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A prelacrimal approach technique to overcome the limitation of the narrow lacrimal recess

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Abstract

Purpose The distance between the anterior wall of the maxillary sinus and the nasolacrimal duct has been classified into three types by Simmen, in which type I (< 3 mm) is the least feasible for a prelacrimal approach. The aim of our study is to present a surgical technique which overcomes the anatomical limitation of the narrow lacrimal recess (type I) in the management of inverted papilloma in the maxillary sinus.

Methods Case series.

Results Eight patients with type I lacrimal recess underwent surgical resection for inverted papilloma in the maxillary sinus via a prelacrimal approach. The technique is described in detail in the article and essentially involves exposure of the nasolacrimal duct using a diamond burr. Complete tumor excision was achieved in all cases through this access, with no significant intra-operative complications.

Conclusions This prelacrimal approach technique is safe and effective for the management of inverted papilloma in maxillary sinuses with a type I lacrimal recess configuration.

Keywords Maxillary sinus · Inverted papilloma · Prelacrimal approach · Narrow lacrimal recess (type I)

Introduction

The prelacrimal approach (PLA) provides wide access to the entire maxillary sinus, especially the frequently difficult to access anterior wall. Its advantage is that it preserves the inferior turbinate (IT) and nasolacrimal duct (NLD) and, therefore, is considered less disruptive to nasal physiology than the medial maxillectomy or Denker's procedure [1, 2]. Studies have shown the PLA to be a safe and effective approach for the excision of primary or recurrent inverted papilloma in the maxillary sinus with low recurrence rates

[1, 3]. However, it is more challenging to apply this approach for maxillary sinuses with a narrow lacrimal recess. Simmen et al. proposed a classification of the lacrimal recess based on the distance between the anterior wall of the maxillary sinus and the nasolacrimal duct describing three types: type I (< 3 mm), type II (3–7 mm) and type III (> 7 mm). This classification system allows a surgeon to predict the difficulty in performing the PLA, with the type I being the least feasible [4]. Our study describes a prelacrimal approach technique, supported by a case series, which is safe and effective for the management of IP in maxillary sinuses with type I lacrimal recess configuration.

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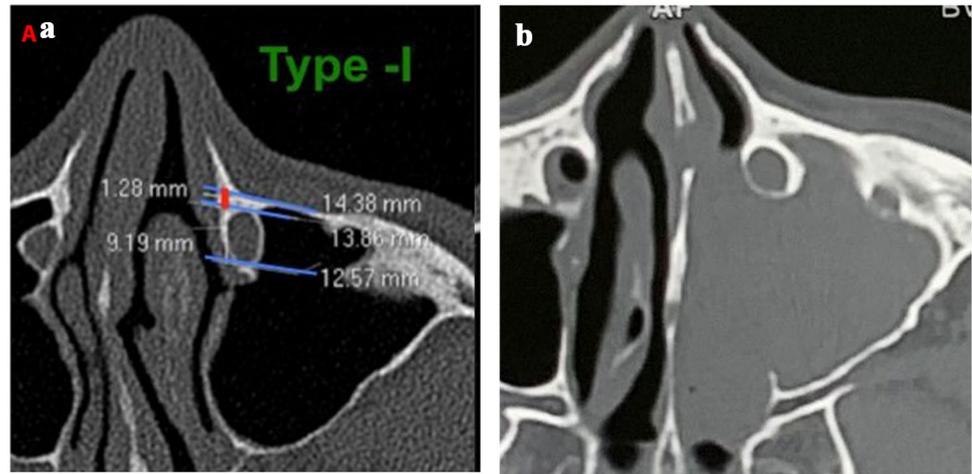
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Materials and methods

Methods: case series

Eight patients with IP arising from the maxillary sinus with type I lacrimal recess were included in this study during the period June 2018 to June 2020 (Fig. 1). Patients with IP which had invaded the NLD or IT were excluded as were

Fig. 1 **a** Type I: distance < 3 mm classified by Simmen et al. [4]; **b** recurrent IP with a type I lacrimal recess configuration



those with squamous cell carcinoma. This research was approved by the Ethics Committee of our institution.

Surgical procedure

All patients underwent endoscopic sinus surgery under general anesthesia. The prelacrimal approach was performed using the following technique. After identifying the uncinate process, an uncinectomy is performed to visualize the natural maxillary sinus ostium. A large middle meatal antrostomy is then performed enlarging the antrostomy posteriorly to the posterior maxillary sinus wall and inferiorly to the IT. Any portion of IP protruding into the nasal cavity, is then debulked with a micro-debrider so that the antrostomy can be completely visualized. A curved incision, using a 15° blade is then made on the lateral nasal wall. This incision is begun at the axilla of the middle turbinate and extended along the lateral nasal wall on the frontal process of the maxilla to just anterior to the head of the IT. The incision is then extended inferiorly to the nasal floor. Using a suction Freer's elevator, a mucoperiosteal flap is raised off the lateral nasal wall. The bone of the head of the IT is completely exposed and used as an important landmark for the Hasner's valve in its location within the inferior meatus. A Medtronic diamond burr (4 mm, 15-degree curve, 30 K) is used to drill the inferior meatus inferior to the bony IT head and anterior to Hasner's valve thinning out the inferior meatal bone without perforating through. Drilling is then coursed superiorly creating a thin bony layer at the anterior medial aspect of the bony canal of the NLD of about 1.5 cm. The inferior meatal wall is perforated by drilling and the thinned bony canal is then removed with the diamond burr or a Kerrison punch. The NLD is then lifted off the lateral and posterior aspect of the bony lacrimal canal and retracted medially within the mucoperichondrial flap. The narrow medial bony wall of the maxillary sinus anterior to the NLD of maxillary sinus is then removed by drilling from the inferior meatus extending

from the nasal floor to the maxillary sinus roof (Fig. 2). The bony medial wall of maxillary sinus posterior to the NLD can also be dislocated medially with a Freer's elevator or partially removed by piecemeal fracturing and drilling. Figure 3b demonstrates adequate access achieved without removal of the medial maxillary wall posterior to the bony canal of the NLD (Fig. 3). Access was adequate through the opening of the inferior meatus and the space between the medial wall of the bony canal of the NLD and the anterior wall of the maxilla. IP is completely removed via this PLA, cauterization and drilling away of the tumor attachment site is performed. The mucoperiosteal flap with the intact NLD is then repositioned and sutured anteriorly. The NLD functions effectively without bony support of the lacrimal canal, the efflux of tears being controlled by the valve of Hasner.

Post-operative care and follow-up

The nasal cavity is packed with a merocel which is removed on the second post-operative day. Nasal irrigation is self-performed twice a day for 2 months. Post-operative debridement is performed within 2–4 weeks. Endoscopic examination is performed every 3 months for the first year then every 6 months for the following years. A 70-degree endoscope scope is used to examine the maxillary sinus. A targeted endoscopic biopsy would be performed if there is suspicion of post-operative recurrence e.g. non healing granulations.

Results

During the period June 2018 to June 2020, eight patients with IP in the maxillary sinus with type I lacrimal recess were operated upon at our hospital. There were five women and three men, with an age range of 40–68 years (mean age, 52.6). Four patients had undergone prior surgery, with IP pathology documented previously in two cases.

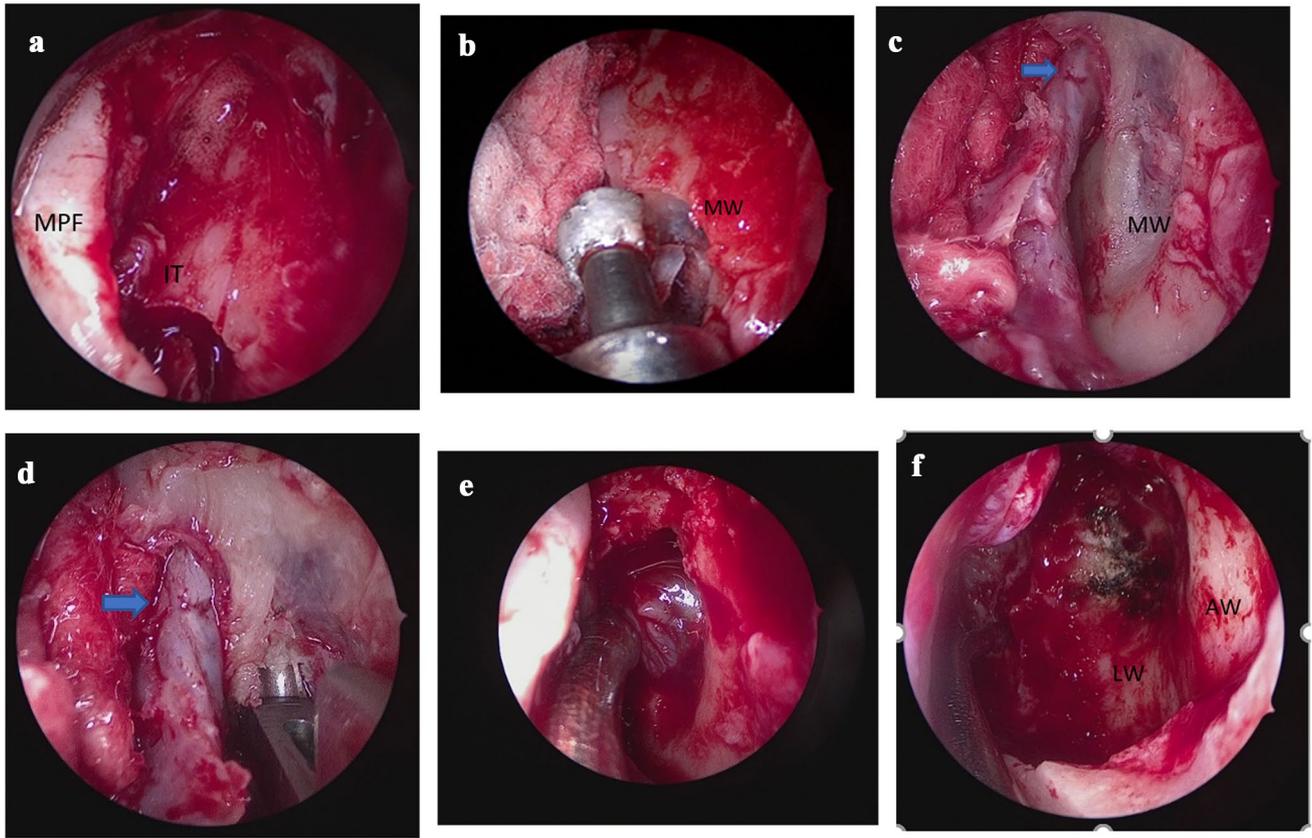


Fig. 2 IP resection via PLA for the left maxillary sinus in a type I lacrimal recess patient. **a** Mucoperiosteal flap is raised, the bony IT head exposed. **b** Drilling is started at inferior meatus inferior to the bony IT head, thinning out the bone without entering into the maxillary sinus yet. **c** Drilling upward anterior to the NLD. **d** The inferior meatal wall is perforated by drilling and bone from around the NLD

is removed with a Kerrison punch. **e** NLD is exposed and dislocated medially with the mucoperiosteal flap, IP is seen via PLA. **f** anterior and lateral wall of maxilla clear of IP, (note cautery burn at tumor origin) observed with a 45-degree scope via PLA. *MPF* mucoperiosteal flap, *IT* bony inferior turbinate head, *MW* medial wall, *LT* lateral wall, *AW* anterior wall of maxillary sinus, blue arrow: NLD

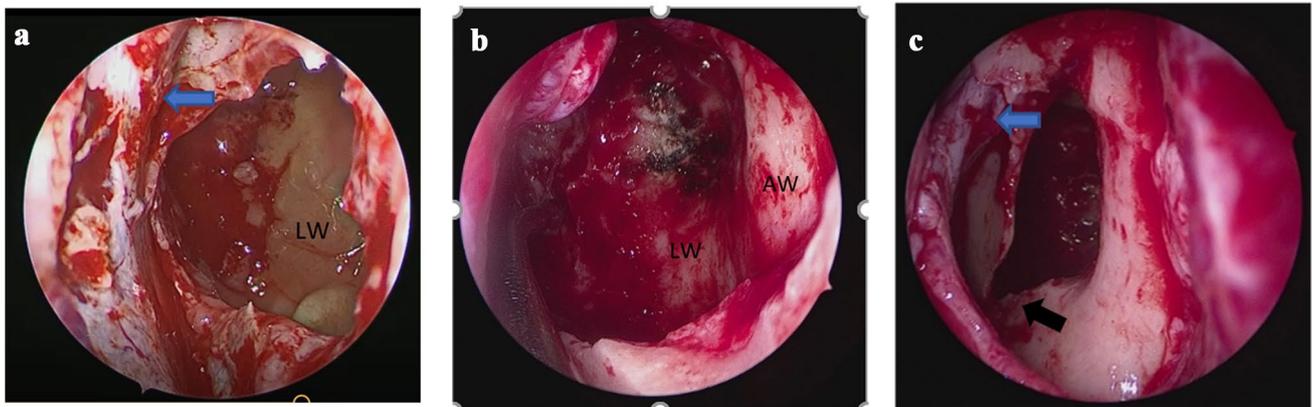


Fig. 3 The bony medial wall of the left maxilla posterior to NLD partially removed (**a**) or dislocated medially (**b**) and replaced back at the end of the surgery (**c**). Note the horizontal cut inferiorly in an ante-

rior-to-posterior direction allowing dislocation of the bony medial wall (black arrow). *LT* lateral wall, *AW* anterior wall of maxillary sinus, blue arrow: NLD

Pre-operative nasal endoscopy findings showed IPs extending into the nasal cavity through the maxillary ostium

in six cases. Focal hyperostosis on CT scan was noted in six cases which correlated intraoperatively with the tumor

attachment as previously described by Yousuf [5]. Opacification of ipsilateral ethmoid and frontal sinus was found in seven cases. All cases had tumor attachment in maxillary sinuses with the most common attachment site at the antero-lateral wall (seven cases–87.5%). Tumor excision was performed as previously described. No intra-operative complications occurred, no post-operative epiphora were noted. One patient had temporary hypoesthesia of the upper lip and the face adjacent to the inferior aspect of the piriform aperture which resolved 6 weeks after the surgery. The diagnosis of IP was confirmed on paraffin sections in all cases, no carcinoma was found. No recurrence was noted during the follow-up period which ranged from 2 to 18 months.

Discussion

Simmen et al. evaluated the feasibility of accessing the maxillary sinus through a prelacrimal access. In their study, the incidence of type I, II and III was 31.5%, 56.5% and 12.5%, respectively. Simmen proposed that type III is the most feasible for PLA, bony removal being not necessary and access through the pre-lacrimal recess could be achieved with a chisel. Type II required temporary NLD dislocation from its bony canal. With regard to type I, NLD dislocation with a significant amount of bone removal was required, but as described in this paper, the window enabled only limited access to the anterior wall of the maxillary sinus, suggesting that the pre-lacrimal approach was not ideal in cases with this anatomy [4].

Lock et al. conducted a study with the same protocol in 100 CT scans in a Chinese population. The results were 6.5% of type I, 53.5% of type II and 39.5% of type III. Lock et al. concluded that PLA was feasible in a larger percentage of Oriental patients (93.5%) as compared to the Occidental population in Simmen's study (68.5%) [6]. In our series of 59 IPs arising from the maxillary sinus operated in our institution between June 2018 and June 2019, 8 patients (13.5%) were type I cases. This small number of Vietnamese patients, eight in total, with type I lacrimal recess anatomy, was similar to the study of Lock et al. consistent with the Oriental features of the Vietnamese population.

Prelacrimal approach (PLA) was first introduced by Zhou in 2007, later refined and described by others [2, 3], was initially described to assist in the resection of inverted papilloma in maxillary sinus with T3 Krouse staging [1]. This approach was chosen due to its advantages in tumor resection at difficult to reach areas such as the anterior and lateral wall, as well as the lacrimal recess of maxillary sinus.

Our study showed that this PLA using a diamond burr is effective for access and safe for the preservation of the NLD as an approach for type I lacrimal recess. Most surgeons preferred to do osteotomies using a chisel to create

the PLA [1, 2]. However, osteotomies may cause NLD injury in a narrow lacrimal recess and is technically difficult for the small maxillary sinus with a thick bony medial wall. Medialization of the NLD and IT is a step of PLA in other studies [1–3] as well as ours, but there has been no described technique to overcome the narrow lacrimal recess using diamond burr to avoid NLD injury.

The key of our surgical technique was using a diamond burr from the outset to avoid NLD injury in type I lacrimal recess patients. We used a diamond burr to create the entrance into the maxillary sinus, inferior to the bony IT head. This site being anterior and inferior to the opening of the valve of Hasner was a safe site to begin to avoid NLD injury. The NLD could then be exposed safely with a diamond burr, or a Kerisson punch upon thinning of the bony canal wall anterior and lateral to the NLD. Another advantage of the technique we describe is the increased pre-lacrimal window created by removing all the medial wall of the maxillary sinus anterior to the NLD. By removing the bone of the inferior meatus, typically preserved in the initial description of this technique, we increase the surgical window affording better access of our instruments as well as improved visualization. Recurrence has been shown to arise from failure of removal of subperiosteal nests of inverted papilloma during resection [7]. This approach allows direct access of a microdrill to the origin of the inverted papilloma easily achieving drilling away of these subperiosteal nests.

There was one case in our series with temporary hypoesthesia of the upper lip and the face adjacent to the inferior aspect of the piriform aperture which resolved after 6 weeks. Generally, this is seen when the osteotomies are performed very close to the anterior edge of the piriform aperture. The anterior superior alveolar nerve or its branches typically course medially inferior to the infra-orbital foramen across the canine fossa towards the alveolus along the anterior wall of the maxilla [8]. Typically, the percentage of patients having this complication is around 7% [1]. The risk of post-operative numbness due to injury of branches of the anterior superior alveolar nerve can be avoided when surgery is limited to the medial side of the piriform aperture.

Conclusion

Our PLA using a diamond burr to address the narrow bony lacrimal recess is safe and effective for maxillary sinuses with type I lacrimal recess.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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