RESULTS OF SURGICAL MANAGEMENT OF ACOUSTIC SCHWANNOMA

THESIS
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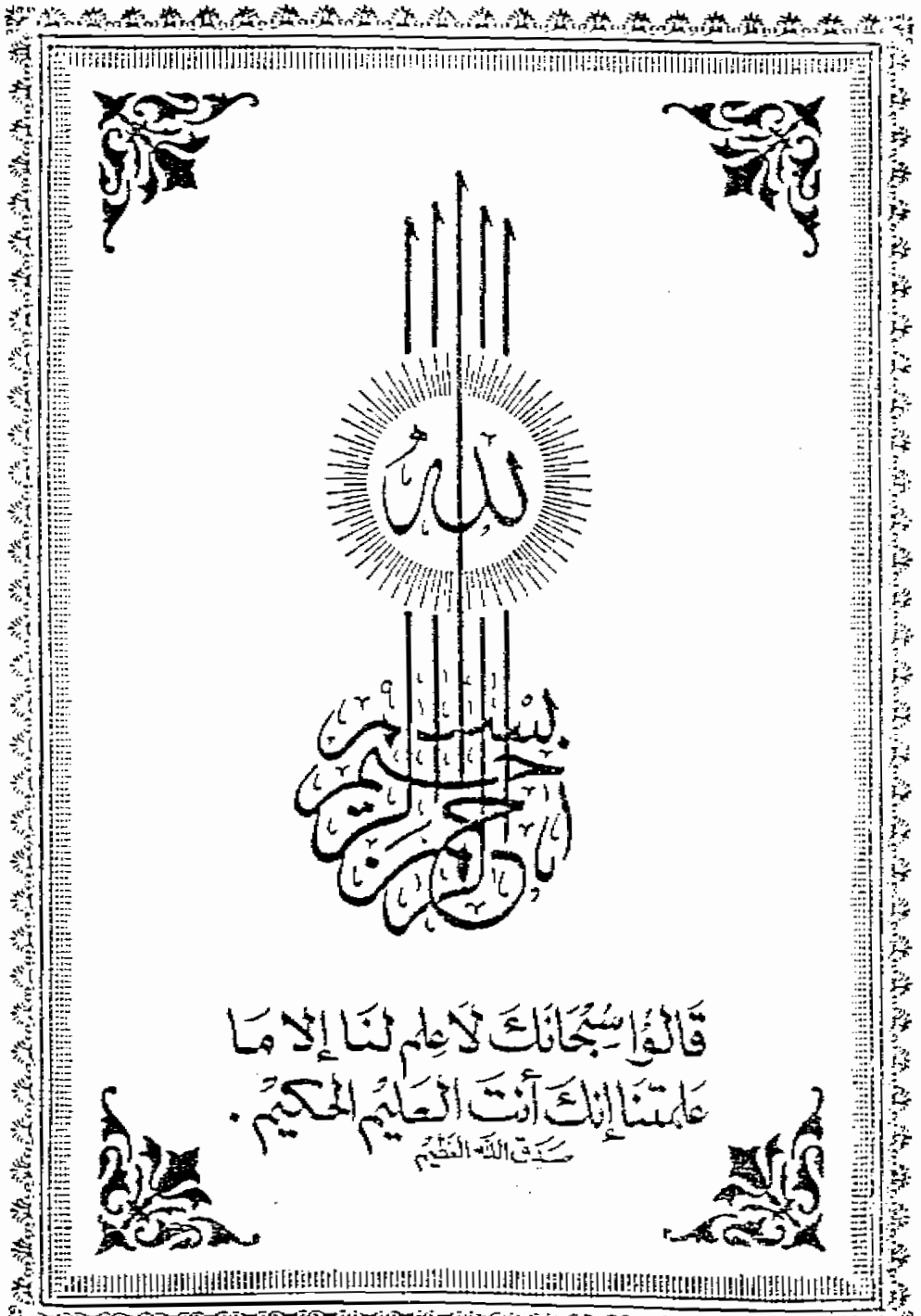
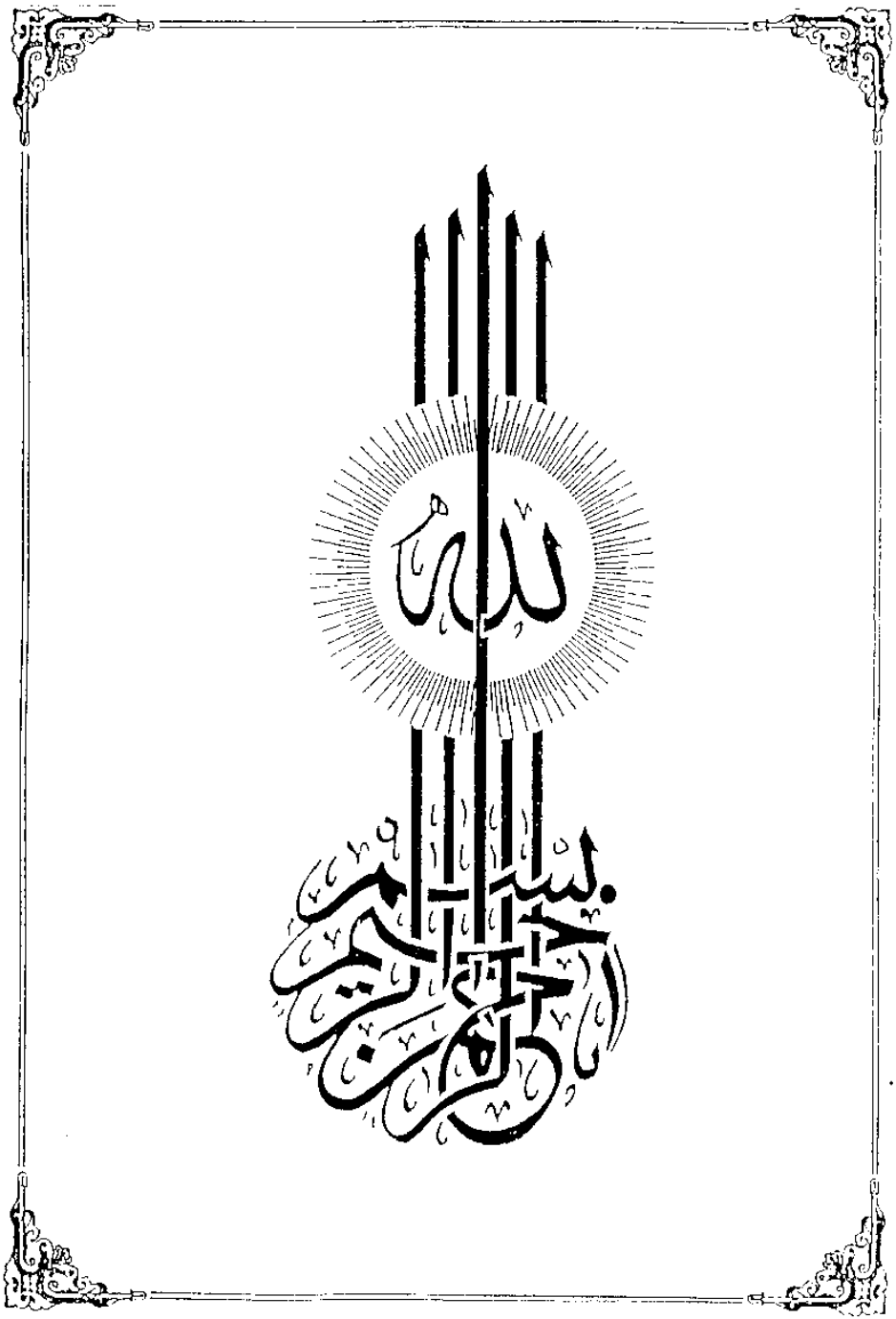

الله
بسم الله الرحمن الرحيم
قالوا سبحانك لا علم لنا إلا ما
علمتنا إنك أنت العليم الحكيم.
صدق الله العظيم



Introduction

Introduction

Acoustic schwannoma represents 8% of all intracranial tumors with an estimate of 2,000 to 3,000 cases are diagnosed annually in the United States.[74] This relatively common brain tumor arises from the vestibulocochlear nerve in the internal auditory meatus and causes clinical manifestations due to compression of the cranial nerves, cerebellum, and brain stem. Recently, acoustic schwannoma is considered a vestibular schwannoma because it arises histologically from Schwann cells and anatomically from the vestibular division rather than the cochlear division of the vestibulocochlear nerve.[43,74] Acoustic schwannoma occurs mainly in adults as a sporadic unilateral event. Initial symptoms are progressive unilateral sensorineural hearing loss, tinnitus, and/or imbalance. In the beginning of this century, the morbidity and mortality of surgical removal of this tumor were relatively high. However, advances in diagnostic tools, microsurgical techniques, laser, ultrasonic aspirator, and intraoperative monitoring of the cranial nerves have dramatically reduced operative morbidity and mortality and enabled tumor removal (without additional neurologic deficit) to be a realistic but a challenging goal.[72]

Surgical Anatomy

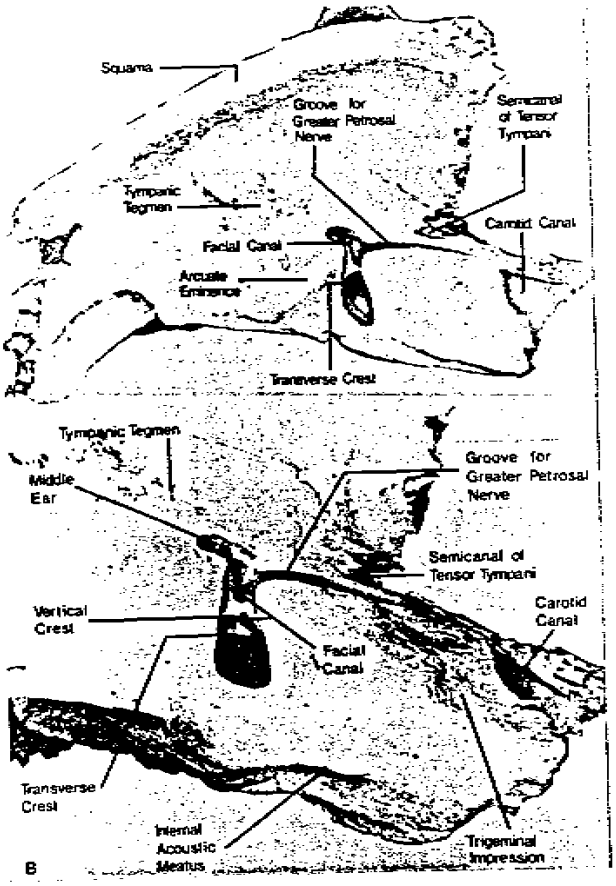
the oval window in the facial canal. The tympanic end of the eustachian tube is anterior and superior to oval window (Fig. 1).[2]

B) ***Posterior View.***

The posterior surface faces the posterior fossa and has the internal auditory meatus, through which passes the facial and vestibulocochlear nerves and the labyrinthine artery. The posterior surface also contains the subarcuate fossa that contains the subarcuate artery, vestibular aqueduct, and cochlear canaliculus; the latter two transmit to endolymphatic and perilymphatic ducts, respectively. The post-surface of temporal bone also has the sigmoid sulcus which is the groove for sigmoid sinus.[2]

C) ***Superior View.***

The temporal bone forms the posterior part of the floor of the middle cranial fossa and consists of the tegmen tympani (the thinnest plate of bone between the tympanic cavity and the brain) and the arcuate eminence (the prominence overlying the superior semicircular canal). The trigeminal impression containing the trigeminal ganglion is located medially above the petrous apex. The superior end of the foramen lacerum extends beneath the trigeminal impression and the petrous portion of the carotid artery passes below it. The absence of bone over the medial part of the carotid canal may expose the carotid artery in the floor of the middle cranial fossa. There are two small openings medial to the arcuate eminence: 1) the medial opening is the facial hiatus that transmits the greater petrosal nerve and the petrosal artery, which is a branch from the middle meningeal artery, and 2) the smaller



. (2): Shows superior view of the temporal bone.
(Piat et al.,: Microsurgical anatomy and dissection of the temporal bone: surg Neurol, 8: 363-391, 1977).

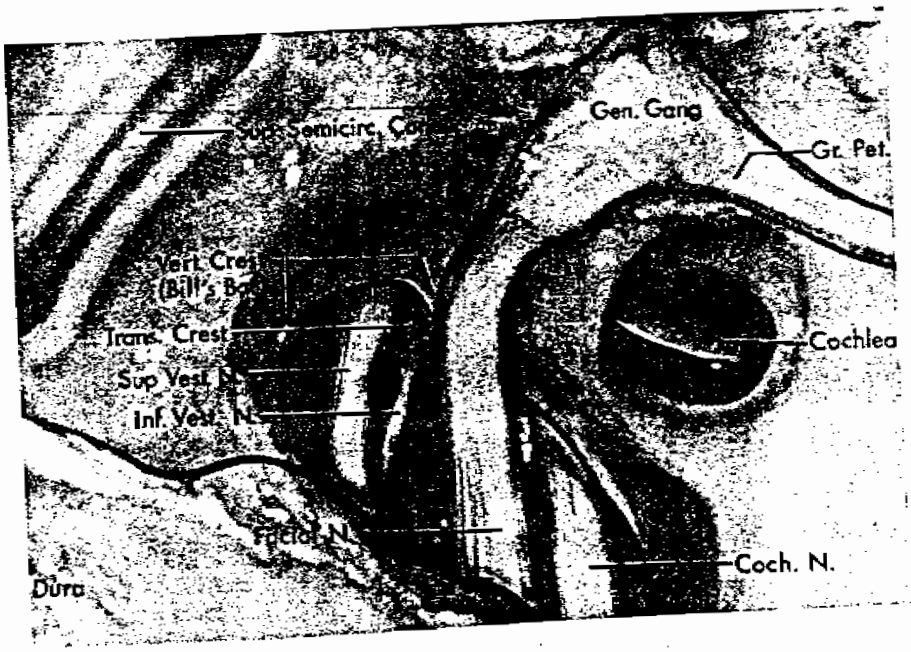


Fig. (4): Shows the course of facial nerve in the petrons bone.
(Piat et al.,: Microsurgical anatomy and dissection of the temporal bone. Surg. Neurol, 8: 363-391, 1977).

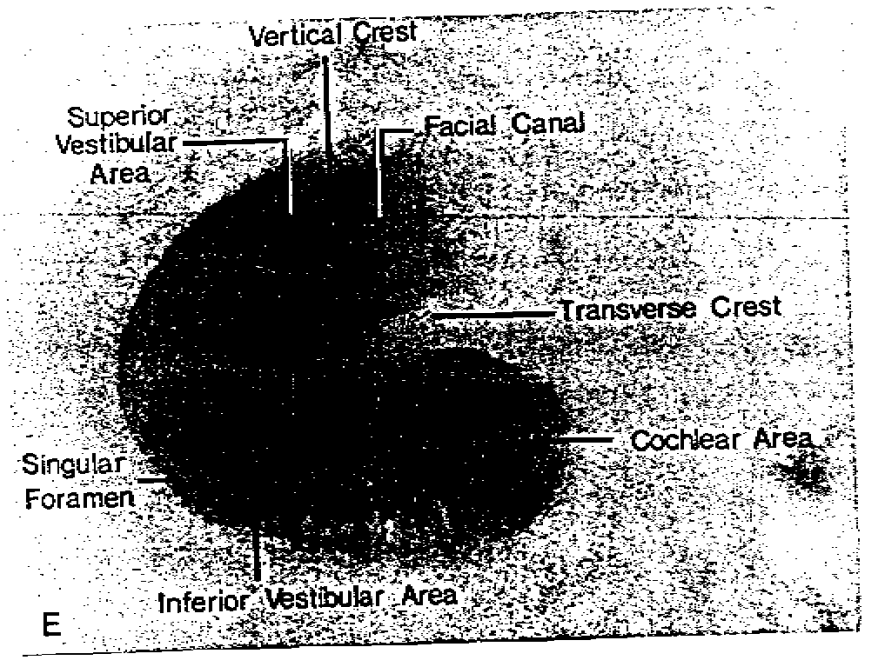
II. *Gross Anatomy of Vestibulocochlear and Facial Nerves*

Vestibulocochlear Nerve

The nuclei of this nerve are in the medulla and encroach on the pons. The nerve is entirely sensory and specialized to sound perception and balance. There are two quite distinct divisions of the eighth nerve. Sound reception and balance are combined in one sensory organ and in a single cranial nerve, in all creatures from fish to man, and no one understands why.[57]

A) *Cochlear Nerve.*

The neuroepithelium for sound reception consists of hair cells in the organ of corti. The first sensory neuron is bipolar. The cell bodies, together referred to as spiral ganglion, have central processes that run along the modiolus of the cochlea and join into many small nerves piercing the dura and the arachnoid at the modiolus base in a spiral pattern. This occurs at the anterior inferior quadrant of the internal auditory meatus. The small nerves join in the subarachnoid space and enter the cerebellopontine cistern with the vestibular part, with the facial nerve anterosuperior to them. These nerves pass together through the cerebellopontine angle in front of the flocculus. The vestibulocochlear nerve enters the inferior cerebellar peduncle at the lower border of the pons. The cochlear fibers relay on the cochlear nuclei in the inferior cerebellar peduncle. The second-order neuron crosses the lower pons



g. (5): Shows the lateral end of the internal auditory canal (Rhoton AL: Microsurgical anatomy of the internal auditory meatus. Surg. Neurol, 2: 311-318, 1974).

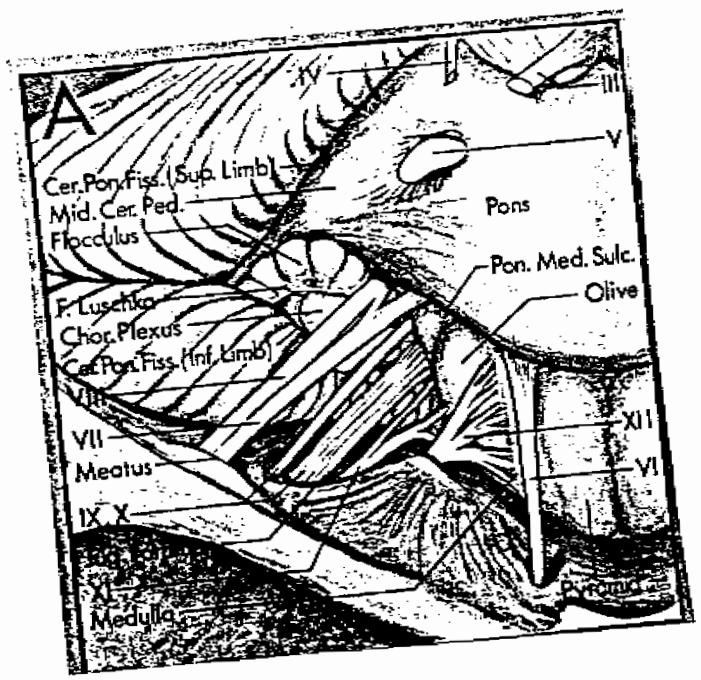


Fig. (6): Shows the inferior cerebellopontine cistern. (Matusuno et al.,: Microsurgical anatomy of posterior fossa cisterins. Neurosurg. 23: 58-80, 1988).

the canal from the inner ear. The lateral end of the canal is divided into four quadrants (Fig. 3). A horizontal crest of bone, the transverse crest, separates the superior from the inferior quadrants. The lateral end of the canal is also split into the anterior and posterior quadrants by a vertical ridge of bone called the vertical crest.[80] The neurovascular bundle seen in the internal auditory meatus is a complex of five nerves and many vessels with a relatively constant relationship to each others. The nerves are the facial nerve (motor root), nervus intermedius (sensory root of facial nerve), cochlear nerve, superior vestibular nerve, and inferior vestibular nerve. The position of the nerves is most constant in the lateral end of the canal.[84] The facial and superior vestibular nerves are superior to the transverse crest. The facial nerve is anterior to the vertical crest while the superior vestibular nerve is posterior. The cochlear nerve and the inferior vestibular nerve run below the transverse crest with the cochlear nerve anteriorly. The nervus intermedius, usually described as a component of the facial nerve, separates from the motor root in the internal auditory meatus running to the brain stem between the facial nerve and the vestibulocochlear nerve.[83] Vascular supply of the meatus is by the labyrinthine artery which is a branch from the anterior inferior cerebellar artery. Anatomical preservation of this artery and its branches should be considered during surgical removal of acoustic schwannoma as thier disruption leads to acoustic and facial nerve infarction and paralysis, even though these nerves were anatomically preserved.[84]

IV. *Microsurgical Anatomy of Cerebellopontine Angle Cisterns*

Cerebellopontine Angle Cistern

The cerebellopontine angle cistern is a paired structure, irregularly shaped but somewhat round. This cistern attaches to the pons at the pontomedullary sulcus posteromedially; the lateral portion of the pons forms the medial aspect of the cistern. Superiorly, this cistern shares an arachnoid wall with the ambient cistern just below the tentorial hiatus. The inferior border of the cistern is formed by arachnoid separating this cistern and the lateral cerebellomedullary cistern. Laterally, the cistern extends along the posterior petrous portion of the temporal bone entering the internal auditory meatus and extending outward into Meckel's Cave. Posteriorly, the cistern is covered by the posterior quadrangular and the superior semilunar lobulus of the anterior cerebellar hemisphere. Medially, the flocculus is immediately posterior to the cerebellopontine cistern. Operative and cadaveric observations show the trigeminal nerve has its own cisternal sleeve separate from but forming a recess into the cerebellopontine angle cistern. The situation is analogous to the oculomotor nerve in the interpeduncular cistern, which carries its own arachnoid sheath, and is separate from the cistern.

The facial and vestibulocochlear nerves arise in the inferior part of the cerebellopontine cistern just above the lateral pontomedullary membrane. The cistern extends into internal auditory canal and surrounds the intracanalicular segment of facial