgery, we have used the anatomical landmarks, and in the case of any difficulty electrical intraoperative stimulation and monitoring the nerve function had to be used. There are cases in which such facilities are not advanced enough to find the main nerve trunk; therefore, a change in the method toward finding the peripheral branches and exploring the nerve backward to the mass has to be established. This technique and approach will bring about the condition to perform a satisfying oncologic surgery and a surgical field for preservation and/or repair of a traumatized facial nerve. In the cases of suspicious perineural invasion, the nerve has to be traced into the mastoid area to eradicate the malignant progression and find an intact proximal end for reconstruction and anastomosis [27].

Parotid malignancies are not common, consisting 3–4% of all head and neck malignancies [28]. However, two main conceptions have to be kept in mind for those who are involved in the surgery of the parotid gland. First of all, the best survival is in the hands of the first surgeon. He or she has to be quite aware of the possibility of perineural invasion [29,30], which has a serious impact on the type of surgery.

In this present series, 52 cases of parotid gland surgery were studied. Of these 52 cases, 20 patients developed facial nerve palsy immediately after operation, whereas five patients developed symptomatic Frey's syndrome. These patients were followed up for 6 months after surgery and re-evaluated the status of nerve palsy to detect whether it was temporary or permanent palsy. The results obtained in this series were compared with other national and international studies.

In our series, of the 52 cases studied, superficial parotidectomy was performed in 40 (76.9%) patients. Of them, facial nerve injury was noted in 10 (25%) patients. Of these 10 cases of facial nerve injury, eight (20%) patients had temporary palsy and two (5%) patients had permanent palsy even after follow-up of 6 months. This study is consistent with the study conducted by Rhman and colleagues who mentioned that, of the 30 cases studied, superficial parotidectomy was performed in 23 (76.67%) patients. Of them, facial nerve injury was noted in six (26.08%) patients. Of these six cases of facial nerve injury, five (21.73%) patients had temporary palsy and one (4.34%) patient had permanent palsy even after follow-up of 1 year [13].

Total conservative parotidectomy was performed in 12 (23.1%) patients. Of them, facial nerve injury was noted in 10 (83.3%) patients; of these 10 cases of facial nerve injury, six (50%) patients had temporary palsy and four (33.3%) patients had permanent palsy even after follow-up of 6 months. This study is consistent also with the study conducted by Rhman and colleagues who mentioned that, of the 30 cases studied, superficial parotidectomy was performed in 7 (23.3%) patients. Of them, facial nerve injury was noted in five (71.4%) patients. Of these five cases of facial nerve injury, three (60%) patients had temporary palsy and two (40%) patients had permanent palsy even after follow-up of 1 year [13]. The difference of facial nerve injury between superficial parotidectomy and total conservative parotidectomy is statistically significant ($P < 0.05$).

In a study, it is mentioned that temporary facial nerve palsy occurred in all (26.67%) and in one or two branches (18.88% of the facial nerve). The permanent total paralysis occurred in 10% of the patients and branches were injured in 3.3% of the patients [31]. Here, we found that the main trunk injury was observed in 2/20 (10%); however, no injury was observed in the temporal and zygomatic branches. Hence, the result is not similar to the above study.

The branch of the facial nerve that is most at risk for injury during parotidectomy is the marginal mandibular branch [32]. In our study, we found that cervical branch was the most common injured, 8/20 (40%). Hence, the result is not comparable with the above study.

In a series in case of parotid tumor, superficial lobe was involved in 63.7% of the patients, whereas the deep lobe was involved only in 10% of the patients [33]. In another series, 90.91% of the patients had pleomorphic adenoma in their superficial lobe [13]. In our study, 32 (61.5%) patients had pleomorphic adenoma. Hence, this study is consistent with the first study.

In a study, Tsai *et al.* [34] mentioned that, in case of parotid tumors, 85% are benign tumors and only 12% are the malignant ones. However, in our study, we found that 73% were benign and only 23.1% were malignant.

The incidence of Frey's syndrome after parotidectomy has been reported to be 10–15% [35]. In our study, 5 (9.6%) patients presented with Frey's syndrome; most of them were observed in superficial parotidectomy, 4/40 (10%) ($P = 0.125$). This result is not similar to the above study.

The incidence of postoperative functional outcomes – that is, parotid leak [$N = 11$ (27.5%)]: all cases were

observed in superficial parotidectomy only as sialocele in 5 (12.5%) patients and as parotid fistula — glandular type in 4 (10%) patients or ductal type in 2 (5%) patients. Only ductal parotid fistula was in need for surgical reconstruction. This result was mentioned by Srinidhi *et al.* [36].

## Conclusion

Facial nerve injury is more common in total conservative parotidectomy than in superficial parotidectomy. Early detection of nerve injury is quite helpful to reduce the facial deformity by early reconstruction and other procedures. However, parotid leak is only observed in superficial parotidectomy; most of this leak can be managed conservatively except ductal fistula. Symptomatic Frey's syndrome is more common in superficial parotidectomy.

## Acknowledgements

### Conflicts of interest

None declared.

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