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Current Views on the Development of the Tympanal Segment of the Facial Nerve (Literature Review)

Gulyamov Sherzod Bakhramdjanovich

Candidate of Medical Sciences National Children Medical Center

Annotation: Ear canal atresia is a congenital or acquired obliteration of the bony cartilaginous canal that connects the auricle to the middle ear. Closure of the auditory canal is accompanied by a decrease in hearing acuity up to deafness. Congenital atresia is often combined with microtia and other developmental anomalies. Diagnosis includes examination by an otolaryngologist with otoscopy, audiometry and computed tomography of the temporal bone. In case of bony overgrowths, skull radiography is performed. Treatment of pathology is surgical. During surgery, an artificial canal is formed using skin and cartilage flaps; if necessary, tympanoplasty is performed. Anomalies of the auricle require plastic reconstructive surgery.

Keywords: congenital; anomaly; atresia of the external auditory canal; facial nerve; aberration.

Introduction. The term ‘atresia’ implies the complete absence of natural canals and openings in the body. Ear canal occlusion is a rare condition that can be combined with pathology of the middle and inner ear, underdevelopment of the auricles. Congenital anomaly occurs in otolaryngology more often than acquired and is 1 case per 10,000 newborns. The ratio of boys and girls with this disease is 1.5:1. Unilateral lesions occur 3 times more often than bilateral ones. Atresia of the auditory canal is combined with sensorineural hearing loss (difficulty in sound perception) in 11-17% of cases.

Causes

The causes of auditory canal atresia fall into two broad groups:

- Congenital. This pathology is associated with intrauterine disruption of the laying of the 1st and 2nd gill arch. The development of anomaly in newborns is associated with infections suffered by the pregnant woman (rubella, cytomegalovirus, influenza, chickenpox), with her taking drugs with teratogenic effect, exposure to radioactive radiation. Children of mothers suffering from alcohol, drug and tobacco addiction are at risk. The older the age of the mother (after 40 years), the higher the probability of developing atresia of the external auditory canal. Often the anomaly is accompanied by bilateral lesions and is combined with a defect of the auricle (microtia).
- Acquired. Burns, wounds, contusions and fractures of the temporal bone often lead to the formation of bone atresia. Cartilaginous overgrowth is formed in recurrent purulent otitis media and other inflammatory diseases.

Classification

The modern community of operating otolaryngologists uses the classification of the German physician G. Schuhnecht. This division reflects the correlation of pathological changes in the auditory canal and the severity of hearing loss. The classification distinguishes four main types of atresia:

- Type ‘A’ - obliteration of the cartilaginous section of the external canal. Hearing loss of the 1st degree is noted.
- Type ‘B’ - contamination occurs in the cartilaginous and bony sections. Decrease in sound perception reaches 2-3 degrees.
- Type ‘C’ - complete canal atresia, which is often accompanied by hypoplasia of the tympanic membrane.
- Type ‘D’ - complete atresia with anomalies of the inner ear structures (cochlea, ossicles), pathology of the facial nerve. With these changes, surgical correction is not carried out, the violation of sound perception is irreversible.

Symptoms

Symptoms of congenital atresia can be noticed in the first hours of a newborn's life. They are manifested by a change in the shape of the auricle (microtia), narrowing of the auditory canal. Audiograms show unilateral or bilateral hearing loss. Congenital anomalies are often combined with paresis of the facial nerve, facial asymmetry, malformations of other systems and organs (congenital heart defects, retinopathy). Late diagnosis may result in delayed development of speech, imagination, memory and thinking.

Acquired atresia is manifested by the development of hearing loss. In complications of chronic purulent processes due to impaired outflow of purulent secretions, pain, increased body temperature, deterioration of the patient's general condition occur. If treatment measures are not taken in time, intracranial complications (meningitis, encephalitis) and osteomyelitis may develop. Incomplete occlusion of the ear canal may not give a clear clinical picture. However, over time, persistent hearing loss occurs when the narrowed canal becomes blocked by grey matter.

Diagnosis

To make a diagnosis, to determine the exact form and type of atresia, to determine the indications and scope of surgical intervention, it is necessary to carry out a comprehensive diagnosis of the hearing organs. In order to detect congenital anomalies in the foetus, women perform screening ultrasound at 20, 31-32 weeks of pregnancy. Diagnosis of different forms of atresia is carried out in several ways:

1. Examination by an otolaryngologist with otoscopy. The otolaryngologist assesses the patency of the external auditory canal and the appearance of the tympanic membrane.
2. Audiometry. The specialist determines the acuity of hearing, sensitivity of the hearing aid to sound waves of different frequencies.
3. CT scan of the temporal bone. Helps to determine the cause of obliteration, the presence of purulent content, as well as the development of complications. It is used to clarify the diagnosis and determine the extent of surgery
4. Radiography of the skull in 2 projections (straight and lateral). The technique is used in case of bony occlusions of the ear canal. With the help of radiography it is possible to determine the extent of the lesion, the presence of fluid (pus, blood) in the middle ear.

Differential diagnosis of atresia of the ear canal should be carried out with neoplasms of the external ear. In this case, the history of the disease and additional methods of research (computed tomography, otoscopy) will help to determine the localisation of the tumour closing the lumen of the canal. Diagnosis is made after consultation with a general practitioner or paediatrician, a surdologist, and in some cases a geneticist.

Treatment

The main method of treatment of atresia is surgical. Only at the initial stage of the acquired form of the disease resort to mechanical enlargement of the ear canal. After diagnosis, the specialist decides on the possibility of surgery and the choice of technique. The aim of the intervention is to restore

the lumen of the auditory canal to ensure normal sound conduction and sound perception. The correction of congenital anomalies consists of several steps. First, temporary hearing aids are fitted. For this purpose, individual selection and fitting of hearing aids and psychological assistance in the child's social adaptation are carried out. If the tympanic membrane and inner ear (auditory ossicles, cochlea) are intact, surgical treatment is carried out.

At the beginning of the operation, pathological membranes and scars are excised. Then proceed to create an artificial passage, the walls of which are covered with a skin flap or fragments of cartilage taken from the rudimentary auricle. If necessary, tympanoplasty is performed, forming a new tympanic membrane from the fascia of the temporalis muscle. Due to the fact that atresia is often combined with developmental anomalies of the auricle, in addition to reconstructive surgery on the ear canal, auricle plasty with the formation of cartilage tissue is performed.

Any intervention is accompanied by antibacterial, analgesic and anti-inflammatory therapy. After surgery, the child is recommended to be monitored by a surdologist, neurologist and speech therapist. Preventive examinations by an otolaryngologist should be carried out at least once every 2-3 months. For adaptation to society, sessions with a psychologist are recommended.

CONCLUSION: Congenital anomalies of the external ear are a complex disease and their surgical treatment still poses various challenges. Knowledge of the anatomical location of the facial nerve is very important for the surgeon. Congenital malformations of the external auditory canal are almost 100% accompanied by various congenital defects of the middle ear. Intraoperative detection of congenital facial nerve defects can prevent postoperative facial nerve complications for the surgeon. Congenital facial nerve defects make it difficult for the surgeon to perform the ossiculoplasty procedure. Intraoperatively, the use of facial nerve neuromonitoring can reduce the duration of surgery and prevent facial nerve injury by timely detection of its atypical location.

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