The use of bipolar pure cut mode technology in dissection of parotid tumors: A novel technique

Hady Abou-Ashour, Mahmoud A. Shahin, Mohamed Nazeh Shaker

Department of General Surgery, Faculty of Medicine, Menoufia University Hospital, Menoufia, Egypt

Correspondence to Hady Abou-Ashour, MD, MRCS, Department of General Surgery, Faculty of Medicine, Menoufia University Hospital, Menoufia 32951, Egypt.
Tel: +20 106 400 8666;
e-mail: drhadyabouashour@gmail.com

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Background
The basic concern in parotid surgery is facial nerve preservation. Various methods of dissection have been used to excise the parotid tissue and spare the facial nerve and its branches. Combined (blunt, mosquito tip, monopolar, and bipolar electrocautery, and scissor dissection) procedures are the most widely used techniques. Further new methods were used as an alternative for hemostasis and dissection such as ligasure and ultrasonic devices. New emerging technology of bipolar energy with high voltage and low current gave a benefit of deep coagulation and powerful cutting with less spread of heat to the surrounding tissue. In this study, we tried a new dissection technique with the pure auto-cut bipolar electrodissection with the new versions of bipolar technology to report its effect in parotid tumor surgery.
The primary objective of the study was to evaluate the safety and efficacy of new bipolar pure cut electrodissection and weighing its benefits in the preservation of the facial nerve branches and reducing the postoperative complications.
The secondary objective of the study was to compare the result of the new technique with the results of the conventional technique that was previously performed in our department and the complication of this new technique if any.
Patients and methods
This prospective and retrospective study was held in Menoufia University Hospital. Our study included 30 patients with parotid tumors, where 15 retrospective patients underwent conventional parotidectomy (superficial and/or total parotidectomy) and were referred as group B, and 15 prospective patients underwent parotidectomy (superficial or total parotidectomy) and were referred as group A, using the bipolar pure auto-cut electrodissection technique by advanced bipolar technology.
Results
The mean operative time was significantly lower in group A patients than in group B, where the time for superficial parotidectomy was 100±14 min in group A and 117±11 min in group B and for total parotidectomy was 118±12 min in group A and 139±18 min in group B (P=0.001). Regarding postoperative complications, in group A, we reported one case with temporary nerve affection. However, in group B, we reported two cases of wound infection, one case with salivary fistula, two cases with seroma, two cases of temporary nerve affection, two cases of permanent nerve branch affection, and one case of Frey syndrome. Regarding tumor recurrence, we reported only one case in group B.
Conclusions
Using the new bipolar pure cut technique in various types of parotid tumors is technically easier for meticulous fast dissection around the facial nerve branches, showing significantly shorter operative time and less incidence of seroma, wound infection, salivary fistula, and facial nerve injury.

Keywords:
bipolar in parotidectomy, parotid tumors, sealing devices in parotidectomy, superficial parotidectomy, total parotidectomy

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Introduction

Salivary gland tumors are the most complicated tumors in the body. Overall, 20% of all parotid tumors are malignant in origin [1–3]. Patients with parotid gland tumor experience several symptoms such as swelling of the face and jaw, often resulting in dissymmetry of the mouth, and even loss of facial movement. In addition, malignant parotid tumors invade adjacent structures, including the facial nerve, weakness, or paralysis [4]. Ultrasound and fine-needle aspiration cytology can help in the diagnosis of parotid tumors. MRI can be used if the tumor does not appear on the US. Moreover, CT can diagnose bone invasion in case of

malignant tumors [5,6]. The main way to treat parotid tumors is through surgery [6]. Extracapsular dissection and partial superficial parotidectomy have become more popular than superficial parotidectomy [7–9].

Several complications may occur postoperatively, including facial nerve paralysis, postoperative Frey syndrome, loss of sensation due to injury of the great auricular nerve [10–13], and the risk of postoperative salivary fistula [14–16]. Thus, treatment of parotid neoplasms has progressed in the direction of less-invasive procedures in the past few years [17]. These safe, effective, and less-invasive procedures that were reported to be performed for parotid surgery are the harmonic scalpel and bipolar dissection methods [18].

Bipolar forceps is considered one of the electrosurgical instruments that is usually used as a hemostatic device during surgeries. In 1998, the first bipolar vessel-sealing devices were offered to the medical community. It differs from the monopolar modes in that in bipolar mode the current passes through the tissue from one side of the forceps to the other side. Therefore, it will be used only in tissues that can be grabbed between the two forceps sides. As a result, the electrical current will be restricted to the area between the forceps. This means the risk of burn is reduced considerably [19,20].

With the use of a pair of bipolar forceps, the devices can compress tissue bundles or arteries while applying a voltage. The current's thermal action leads the walls of vessels to close off and prevent leakage. The optimal temperature range for denatured tissue proteins is 60–70°C. Mild thermal collateral injury is sustained as the heat is contained almost entirely within the forceps [20].

In this study, we aimed to evaluate the safety and efficacy of bipolar pure cut forceps for not only being hemostatic but also as a new technique in the continuous dissection of the parotid tissue and weighing its benefits in the preservation of the facial nerve and reducing the postoperative complication and comparing it with the conventional technique.

Patients and methods

Study design and setting

This combined prospective and retrospective study was held at Menoufia University Hospital in Egypt.

The primary objective of the study was to evaluate the safety and efficacy of new bipolar pure cut electrodissection in the continuous electrodissection of the parotid tissue and weighing its benefits in the preservation of the facial nerve branches and reducing postoperative complications.

The secondary objective of the study was to compare the result of the new technique with the results of the conventional technique performed in our department and the complication of the new technique if any.

Study populations

Our study included 30 patients with parotid tumors from two different periods (prospective and retrospective). The prospective period was from January 2021 to December 2022. This period included 15 patients (group A) with parotid tumors who underwent superficial or total parotidectomy using the bipolar pure auto-cut technique. The retrospective period was from September 2019 to December 2021. This period included 15 patients (group B) with parotid tumors who underwent a conventional superficial or total parotidectomy. Patients of the two groups were matched for age and sex.

Before the study initiation, the sample size was calculated using G*power software (version 3.1.9.2, Heinrich-Heine-Universität Düsseldorf, Germany) (*Z* test – proportions): the difference between two independent proportions, with an alpha error of 5%, and power of 80%, and based on the effect size of 0.73 for the outcome of XXXX, the required sample size for the study was 30 patients (15 for each group).

Ethical approval was obtained from the institutional review board of the Menoufia Faculty of Medicine for prospective cases. Our research adhered to the principles of the Helsinki declaration. Written informed consent was obtained from each patient in the prospective group before the recruitment. The exclusion criteria of the patients were (a) patient age less than 18 years old, (b) previous parotidectomy, (c) previous head and neck radiation therapy, (d) previous facial nerve weakness, (e) advanced parotid cancers with facial nerve involvement with or without nodal involvement, (f) patients with coagulation disorders, (g) patients with insufficient data, and (h) patients who had been lost to follow-up.

Data collection

For the retrospective group, the following data were obtained from the hospital records: demographic data (age and sex), clinical presentation, type of tumor, preoperative assessments, diagnosis, surgical management, operative time, intraoperative blood

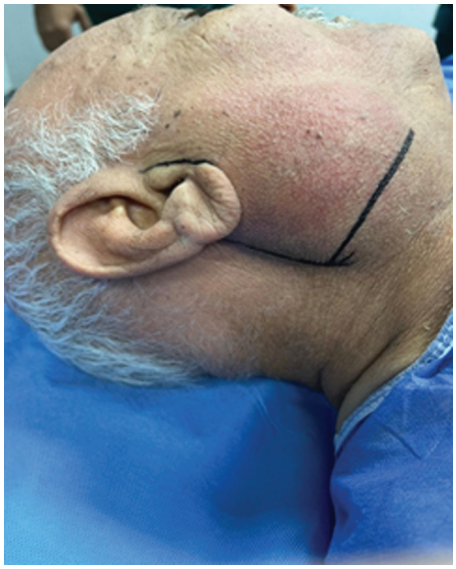
bleeding, and postoperative complications. For the prospective group, complete medical history and physical examination were done for each patient. Ultrasonographic examination was done on all patients. Magnetic resonance tomography was done on the tumors that cannot be assessed accurately by ultrasound. If a patient was suspected to have a parotid malignancy or bone infiltration, computed tomography was performed. The same outcomes collected for the retrospective group were also collected for the prospective cases. After the confirmation of diagnosis, the patients were prepared for superficial or total parotidectomy using the bipolar pure auto-cut technique.

Surgical procedure of the new technique

Conventional bipolar energy forceps were conventionally used for hemostasis during dissection to have a focused electrocoagulation with less spread of heat to the surrounding tissues and the adjacent nerve branches, but it had low coagulation capacity and short interval of delivering energy to tissues. Some new energy devices deliver bipolar energy with deep coagulation with a cutting ability like ligasure device. In our study, we tried this advantage of the cutting mode for dissection of the parotid tumors (video is provided and uploaded). Under general anesthesia, the patient's position was adjusted using head collar and the patient neck was extended and flexed to the opposite side of the tumor to facilitate surgery and exposure of the parotid region during dissection. A modified Blair skin incision was performed in all cases. Modified Blair incision or incision was generally performed in parotidectomy (Fig. 1). Monopolar diathermy and/or face lift scissors were used to raise the flap. We dissected the anterior edge of the sternocleidomastoid muscle and the posterior bottom of the digastric muscle. At this point, a tunnel was created in front of the tragus until the pointer cartilage was reached. Once we identified the main trunk of the facial nerve, we used Lamidey Noury electrosurgical generator, Optima, France, which is available as one of the advanced energy devices in our operative theater in the Department of General Surgery, Menoufia University Hospital. We continued dissection adjacent to the nerve branches one by one, starting from the main trunk, where it was carried out with the aid of bipolar pure cut electrodissection mode (power 70–90 W) (Fig. 2). Using the electrodissection forceps for patients in group A, we grasped sequentially a bundle of parotid tissue and the device directly started its action once there is tissue impedance between the two fine blades of the forceps. Pure auto-cut energy can continue delivering energy until the tissues automatically separate within about 2 s without carbonization of tissue or heat dissemination. We used the conventional technique of blunt mosquito tunneling of the parotid tissue then electrocautery and then scissor dissection for the patients in group B (Fig. 3). After dissection of the superficial lobe, we assessed the integrity of the facial nerve and its branches and confirmed the precision of surgery.

In total conservative parotidectomy, bipolar cut technique is used for separating the facial nerve from the surface of the deep lobe, and then the parotid tissue was separated from the underlying structure, including

Figure 1

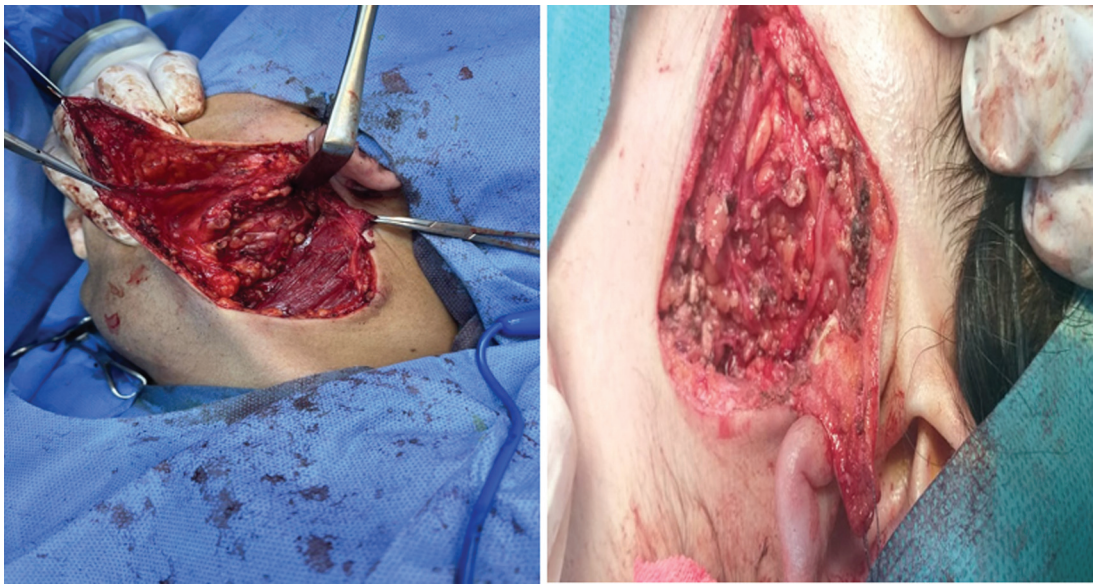


Preauricular incision and 3 cm below the mandible.

Figure 2

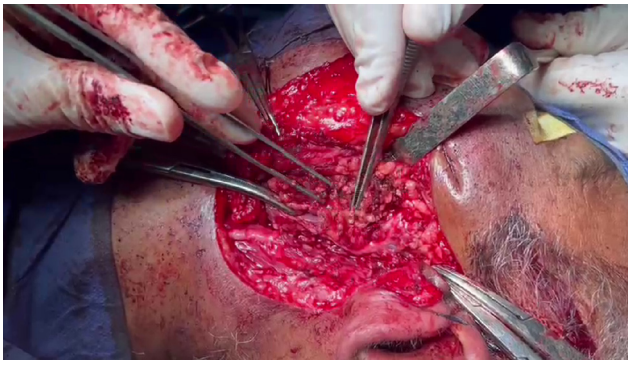
An electrosurgical device with an option of precise pure and various cutting and coagulation modes (we preferred the pure auto-cut mode (good synchronous both cutting and coagulation). Lamidey Noury Medical, Optima generator, France (a new device which can deliver monopolar, bipolar, plasma energy with different modes).

Figure 3



Superficial parotidectomy using the conventional technique in two different patients. Left superficial parotidectomy in a male patient. Left superficial parotidectomy in a female patient.

Video 1



Dissection around the facial nerve branches.

the retromandibular vein (Video 1) The parotid tissue was carefully dissected and delivered under bridges of facial nerve branches and extracted either between buccal branches or the buccal and the marginal mandibular branch (Fig. 4). Finally, a suction drain was placed, and the skin was closed in layers.

We assessed the facial nerve function after surgery immediately and one day after surgery, and the patient was asked to furrow their eyebrows, forcibly close their eyes, show their teeth, and pucker the lips into a whistling shape (Fig. 5).

Follow-up: patients were followed up for 1 year, which included evaluation of the surgical outcome facial nerve functions, Frey syndrome, and recurrence.

Statistical analysis

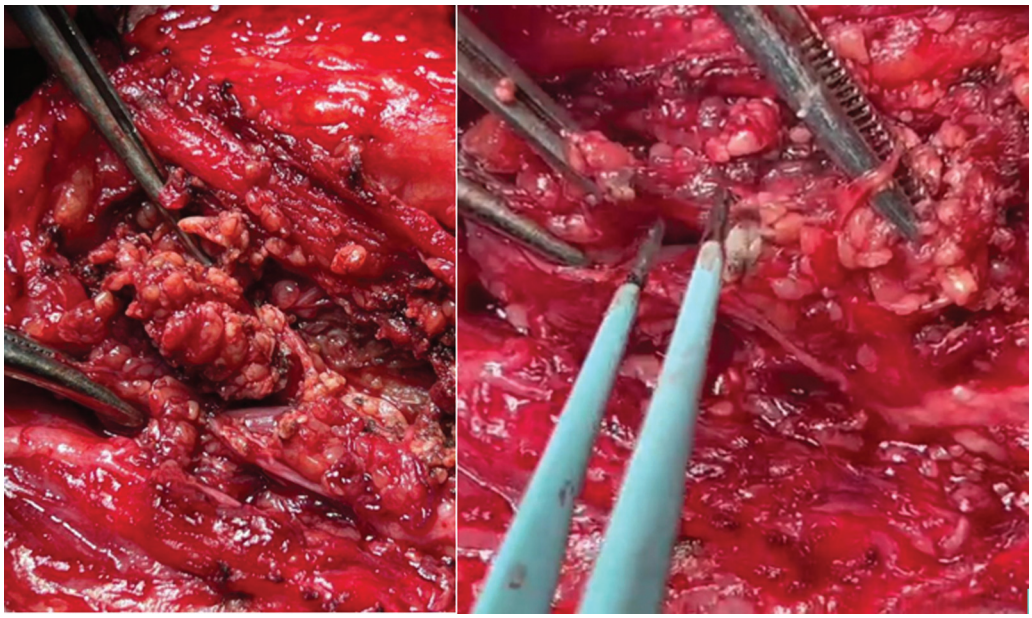
Statistical analysis was performed with SPSS statistical software, version 26 (IBM, Chicago, Illinois, USA). The normality of the data was tested by Shapiro–Wilk test. Continuous data were expressed as mean±SD and were compared using the independent t test. Categorical data were expressed as numbers and percent and were compared using the χ^2 test and Fisher exact test. P value less than 0.05 was considered significant.

Results

Our study included 30 patients with parotid tumors: 15 patients who underwent conventional parotidectomy, and 15 patients who underwent parotidectomy using the bipolar pure auto-cut technique. The procedure was performed by the same surgical team.

Table 1 shows the demographic and clinical data of the studied patients. The male and female percentages were equal in the study (Fig. 6); however, the percentage of females was more than that of males in both groups. In our study, the most prevalent types of parotid tumor were the pleomorphic adenoma, which was present in 46.7% of the patients in group A and 53.3% of the patients in group B, followed by Warthin's tumor, which was present in 26.7% of patients in group A and 20% of the patients in group B (Fig. 7). The difference between the two groups regarding the type of tumor was not significant statistically (P=0.62).

Figure 4



Dissection and delivering the deep lobe between the facial nerve branches in two different cases.

Figure 5

Preoperative parotid tumor and assessing the facial nerve function (frontalis frowning and orbicularis oculi and facial expressions).

Regarding the operative outcomes of the study, 66.7% of the patients in group A and 73.3% of the patients in group B underwent superficial parotidectomy. The mean operative time was significantly lower in group A patients than in group B, where superficial parotidectomy time was 100±14 min in group A and 117±11 min in group B, as well as in total conservative parotidectomy, where the time was 118±12 min in group A and 139±18 min in group B (Fig. 8), with *P* value of 0.001 (Table 2).

In terms of postoperative complications (Fig. 9), in group A, we reported only one case with temporary nerve affection which resolved after 2 months. However, in group B, we reported two cases of wound infection, one case with salivary fistula, two cases with seroma, two cases of temporary nerve affection (resolved after 4 months), two cases with permanent nerve branch affection(continued over 1 year), and one case of Frey syndrome that appeared after 8 months. We did not report any cases of postoperative bleeding. Regarding tumor recurrence, we reported only one case in group B in a polymorphic adenoma case. The difference between the two groups regarding the complications was not significant statistically (*P*=0.2) (Table 3).

Discussion

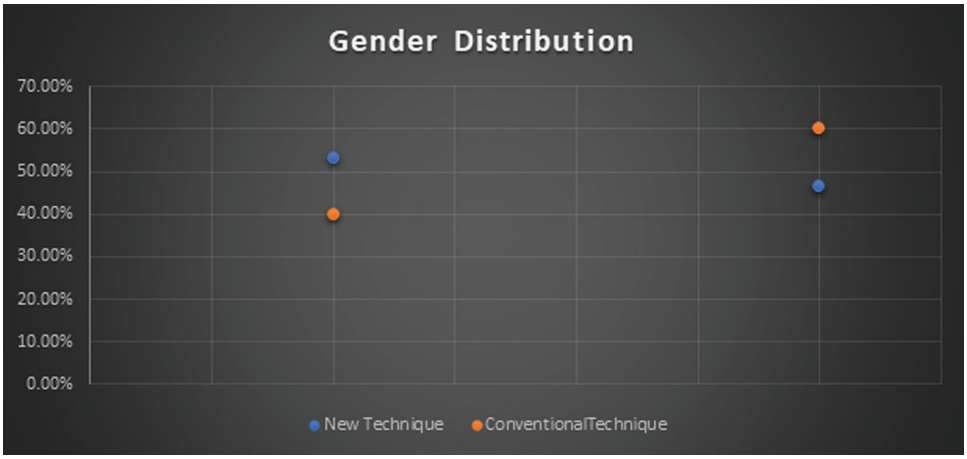
The main way to treat parotid tumors is through surgery [6]. The most frequently reported benign

Table 1 Demographic and clinical characteristics of the studied patients

Variables	Group A (new technique) (*N*=15)	Group B (conventional technique) (*N*=15)	*P* value
Age (years) (mean±SD)	59.8±2.9	60.4±3.2	0.5[a]
Sex [*n* (%)]			
Male	8(53.3)	6 (40)	
Female	7 (46.6)	9 (60)	0.64[b]
Type of tumor [*n* (%)]			
Pleomorphic adenoma	7 (46.7)	8 (53.3)	
Monomorphic adenoma	1 (6.7)	3 (20%)	
Warthin's tumor (Fig. 12)	4 (26.7)	3 (20)	0.62[c]
Mucoepidermoid carcinoma	2 (13.3)	1 (6.7)	
Pleomorphous low-grade adenocarcinoma	1 (6.7)	0	

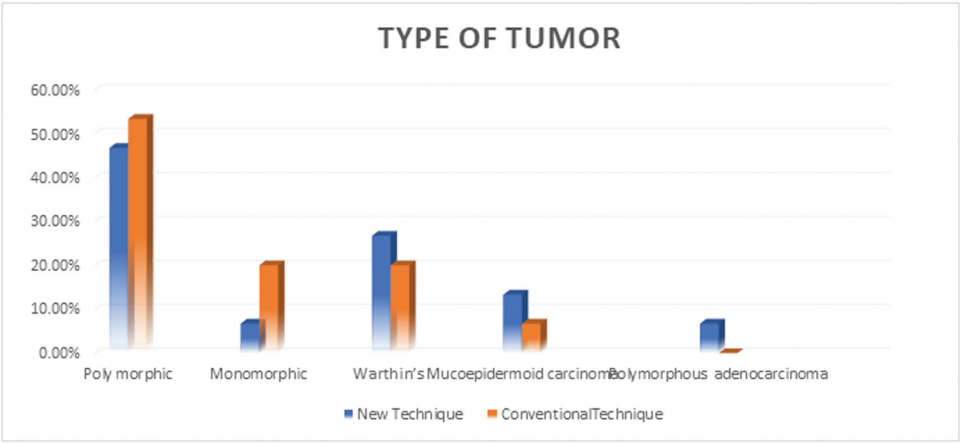
Column percentages are considered. [a]Independent *t* test. [b]Fisher exact test. [c]χ^2 test.

Figure 6



Sex distribution.

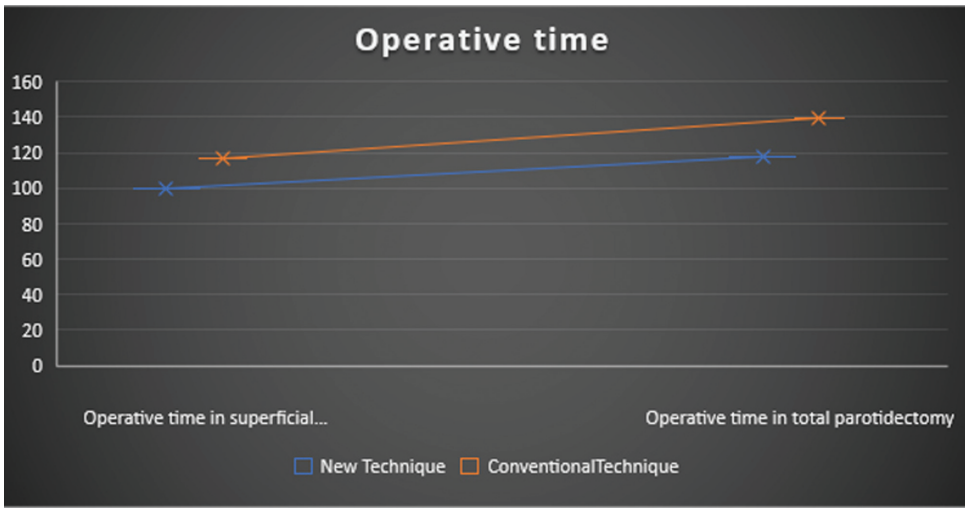
Figure 7



The type of tumors.

parotid tumors were pleomorphic adenomas [21,22]. Pleomorphic adenomas have been reported in the literature in 51–85% of benign parotid tumors [22–24]. In our study, pleomorphic adenoma was also reported as the most common benign parotid tumor, accounting for ~51% of all benign parotid masses in both groups combined. A pleomorphic adenoma may spread into the surrounding normal gland tissue. Thus, if the tumor cannot be entirely dissected, the recurrence rate would be high [20].

Figure 8



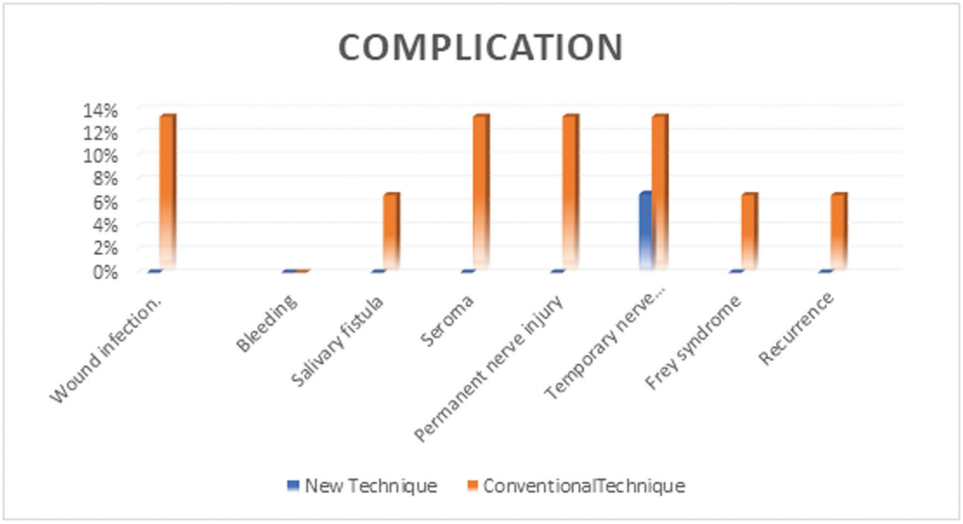
Boxplot change in operative time from two techniques.

Table 2 Operative outcomes of the studied patients

Variables	Group A (*N*=15)	Group B (*N*=15)	*P* value
Operative time in superficial parotidectomy (min)	100±14	117±11	0.001[a*]
Operative time in total conservative. parotidectomy	118±12	139±18	0.001[a*]
Type of surgery [*n* (%)]			
Superficial parotidectomy	10 (66.7)	11 (73.3)	1[b]
Total conservative parotidectomy	5 (33.3)	4 (26.7)	

Column percentages are considered. [a]Independent *t* test. [b]Fisher exact test.

Figure 9



Complications between two groups.

Hemostatic devices were proven to be very effective in parotid tumor surgeries. Allen *et al.* [25] reported that they were found to reduce surgery time, intraoperative blood loss, and postoperative drain output. However, they did not favor either device. Now several hemostatic devices are used for this purpose, for example, Prokopakis *et al.* [26] used Ligasure Vessel Sealing System in their prospective study for treating patients undergoing superficial parotidectomy. Moreover, Jackson *et al.* [27] and Polacco *et al.*, [28]

Table 3 Postoperative complications of the studied groups

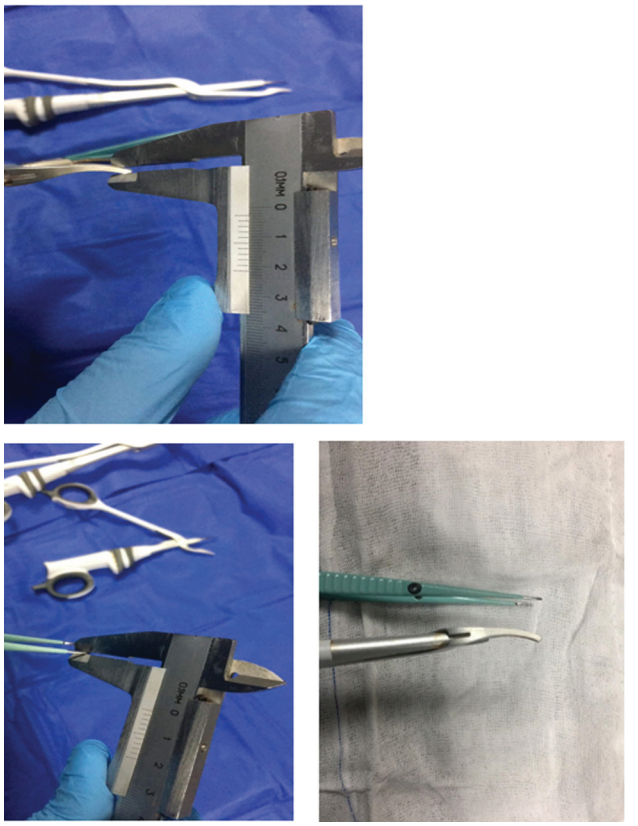
	Group A (*N*=15)	Group B (*N*=15)	*P* value[a]
Complications [*n* (%)]			
Wound infection	0	2 (13.3)	
Bleeding	0	0	
Salivary fistula	0	1 (6.6)	0.1
Seroma	0	2 (13.3)	
Permanent nerve branch injury	0	2 (13.3%) (frontal+buccal)	
Temporary nerve affection (frontal)	1 (6.7)	2 (13.3%) (buccal+frontal)	
Frey syndrome	0	1 (6.6)	
Recurrence of the tumor	0	1 (6.6)	
Duration of drain	Mean (2±1) 2–3 days	Mean (3±1.6) 2–5 days	0.1

Column percentages are considered. [a]χ^2 test.

used harmonic scalpels in their total and superficial surgeries. In 2020, Chiesa-Estomba *et al.* [18] compared conventional bipolar diathermy versus harmonic scalpel in parotid tumor surgeries and found that harmonic scalpel had a higher complication rate (48.3%) than the bipolar dissection method (39.6%). They reported an operative time of 114±39 min in harmonic scalpel and 135±38 min with bipolar dissection, considering that 76% of their patient underwent partial superficial parotidectomy and 13% extracapsular dissection. Comparing our study with the study of Chiesa-Estomba *et al.* [18], we reported a shorter operative time for superficial parotidectomy (100±14 min) compared with total parotidectomy (118±12 min) than the reported operative time of both techniques they used. We tried ligasure and harmonic scalpel sporadically in our clinical practice in parotid surgery, but we found their jaw blades are too large to dissect around the facial nerve branches; moreover, they have a higher cost burden and are nonreusable nor autoclavable compared with the reusable autoclavable bipolar forceps. In addition, we found bipolar forceps had finer tips and compatible in size with nerve branches compared to the wide jaw's blades of both ligasure and harmonic scalpel (Fig. 10). This allowed us to easily trace the facial nerve branches and dissect around it through the parotid tissue. Again, the bipolar forceps were easily grasped between the thumb and index fingers, which gave more precise dissection around the fine facial nerve threads. On the contrary, ligasure and harmonic scalpel are grasped by the hand grip, which has a less precise function for accurately tracing the fine nerve threads than the thumb and finger control (Video 2)

Surgery time is very crucial, in which the length of surgery correlates with a higher incidence of intraoperative and postoperative complications. Shkedy *et al.* [29] reported a period of more than 120 min as a predictor of surgical wound infection.

Figure 10

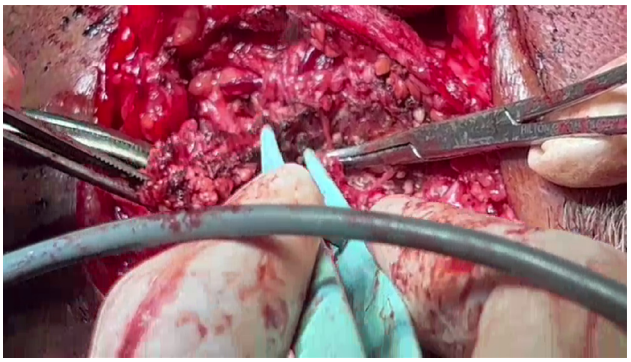


Comparing the caliber of bipolar forceps tip, ligasure, and harmonic scalper tips (note the thinner caliber of the bipolar forceps 1 and 2.4 mm, respectively).

Thus, a huge advantage in our study was the shorter time of surgery with an average of 118±12 min in total conservative parotidectomy using the new bipolar pure cut technique. Moreover, there was a significant short operative time in superficial parotidectomy (100 ±14 min) in group A compared with group B (*P*=0.001) (Table 2).

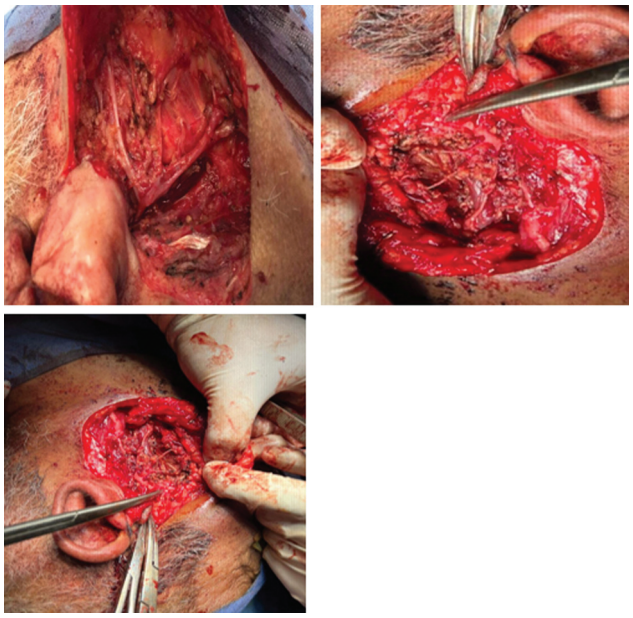
On the contrary, Bohatch Júnior *et al.* [30] reported a longer average surgical time of 219.33±88.99 min.

Video 2



Dissection of the deep lobe and preserving the facial nerve branches.

Figure 11



Right total conservative parotidectomy using the new bipolar auto-cut technique (removal of all parotid tissue including the deep lobe with no carbonization and preserved facial FN integrity) and left total parotidectomy with the same technique (note the variability between the nerve branches caliber from patient to patient and the quality of complete dissection and integrity of fine and the finer FN branches). Note the nerve branches on the left parotid are variably finer than that of the right parotid and more liable to injury. Right total conservative parotidectomy. Left total conservative parotidectomy. FN, facial nerve.

According to our study, we had no recurrence in group A, but we had one case (one out of 15) (6%) of recurrence in group B. Absence of recurrence in group A may be owing to the finer dissection of all the affected tissue close to the nerves. Mlees and Elbarbary [31] and Uyar [32] reported a 0% recurrence rate in their studies of a total of 104 patients. However, McGurk *et al.* [33], Cristofaro *et al.* [34], and Ozturk *et al.* [35] reported a nearly 2% recurrence rate in their studies. Yet, Natvig and Søberg [36] suggested that the rate of recurrence could increase slightly by nearly 2.5% when the minimum follow-up was higher than 10 years.

Concerning facial nerve injury, Orabona *et al.* [37] and Bonavolontà *et al.* [38] reported transient facial nerve injury of 26.8 and 23.6%, respectively, and facial paralysis of 3.9 and 6.7%, respectively in their cases who underwent superficial parotidectomy. Bohatch *et al.* [30] reported that 42.1% of their patients had some degree of facial nerve injury, which was very high. In contrast, our study reported much more favorable outcomes in which transient facial nerve injury and facial branch affection of the new and conventional groups showed 0% in group A compared with 2% in group B – permanent – and 1% in group A compared with 2% in group B – temporary.

Moreover, we found the use of pure cut technique facilitates and fastens dissection of parotid tissue leaving a clear white field without carbonization and precise tracing of the facial nerve fibers without the need for magnification of neurostimulation (Fig. 11).

A salivary fistula sometimes occurs when saliva leaks from the resected edge of the remaining parotid gland and accumulates under the skin flap. As a result, this collected saliva flows through the wound and forms a salivary fistula [39]. No complications concerning salivary fistulas or seromas were reported in the bipolar pure cut group (group A), but we had one (6%) case of salivary fistula in group B, which may denote that the new bipolar pure cut technique addressed a better sealing of the fine glandular ducts. We also reported a shorter period of postoperative drainage in favor of group A (Table 3). A similar rate was found by Cristofaro *et al.*, [34], who reported only a case with salivary fistula in their series of 45 cases. However, Bonavolontà *et al.* [38] and Laskawi *et al.* [40] reported a higher incidence of salivary fistulas (4.5 and 4%, respectively) in their study following parotidectomy. Yet, the highest incidence was reported by Wax and Tarshis [41], who reported an overall postoperative fistula rate of 14% (Fig. 12).

Bleeding usually occurs owing to inadequate hemostasis at the time of the surgery. Thus, we had no cases of bleeding or hematomas. On the contrary, Bonavolontà *et al.* [38] and Bohatch Júnior *et al.* [30] had 9 and 10.5%, respectively, bleeding incidents in their studies.

Figure 12

Dumbbell type of Warthin's tumor originating from the deep lobe in dumbbell with multiple intraglandular similar cysts treated by total conservative parotidectomy with the new technique.

We did not report postoperative infections in group A. However, two patients had postoperative infections in group B. Similar infection rates were reported by Meccariello *et al.* [42], who reported an infection rate of 6.5% of their 448 cases, and Bohatch Júnior *et al.* [30], who reported 10.5% of their cases had surgical site infections. We found the new bipolar pure cut technique to be feasible, rapid, safe, and effective with minimal complication rate.

Conclusion

When treating parotid gland tumors, total and superficial parotidectomy using the bipolar pure cut method is superior to conventional parotid excision by combined blunt mosquito tip dissection, cautery, and scissors dissection. In addition, the bipolar pure cut technique was found more convenient than conventional method concerning the length of surgery and the lesser incidences of facial nerve affection, wound infection, seroma, and duration of wound drainage.

Limitations of this study

The study was limited by its combined retrospective and prospective nature, as well as its small sample size.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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