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ORIGINAL ARTICLE

Imaging features of pharyngeal hairy polyps in infants

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Abstract

Background Hairy polyps are the most common congenital deformity of the oral-nasopharynx/oral cavity in infants, which may lead to severe complications in the newborns. However, few studies have been published with respect to their radiological features, and most are case reports.

Objective This study aimed to analyze radiological features of the oral-nasopharyngeal hairy polyps and to identify the radiological features with the highest diagnostic value.

Materials and methods From 2014 to 2019, pediatric cases pathologically diagnosed as hairy polyps and having received radiological examination at the Children's Hospital Affiliated to Zhejiang University were retrospectively analyzed. Radiological evaluations were conducted on tumor size, location, morphology, density or signal features as well as the enhancement pattern.

Results A total of six infants were recruited. Clinical features observed in these cases included choking on milk with cyanosis, intermittent dyspnea, oropharyngeal mass, and snoring. Lesions were derived from the left tubal torus in three out of six cases, from the left lateral aspect of soft palate in one, from the left lateral pharyngeal wall in one, and from the right tubal torus in one. They were shown as pedicled polyp-like well-circumscribed mass with fat density or signal as well as a stalk on CT or MRI. In the contrast-enhanced scan, the fat components were not enhanced, while the stalk was mildly enhanced.

Conclusion Hairy polyps had typical radiological features. Hairy polyps should be considered for pedicled polyp-like well-circumscribed mass in the oral-nasopharynx of infants with fat density or signal as well as a stalk.

Keywords Infants · Oropharynx · Hairy polyp · MRI · CT

Introduction

Hairy polyps are the most common congenital tumor of the oral-nasopharynx in infants [1], which are derived from the ectoderm and mesoderm [2]. They are one cause of upper airway obstruction in infants. Hairy polyps usually affect the newborns and infants, which are more common in females than in males, with a male-to-female ratio of 1:6 [3]. The symptoms vary with tumor size and location, and respiratory distress, feeding disturbance, wheezing and snoring are common symptoms in clinic [4]. Endoscopy usually reveals a pharyngeal polyp-like mass with pedicle, which is covered by hairs and sebaceous glands [5]. Case reports of pharyngeal hairy polyps are very limited, and most of them describe clinical and histopathological findings but rarely describe the radiological features [6–8]. In this study, the radiological features of pharyngeal hairy polyps were analyzed and the features with the highest diagnostic value were identified.

Materials and methods

This study was a retrospective observational study and formal consent was not required, according to our local research ethical committee guidelines. Pediatric cases with pathologically confirmed hairy polyps and intact radiological data were included. From January 2014 to October 2019,

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pediatric cases pathologically confirmed as hairy polyps at the Children's Hospital Affiliated to Zhejiang University were retrospectively analyzed. The baseline data, clinical features and radiological examinations of seven infants were analyzed, and one infant was excluded due to an absence of radiological examination.

MRI scan was performed using 3.0 T MRI scanner (Achieva; Philips Healthcare), with eight-channel phased-array coil. All cases received transverse T1WI, fat-suppression T1WI and T2WI, sagittal or coronal T1WI scan, with a slice thickness of 3 mm. For enhancement, the contrast medium was injected. CT scan was performed using the 64-row CT scanner (Optima CT660; GE Healthcare), from the base of skull to the level of thoracic inlet. The scan was performed once before and after the injection of the contrast medium [(Ioversol 320 mg/ml, 1 ml/kg (Hengrui Medicine, Jiangsu, China)], respectively. The tumor origin, location, size, morphology, density/signal and enhancement pattern were analyzed on the CT or MRI images. The origin of tumor was defined as the attachment between the tumor and pharyngeal wall; tumor location was defined as where the main body of the tumor was located; tumor size was described by the maximum diameter of the tumor (superoinferior diameter × anteroposterior diameter × left-to-right diameter). Changes in the tumor signal intensity or density before and after enhancement were compared to determine the enhancement pattern of the tumor.

Results

Table 1 shows the clinical and radiological features of infants with hairy polyps. A total of six infants were collected, with a male-to-female ratio of 1:5. They were aged 9 months and 21 days (range 1 day to 3 years and 8 months) on average. The clinical features included vomiting, choking on milk, asphyxia and snoring. One infant was combined with severe hypoxic ischemic encephalopathy due to the tumor-induced asphyxia. Oropharyngeal masses were found in four infants during routine physical examination, and the time from birth to the discovery of oropharyngeal masses varied from 1 day to 3 years and 8 months. All the six cases received surgical resection. Intraoperative findings showed that the tumors were derived from the left tubal torus in three out of six cases, from the back side of the left soft palate in one, from the left choanal region in one, and from the right tubal torus in one. The symptoms of vomiting, dyspnea and snoring disappeared after surgery.

All the six cases received MRI scan, and three of them received contrast-enhanced scan. Two cases received plain and contrast-enhanced CT scan. Upon MRI scan, well-circumscribed pedicled tumors were found in all of the six cases. The tumors were tongue shaped in one case and pear shaped in five cases. The pedicle length was 2.5–6.5 cm. The tumors were derived from the left tubal torus in three out of six cases, from the left lateral aspect of soft palate in one, from the left lateral pharyngeal wall in one, and from the right tubal torus in one. The main body of the tumor was located in the oropharynx in five cases, and in the esophagus in one case. The tumors showed high signal intensities on T1WI and T2WI images and loss of signals on the fat-suppression sequences in all cases. The signal intensities on all sequences were similar to the fat signals, with hypointense stalk in the middle of the tumors (shown as hypointense cores on the transverse view). The signal intensities were similar to those of muscles (Fig. 1). After the enhancement, components of the fat signals of the tumors were not enhanced, while the stalk in the middle was mildly enhanced (Fig. 2). CT findings were similar to the MRI features, which showed fat density mass enveloping the iso-intense stalk. The stalk was mildly enhanced, but the fat components were not (Fig. 3). On histological examination, Hairy polyps consisted of a mesenchymal core of fibrous adipose tissue usually accompanied by focal cartilage, muscle and bone, as well as skin with soft keratinocyte layer, hair follicles and sebaceous glands (Fig. 4).

Table 1 Clinical and radiological features of infants with hairy polyps

Case	Gender	Age	Clinical features	Radiological examination	Tumor origin	Tumor location	Tumor size (cm)
1	Female	3 years and 8 months	Oropharyngeal mass	MRI	Left tubal torus	Oropharynx	2.7 × 1 × 1
2	Male	1 month and 7 days	Vomiting, feeding disturbance	MRI	Left tubal torus	Oropharynx	3.4 × 0.7 × 0.8
3	Female	20 days	Choking on milk, with cyanosis Oropharyngeal mass	MRI	Left lateral aspect of soft palate	Oropharynx	6.5 × 1 × 1.4
4	Female	1 days	Respiratory distress	CT, MRI	Right tubal torus	Oropharynx	3.6 × 0.9 × 1.4
5	Female	9 month and 6 days	Vomiting, oropharyngeal mass	MRI	Left tubal torus	Esophagus	3.1 × 0.9 × 1.2
6	Female	3 month and 2 days	Vomiting, snoring, oropharyngeal mass	CT, MRI	Left nasopharynx	Oropharynx	2.5 × 0.8 × 0.8

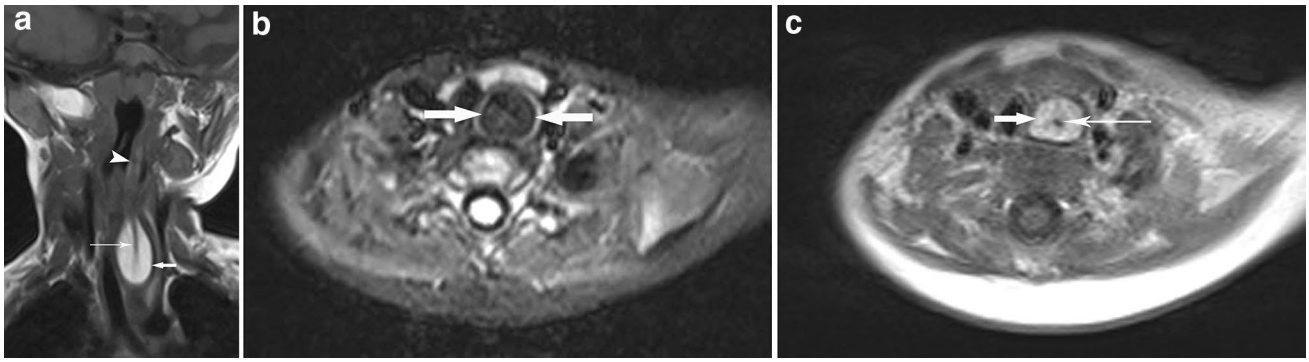

Fig. 1 An esophageal hairy polyp in a girl aged 9 months and 6 days. **a** Coronal T1WI (TR/TE 500 ms/18 ms) showed a well-circumscribed mass with high signal intensity (short arrow) in the esophagus; in the middle of the mass was a strip-like hypointense stalk (long arrow); the tumor was connected to the left pharyngeal wall via the long pedicle (arrowhead). **b** Axial fat-suppression T1WI (TR/TE 561/18 ms), with the mass shown as loss of signal intensity (arrows). **c** Axial T2WI (TR/TE 2500 ms/90 ms), with the mass shown as high signal intensity (the short arrow) and a hypointense core in the middle of the mass (the long arrow)

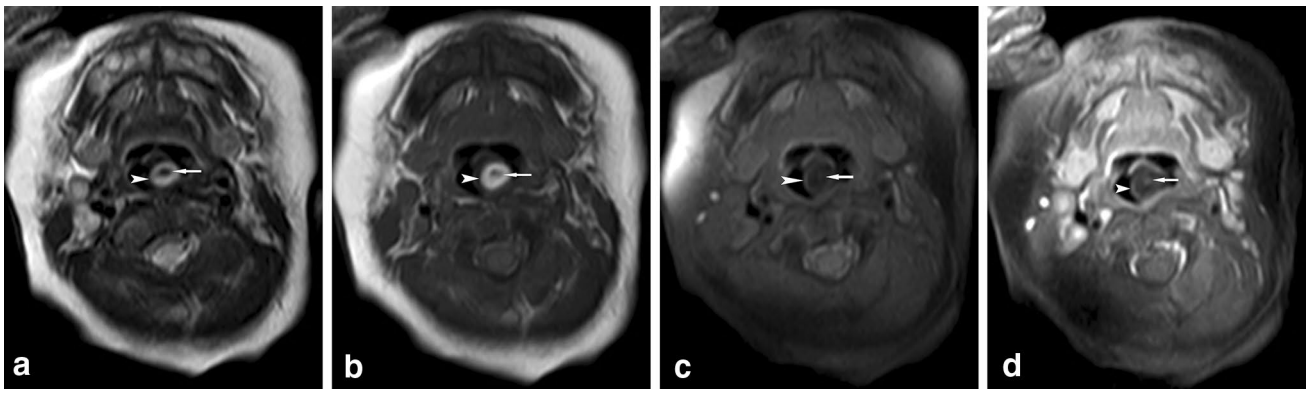

Fig. 2 An oropharyngeal hairy polyp in a boy aged 1 month and 7 days. **a** Axial T2WI (TR/TE 2500 ms/90 ms), with the mass shown as quasi-circular high signal intensity in the oropharynx (arrowhead) with a hypointense core (arrow). **b** Axial T1WI (TR/TE 500 ms/18 ms), with the mass shown as high signal intensity (arrowhead) with a hypointense core in the middle (arrow). **c** Axial fat-suppression T1WI (TR/TE 561/18 ms), with the hyperintensities of the mass suppressed (arrowhead) and slightly hyperintense core in the middle of the mass (arrow). **d** Axial contrast-enhanced fat-suppression T1WI (TR/TE 561 ms/18 ms), with non-enhancement of the mass (arrowhead) and mild enhancement of the core (arrow)

Discussion

Hairy polyps are the most common congenital tumor of the oral-nasopharynx in infants [1, 9], which were first reported in 1784 [3], and first descried in details by Brown–Kelly in 1918. Hairy polyps generally occur in the newborns and infants, with an incidence of 1/4000 [8]. They are more likely to affect females than males. According to the literature report, the ratio of male-to-female is about 1:6 [3]. In our study, the male-to-female ratio was 1:5, which was slightly higher than the reported, probably due to the small sample size of the present study. Hairy polyps are mostly derived from the lateral nasopharyngeal wall or the back side of soft palate, and a few are from the palatal arch [10]. In this study, the lesions were derived from the lateral pharyngeal wall in five cases, and from the soft palate in one case. Hairy polyps occur more commonly on the left side than on the right side, and the incidence on the left side is about 6.5 times of that on the right [4]. We reported five cases with lesions derived from the left side, and one case from the right pharyngeal wall. The reason for the predominance of lesions on the left side may be due to the complex epithelial mesenchymal interactions during the regulation of pharyngeal arch formation by the sonic hedgehog gene and Hox gene [4].

The clinical symptoms associated with the hairy polyps depend on tumor size, tumor location and mobility, and respiratory distress is a major feature of the pharyngeal hairy polyps. Smaller polyps are usually asymptomatic or present

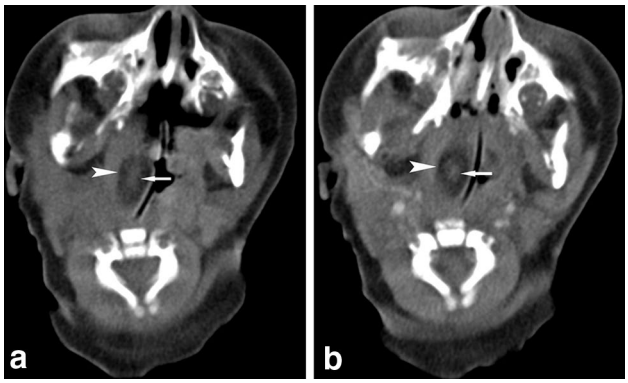

Fig. 3 A right nasopharyngeal hairy polyp in a girl aged 1 day. **a** Plain CT scan shows the fat density mass in the right lateral nasopharyngeal wall (arrowhead) with soft tissue density core (arrow). **b** Contrast-enhanced CT scan shows mild enhancement of the core, and non-enhancement of the rest of the mass

as wheezing after birth, with intermittent dyspnea; larger ones are associated with a risk of asphyxia [2]. Other symptoms may include vomiting, feeding disturbance, cyanosis, recurrent coughing, and snoring. Dyspnea is largely caused by the blockage of the upper respiratory tract by the tumor, and the plane of blockage can be found behind the soft palate and the tongue base or in the pharyngeal vestibule. For hairy polyps with a longer pedicle, the location of their main body may vary with the crying and swallowing movements of the infants, resulting in intermittent relief and aggravation of dyspnea. When the tumor touches the pharynx or larynx during its movement, the symptom of vomiting may occur. Hairy polyps can either occur alone or concurrently with cleft palate, maldevelopment of uvula, microtia and developmental asymmetries of the face. However, these developmental malformations were not observed among our cases.

Given the distinctive clinical features of hairy polyps, laryngoscope and fiber optic laryngoscope are usually used to facilitate the diagnosis. For this reason, preoperative radiological images are absent in most cases, which explains the limited number of literature reports on the radiological features of hairy polyps. Kochanski et al. [7] reported that hairy polyps were shown as fat signal masses with iso-intense cores or fat density masses with cores of soft tissue density on the transverse view of MRI and CT. Cerezal et al. [11] described MRI features of hairy polyps in an adult case, which were shown as a round, well-circumscribed pedicled mass in the oropharynx, with fat signals, linear hypointense signals in the middle but no enhancement in the contrast-enhanced scan. The report by Kraft et al. [6] was similar, and it was indicated that intracranial and intraspinal involvement was uncommon for hairy polyps. We presented some typical features of hairy polyps in our cases. Upon CT or MRI scan, a hairy polyp is usually shown as a fat density or signal polyp-like well-circumscribed mass containing a stalk. The density or signal of the stalk was similar to that of soft tissue, and it is mildly enhanced in the contrast-enhanced scan, while the remaining part of the tumor is not enhanced. On the transverse view, the mass is round, and on the sagittal view, the mass was tongue- or pear-shaped. It is easier to identify origin of the mass on the transverse view, while on the sagittal or coronary view, it is more likely to capture the full tumor. Intracranial or intraspinal involvement was found in none of the lesions in the present study, which was consistent with the existing reports. Radiological findings of hairy polyps usually reflect the pathological features of the lesions. A hairy polyp is composed of a mesodermal core and the inner membrane of ectoderm. The mesodermal core is usually composed of fibrous fat, and muscles or cartilages are also possible; the ectoderm is composed of mature stratified squamous epithelium and skin appendages [12]. CT or MRI can clearly show the fatty and fibrous components of the mass. The stalk in the middle of the mass represents the fibrous muscle components, which are shown as soft tissue density or signals on CT or MRI, and this soft tissue core helps us trace the origin of the tumor, which is particularly important for the

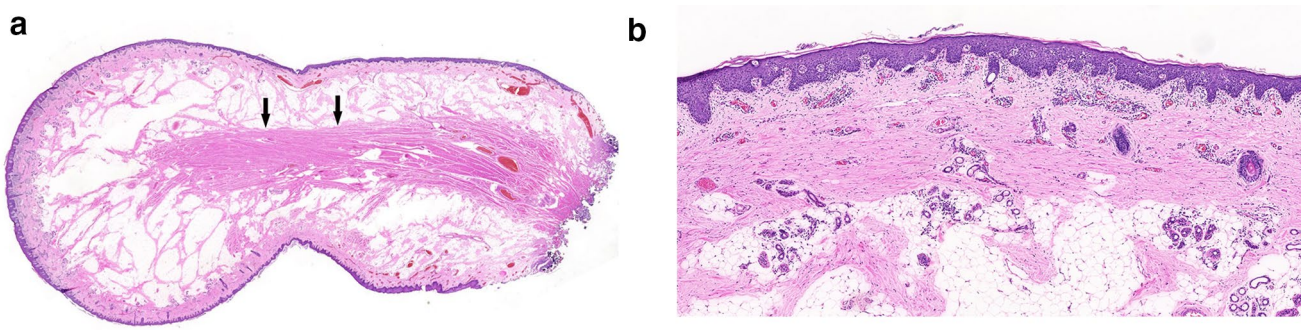

Fig. 4 Histological examination of the hairy polyp of the case in Fig. 2. Photomicrographs (hematoxylin–eosin stain) obtained at ×5 (**a**) and ×50 (**b**) original magnification show skin with hair follicles and sebaceous glands overlying a mesenchymal core predominantly comprised of fibrous fat and a striated muscle stalk (arrows), and the stalk is shown as soft tissue signals on MRI

choice of surgical methods, because the best treatment for hairy polyps is a simple surgical resection at the root of the pedicle, using a trans-oral, trans-nasal, or trans-tympanic approach [8, 13]. The fatty components enveloping the stalk generally have similar density or signals as the subcutaneous fat on CT or MRI.

Radiological examination plays a significant role in assessing the origin and extent of hairy polyps, determining whether there is intracranial invasion, and formulating surgical plans. CT can show the lesion and the state of its surrounding bone, such as any widening of the bony eustachian tube and the cartilage integrity of the carotid artery [10]; magnetic resonance imaging (MRI) can clearly and accurately show the location and extent of the lesion, and its relationship with blood vessels (such as the carotid sheath). MRI sagittal and coronal images are particularly important for identifying lesions such as meningocele [11]. On the other hand, radiological examination is significant for the differential diagnosis. Since hairy polyps are rich in fatty components, CT and MRI can facilitate differential diagnosis of oral-nasopharyngeal masses in infants, for example, hamartoma, teratogen and dermoid cyst. Therefore, some other diseases are excluded, such as neuroblastoma, angioma, meningeal herniation and congenital cysts [8]. In other reports, hairy polyps are usually classified as teratoma, hamartoma and dermoid cyst. Currently, it seems more appropriate to classify the hairy polyp as choristoma, which only consists of two germ layers without an endoderm [8]. In contrast, the other three types of lesions are the results of varying differentiation of the three germ layers [10]. The hairy polyps are differentiated from the other three types of fat-containing lesions in terms of radiological features. Compared with hairy polyps, hamartoma is associated with greater non-uniformity of density or signals [13]. Therefore, hairy polyps can be differentiated from hamartoma based on epidemiology and density or signal features. Hairy polyps are more common in females, with a male-to-female ratio of 1:6, while the incidence of teratoma among males and females is similar. Moreover, teratoma is featured by mixed density and signals, usually with thick calcifications and cystic, cystic–solid or solid components [14]. On the contrary, density or signals of hairy polyps are more uniform, usually without calcifications. Hairy polyps and dermoid cyst can be differentiated based on tumor location and density or signal features. Hairy polyps are generally a pedicled tumor protruding towards the oropharynx and derived from the lateral nasopharyngeal wall. They occur more frequently on the left side than on the right side. However, the dermoid cyst is usually found in the middle and front of the oral cavity [14]. A hairy polyp is more uniform in density or signals, and shown as a pedicled fat density mass, without restricted diffusion on the diffusion-weighted imaging. However, a dermoid cyst is shown as a thin-walled cystic mass, probably with calcifications in the cyst wall. The density or signal is usually non-uniform, with a fluid level and marble-like appearance by MRI and diffusion restriction [14, 15].

Conclusion

There are some distinctive radiological features for pharyngeal hairy polyps. Hairy polyps may be considered for a well-circumscribed pedicled polyp-like mass with fat densities or signals and without intracranial and intraspinal involvement on CT or MRI.

Compliance with ethical standards

Conflict of interest Authors Meijun Sheng, Yanhong Mi, Fusheng Gao, Jiawei Liang, and Haichun Zhou declare that they have no conflict of interest.

Human rights statements and informed consent All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5). Informed consent was obtained from all patients for being included in the study.

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