Traumatic Dislocation of the Incus Associated with Basilar Skull Fracture

A Treatable Cause of Deafness Following Cranial Trauma*

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A neurosurgeon is frequently presented with the problem of a patient with hearing loss following head injury. This head injury is often associated with a skull fracture, particularly one involving the temporal bone. All too often, the resultant hearing loss is not adequately investigated. This paper presents a case in which the hearing deficit following cranial trauma was due to a traumatic dislocation of the incus which was corrected by transposition of the malleus to the head of the stapes providing an intact middle ear sound conduction mechanism.

Case Report

A 19-year-old sailor was admitted to the neurosurgical service of the U.S. Naval Hospital, Charleston, South Carolina, on October 5, 1964, following an automobile accident. He had been riding in the front seat of an automobile which was involved in a head-on collision. He was immediately rendered unconscious.

Examination. On examination, the patient was comatose, with a blood pressure of 130/90, pulse 60, respirations 20. There were bilateral contusions of the scalp in the frontal area, a large subgaleal hematoma underlying the left frontal scalp, and multiple puncture wounds due to glass in the frontal scalp. The pupils were equal and reacted to light. The fundoscopic picture was normal; in particular, there were no hemorrhages and no papilledema. Examination of the ears revealed a cerebrospinal fluid otorrhea on the right, and blood behind the left tympanic membrane. There was a fracture of the right clavicle. The chest, abdomen and extremities were normal.

Admission skull x-rays showed a linear fracture of the right parietal bone. In addition, there were bilateral linear fractures of the temporal bones descending into the base of the skull. Mastoid films revealed a questionable defect in the tegmen tympani adjacent to the epitympanic area; this probably was part of the basilar fracture and thus related to the traumatic displacement of the incus discovered later. Chest x-rays revealed a comminuted fracture of the right clavicle. The lung fields were clear. The remaining laboratory examinations were normal except for a gross hematuria which cleared on the day of admission. The patient was treated in the intensive therapy ward and a figure-of-eight dressing applied for the right clavicular fracture. Prophylactic antibiotics were initiated. His state of consciousness rapidly improved but he continued to have a persistent cerebrospinal fluid otorrhea on the right side. The right ear was covered with a sterile gauze square which was changed every 2 hours. Early on the evening of admission, a small spicule of bone mixed with the blood and cerebrospinal fluid was noticed in the sterile dressing. Closer examination of this revealed it to be the incus (Fig. 1). Later that evening a small amount of brain tissue extruded from the right ear canal. A lumbar puncture on the day following admission revealed a pressure of 480 mm. The spinal fluid contained 765 red blood cells and a total protein of 149 mg. per cent. The cerebrospinal fluid pressure was decreased by multiple lumbar punctures and the use of intravenous urea. With this treatment, the spinal fluid pressures were kept in the 120–140 range and there was no further extrusion of brain tissue from the right ear. The patient continued to make an uncomplicated recovery and 3 weeks after his accident his only complaints were occasional headaches and a right-sided hearing loss. There was good strength in all of his extremities and no evidence of facial nerve paresis or vestibular disorder.

On October 28, 1964, he was placed in a plaster jacket for further immobilization of the clavicular fracture. Audiometric evaluation at this time revealed a significant conduction deafness in the right ear. He was there-

Fig. 1. Photograph of incus which spontaneously extruded from the right ear canal following a basilar skull fracture.
fore transferred to the otolaryngology service for operative repair of the break in continuity of the ossicular chain. Otolaryngological evaluation in November, 1964, revealed the right external ear canal to be normal in size and shape. The right tympanic membrane contained a central tympanosclerotic plaque with some scarring posteriorly and superiority. The Eustachian tube was open to self inflation and there was no evidence of fluid in the middle ear. Tuning fork tests suggested a conductive type of hearing loss on the right and lateralization of the Weber to the right. The left tympanic membrane and ear canal were normal. The nasopharynx was clear and the Eustachian tube orifice on the right did not reveal any drainage of fluid that would suggest a cerebrospinal fluid leak into the nasopharynx.

Operation. On March 23, 1965, exploration of the right middle ear was undertaken under local anesthesia, utilizing the Zeiss operating microscope. There was marked scarring and fibrosis of the middle ear space. Fibrous tissue completely enveloped the superstructure of the stapes. Inspection of the head of the malleus and the epi tympanic area resulted in a cerebrospinal fluid leak that was readily controlled with pressure packing in the middle ear. The sound conduction mechanism was reconstructed by freeing the head of the malleus from its ligaments and adhesions as well as transecting the tensor tympani muscle and then rotating the head of the malleus onto the head of the stapes.

The postoperative course was uneventful. There was no evidence of spinal fluid drainage. Ten days following surgery, examination indicated that air conduction was greater than bone conduction with a 500 cycle per second fork. During the next 4 weeks the patient’s hearing continued to improve and audiograms upon discharge were as in Table 1. The patient returned to full duty on April 22, 1965.

Discussion

It is interesting that the presence of ossicles within the inner ear escaped the notice of such physicians as Democritus, Celsus and even Galen. It was left for the Italian physician, Bengario da Carpi, to give the first recorded description of the malleus and incus, describing them as “two small ossicles adjacent to the aforesaid panniculus (tympanic membrane) which are moved by the moving ear and strike one against the other.” Da Carpi not only described the ossicles but attempted to explain their function by their striking together much as a hammer strikes an anvil. It remained, however, for Vesalius to point out the anatomical similarity of the 2 ossicles to a ham-

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