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Experiences with the surgical management of preauricular sinus

J. Song[1,2], L. Wu[1,2], H. Wu[1,2], L. Mei[1,2], Y. Feng[1,2], X. Wu[1,2,3]

[1]Department of Otolaryngology Head and Neck Surgery, Xiangya Hospital of Central South University, Changsha, Hunan 410008, PR China; [2] Province Key Laboratory of Otolaryngology Critical Diseases, Changsha, Hunan 410008, PR China. [3]National Clinical Research Center for Geriatric Disorders, Xiangya Hospital of Central South University, Changsha, Hunan, 410008, PR China.

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Abstract. *Objectives*. We aimed to summarize individualized surgical treatment approaches for congenital preauricular sinuses, based on a new surgical classification scheme.
Methods. Clinical data were retrospectively collected for 104 patients (117 ears) that visited our hospital and received surgical treatment from October 2011 to October 2017. All cases were classified into four types (I, II, III, and IV) according to the location of the preauricular sinus lesion and the presence of infection. Type I sinuses were defined as sinuses with mild or no inflammation. Type II and III were defined as sinuses with inflamed tissue close to (< 1.5 cm) or distant from (≥ 1.5 cm) the sinus openings. Type IV sinuses were referred to as "variant sinuses", which were positioned in unusual areas.
Results. Type I sinus received a local, wide resection. Type II sinus underwent an extended local resection with an extended incision. Type III sinus received an extended local resection with double incisions. Type IV sinus received a local, wide resection, with or without a retroauricular incision. All pathological tissues were removed after one procedure. Within 7 days after surgery, 3.8% (4/104) of patients developed vomiting, and 2.9% (3/104) had a fever, but all issues were resolved with conservative treatment. During the follow-up period, only one recurrence (1/117, 0.85%) was observed in type IV preauricular sinus.
Conclusion. The preoperative classification of preauricular sinus can assist surgeons in selecting appropriate individualized surgical procedures with low recurrence rate.

Introduction

Congenital preauricular sinus is a common congenital malformation of the preauricular soft tissue, first described by Van Heusinger in 1864.[1] The prevalence of preauricular sinus varies among different countries and races. For example, it has been reported that the incidence rates in Asia (1-6%) and African regions (4-10%) are higher than those in Western countries (0.1-0.9%).[2–5] The malformation itself is closely associated with the development of the first branchial arch during the sixth week of gestation, and this feature has given rise to different hypotheses about the etiology. Among these hypotheses, the most widely accepted involves the defective fusion of the six auditory hillocks, an area also known as the Hillock of His.[4]

Preauricular sinuses are generally located in the anterior area of the ascending limb of the helix. However, they occur in various locations, such as the superior regions of the auricle, the posterior surface of the cymba concha, the lobule, and even the postauricular area.[6,7] The majority of preauricular sinuses present asymptomatically, and no treatment is required. When signs of infection occur, such as chronic recurrent discharges, erythematous changes, abscess formation, and local swelling, patients are recommended to undergo complete surgical excision of the sinus tracts.

The traditional surgery for preauricular sinus is associated with a high recurrence rate, ranging from 9% to 42%.[2,4,8] This high rate is most likely due to branches of the sinus tract that were missed during the excision. To reduce the risk of recurrence,

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various techniques have been introduced in previous studies, including the supra-auricular approach and the inside-out technique.[9,10] Nevertheless, it remains difficult to excise inflamed preauricular sinuses completely. This difficulty is due to various factors, such as abscess incision and drainage after recurrent infections; interrupted discharge from the tracts after incision; severe postoperative scarring; and granulated tissue proliferation.

Clinically, the severity of inflamed preauricular sinuses varies from case to case, and the openings are in different locations. Due to these variations, the primary goal is to select an appropriate surgical method that will permit a thorough excision of the preauricular sinus with a low recurrence rate. In this study, we present our experiences in the management of preauricular sinuses, based on a new surgical classification of preauricular sinuses. We investigated the proper timing of surgery, the resection range, and potential surgical cautions.

Materials and methods

Study design

This retrospective case series study included patients with congenital preauricular sinuses that underwent surgical treatment between October 2011 and October 2017 at Xiangya Hospital of Central South University. Medical records were reviewed to obtain demographic information, operative indications, operative findings, and postoperative outcomes. Long-term outcomes were evaluated via outpatient visits. All procedures involving human participants were completed in accordance with the declaration of Helsinki and the ethical standards of the Xiangya Hospital Ethics Committee.

Patients

Between October 2011 and October 2017, 104 patients (117 ears) with congenital preauricular sinuses underwent surgical excisions at the Department of Otolaryngology of Xiangya Hospital. Patients lost to follow-up were excluded from the final analysis.

All patients were treated as follows: acutely infected preauricular sinuses were first treated with a course of oral or parenteral antibiotics for 7-14 days. Any abscess was incised and drained, as close as possible to the sinus opening, to facilitate future excision. Then, at 1 month after all signs of inflammation (e.g., erythema, swelling, and purulent discharge) subsided, a sinus resection was performed. Before performing surgery, the inflammation status of the preauricular sinus was reexamined to select the appropriate surgical technique for complete excision.

Recurrence was defined as a recurrent infection or a chronic wound that persisted after the initial healing stage, following surgery. Sinuses were classified into 4 types, mainly according to two important factors: (1) the location of the sinus opening and (2) the relationship between the sinus opening and the inflamed tissue at the time of surgery. Type I sinuses had mild or no inflammation at the time of surgery (Figure 1A). Types II and III sinuses were inflamed with an iatrogenic fistula, due toan incision or drainage, or exhibited additional granulated inflamed tissues. Type II was defined as a sinus with inflamed tissue close to the sinus opening (< 1.5 cm; Figure 1B). Type III was defined a sinus with inflamed

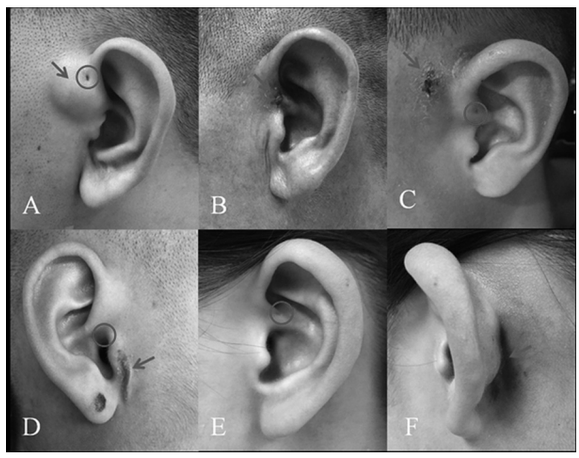

Figure 1

The different types of preauricular sinus. A: Type I sinus: a sinus opening (red circle) is apparent, at the ascending area of the helix crus, with local swelling (blue arrow). B: Type II sinus: are current infection occurred after a sinus excision; inflamed tissues are apparent at the surgical scar (blue arrow). C: Type III sinus: an extra iatrogenic fistula is surrounded by inflamed tissue (blue arrow), distant from the sinus opening (red circle). D: Type IV sinus: a sinus opening (red circle) is at the top wall of the right external auditory canal, and an extra iatrogenic fistula, surrounded by inflamed tissue, is in front of the tragus (blue arrow). E and F: Type IV sinus: in a single patient, a sinus opening (red circle) is apparent at the edge of the helix crus, and inflamed tissue (blue arrow) is apparent at the postauricular area.

tissue distant from the sinus opening (≥ 1.5 cm; Figure 1C). Some cases were revisions. Type IV sinuses were referred to as "variant sinuses", which were positioned in unusual areas, including the posterosuperior or inferior edge of the crus of the helix, in front of the tragus, in the supra-auricular area, or even in the postauricular area or at the opening of the external auditory canal (Figure 1D-F). Unlike the first branchial fistula, these periauricular sinuses were all related to the auricle anatomically. Their locations were limited to the lateral side of the temporalis muscle and parotid gland, and they were not associated with the facial nerve.[6]

Operative techniques

Patients younger than 14 years and those that feared the surgical procedure were placed under general anesthesia. Others received local anesthesia, with an injection of 1% lidocaine and a 1:100,000 epinephrine solution. Study participants underwent different operative procedures, according to the type of preauricular sinus. Patients with a type I sinus received a local, wide resection. Those with a type II sinus underwent an extended local resection, with an extended incision. Those with a type III sinus received an extended local resection with double incisions; this surgical method comprised 2 elliptical incisions: one included the sinus opening, and the other included the iatrogenic fistula openings and the surrounding necrotic skin. Those with a type IV sinus received a local, wide resection, with or without a retroauricular incision (a second postauricular incision).

For the local, wide resection, a preauricular elliptical incision was first created around the sinus opening to minimize cosmetic alterations. For inflamed types II and III preauricular sinuses, patients received an extended local resection with an appropriate extended or a separate elliptical incision. This technique was designed to remove the deep sinus tracts and their branches completely and to clear all inflamed granulated tissues to provide a wider surgical view.

The dissection was carried out along the sinus tract, down to the temporalis fascia, which formed the medial limit; then it continued over the cartilage of the anterior helix, which was regarded as the posterior margin of dissection. It is worth noting that the supra-auricular branch and trunk of the superficial temporal artery required protection. The key point was to remove, en bloc, all preauricular tissue in the surgical area, including all sinus tracts and inflamed tissues. Additionally, a portion of the perichondrium of the helix close to the sinus was also excised to ensure complete excision.[11] For large skin defects (short diameter > 3 cm), a local rotation skin flap was used for repair. The wound was closed via a layered closure, with compression, as needed, to prevent dead space formation.[12] A drain was inserted, when the incision extended halfway through the postaural region, or alternatively, the wound was closed.[13]A mastoid dressing was applied, then removed after 48 h. All patients received a course of antibiotics for 3-5 days and wound care once every other day. The suture was removed after 7-14 days. Several representative cases of the different types of sinuses are described below.

Type I case

A 17-year-old male visited the hospital with a congenital sinus at the ascending helix crus and through the surrounding protruding soft tissue. A physical examination revealed that the sinus opening was associated with local swelling. After administering general anesthesia, an elliptical incision was performed around the opening, and the sinus tract was dissected. The entire tract and

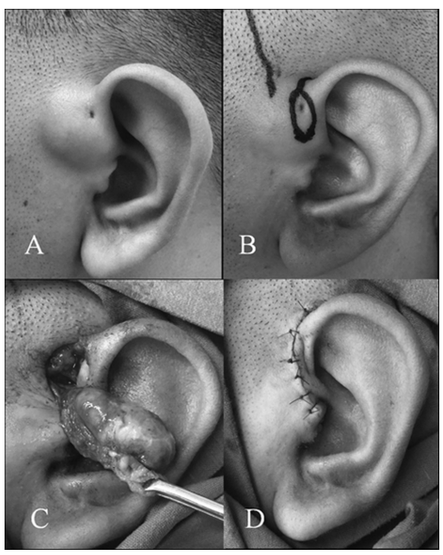

Figure 2

Photograph of a type I preauricular sinus. A: Before surgery. B: An elliptical incision was performed around the opening. C: Sinus excision: the sinus tract and cyst were excised, exposing the cartilage of the helix crus. D: After surgery.

the attached perichondrium of the helix crus were excised en bloc (Figure 2).

Type II case

A 9-year-old female experienced a recurrent infection in an opening in the left preauricular skin, which was present from birth. Upon physical examination, a sinus opening was found in the anterior aspect of the helix crus, with inflammation that spread in the anteroinferior direction from the sinus opening. Under general anesthesia, an elliptical incision was performed that enclosed the area of inflamed tissue. The sinus tract, with all the inflamed tissue, and the attached perichondrium of the helix crus were excised. The tract ran inferiorly, then lateral to the temporalis fascia. The dissected tract was 1.8 cm long (Figure 3).

Type III case

Within 1 year prior to the study, a 12-year-old male had previously had an abscess in the preauricular skin, which was excised and drained. At the current visit, he complained of are current infection in the left preauricular skin. A physical examination showed a surgical scar in the skin of the left helix crus, with an extra iatrogenic fistula, surrounded by

Figure 3

Photograph of a type II case. A: Before surgery. B: An elliptical incision was performed around the opening that included the inflamed tissues. C: Five days after surgery. D: One month after surgery.

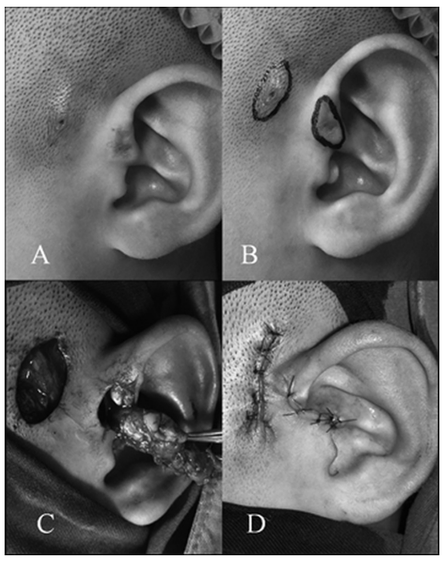

Figure 4

Photograph of a type III preauricular sinus. A: Before surgery. B: Two elliptical incisions were performed around the surgical scar and inflamed tissue. C: The sinus tract was excised, exposing the trunk of the superficial temporal artery, temporalis fascia, and the cartilage of the helix crus. D: After surgery.

inflamed tissue, located distant from the surgical scar. The operation started with an elliptical incision around the surgical scar. Then, a second incision was made around the iatrogenic fistula, parallel to the first elliptical incision. The sinus tract, with all the inflamed tissue, and the attached perichondrium of the helix crus were excised. The tract ran superior, medial to the auricle, and lateral to the temporalis fascia. The fistula and skin tag removal was performed under general anesthesia. The postoperative course was uneventful. The dissected tract was 2 cm long (Figure 4).

Type IV case

A 14-year-old female visited the hospital with a recurrent infection in the right preauricular skin. She had a history of repeated swelling and discharge from the inflamed tissue. A physical examination showed a sinus opening at the top wall of the opening of the right external auditory canal, with an extra iatrogenic fistula surrounded by inflamed tissue in front of the tragus, distant from the sinus opening. This case was treated as an instance of variant preauricular sinus. The sinus tract, with the inflamed tissue, was excised, with an elliptical incision around the inflamed tissue

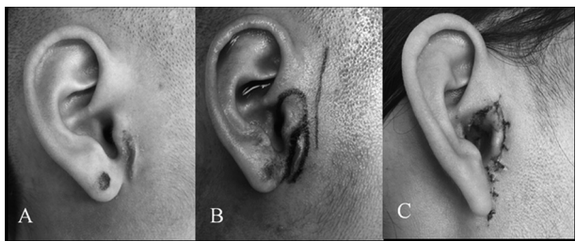

Figure 5

Photograph of a type IV preauricular sinus. A: Before surgery. B: Two elliptical incisions were performed: one around the sinus opening and one around the inflamed tissue. The two incisions were connected by an arc incision. C: Seven days after surgery.

and another elliptical incision around the sinus opening. The two incisions were connected by an arc incision. During the operation, it was found that the sinus tract was unrelated to the parotid tissue, facial nerves, or cartilage of the external acoustic meatus (Figure 5).

Results

This study included 104 patients (117 ears), and of these, 13 had bilateral lesions. Fifty patients were male, and 54 were female. The mean age at the time of surgery was 18.4 years (range: 1.2-57 years). Forty patients had undergone previous incisions and drainage for abscesses, and 20 patients had previously undergone a sinus excision and had experienced recurrences. The mean follow-up time was 3.9 years (range: 6-68 months). Demographic data for each group are shown in Table 1.

In all cases, the diagnostic criteria of preauricular sinus were met, according to the histopathologic examination. All pathological tissues were removed after one procedure. After surgery, 3.8% (4/104) of patients showed symptoms of vomiting, and 2.9% (3/104) of patients had fever. All findings were controlled with conservative methods, and during the postoperative period, no other complications occurred, including hemorrhage, facial paralysis, saliva leakage, and auricular perichondritis. One patient had a wound infection atthe suture on postoperative day 4. That patient underwent 14 days of antibiotic treatment and wound care; ultimately, the wound was completely healed at 20 days after the surgery. During the follow-up period, out of 117 cases, we observed only 1 recurrence (0.85%), in a type IV case (Table 2).

Table 1

Demographic characteristics of patients with preauricular sinus

Characteristic	No. of patients (%)
Gender	
Male	50 (48.1%)
Female	54 (52.9%)
Total patients	104
Age	
Age ≤ 12 years	39 (37.5%)
Age >12 years	65 (62.5%)
Mean age (± SD)	18.1 ± 12.1 years
Site of involved sinus	
Right side	43 (41.3%)
Left side	48 (46.2%)
Bilateral	13 (12.5%)
Total cases	117

Discussion

The recurrence of an excised preauricular sinus is due to an incomplete excision of the sinus tract and the presence of residual, viable squamous epithelium.[14] In our study, only one recurrence was observed out of 117 cases in the follow-up period. This outcome was lower than those in previous reports.[15]We speculated that this recurrence of a type IV sinus might have arisen because the variant tract might have branched into either a single or multiple tributaries that extended medially to the auricle. Taken together with results from previous studies, our findings made it clear that there

Table 2

Clinical history and follow-up of patients with different types of preauricular sinus

Class	Ear surgery(N)	RevisionsN (%)	Previous I&D, N (%)	Recurrence N (%)	Follow-up period (months)
Type I	43	0	0	0	6-52
Type II	44	11(25)	24(54.5)	0	10-68
Type III	22	8(36.4)	14(63.6)	0	8-57
Type IV	8	1(12.5)	2(25)	1(12.5)	7-47
Total	117	20(17.1)	40(34.2)	1(0.85)	6-68

Abbreviation: I&D: incision and drainage.

are several important factors that might prevent complications and recurrence.[2,4,8,10,16]

Determining the appropriate time for surgery is one of the most critical decisions. Generally, the operative procedure should not precede the stabilization of an infected condition. Infection status is typically managed with antibiotics and/or an incision with drainage. Surgical treatments are avoided during and shortly after this period, due to the risks of bleeding in the surgical field, recurrence, and postoperative complications, including scarring, repetitive infections, and undesirable healing in infected conditions.[17] However, a recent study demonstrated that, compared to the stable condition, when a surgical intervention was performed during an infection condition, the complication and recurrence rates were not affected.[14] From our perspective, to secure a better operative field and reduce the postoperative recurrence rate, surgical treatment should not be performed until the inflammation is stable (typically 1 month after treatment).

Good visualization of the sinus is also important in reducing recurrence rates. A methylene blue dye injection can achieve good visualization, but this method iscontroversial.[2,9] In our experience, applying methylene blue dye during an operation could introduce the potential risk that a sinus tract perforation might lead to a leak of methylene blue dye into the operative field. Moreover, in inflamed or revision conditions, parts of sinus tracts might not be visible, due to stenosis, blockage, or an absence of openings. Therefore, no methylene blue dye was instilled in any of our cases.

Next, the surgical strategy is critical for treating preauricular sinuses. A review of the literature showed that various surgical techniques are available for managing a preauricular sinus. Two common major surgical techniques are the classic sinusectomy and the supra-auricular approach, but recently, variations in the preauricular sinus approach have been applied. For example, the inside-out technique described by Baatenburg et al.[9] was proposed to facilitate small sinus tract identification. Huang et al.[18] proposed the selection of surgical methods based on disease severity. Based on our clinical experience, we developed a new classification system to assist surgeons in selecting an appropriate operative strategy for each case.

The supra-auricular approach was also described as a simple, less-time-consuming option associated with fewer clinical difficulties, compared to other approaches. Furthermore, the supra-auricular approach does not require magnification. This feature makes the supra-auricular approach highly effective, particularly in revision cases.[19]In the present study, the local, wide excision was considered a basic operative strategy, based on the Prasad supra-auricular approach.[20] A thorough resection was executed for more complicated cases (i.e., types II-IV). Initially, an elliptical incision was performed around the sinus opening; then, it was extended, when necessary, according to the range of inflamed tissue or scarring. An additional incision, in type III inflamed cases, provided a wider surgical view and enabled meticulous excision of the preauricular sinuses and inflamed tissues. This technique was first described by Choo et al.[14] This double incision approach enables better targeting during the operation. Furthermore, it was designed to enhance the cosmetic outcome.

Identifying the basic surgical plane and boundaries can both ensure good visualization of the lesions and assist surgeons in complete sinus excisions. Typically, sinus tract lesions are located in the soft tissue, between the tragus cartilage and the crus of the helix or on the medial side of the auricle cartilage-perichondrium. Consequently, we agree with Prasad et al.[20] that the temporalis fascia forms the medial limit of the dissection. Then, the dissection continues over the cartilage of the anterior helix, which is considered the posterior margin of dissection. Moreover, as in this study, the sinus tracts typically encounter the supra-auricular branch and trunk of the superficial temporal artery. We suggest that the supra-auricular branch and trunk of the superficial temporal artery should be carefully separated, and generally, these vessels should be regarded as the superior and anterior limits of the surgical area, respectively; this concept has not been considered in previous studies.[21]

In recent years, variant and ectopic preauricular sinuses have been reported that were located in unusual areas, including the posterosuperior or inferior edge of the crus of the helix, in front of the tragus, in the supra-auricular area, or even in the postauricular area or at the opening of the external auditory canal. These areas should be checked carefully during surgery to avoid missing a potential opening or fistula.

Conclusion

In this study, several techniques and suggestions were described to aid complete excision and to prevent recurrence of the preauricular sinus, as follows:

1. Surgery should be delayed for 1 month, until all signs of inflammation have subsided.
2. A surgical method should be selected according to the sinus classification.
3. The superficial temporal artery should be carefully exposed and ligated, when necessary.
4. All sinus tracts and inflamed tissues above the temporalis fascia must be removed en bloc. A portion of the perichondrium of the helix crus at the base of the sinus must also be removed, to ensure complete excision.
5. Avoid damaging the parotid tissue.
6. Large skin defects (short diameter > 3 cm) should be repaired with a local rotation skin flap.

In conclusion, the selection of an appropriate surgical time, explicit surgical boundaries, and an en bloc excision of the entire lesion can facilitate the complete excision of a complicated congenital preauricular sinus with low recurrence rate.

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Xuewen Wu. MD.
Department of Otolaryngology Head and Neck Surgery,
Xiangya Hospital of Central South University,
87 Xiangya Road,
Changsha, Hunan 410008, PR China.
E-mail: xwwu840903@hotmail.com.