

Techniques of Removal of Human Temporal Bones

Detailed information on the techniques of temporal bone removal is contained in [Nadol. 1996](#) and in a DVD available from the [NIDCD National Temporal Bone Registry](#).

The equipment that is useful for temporal bone removal is shown in the image below. The autopsy saw ([Stryker](#)) may be used to drive an oscillating saw for the block technique of removal or to drive circular bone plug saws for the bone plug method with either the intracranial or extracranial approach. The Ferguson bone holding forceps is useful in extraction of the specimen from the skull base.



Intracranial method

Permission to remove temporal bones is ordinarily implied in a complete (including head) autopsy permit; however, at all institutions, the policy must also conform to local laws and practices. Delays in procuring specimens are often unavoidable because of the need to acquire properly endorsed autopsy permits and because of the work schedules of the pathologists. In many hospitals, the bodies are placed in cold storage, and postmortem examinations are performed at a scheduled time each day; thus the time lapse between death and autopsy may be prolonged.

Fortunately, refrigeration delays postmortem autolysis, therefore useful specimens may be acquired as long as 24 hours after death. Another technique to delay postmortem autolysis is by intratympanic injection of a fixative before the autopsy is done. Alternatively, if proper facilities are available, a surgical microscope may be used to elevate the tympanomeatal flap. When the stapes is removed and the round window membrane is punctured, a fixative solution may be slowly instilled through the oval window to perform intracochlear perfusion. Yet another technique to delay autolysis is to embalm the body, since most embalming solutions contain formaldehyde. Temporal bone specimens removed at autopsy several weeks to months after embalming demonstrate good preservation of structures of the inner ear.

A portion of the temporal bone adequate for routine histologic study can be acquired at autopsy without disfigurement of the head (Schuknecht. 1968). Before the brain is removed, the seventh and eighth cranial nerve trunks should be purposely cut at the porus acusticus to avoid traumatic avulsion from the internal auditory canal.

1. **Block Technique.** The block technique of removal consists of making four linear bone cuts with either an osteotome or an electrically operated oscillating saw. The temporal bone is then grasped and loosened by gentle rocking to free the

specimen sufficiently to permit cutting of the attached muscular, ligamentous, and fibrous structures. Care must be used to avoid crushing a highly pneumatized and fragile temporal bone.

2. **Bone Plug Method.** The bone plug method of removal is performed with an electrically operated oscillating trephine. For adult subjects, the trephine measures about 1½ inches (38 mm) inside diameter and 2 inches (51 mm) in length. For infant skulls, a 1 inch (25 mm) inside diameter trephine is used. Trephines are available from [Baxter V. Mueller Division](#). The trephines should be centered precisely over the arcuate eminence and directed perpendicular to the floor of the middle cranial fossa. The head should be steadied by an assistant to prevent damage to the trephine. A loss of resistance indicates that the base of the skull has been penetrated. After removal of the trephine, the bone plug is grasped with forceps (Ferguson bone holding forceps, lion jawed, box lock, length 8½ inches [200 mm], available from [Baxter V. Mueller Division](#), and retracted sufficiently to permit cutting of the attached structures.

These methods accomplish the removal of all anatomic structures that are needed for routine otopathologic study. When properly performed, the external configuration of the head is not disturbed and embalming procedures are only minimally impaired.

Extracranial method

This method can be used when temporal bones have been pledged for scientific study but, for some reason, permission for complete autopsy with brain removal has not been granted ([Nadol. 1980](#)).

An incision is made in the postauricular fold and the external auditory canal is transected. A special trephine 1½ inches (38 mm) inside diameter and 2¾ inches (70 mm) in length is centered on the external auditory canal and advanced into the skull in a line with the opposite external auditory canal. The ear canal is sutured shut and the defect in the skull is tightly packed with gauze. These trephines are also available from [Stryker](#).

Special considerations

Cochlear implantation. The intracranial block method is the most suitable technique for cochlear implant specimens. The oscillating saw should not be allowed to come into contact with the cochlear implant electrode array, as this can result in severe postmortem artifact. The electrode array must be sharply cut with scissors by opening the mastoid through the incision made in the scalp (for removal of the skull cap) or via a separate postauricular incision. Alternatively, the electrode array may be cut in the middle ear by elevating a tympanomeatal flap. After the electrode array is severed and the temporal bone specimen is removed, the electrode array may be carefully removed or left in-situ for subsequent histologic preparation and sectioning.

Minimizing cosmetic defects and facilitation of subsequent embalming. Careful professional collaboration with the funeral director should be sought to minimize cosmetic defects and facilitate embalming. After removal of the temporal bone, ligating the internal carotid artery with a heavy silk suture and coating the muscular bed in the base of the skull with cyanoacrylate glue (e.g., Krazy Glue) will help to accomplish a nearly-water tight seal and prevent subsequent leakage of embalming fluid. The external auditory canal may be sutured shut. Defects in the mastoid cortex may be repaired with orthopedic fiberglass casting material or packed with gauze. Cut bone surfaces may be sealed with drying powders such as QS Quick Sealing powder or Inr-Seal ([Dodge Chemical Company](#)).

