Management of endolymphatic sac tumors: a case series report
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Abstract Objective To study clinical characteristics of endolymphatic sac tumor (ELST) and its diagnosis and treatment. Methods ELST was diagnosed in 6 cases based on surgical and histological findings. These cases were reviewed for their clinical manifestations, differential diagnosis and surgical treatment techniques. Results There were 1 male and 5 females in this group, aged from 28 to 59 years (mean age = 38.7 years). The tumor was in left ear in 4 cases and in right ear in the other 2 cases. Disease courses ranged from 5 to 30 years (mean duration = 12.6 years). Clinical presentations included sensorineural hearing loss (n = 4), otorrhea and tinnitus (n = 2), tinnitus and facial spasm (n = 1), otorrhea with facial paralysis (n = 1), and hearing loss with tinnitus (n = 2). None of the cases was diagnosed as ELST preoperatively. Two cases were misdiagnosed as glomus jugulare tumor, 2 as chronic suppurative otitis media, 1 as sweat gland adenoma on biopsy and 1 as temporal bone tumor. Tumors were surgically resected in all 6 cases via the mastoidectomy (n = 2) or combined oto-cervical or cranio-oto-cervical approaches (n = 4). Postoperative cerebrospinal fluid otorrhea occurred in 1 case. The tumors were confirmed on histological examination to be a low-grade adenocarcinoma. All patients have survived at the time of this paper. Conclusion ELST is rare and commonly misdiagnosed and inadequately treated. Its prognosis is relatively favorable because of its slow growth rate.

Key words Endolymphatic sac, neoplasm

Introduction
Endolymphatic sac tumor (ELST) is a rare and low-grade malignancy. However, its unique anatomical location and relationship with neighboring important neural and vascular structures make its diagnosis and treatment a challenge. Surgical approaches for ELST resection can be difficult and surgical complications are not uncommon and sometimes fatal. A thorough knowledge of its clinical presentation and imaging features is critical for adequate management of this condition.

This paper reports 6 cases of histologically confirmed ELST treated at the Chinese PLA General Hospital.

Patient Data
Case 1. A 28 years old female presented with left side chronic ototorhea, progressive hearing loss and facial weakness of 8 years. Otoscopy revealed a dark red mass from the left tympanic cavity (TC) and fullness in posterior canal wall of the external auditory canal (EAC). Audiometry showed complete hearing loss in left ear. CT and MRI scans demonstrated a lesion of irregular signal densities invading the petrous temporal bone and the internal auditory canal (IAC) with compression effects on the temporal lobe and cerebellum. Surgical resection was attempted via an extended temporal bone resection through a combined cranio-oto-cervical approach. A mass lesion was found to occupy the medial portion of the EAC, TC and mastoid, invading the mastoid segment of the fallopian canal and anterior wall of the sigmoid sinus. The dura was intact. Following resection of the lesion including part of the facial nerve, the defect was obliterated with a musculofascial graft, with primary hypoglosso-facial nerve anastomosis (HFNA). Blood loss
Case 1. A 53 years old male patient who suffered from intermittent otorrhea and hearing loss of 30 years and suppurative otitis media was referred to our center. Otoscopy revealed a retracted tympanic membrane. Hearing tests showed right side total loss. CT scans demonstrated soft tissue shadow filling the TC, attic and mastoid. Otitis media with cholesteatoma was suspected and a tympanomastoidectomy was planned. Large amount of granulation tissue was seen during the surgery with no cholesteatoma. The dura was exposed and intact. Low grade adenocarcinoma from the ELS was reported on pathology report.

Case 2. A 48 years old woman presented with left side pulsating tinnitus, hearing loss of 5 years and facial spasm of 2 months. Other symptoms included fullness, vertigo attacks, facial numbness and bloody otorrhea. Physical examination (PE) showed a red mass in the inferoposterior TC and left facial paresis. Audiometry showed left total hearing loss. Imaging studies suggested glomus jugulare tumor (GJT). Surgical resection was attempted via a retromastoid approach following embolization of the supplying artery. The lesion invaded the TC, mastoid, occipital bone, jugular foramen (JF) and local dura. A temporalis myofascial graft was used to repair dura defect following resection of the mass and involved section of the facial nerve. Primary HFNA was performed. Low grade papilloadenocarcinoma was reported on histological examination.

Case 3. A 25 years old young woman presented with right side pulsating tinnitus of 10 years and facial weakness of 7 years. PE showed a red mass lesion in the EAC with tuning fork tests suggesting right side sensorineural loss. MRI scans suggested well demarcated mastoid and jugular bulb mass lesion with rich blood supply and local bone erosion. Severe bleeding occurred at biopsy and forced abortion of a local resection attempt. Resection was attempted again via an oto–cervical approach. A dark red mass lesion was found to occupy the EAC, TC and mastoid, causing destruction of the posterior EAC wall. Dura over the sigmoid sinus remained intact. Pathology report confirmed a low grade adenocarcinoma from the endolymphatic sac (ELS), staining positive for keratin and neuron–specific enolase (NSE).

Case 4. This was a 38 years old woman with right side intermittent otorrhea and hearing loss of 30 years and dizziness shortly before presentation. Otoscopy revealed retracted tympanic membrane. Hearing tests showed right side total loss. CT scans demonstrated soft tissue

Discussion

ELST originates from the pars rugosa of the ELS. Its terminology remains controversial. Names such as aggressive papillary tumor of the middle ear, aggressive papillary tumor of temporal bone and ELS and low–grade ade-
nocarcinoma of ELS have been used. Since it shares many histological features of the ELS, the ELS has been widely accepted as its origin. Because it is often seen in von Hippel–Lindau disease, it is also considered an otological representation of von Hippel–Lindau disease. von Hippel–Lindau disease is an autosomal dominant syndrome with predisposition to neoplasms involving the retina, central nervous system, viscera and ELS. Further investigation for possible neoplasms such as angiomomas in the retina and brain, renal carcinoma and other neoplasms in the pancreas, adrenal glands and epididymis is recommended in patients diagnosed with ELST. None of these neoplasms was found in this series.

ELST is considered a low grade malignancy because of its slow growth rate, high degree of cellular differentiation, rare distant metastasis and relatively benign prognosis. Average disease duration in the current series was 12.6 years. It often takes years for symptoms to develop and for the patient to seek medical care, indicating a slow disease course and favorable prognosis. Patients who received partial disease resection have been reported to survive for 10 years or longer. All 6 patients in this series survived during the 10 months to 8 years follow up.

Clinically, ELST often presents with typical otological manifestations, including hearing loss, tinnitus and dizziness. Hearing loss is usually sensorineural in nature and can present as sudden SNHL. Hearing loss was identified in all cases in this series, with total loss in 4 cases. Other typical features include symptoms simulating otitis media (Cases 1, 4 and 5 in this series) and red colored mass and blood–tinted discharge in the EAC. In cases with advance lesion, functions of the facial nerve and/or lower cranial nerves will be compromised, resulting in facial paralysis/spasm, hoarseness and tongue atrophy.

There lack studies on age and gender distributions in ELST, although it seems to affect females more than males. Five of the 6 cases in this series are female. There is a wide age range for this disease (10–80 years), and the onset age can be as young as 4 years. The average age in this group is 39.8 years.

Imaging studies in ELST typically reveal destruction of bony structures between the IAC and sigmoid sinus, often involving the posterior cranial fossa. Bony erosion is sometimes limited to the mid section of the petrous temporal bone, but can be extensive and involving the mastoid, TC and JF. Irregular signal enhancement is commonly seen on ELST images, often showing calcification and cystic or necrotic changes. DSA images usually indicate rich blood supply, but not as strong or homogeneous as in GJT or meningioma and sometimes with non–vascular (cystic) areas.

Histologically, ELST features papilloglandular patterns that can be dominated by either colloidal or papillary areas. The glandular structures contain large number of papillae and cysts covered by cuboidal or flat epithelium and are rich in blood vessels, similar to choroid plexus papilloma. The cysts are filled with colloidal substance, similar to papillary carcinoma of thyroid. Clear cells can be seen, as in clear cell carcinoma of kidney. Because the ELS derives from the neuroectoderm, immunohistological staining for epithelial membrane an-
tigen (EMA) and NSE can help diagnosis \(^9\), usually positive for CK and NSE and negative for EMA, glial fibrillary acidic protein (GFAP), TG, CgA, Syn and S–100. None of these tests are specific for ELST, but nonetheless helpful \(^7\).

Important differentials in ELST include GJT, schwannoma, meningioma, metastatic malignancies and middle ear carcinoma. Because of its retro–labyrinthine origin site, early ELST is located superior, lateral and anterior to a typical GJT which is inferior to the labyrinth. The difference is however not discernable in advanced cases. Enhancement is usually irregular in ELST with possible non–vascular areas, in contrast to that in GJT which is usually homogenous with “salt and pepper sign”. Hearing loss in GJT is usually conductive. Schwannoma in the JF area is rare and can also show irregular enhancement and cystic signs on imaging, but bone destruction is usually a result of compression not erosion and otorrhea and SNHL are uncommon. Meningioma in the same area can cause bony destruction and lower cranial nerves dysfunction, usually without SNHL, tinnitus or dizziness. Its imaging is characterized by calcification, strong enhancement, rich blood supply and unique meningeal “tail sign”. Cystic changes are rare in meningioma. Acoustic neuroma and choroid plexus papilloma or carcinoma are intracranial lesions and seldom cause bony destruction. Middle ear carcinoma starts from the TC and contains no papillary or cystic structures (suggestive of middle ear invasion by ELST when present) but epithelial cells with filaments on electric microscopy.

To summarize, clinical features in ELST include SNHL, female gender preponderance, retropetrous lesion easily separated from the dura, destruction of middle and posterior portion of the petrous temporal bone with irregular enhancement on imaging, rich blood supply, and papillary and/or cystic structures on histological examination.

The preferred treatment is surgical resection. Preoperative embolization helps reduce intraoperative bleeding, surgical time and postoperative complications \(^6\). The supplying artery is usually from the external carotid artery (posterior auricular, occipital, ascending pharyngeal arteries, etc) or vertebral artery (usually anterior inferior cerebellar artery). A retroauricular approach is preferred because of the lesion’s retrolabyrinthine location. A combined lateral ear–neck approach is helpful in a lesion with extensive involvement. Approach begins with a mastoidectomy with exposure of the sigmoid and posterior cranial fossa dura. Preservation of posterior wall of the EAC is possible when it is free of lesion, but the wall can be removed and the entire EAC obliterated if needed. Subtotal temporal bone resection is sometimes necessary. Efforts should be made to preserve the facial nerve and fallopian canal, but lesion–laden facial nerve should resected with the tumor with primary HFNA or transplant with the great auricular nerve graft. Involved dura should be resected with the tumor and the defect repaired with myofascia from the temporalis. Surgical defect can be obliterated with muscle or fatty tissue graft after ample irrigation. Regular irradiation or chemotherapies are not effective in ELST, but gamma–knife treat-
ment may be helpful \(^{10}\).

References


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