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RHINOLOGY

Choanal polyps in children and adults: 10-year experience from a tertiary care hospital

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Abstract

Purpose Choanal polyps (CPs) are benign, solitary, soft-tissue lesions extending towards the junction between the nasal cavity and the nasopharynx through the choana. The aim of this retrospective study was to evaluate clinical and histological characteristics of CPs in children comparing to adult patients.

Methods Characteristics of CPs treated in our hospital (demography, main complaints, side, localization, surgical approach, histological characteristics, accompanying paranasal sinus diseases, association with allergic rhinitis, postoperative follow-up period, and recurrence rates) were retrospectively reviewed.

Results Seventy-eight patients with CPs were included, 22 (28%) patients in children and 56 (72%) patients in adults. We found no differences in the prevalence of main nasal complaints (nasal obstruction, rhinorrhea, snoring, and epistaxis) between the child and adult. In 27% children and in 7% adults, we found the oropharyngeal extension of CPs ($p < 0.01$). In 18% children and in 5.3% adults, we found the histological characteristics of an angiomatous CP ($p < 0.05$). The association with allergic rhinitis was more frequent in children (32%) than in adults (18%) ($p < 0.05$). In 32% pediatric patients and in 14% adult patients, we found the association with ipsilateral chronic maxillary rhinosinusitis without nasal polyps (CRSsNP) ($p < 0.05$). After the surgical treatment, we found the recurrence in 3 (14%) pediatric and in 5 (8%) adult patients, without the significant difference.

Conclusion Our results suggest some specificities of CPs in children comparing to adults. Oropharyngeal extension, association with allergic rhinitis and ipsilateral CRS, and the presence of angiomatous histological type of CPs are more frequent in the pediatric population.

Keywords Child · Inflammation · Nasal cavity · Nasal mucosa · Nasal polyps · Nasal surgical procedures

Introduction

Choanal polyps (CPs) are benign lesions of inflammatory origin arising from the mucosa of the nasal cavity and paranasal sinuses that extend to the nasopharynx through the choana. CPs usually originate from the mucosal layer of the maxillary sinus and these most commonly seen forms are known as antrochoanal polyps (ACPs) [1, 2]. They originate from the inner wall of the maxillary antrum, and growing slowly, they pass through the accessory or, rarely, through the natural ostium [1]. However, the other sites in the sinonasal region can be the places of CP origin: ethmoid and sphenoid sinus, nasal septum, middle, and inferior turbinate [3]. These polyps are usually unilateral lesions, but we can find in the literature the extremely rare cases of bilateral presentation of CPs [4, 5].

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The etiology and pathogenesis of CPs are still unclear. However, chronic inflammation, atopy, as well as chronic lymphatic obstruction are though to play the roles as factors in the etiology of CPs [6, 7]. These lesions account for approximately 4–6% of all nasal polyps in the general population, but this ratio is about 33% in children [8]. The main diagnostic procedures and the groundworks for treatment options are rhinoscopy, and nasal endoscopic examination and computed tomography (CT) of the paranasal sinuses and surgical removal of CPs are the treatment of choice [9].

The aim of this study was to evaluate clinical and histological characteristics of CPs in the pediatric population in comparison with adult patients with the same clinical entity. By the literature review, we found only two previous studies comparing the clinical specificities of ACPs in children and adult [9, 10] and our investigation is, to our knowledge, the first one which evaluate both clinical and histological findings of pediatric and adult patients with CPs as an extended clinical entity in comparison with ACPs. To the best of our knowledge, this is the first case series of CPs to be reported from our country.

Materials and methods

This retrospective descriptive study enrolled 78 patients (47 males and 31 females) with mean age 38.7 years, range 4–67 years, diagnosed with CPs, treated and followed-up between January 2008 and December 2017 in our Department of Otorhinolaryngology and was conducted according to the Declaration of Helsinki. The Institutional Review Board Approval was obtained from the Ethics Committee of our institution. Written informed consent was obtained from all individual adult participants and from parents of children included in the study to use their data.

Demographic characteristics, main complaints, as well as clinical characteristics of CPs (side, localization, surgical approach, histological characteristics, accompanying paranasal sinus diseases, association with allergic rhinitis, postoperative follow-up period, and recurrence rates) were retrospectively reviewed. The patients were classified into children (< 18 years) and adults (> 18 years). All patients underwent CT scans of the paranasal sinuses in coronal, axial, and sagittal planes, however, in some cases, we used magnetic resonance imaging (MRI) for differential diagnosis. In majority of cases, endoscopic sinus surgery (ESS) was used as a treatment of choice. In all pediatric patients with ACPs and in adult ACP patients, where the site of polyp origin could be easily accessed through a classically widened middle meatal antrostoma, we performed the endoscopic middle meatal antrostomy. However, in adult patients, in cases of origin of the polyp in the mucosa of inferior and anterior wall of the maxillary antrum, the treatment was completed by inferior meatal antrostomy. After the endoscopic middle meatal antrostomy, we opened a new window through removal of the lateral bony skeleton of the inferior meatus with downward displacement of the inferior turbinate provided accessibility to the inferior and prelacrimal recesses of the maxillary sinus. In some adult patients, when the maxillary component of ACP could not be observed and it cannot be properly cleaned, we performed the combination of endoscopic middle meatal antrostomy and an external approach, so-called mini-Caldwell Luc procedure. It was a combination of endoscopic endonasal surgery with uncinectomy and antrostomy with a small window of 5 × 5 mm opened externally in the sublabial space, where the endoscope and forceps were introduced into the maxillary sinus to remove the entire stalk of the ACP. In cases of location of CPs in the anterior ethmoid, we used the endoscopic anterior ethmoidectomy for complete removal of the polyps, and in cases of polyps arising from the middle of inferior nasal concha, we performed the simple endoscopic excision.

The follow-up period was variable and it was a minimum of 24 months after the surgical treatment. The patients who did not have follow-up evaluations and patients with polyp recurrences who had been operated on in different hospitals were excluded from this investigation.

After the surgical removal, all excised lesions were histopathologically studied (haematoxylin and eosin staining) by the same pathologist to evaluate potential histological specificities of CPs in children, as well as to eventually detect accompanying sinus disease. Allergic status was evaluated in all study subjects in accordance with the presence of nasal symptoms (nasal obstruction, rhinorrhea, sneezing, itching, hyposmia), local rhinoscopic/endoscopic findings (edematous, pale blue nasal mucosa with hypertrophy of the inferior turbinates) and by results of skin prick tests and serology tests. For skin prick tests, we used the standard battery of 15 respiratory allergens. Histamine dihydrochloride (1 mg/ml solution) was used as positive and saline as negative control. The size of the cutaneous reaction on the volar part of the forearm was measured after 15 min. The allergic response was considered positive when the mean wheal diameter was greater than or equal to the diameter of the histamine wheal. Total serum IgE was detected by enzyme-linked immunosorbent assay (ELISA) kit and subjects with serum IgE level > 100 IU/ml were considered atopic.

Statistical analysis

As we had categorical data (frequencies) that result from classifying objects in two different ways, we used the Fisher's exact test to examine the significance of the association between the two kinds of difference. p values < 0.05 were considered significant. The analysis was done using

the Statistical Package for the Social Sciences, version 15.0 software (SPSS Inc., Chicago, USA).

Results

Demographic and clinical characteristics of CPs in children and adults are presented in Table 1. Seventy-eight patients with CPs were included in this study, 22 (28%) patients in children and 56 (72%) patients in adults. In the pediatric patients, there were 13 boys and 9 girls; the mean age was 13.7 ± 1.8 years, with a range of 4–17 years. In adults, there were 34 male and 22 female patients; the mean age was 51.8 ± 4.2 years, with a range of 19–67 years. The main complaints in both groups of patients were nasal obstruction, rhinorrhea, snoring, and epistaxis. We found no significant differences in the prevalence of main nasal complaints between the child and adult.

All CPs in both children and adults were unilateral lesions. The origin of CPs in 17 pediatric patients was maxillary sinus (Fig. 1a), in three patients was anterior ethmoid, in one patient middle turbinate, and in one inferior turbinate. In adult patients, 50 CPs originated from the maxillary sinus, four from the anterior ethmoid, one from the middle, and one from the inferior turbinate. Oropharyngeal extension (Fig. 1b) of CPs was more frequent in pediatric than in adult patients ($p < 0.01$).

Regarding the surgical treatment, endoscopic approach was used in 100% pediatric patients and in 85% adult patients. In all pediatric patients with ACPs, we performed the middle meatal antrostomy. Due to the specific attachment of ACP stalk to the inferior and anterior wall of the maxillary antrum, in 10 (20%) adult patients with ACP, we performed the combined middle meatal and inferior meatal antrostomy. In addition, in 8 (15%) adult patients, we performed a combination of endoscopic middle meatal antrostomy with an external mini-Caldwell Luc procedure to prevent the recurrence of ACPs.

In all participants, histopathological analysis confirmed the diagnosis of CP. The polyps were covered with ciliated pseudostratified respiratory epithelium. The stromal inflammatory infiltrate is composed of a mixture of macrophages, plasma cells, lymphocytes, eosinophils, and neutrophils. In the antral parts of ACPs in 54% pediatric and 67% adult patients, we occasionally found the stromal dilated ductal retention cysts (Fig. 2). Four patients in children and three adult patients were diagnosed as having angiomatous CPs, a rare subtype of CP with large, dilated blood vessels. Histological differences between the "normal" and angiomatous CP are presented in Fig. 3. Therefore, we found the prevalence of angiomatous CPs to be higher in children than in adults ($p < 0.05$). The histological results are presented in Table 2. The association with allergic rhinitis was more frequent in children than in adults ($p < 0.05$). In 32% pediatric patients and in 14% adult patients, we found radiologically, clinically, and histologically, the association with ipsilateral chronic maxillary rhinosinusitis without nasal polyps (CRSsNP) ($p < 0.05$). The mean post-surgery follow-up was

Table 1 Clinical characteristics of choanal polyps in child and adult groups

Parameters	Children ($n = 22$) (28%)	Adults ($n = 56$) (72%)
Age (years)	4–17 (13.7 ± 1.8)	19–67 (51.8 ± 4.2)
Sex (M:F)	13:9	34:22
Main complaints	Nasal obstruction (71.8%)	Nasal obstruction (83.5%)
	Rhinorrhea (43%)	Rhinorrhea (68%)
	Snoring (57%)	Snoring (73%)
	Epistaxis (22%)	Epistaxis (15%)
Side (R:L:B)	10:12:0	26:30:0
Origin (MS:ES:SS:NS:MT:IT)	17:3:0:0:1:1	50:4:0:0:1:1
Endoscopic surgery	22 (100%)	47 (85%)
Endoscopic MMA + IMA	0	10 (20%)
Mini-Caldwell Luc procedure	0	8 (15%)
Oropharyngeal extension**	6 (27%)	4 (7%)
Accompanying CRSsNP*	7 (32%)	8 (14%)
Allergic rhinitis*	7 (32%)	10 (18%)
Follow-up	58.8 ± 28.5	57.5 ± 27.8
Recurrence	3 (14%)	5 (8%)

M male, *F* female, *R* right, *L* left, *B* bilateral, *MS* maxillary sinus, *ES* ethmoid sinus, *SS* sphenoid sinus, *NS* nasal septum, *MT* middle turbinate, *IT* inferior turbinate, *MMA* middle meatal antrostomy, *IMA* inferior meatal antrostomy, *CRSsNP* chronic rhinosinusitis without nasal polyps

Statistically significant difference: *$p < 0.05$; **$p < 0.01$

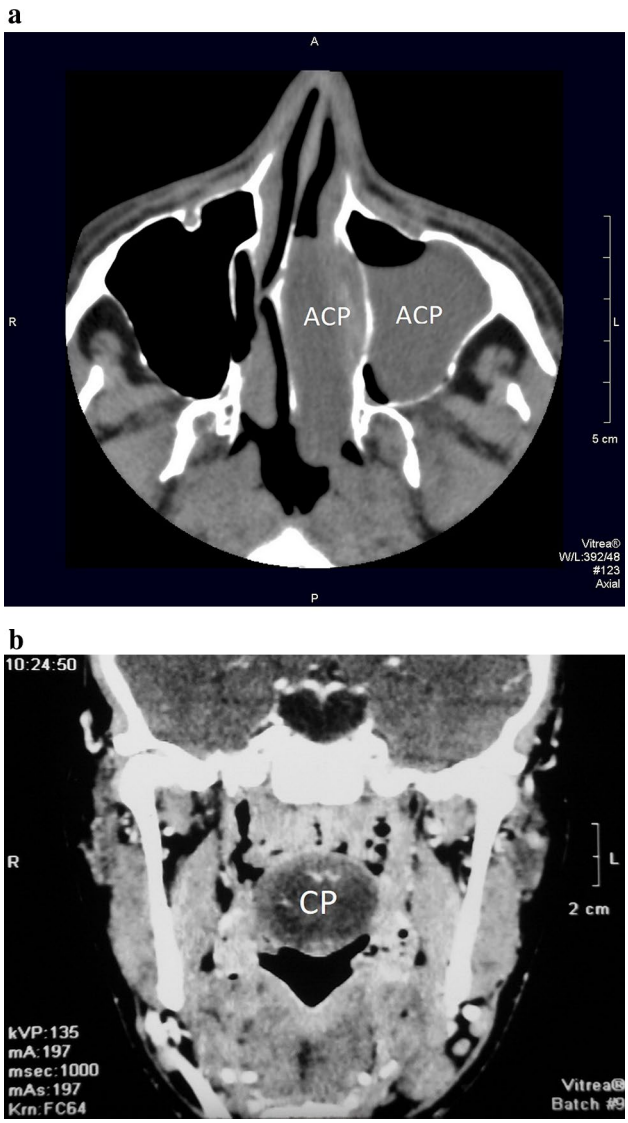

Fig. 1 **a** Axial plane of CT scan of the paranasal sinuses in a 15-year-old boy with ACP. Note the presence of an antral and a nasal portion of the same polyp. **b** Coronal plane of CT scan on the level of nasopharynx showing an extremely big pharyngeal portion of a CP in a 12-year-old boy

58.8 ± 28.5 months in children and 57.5 ± 27.8 months in adults. We found the recurrence in 3 (14%) pediatric and in 5 (8%) adult patients, in all cases with ACPs, but without the significant difference. Of these five adult patients, all of them had recurrences after we performed the simple endoscopic middle meatal antrostomy. However, none of adult patients had recurrences after the combined endoscopic middle meatal and inferior meatal antrostomy and after the combined endoscopic endonasal antrostomy plus mini-Caldwell Luc procedure. On the other hand, we found no relation between the place of ACP stalk attachment to the inner surface of the maxillary sinus and the recurrence rate.

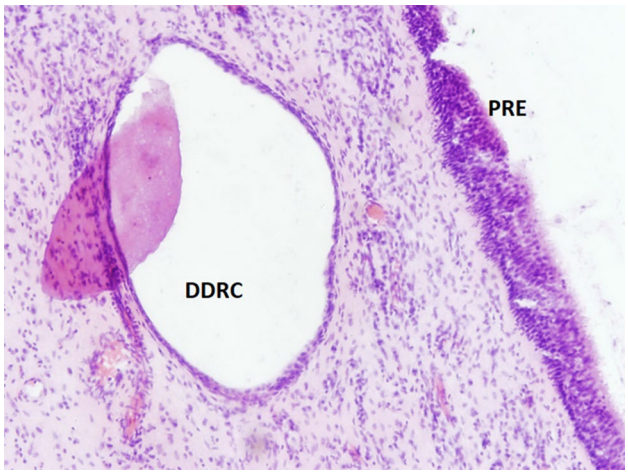

Fig. 2 Histological features of an antral portion of an ACP. The polyp is lined by pseudostratified respiratory epithelium (PRE), situated on the thickened basement membrane. The edematous stroma showing the high level of fibrosis and inflammatory infiltrate is composed of a mixture of plasma cells, lymphocytes, neutrophils, and small number of eosinophils. Note the presence of a stromal dilated ductal retention cyst (DDRC). (haematoxylin and eosin staining, magnification ×100)

Discussion

CPs show histological characteristics in comparison with bilateral inflammatory nasal polyps. Whereas inflammatory infiltrate of bilateral nasal polyps in more than 90% patients consists usually of eosinophils, lamina propria of CPs is composed of plenty of lymphocytes, plasma cells, macrophages and neutrophils [11]. The antral parts of the ACPs may also have ductal cysts in the lamina propria and we could see this manifestation in mostly children and adults included in our investigation. This interesting phenomenon could be a result of irregular development of glands during the growth of ACPs.

Our results showed no significant differences in the prevalence of main nasal complaints between the child and adult. However, we found significantly higher percent of oropharyngeal extension of CPs in pediatric than in adult patients. This finding could be explained by higher growth potency of CPs in children than in adults and by the fact that younger children usually have not such developed possibility to report their health problems as adult. In one study evaluating the characteristics of ACPs in children, Lee et al. [9] demonstrated higher incidence of more severe CT stage in the child group with ACP suggesting that children with ACP present at a more advanced stage because of late diagnosis.

We also found higher percentage of presence of an angiomatous histological subtype of CP in children comparing to adult patients and this phenomenon is in accordance with the results of two previous similar studies evaluating the patients with ACPs [9, 10]. This uncommon type of CPs is

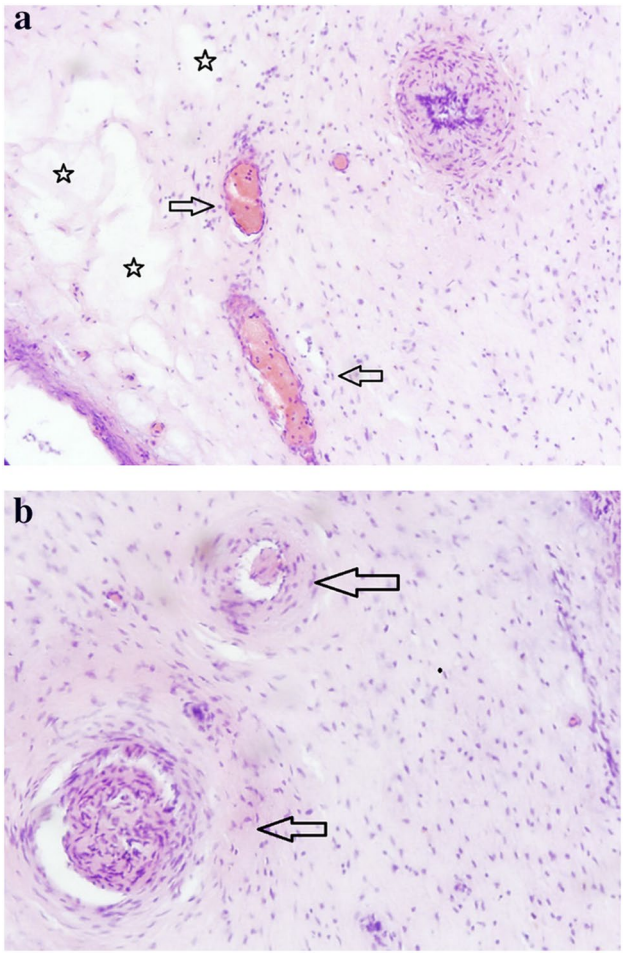

Fig. 3 Histological features of an angiomatous (**a**) and a "normal" (**b**) CP in a child. Note the presence of dilated capillary spaces (arrow heads) and dilated lymphatic vessels (asterisks) in an angiomatous (**a**) and regular blood vessels (arrow heads) in the stroma of a "normal" CP (**a**). (haematoxylin and eosin staining, magnification ×100)

Table 2 Histological characteristics of choanal polyps in child and adult groups

Parameters	Children ($n=22$) (28%)	Adults ($n=56$) (72%)
Dilated ductal retention cysts (antral parts of ACPs)	12 (54%)	38 (67%)
Angiomatous CPs*	4 (18%)	3 (5.3%)

ACPs antrochoanal polyps, *CPs* choanal polyps

Statistically significant difference: $*p<0.05$

characterized by numerous dilated blood vessels, embedded in a fibrous stroma that is infiltrated with plenty of plasma cells [12]. The nature of angiomatous CPs is not clear. Batsakis and Sneige [13] proposed that this subtype of CPs develop secondary to histological changes in a CP as a result of vascular compromise, whereas Sayed and Abu-Dief [14] suggest that these polyps are separate clinical entity formed as the results of angiogenesis and vascular endothelial proliferation initiated by strong plasma cell infiltration of nasal mucosa during the chronic inflammation. Relatively frequent occurrence of this subtype of CPs could be explained by higher activity of endothelial growth factors in stroma of pediatric CPs. As the main symptoms of angiomatous CPs are nasal obstruction and epistaxis, these polyps may be confused with vascular nasal lesions, especially with angiofibroma and hemangioma [12].

The association of CPs with allergy is controversial and this relationship has not been clearly investigated. Some authors suggest moderate percentage of relationship of ACPs and atopic disease, from 23 to 69% [15, 16]. Our results showed higher percentage of association between allergic rhinitis and CPs in the pediatric than in adult patients. Therefore, we found more frequent association of CPs with ipsilateral chronic maxillary sinusitis in the pediatric than in adult patients. These findings could be explained by fact that allergic rhinitis can make the conditions for chronic sinus disease, due to the mucosal edema of the ostiomeatal unit and hypersecretion of nasal mucus. These conditions could be reached easily in children than in adults due to the limited spaces in the nasal cavity and the middle meatus in children. According to our histological findings, the small number of eosinophils and predomination of other inflammatory cells may suggest that the chronic nasal congestion and paranasal sinuses ostia obstruction secondary to allergic inflammation of the nasal mucosa could play a role in the pathogenesis of CPs rather than sole allergic rhinitis. According to Mostafa et al. [7], lymphatic obstruction due to the nasal congestion and sinus ostia obstruction and chronic sinus infection might play the most important role in the development of ACPs.

The treatment of choice for CPs is surgical excision and the complete removal of ACPs is still the principal challenge. All the patients with polyp recurrence in our study were those with ACPs and we found higher percent of ACP recurrence in children than in adults (14% vs 8%), but without the statistically significant difference. This percent of recurrence in children could be explained by fact that we had the tendency to restrict the removal of bone structures in the region of ostiomeatal complex to prevent disturbance in the development of these very important structures during the childhood and puberty. In all pediatric patients, we performed the endoscopic excision of the polyps by middle meatal approach. These pediatric patients evidently underwent an incomplete surgical removal of antral parts of ACPs at its inferior aspect probably due to the fear of damaging the teeth buds interfering with facial growth. However, in adult patients, when the origin of the polyp in the maxillary antrum was inferior and anterior wall, the treatment was completed by inferior meatal antrostomy. According to

the previous studies, this extended endoscopic technique is useful for removing severe disease that cannot be reached through the middle meatal antrostoma and yields both better subjective and better objective outcome [17–19]. Albu et al. [17] suggested that the additional inferior meatal antrostomy most likely improves drainage and ventilation in the postoperative period. In our case series, we operated eight adult patients by combined endoscopic endonasal antrostomy plus mini-Caldwell Luc procedure and we found no recurrences in these patients in the postoperative period. The results of a systematic review, presented by Galluzzi et al. [20], found the recurrence rates of ACP 15% in children, which is in accordance with our result. Pagella et al. [21], however, found the recurrence rate of 20.5% pediatric patients with ACPs, suggesting that recurrence rates of ACP after the endoscopic middle meatal antrostomy are still relatively high despite the modern surgical techniques. Galluzzi et al. [20] suggested that the combined endoscopic sinus surgery with a transcanine sinusoscopy (mini-Caldwell Luc) could reduce recurrence rates in treatment of ACPs. It seems that the combined approach could reduce recurrence rates in selected patients that cannot be completely managed with endoscopic approach. However, although Caldwell-Luc approach ensure excellent view of the maxillary sinus and complete removal of antral portion of ACP, this procedure is related to risks of disturbance in the bone growth centres of the maxilla and in development of teeth in children [22].

Our investigation had some limitations. It was a retrospective cohort study, so we did not have the complete information regarding the duration of symptoms for all participants, especially for young children. Accordingly, we did not include this important parameter in our investigation. As it was a single-center study, the number of patients included in investigation was relatively small. Therefore, we suggest the importance for conduction of further multicenter studies with higher number of participants.

Conclusion

Our results suggest the presence of some clinical and histological specificities of CPs in children comparing to adults. According to our results, oropharyngeal extension, association with atopic disease and ipsilateral CRS, and the presence of angiomatous histological type of CPs are more frequent in the pediatric than in adult population. Endoscopic approach is safe and relatively effective option in treatment of CPs in both children and adults. However, in some cases of ACPs, the middle meatal antrostomy has not the capability to ensure complete removal and to prevent the recurrence of ACPs. In adult patients, this endoscopic approach from the middle meatus can be completed by inferior meatal antrostomy. Transcanine sinusoscopy (mini-Caldwell Luc procedure) can be useful in some adult patients with difficult to remove ACPs. However, due to the possibility of damaging the teeth buds interfering with facial growth, this combined procedure cannot be recommended in children, where the recurrence rates of ACP are still high. Further investigations are necessary to find an optimum surgical technique for ACPs in children to prevent the recurrences.

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Compliance with ethical standards

Conflict of interest No conflict of interest was declared by the authors.

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