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HEAD AND NECK

Long-term results of combined approach in parotid sialolithiasis

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Abstract Combined sialendoscopic and transcutaneous approach in parotid sialolithiasis is a surgical option for large and impacted stones. The aim of this study is to assess the long-term results regarding postoperative stenosis, recurrent swellings and gland function. Prospective study in a tertiary referral center of patients with parotid sialolithiasis requiring combined approach. A total of 12 patients have been treated within a period of 3 years. Intraductal stents were placed in 9 of 12 cases. Scintigraphic evaluation of salivary glands and follow-up sialendoscopy performed 1 year postoperatively. In total, fourteen stones (two stones in two cases) were successfully removed along with two coexisted inflammatory polyps. Postoperative endoscopic evaluation revealed mild stenosis in 7 out of 12 cases without clinical significance as no recurrent swellings were reported. Scintigraphy showed normal gland function in 11 cases and mild hypofunction in 1 case with long-standing history of sialolithiasis. All patients were free of symptoms within the follow-up period of time (median follow-up 15.5 months). Combined approach is a safe, gland preserving and efficacious procedure in long term. The stenosis in the area of ductal surgical opening when present does not seem to be of clinical value.

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Introduction

Although the evolution of endoscopic techniques decreased significantly the external procedures for parotid sialolithiasis, almost 25 % of all cases require an open surgical approach of the gland [1, 2].

The majority of these cases can be treated with a combination of sialendoscopy and transcutaneous access extending the indications of gland-preserving strategy [1, 2]. Indications for this combined approach are failure of interventional sialendoscopy to treat impacted calculi or stones larger than 7 mm and a non successful extra- or intracorporeal lithotripsy [3].

Only a few studies on combined approach for parotid sialolithiasis exist with relatively small cohorts of patients. Nahlieli et al. [4], first presented 12 patients, followed by McGurk et al. [5] with 7 patients, Marchal [6] with 37 patients, Koch et al. [7, 8] in two studies with 9 and 19 patients, Walvekar et al. [9] with 10 patients, Kopec et al. [10] with 5 patients and Klein and Ardekian [11] with 6 patients. Although their results present high success rates their follow-up is relatively short. Only one study by Koch et al. [8] reported medium to long-term results, however, without postoperative endoscopic evaluation. As the removal of a stone via this procedure requires incision of the ductal system one can argue that this may cause stenosis in the long term. Our study aims to assess the long-term efficacy of the combined approach presenting sialendoscopy findings, parotid scintigraphy results and clinical outcome 1 year post-intervention.

Table 1 Patients' demographics in relation with stone characteristics and need for stent

Patient	Gender (F/M)	Age	Side (L/R)	Disease duration (months)	Gland incision	Number of stones	Stone size (mm)	Stone location	Stent
1	M	73	L	5	π	1	9 × 4	Proximal	+
2	M	51	R	10	π	1	12 × 8 × 4[a]	Proximal	+
3	M	60	L	7	π	1	5 × 7	Proximal	–
4	F	61	L	11	π	1	8 × 4	Middle	+
5	M	65	R	23	l	2	7 × 3 2 × 2	Middle	+
6	F	71	L	8	π	1	7 × 4	Proximal	–
7	M	59	R	14	l	1	6 × 5	Proximal	+
8	M	51	R	7	l	1	5 × 3	Middle	–
9	M	56	L	120	I	1	6 × 4	Middle	+
10	M	67	R	8	π	1	7 × 3	Middle	+
11	M	58	R	12	l	1	10 × 4	Proximal	+
12	M	55	R	9	π	2	8 × 3 3 × 2	Proximal	+

Gland incision is described as "π" for π-shaped parenchymal flap or "l" for a longitudinal parenchymal incision over the duct. Stones divided according to their location to those in the proximal third to the gland, middle third and distal third

[a] Three diameters are reported as the stone was fork shaped

Material and methods

Patients

A total of 12 patients with parotid sialolithiasis have been treated at the 2nd Academic ORL Department of Aristotle University of Thessaloniki in a period of 3 years with the combined approach. This represents approximately the 5 % from a total of 220 patients with obstructive parotid disorders treated in the above period of time endoscopically. This case series included 8 male and 4 female patients, with a mean age of 60.2 years (range 35–67) and had the approval of the Aristotle's University Ethic Committee. The indications were stones ≥7 mm in 6 cases, coincidence of ductal polyp and stone in 2 cases, impacted stone in 4 cases. Demographic data are analytically presented in Table 1.

Although our first line of imaging is ultrasound (U/S), the vast majority of patients (11/12) had unfortunately a preoperative computerized tomography (CT) scan from elsewhere. In one patient who evaluated in our department, the U/S could not distinguish the presence of one or two stones and a CT scan gave the additional information.

Diagnostic sialendoscopy was carried out before the procedure in all patients to ensure that endoscopic localization of the stone was possible. A semirigid endoscope [Marchal type 1.1 (Karl Storz Ltd., Tuttlingen, Germany] and instruments for sialendoscopy were used.

All patients provided written informed consent after detailed explanation of the procedure and its risks.

Surgical technique

All operations performed under general anesthesia and facial nerve monitoring (four-channel electromyography, NIM pulse 2.0, Medtronic Inc, Minneapolis, USA).

Initially sialendoscopy confirmed the location of the stone in the ductal system and its position was marked on the skin of the parotid area via transillumination.

In all cases, a parotid incision approach performed with the skin flap exposing enough surface of the gland for stone removal. Transillumination of the sialendoscope's tip into the ductal system is mandatory for a precise gland-preserving dissection technique.

When the stone was located superficially, a longitudinal incision of the gland parenchyma (1–1.5 cm in length) above the endoscope light was performed (Fig. 1a). However, in stones with deeper location (>5 mm from the surface of the gland), a glandular Π-shaped mini-flap prepared above the ductal system (Fig. 1b).

In cases with coincidence of a ductal polyp or with extended opening (>1 cm) of the ductal system or laborious removal of an impacted stone, a stent (Sialotech Ltd., Ashkelon, Israel) was placed retrograde via the surgical field and secured in buccal mucosa with absorbable sutures. The stent stayed in place for a period of 3 weeks.

The closure of the parotid duct was carried out using absorbable sutures (Vicryl 5-0; Ethicon Products, Norderstedt, Germany). Fibrin glue and absorbable sutures were used for the repositioning of the gland flap in cases of non superficial stone location.

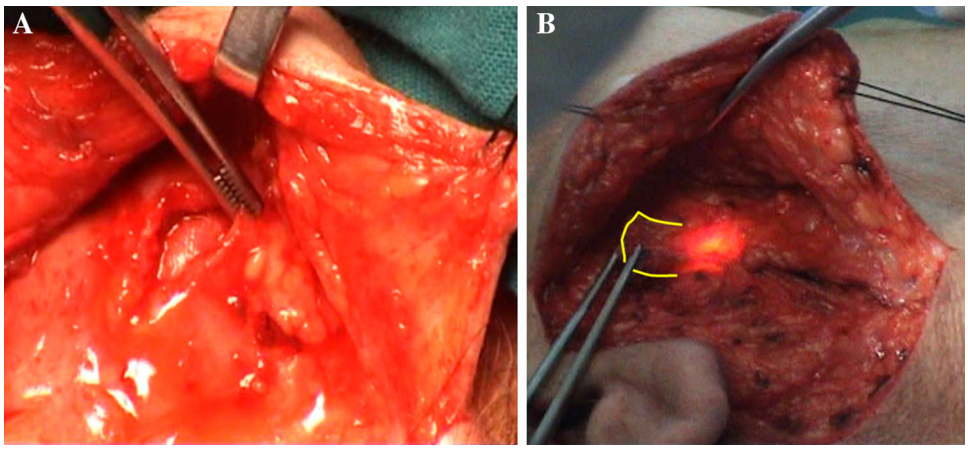

Fig. 1 **a** Longitudinal incision of the parotid gland parenchyma for exposure of a stone located superficially. **b** Mini-flap (*Π shaped*) of parotid parenchyma for exposure of a stone located deeper that 0.5 mm from the surface of the gland. Location of the stone is indicated by the transillumination of the endoscope's light

Follow-up

Early complications such as hematoma, sialadenitis, wound infection, fistula, and obstructed and/or extruded stent were recorded within the first postoperative month where patients assessed on a weekly basis. Then all patients had a regular follow-up every 3 months in which they were examined to assess a normal saliva flow after palpation of the gland and they were asked to report any parotid swelling. At the regular clinical examination, undisturbed glandular function was evident from the lack of symptoms and from clear secretory flow from the papilla after gland massage. One year postoperatively they underwent a follow-up sialendoscopy under local anesthesia.

In addition, scintigraphy of the salivary glands was also performed in all cases for an objective functional evaluation. Dynamic imaging of the whole anterior head started after a bolus of intravenous injection of 185 MBq ^{99m}Tc-pertechnetate, at 1 frame per 30 s for 30 min. At 15 min after injection, diluted lemon juice was given orally. Two function parameters were measured after analysis of the time-activity curves: (1) uptake rate, taken as the value of the initial slope of the time-activity curve, and (2) washout fraction, which was the relative mobilized radioactivity from each parotid gland after ingestion of the sialogogue.

Descriptive statistics are presented within the body of the text as mean values or percentages ± standard deviation of means (SD).

Results

In total, 12 patients (10 males, 2 females) with a mean age of 48.8 years underwent a combined (endoscopic and transcutaneous) removal of a parotid stone. Fourteen stones were removed in total. Two patients had two stones in the site of obstruction with the smaller stone lying just behind a larger stone in both cases. Additionally, two patients had impacted stones behind a ductal polyp (Fig. 2a, b). The location of stones was mainly the proximal third of the ductal system in 7 cases and the middle in 5 cases. In nine patients, a stent was placed in the parotid duct after the stone removal (Table 1).

Early complications included one case of hematoma, one case of microbial parotitis, and one case of stent extrusion. Hematoma was managed conservatively; infection was managed with antibiotics for 2 weeks and removal of the stent. In another patient the stent was extruded after 2 weeks being in place and thus our decision was not to replace it to avoid forceful movements at the site of duct surgical opening. None of the patients presented facial nerve paralysis or fistula in our series.

In total, the gland was preserved in all cases and a parotidectomy was avoided. The required operative time for the entire study group had a mean of 108.5 min (range 97–140 min). The first four cases lasted longer than the following eight operations as an effect of our learning curve (initial mean time 124.5 min vs late mean time 104.2 min).

Endoscopic findings 1 year later showed patent ductal system in all cases with no stenosis in 5 patients and mild stenosis in 7 patients allowing the assessment of the post-stenotic area with 1.1 mm diameter endoscope (Fig. 3a, b). No epithelial debris or inorganic material was observed in the follow-up endoscopy.

Scintigraphic evaluation of the parotid glands 1 year postoperatively showed normal function in 11 cases and mild hypofunction in one case. The patient with the gland hypofunction had superficial stone and minimal surgical manipulation of the gland was performed. However, in this case a long history of sialolithiasis was reported (21 years). Specifically scintigraphic results showed a mean uptake value of 0.34 % ± 0.08 (normal range 0.6–0.17 %) [12]. The mean washout fraction of the tracer after the lemon

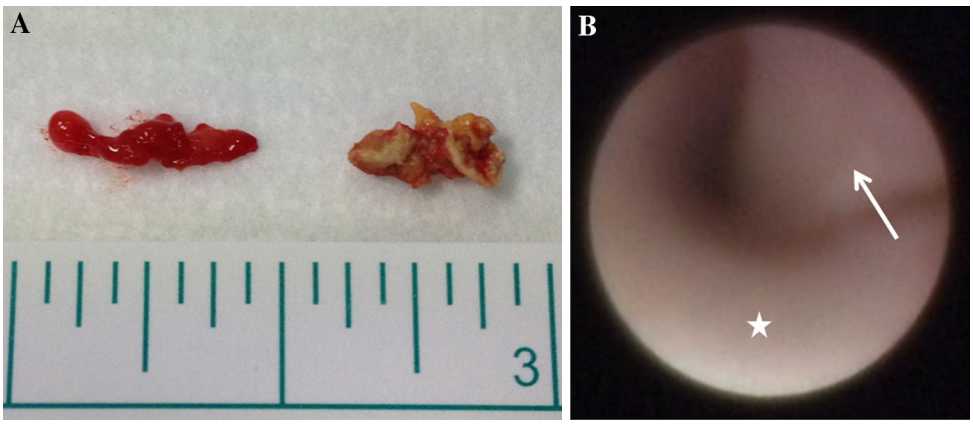

Fig. 2 **a** Ductal polyp and impacted stone after their removal via a combined approach. **b** Endoscopic view of the polyp's pedicle

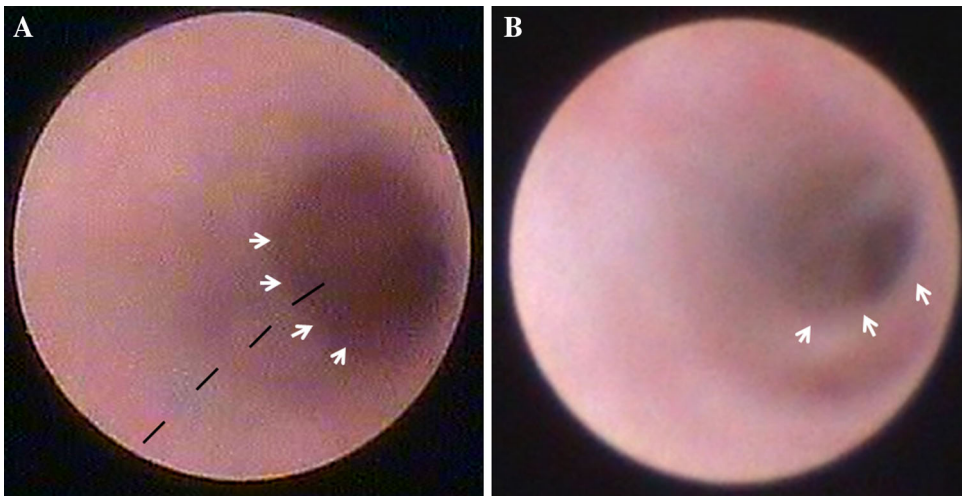

Fig. 3 Endoscopic findings 1 year postoperatively. **a** Mild stenosis as noted in the left side of ductal lumen (*white arrows*). The *interrupted line* indicates the site of incision. **b**. Postoperative stenosis (*white arrows*) in a patient with coincidence of stone and ductal polyp

Table 2 Scintigraphic results of the study group

Patient	Gender (F/M)	Age	Duration of the disease (months)	Tracer uptake	Tracer washout (%)	Gland function
1	M	73	5	0.42	49	Normal
2	M	51	10	0.33	55	Normal
3	M	60	7	0.27	52	Normal
4	F	61	11	0.25	50	Normal
5	M	65	23	0.26	48	Normal
6	F	71	8	0.51	60	Normal
7	M	59	14	0.38	51	Normal
8	M	51	7	0.44	56	Normal
9	M	56	120	0.16	43	Mild hypofunction
10	M	67	8	0.37	50	Normal
11	M	58	12	0.28	51	Normal
12	M	55	9	0.49	57	Normal

juice stimulation was 51.8 % ± 2.1 (normal range 61–48 %) [10]. All scintigraphic results are analytically presented in Table 2.

Clinical examination revealed clear saliva flow from the papilla in all patients. Parotid glands were not swollen and soft in palpation at the follow-up assessment. In all patients

there was complete resolution of symptoms within the follow-up period postoperatively (median follow-up 15.5 months, range 13–20 months).

Patients with early complications did not present late stenosis or persistent swellings.

Discussion

Several studies have been published within the last decade on the combined (endoscopic and transcutaneous) approach as an alternative treatment option in parotid sialolithiasis [1–11]. However, only one study by Koch et al. [7], reported medium to long-term results. The question regarding the efficacy of the method in the long term till now remains without an evidenced-based answer.

The present study had two major results: (1) Combined approach did not cause significant stenosis of the ductal system 1 year postoperatively. (2) The procedure seems to not have negative impact on the glandular function.

The major concern of surgeons against the procedure was the possibility of postoperative stenosis at the site of the ductal opening. According to our data, this possibility exists as seven patients had an endoscopically diagnosed postoperative stenosis. However, these stenotic areas were not severe and did not cause swellings. The fact that the incision is parallel to the duct axon eliminates the chance for a significant stenosis even in extended openings. In such cases, stenting is an additional tool, as a precise intraoperative placement through the surgical field can be achieved. However, larger studies are needed to clarify the limits of ductal opening which are safe to avoid stenosis and provide enough access. Limitation of our study is the fact that we had no cases of stones located behind pre-existed severe stenotic areas, to assess the postoperative behavior of these areas regarding ductal system healing.

Extracorporeal and laser intraductal lithotripsy require expensive devices and this fact may explain why these techniques are not so widely used. The described technique is an alternative option in cases where the above techniques are not available or have been failed. Moreover, some patients prefer this surgical option instead of lithotripsy which may need multiple sessions [13].

In cases of superficial location of the stone, a small longitudinal parenchymal incision is enough for duct identification. However, in deep-located stones, a parenchymal flap is necessary and its re-approximation with tissue glue and sutures at the end of the operation is mandatory. Thus in all cases, there is no removal of gland tissue and its function is preserved as much as possible. Some authors suggest a different approach in deep-located stones [5], however, our experience with the glandular mini-flap and careful dissection with the use of neurostimulation showed that this technique can be effective even in stones located in depth >5 mm from the surface of the gland.

The use of stents although highly recommended by many authors is not necessary for all patients [1–5]. In our series, this was the decision in three patients without any postoperative significant stenosis. If we add one patient with spontaneous extrusion of the stent and one patient where it had to be removed early due to infection without postoperative stenosis, we suggest that surgeons should reconsider their role and their indications. We suggest that stent placement could be avoided when all the following criteria are fulfilled: (1) the stone is located superficially and the opening of the duct is minimal ($\geq$1 cm), (2) the stone is not impacted and (3) there is no evidence of inflammatory tissue in the ductal system.

When the indication is correctly established, this combined approach offers a success rate of approximately 90 %, according to the available data [4–11]. Assessment of the success rate of the procedure should include the symptom-free condition of patients, the complete removal of obstructing material (stones, polyps) and the recovery of the glandular function. Our patients were free of symptoms in the follow-up period and their salivary glands scintigraphic evaluation showed very promising results as 11 out of 12 parotid glands had normal function and only one had mild hypofunction. In this case, the gland hypofunction may be attributed to the long-standing history of sialolithiasis and not to the surgical manipulation of the gland.

A scintigraphic evaluation pre- and postoperatively would present more accurately the effect of surgery on parotid gland function. However, the fact that our measurements showed normal function according to published normative data on salivary glands function, and the assessment of two parameters (baseline function and after stimulation) diminishes the possibility of a false interpretation of our results.

No major complications occurred in this case series. Some minor complications were treated successfully with conservative management. Our results are in agreement with previous studies reporting similar complication rates [4, 6, 9] and adds additional evidence regarding the safety of the procedure.

Contraindication of the procedure is the presence of diffuse ductal stenosis [3, 8, 9]. Another limitation of the technique is to manage cases of multiple parenchymal stones. In such cases, the options are the duct ligation awaiting atrophy of the gland, a parotidectomy or both [14]. Experimental studies showed that duct ligation leads to acinar atrophy and increased acinar apoptosis [15]. However, both techniques present significant morbidity and should be preserved as the last surgical options [3, 9, 16].

Conclusions

Our results suggest that the combined approach in parotid sialolithiasis is an effective method for such patients because it provides resolution of symptoms with preservation of gland function in the long term. Endoscopic findings 1 year postoperatively showed that stenosis, if exists, is mild and does not cause symptoms.

Conflict of interest None to declare.

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