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Pneumolabyrinth after Temporal Bone Fracture: Documentation by High-Resolution CT

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The incidence and clinical features of temporal bone fractures have been well documented in the medical literature. Characteristically, longitudinal fractures account for 80% of the total [1, 2] and result from trauma to the parietal and temporal regions of the skull [3]. The fracture line starts at the tympanic annulus and runs parallel to the petrous pyramid, traversing the external auditory canal, mastoid air cells, tympanic membrane, and ossicles before it extends across the floor of the middle cranial fossa to the area of the trigeminal ganglion. Facial weakness occurs in about 25% of the cases and is usually temporary [4]. Hearing loss is generally of the conductive type, although often there is some degree of neurosensory deafness [5].

Transverse fractures make up 10%–20% of the total and classically result from trauma to the occiput. The fracture line starts at the floor of the middle fossa and runs perpendicular to the petrous pyramid, traversing the vestibule, cochlea, and the labyrinthine part of the facial nerve near the geniculate ganglion. There is usually complete loss of cochlear and vestibular function on the side of the injury. The facial nerve is involved in almost half of the cases, often requiring surgical decompression.

Plain films of the temporal bone often do not reveal the site of fracture [6], although the evolution of hypocycloidal polytomography has tremendously aided in anatomic localization [7]. The advent of high-resolution computed tomography (CT) of the temporal bone [8, 9] has added a new dimension of accuracy to diagnosis.

Case Report

A 26-year-old man was admitted to Methodist Hospital, Houston, after being struck in the right temporal region with an unknown object. After injury, he experienced severe vertiginous episodes, associated with headaches, nausea, and vomiting. He also noted severe hearing loss and tinnitus in the right ear. Examination showed abrasions over the right face and temporoparietal area. Periorbital ecchymosis and a hemotympanum were also present on the right side. The cranial nerves were intact with the exception of the right eighth, and neurologic status was unremarkable. Audiometric studies documented a severe sensorineural hearing loss in the right ear with a pure tone average of 84 dB. The left ear was within normal limits. Electronystagmography showed a total loss of vestibular function in the right ear on caloric irrigation. An electroencephalogram was essentially unremarkable. Radiographic studies included anteroposterior (AP) and lateral polytomography and CT of the temporal bones. The tomograms showed a longitudinal fracture extending across the epitympanum with a fracture of the long process of the malleus (fig. 1). No labyrinthine fracture was seen. However, on CT there was a collection of air within the vestibule of the inner ear (pneumolabyrinth) that indicated a fistula and probable fracture or stapedial dislocation.

The patient had persistent vertigo and severe hearing loss. Exploration of the middle ear on the sixth day postinjury revealed a hairline fracture crossing the ponticulus and extending inferiad toward the hypotympanum, just posterior to the round window. Palpation of the handle of the malleus demonstrated movement of the stapes, and the incudostapedial joint was intact. The mucosa overlying the fracture was abraded and fat taken from the lobule of the pinna was placed in the posterior mesotympanum and around the area of the posterior crus of the stapes to seal off the perilymph leak. Postoperatively, the patient's vertigo subsided and his hearing improved about 40–50 dB. He had a persistent conductive hearing loss secondary to the fat that was placed in the mesotympanum.

Discussion

Thin-section, high-resolution CT of the temporal bone can make sections of under 2 mm with extremely high transverse resolution (under 1 mm) [10]. CT is superior to complex-motion tomography in demonstrating air, soft tissues, and sloping bone surfaces; and it does so with less radiation exposure [11]. It has become the procedure of choice for evaluating temporal bone and cerebellopontine angle tumors, and complements tomography in evaluating cholesteatomas and fractures [10].

To our knowledge, intravestibular air, or pneumolabyrinth, indicative of a labyrinthine fistula has not been previously demonstrated on CT after temporal bone injury, although a case of pneumolabyrinth was reported in association with stapedial foot-plate fracture after mastoid surgery [12]. The labyrinthine fracture and stapedial dislocation was radiograph-

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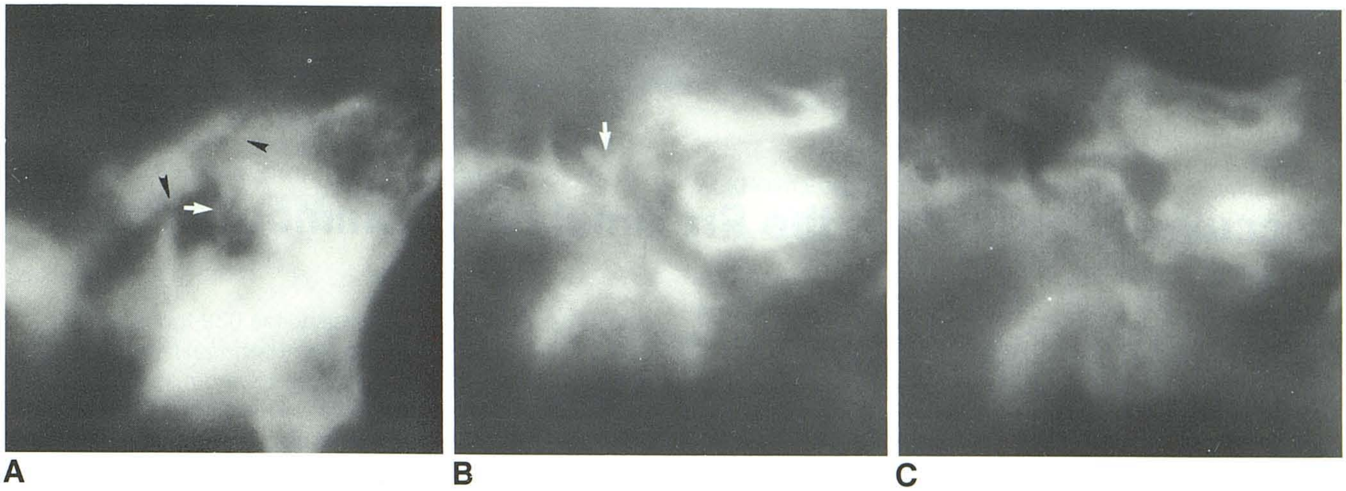

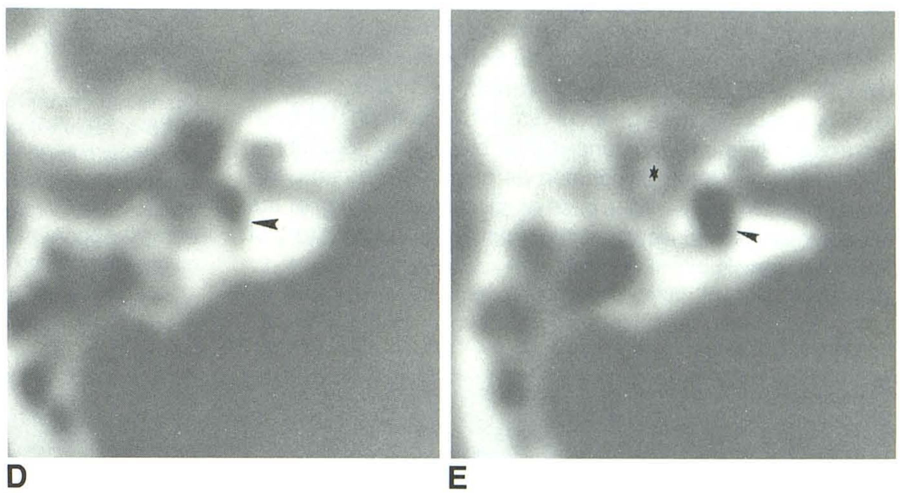

Fig. 1.—**A**, Lateral pluridirectional tomogram of temporal bone. Longitudinal fracture involving attic and anterior wall of tympanic cavity (*arrowheads*). Fracture of manubrium of malleus (*arrow*). **B** and **C**, AP tomograms. Malorientation of ossicles (*arrow*) indicative of ossicular dislocation. No definite fracture. Radiolucency of vestibule was comparable to that on opposite-ear tomograms. **D** and **E**, Axial 1.5-mm-thick CT scans. Abnormal soft-tissue density in tympanic cavity and attic surrounding superior ossicular mass (*). Distinct collection of air fills vestibule (*arrowhead*), indicative of fistulous communication.

ically suggested only by the labyrinthine air, though the clinical hearing loss and vertigo strongly suggested such a lesion. The air was not noted on tomography, further underscoring the usefulness of this finding with modern CT scanning. As CT becomes more sophisticated, we believe that even more minute abnormalities of the cochlea, vestibule, semicircular canals, and facial nerve will be demonstrable.

In conclusion, CT is an increasingly accurate diagnostic tool in temporal bone abnormalities, permitting localization of injuries. It is a valuable adjunct to plain films and tomography and may become the procedure of choice in evaluating temporal bone fractures.

REFERENCES

1. Fischer J, Wolfson L. *The inner ear*. New York: Grune & Stratton, **1943**
2. Hough JVD. Otologic trauma. In: Paparella MM, Shumrick DA, eds. *Otolaryngology*, vol 2, 2d ed. Philadelphia: Saunders, **1980**:1656–1679
3. Proctor B, Gurdjian E, Webster J. The ear in head trauma. *Laryngoscope* **1956**;66:16–59
4. Fisch U. Facial paralysis—fractures of the petrous bone. *Laryngoscope* **1974**;84:2141–2154
5. Schucknecht H. A clinical study of auditory damage following blows to the head. *Ann Otol Rhinol Laryngol* **1950**;59:331–358
6. Grove W. Skull fractures involving the ear. A clinical study of 211 cases. *Laryngoscope* **1931**;49:678–707
7. Noyeka A, Zizmor J. The evolution of diagnostic radiology of the temporal bone. *J Otolaryngol* **1977**;6:1–6
8. Hanafee W, Mancuso A, Jenkins H, Winter J. Computerized tomography scanning of the temporal bone. *Ann Otol Rhinol Laryngol* **1979**;88:721–728
9. Shaffer K, Haughton V, Wilson C. High resolution computed tomography of the temporal bone. *Radiology* **1980**;134:409–414
10. Shaffer K, Haughton V. Thin section computed tomography of the temporal bone. *Laryngoscope* **1980**;90:1099–1105
11. Shaffer K, Littleton J, Durizch M, Callahan W. Temporal bone anatomy: comparison of computed tomography and complex motion tomography. *Head Neck Surg* **1982**;4:296–300
12. Mafee MH, Kumar A, Yannias DA, Valvassori GE, Applebaum EL. Computed tomography of the middle ear in the evaluation of cholesteatomas and other soft tissue masses: comparison with pluridirectional tomography. *Radiology* **1983**;148:465–472