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Oddział Otolaryngologii Wojewódzkiego Szpitala Specjalistycznego w Lublinie
Otolaryngology Department of Medical University of Lublin
Otolaryngology Ward of the District Specialistic Hospital in Lublin

KRZYSZTOF KUPISZ, JANUSZ KLATKA,
ELŻBIETA HRYCIUK-UMER, STANISŁAW KLONOWSKI

Injuries of the middle ear with a welding spark

Uszkodzenia ucha środkowego iskrą spawalniczą

Posttraumatic perforation is the commonest type of the middle ear damage. It can result from an injury related to work, practising sport or a road accident (2, 5). Some cases of tympanic membrane perforation are due to autolesions sustained during hygienic activities or can result from iatrogenic trauma (5). A separate group of tympanic membrane injuries are damages caused by high pressure (barotrauma).

A welding spark is a rare cause of tympanic membrane injuries. In available literature of Medline 1980-1999 we found few reports of the middle ear injuries with a welding spark (1, 3, 4, 6). The aim of our examinations was to describe this type of posttraumatic changes in the middle ear, its consequences as well as methods and results of treatment.

MATERIAL AND METHODS

5 patients were treated for the middle ear injuries with a welding spark at the ENT Department of Medical University in Lublin and at the ENT Ward of the District Specialistic Hospital named after Cardinal Stefan Wyszyński in Lublin in the years 1997-1999. The age of patients ranged from 41 to 52 years. Each patient had sustained an ear injury during the welding activities. 3 patients reported to the laryngologist 1 to 2 months from sustaining the injury. 2 patients, however, reported to the Laryngology Consulting Unit 4 years after the middle ear injury.

The patients underwent a routine laryngologic examination, threshold audiogram and radiologic diagnostic procedure: X-ray of mastoid processes with the Schiller's method as well as CT of the middle ear (the tympanic membrane was targeted in the bone window in 1 mm layers using the high resolution program).

RESULTS

The patients made the following complaints: defective hearing (bradyacusia) - 5 patients, tinnitus - 2 patients and vertigo - 2 patients.

Otoscopic examination revealed: tympanic membrane defect in posterior quadrants - in 2 cases, tympanic membrane defect in anterior quadrants and a "welding pearl"- a metal filing set in the tympanic membrane on the border of the posterior quadrants – in 1 patient. In the two remaining patients the prolapse of the postero-superior wall of the external auditory meatus, granulation in the meatus as well as considerable loss of thympanic membrane with preservation of its marginal part was found.

Basing on threshold audiometry, in 3 patients with dry perforation of the tympanic membrane the hearing defect of the conduction type was found by about 35 dB (curve of air conduction at 500Hz frequency - mean 35 dB, at 1000Hz frequency - mean 40 dB, at 2000Hz frequency - 30 dB, at 3000Hz frequency - 30dB, at 4000Hz frequency - 25dB). In 2 patients, however, hypoacusis of mixed type was observed - with lowering of bone conduction curve to about 20 dB and air conduction curve to about 50 dB.

The CT scans of the middle ear showed a foreign body in the middle ear in 4 subjects. In 1 patient three tiny foreign bodies were shown: one in tympanic membrane projection, while the two others gave shadows in the lower tympanic region. In 3 patients metal filings in individual scans resided in the lower tympanic region. In 1 patient CT did not reveal a foreign body in middle ear spaces.

All the patients were subjected to surgical treatment. In 3 of them myringoplasty was preceded by anterior tympanotomy. As graft material fascia of the temporal muscle was used. In 1 patient two metal filings were found during the operation residing beneath the recess of the oval window in the tympanic sinus and a tiny filing on the border of posterior quadrants of the tympanic membrane. In one case a small metal filing residing in the lower tympanic region was found and removed during the aspiration of the tympanic cavity. In the third patient from the group under discussion no foreign body was found in middle ear spaces during tympanotomy.

2 patients were qualified for a radical, modified surgery because of the otoscopic picture and X-ray changes in air spaces of the mastoid process. In these patients inflammatory condition was observed in the cells of the mastoid process, the presence of mucous secretion and hypertrophic ependyma. In both cases granulation also filled the mastoid cavity, upper and middle part of the tympanic cavity and through the defective opening in the tympanic membrane ran to the external auditory meatus. After removal, granulation

was histopathologically examined and in both cases chronic inflammatory changes were found. In these patients metal filings of about 2 mm diameter each were detected in the lower recess of the tympanic cavity. In both cases the posterior wall of the external auditory meatus was removed and the loss of tympanic membrane was supplemented with temporal muscle fascia. In each of the 5 patients operated on the chain of auditory ossicles was retained.

RESULTS

In 3 patients with a dry defect of the tympanic membrane the myringoplasty was preceded by explorative anterior tympanotomy. In these patients the healing of the tympanic membrane transplant was obtained within 14-18 days after operation and audiometric examination done 3 months after operation showed hearing improvement in two cases by 15 dB, in one case by 10 dB, with diminishing of the cochlear reserve to 15-20 dB.

Among the cases where modified radical surgery combined with the removal of the posterior wall of the external auditory meatus and myringoplasty was performed the healing of tympanic membrane graft and dry ear were obtained in 1 patient. In the other patient, however, myringoplasty proved a failure. The improvement of hearing was not obtained in any of the patients.

CONCLUSIONS

The welding spark injury caused the tympanic membrane perforation in all the cases examined. The long-lasting presence of a metal filing in the middle ear spaces led to a chronic inflammatory process with the formation of granulation, otorrhea and progressive hearing loss in 2 of the treated patients.

Patients with the middle ear injury caused by a welding spark should have surgical treatment 2-3 months after trauma at the latest.

Fast surgical intervention allows to rule out the presence of a foreign body, or to remove it from the middle ear spaces and gives better treatment results in the healing of the tympanic membrane graft and in the improvement of hearing.

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STRESZCZENIE

W latach 1997-1999 w Klinice Otolaryngologii Akademii Medycznej w Lublinie oraz w Oddziale Otolaryngologii Wojewódzkiego Szpitala Specjalistycznego w Lublinie leczono pięć przypadków urazu ucha środkowego iskrą spawalniczą. We wszystkich przypadkach stwierdzono ubytek błony bębenkowej i stałe lub okresowe wycieki z ucha, w dwóch przypadkach dolegliwościom tym towarzyszyły zawroty głowy. Chorych poddano leczeniu operacyjnemu. U trzech chorych wykonano myringoplastykę zamkniętą, poprzedzoną eksploratywną tympanotomią przednią, natomiast w dwóch przypadkach wykonano myringoplastykę otwartą jako etap operacji radykalnej zmodyfikowanej. U czterech pacjentów stwierdzono obecność ciała obcego w jamie bębenkowej, w jednym przypadku nie stwierdzono resztek iskry spawalniczej.