ROLE OF MRI IN THE DIAGNOSIS OF MIDDLE EAR AND MASTOID PROCESS LESIONS

E S S A Y
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By
HOSAM ABD ELKADER MORSY
MB, BCh

Supervised by

Dr. SAAD ALI ABD RABOU
Assistant Professor of Radiodiagnosis
Faculty of Medicine, Ain Shams University

Dr. OMAR HUSSAIN OMAR
Lecturer of Radiodiagnosis
Faculty of Medicine, Ain Shams University

Department of Radiodiagnosis
Faculty of Medicine, Ain Shams University

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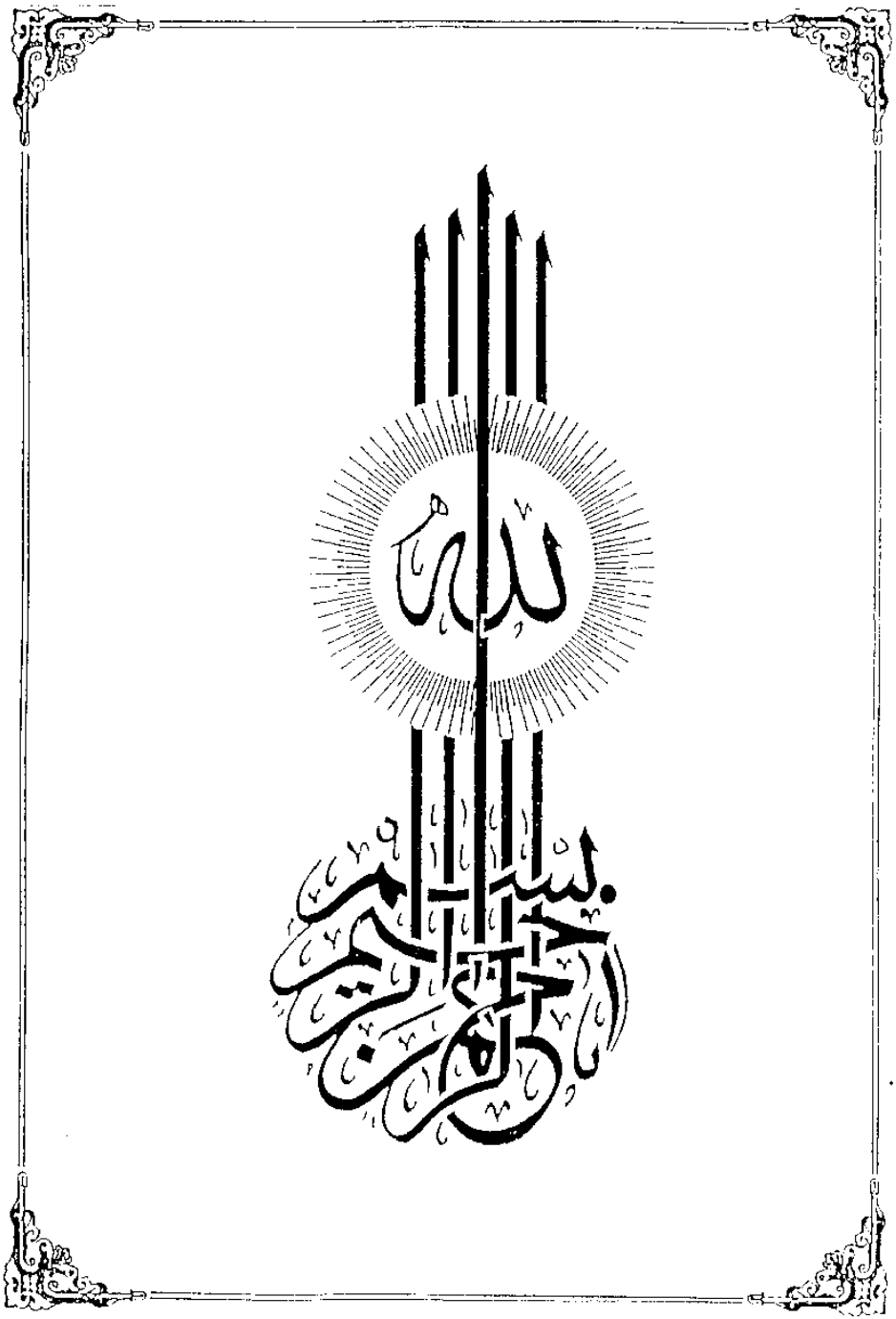

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Hearing is the ability to perceive certain pressure vibrations in the air and interpret them as sound, while deafness simply is a decrease of the auditory acuity of the individual.

Deafness could be:

1. **Nerve deafness:** which may occur due to damage of the delicate structures of the inner ear or due to injury of the eighth cranial nerve along its course till the auditory center at the temporal lobe of the brain.
2. **Conductive deafness:**which may be due to lesions affecting the pathway of sound waves to the inner ear, i.e. lesions affect external and/or middle ear.

Fortunately most of the cases of conductive deafness are curable and the patient may recover completely while in the cases of nerve deafness the recovery may be incomplete.

The correct management of conductive deafness depends on the correct diagnosis, and - as we know - many diseases of the external ear and middle ear are easily to be diagnosed by simple ENT examination like wax, trumatic

rupture of the drum and otitis media, while many others such as otoscelerosis, cholesteatoma and neoplasms nead further investigations to be correctly and finally diagnosed.

Some of thesse important investigations are the radiological imaging starting by simple plain X-ray till the sofosticated techniques such as CT and MRI.

Although the mastoid process lesions don't cause deafness, it was found that these lesions are closely related to middle ear lesions, so they are studied together as one entity.

The aim of this work is devoted to evaluate the role of MRI which is the most recent imaging method in the diagnosis of middle ear and mastoid process lesions.It also shows how MRI can diagnose the above mentioned lesions more accurately and precisely.

The work will cover the following items:

1. *Anatomy of the middle ear and mastoid process.*
2. *Pathological lesions of the middle ear and mastoid process.*
3. *Radiological and imaging manifestations.*
4. *Illustrated cases.*
5. *Summary and conclusion.*
6. *References.*
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ANATOMY OF MIDDLE EAR AND MASTOID PROCESS

Anatomy of the middle ear and mastoid process:

The ear consists of the auditory apparatus and the organs concerned with balance which record both rotatory movements of the head and the direction of the gravitional field acting on it. For descriptive purpose it is divided into three parts: the external ear, the middle ear and the inner ear ***(Romanes GJ, 1982)***.

Anatomy of the middle ear:

The narrow middle ear cavity together with the tympanic membrane is known as tympanum. It is lined with mucous membrane, and is filled with air. It communicates anteriorly with the nasophanynx through the auditory tube **(Fig. 10)**, and posteriorly through the mastoid antrum with the mastoid ear cells **(Fig. 6)**, which are small, air filled cavities in the mastoid process.

The middle ear also contians:

1) The auditory ossicles:

   Malleus, incus and stapes.

2) The tendons of stapidius and tensor tempaini muscles.

3) Chorda typani and tympanic plexus of nerves.

The vertical and anteroposterior diameters are each approximately 15 mm; the width varies from 6mm above to 4mm

below, and is even less centrally where the medial and lateral walls bulge into the cavity ***(Romanes GJ, 1982)***.

The parts of the cavity superior to the tympanic membrane is called the epitympanic recess **(Figs. 1,7)**.

The roof:

Or tegmental wall is the thin tygmen tympani, which separates the cavity from the middle cranial fossa. Chronic inflammatory conditions of the middle ear may cause meningitis or brain abscess if it extends through the roof ***(Romaes GJ, 1982)***.

The floor:

Or the jugular wall is narrow. It is formed by a thin bony lamina which separates the cavity from the jugular fossa and its contents of the superior bulb of jugular vein. Extension of the inflammations thorugh the floor may involve the vein and causes thrombophelibitis and septic emboli.

The posterior wall:

Or the mastoid wall **(Fig. 5)** has a series of openings in it:

1) in its upper part is the aditus which leads from epitympanic recess to the mastoid antrum.
2) inferiorly close to its medial wall,is a small apperature

on the apex of a hollow, conical projection called the pyramid **(Fig. 7)**. This contains the stapidius muscle with its tendon emerging through the apperature on the summit, to pass to the stapes.

3) lateral to the pyramid , the opening through which the chorda tympani nerve enter the middle ear from the facial nerve posteriorly.

The medial wall:

Or labirynthine wall separates the middle ear from the inner ear, and is entirely bony except two small aperatures **(Fig. 6)**

1) The fenestra vestibuli or oval winodow which is filled by the base of the stapes **(Fig. 4)** mountes in an elastic ring.
2) The fenestra cochlea or round window which is closed by the delicate 2ry tympanic membrane.

These two appratures lead into the cavity of the bony labirynth and movements of the stapes are transimitted in the form of pressure waves to the fluid (perilymph) in that cavity. Since the the fluid is uncompressible, movements of the stapes are allowed by corresponding movements of the seccondary typanic membrane, which thus prevent damping of stapedial collections ***(Romanes GJ, 1982)***. Between the two

windows there is a depression called the sinus tympani **(Fig. 6)**.

The anterior wall:

Or the carotid wall is narrow , because the medial wall and the lateral wallconverge anteriorly. It consists of three parts:

1) Superiorly is the canal for tensor tympani.
2) The orifice of the auditory tube in the middle.
3) Inferiorly a lamina of bone separating the cavity from the carotid canal **(Fig. 10)**.

The bony septum between the canal for the tensor tympani and the auditory tube is continued posteriorly on the medial wall of the middle ear as a shelf (processus cochleariformis).

The lateral wall:

Or the tympanic membrane is like an eleptical disc. It slopes downforward and medially being concave laterally. The handle of malleus is resting on its inner convex surface. The typmpanic membrane is formed of three layers ***(McMinn and Taylor, 1978)***.

1) Outer layre:

is an extension of the skin of the external auditory canal.

2) Middle layer:

is formed of a taut fibrous tissue.

3) Inner layer:

is a continuation of a mucous membrane of the middle ear.

The tympanic membrane appears highly polished, and a cone of light extends from the tip of the handle of malleus, parallel to it is the long process of incus **(Fig. 2)**.

Mucous membrane of middle ear cavity:

Is thin, delicate and lines the walls of the cavity and covers the ossicles being simple cuboidal epithelium or by columinar ciliated epithelium in the anterior part and cuboidal epithelium in the posterior part and mastoid antrum ***(Sade, 1966)*** and ***(Paparella et al, 1969)***.

Auditory ossicles:

Three small bones extending in a chain from the tympanic membrane to the oval window.

1) The malleus:

with rounded head superiorly and the handle or manubrium inferiorly resting on the drum.

2) The incus:

its body articulates with the head of the malleus, its long crus articulates inferiorly with the stapes and its

short crus articulates with the aditus through a legament.

3) The stapes:

has a foot or base which is held in the oval window by the annular ligament **(Fig. 7)**.

Tympanic muscles:

1) Tensortympani:

arises from the superior surface of the cartilagenous part of the auditory tube and the adjacent parts of the greater wing of sphenoid and petrous bone. It is inserted in the superior part of the handle of malleus. It is supplied by the mandiubular nerve.

2) Stapidius:

it lies within the pyrmid and is inserted in the posterior surface of the neck of stapes, supplied by facial nerve.

Action:

the tensor tympani tensens the tympanic membrane restricting its free mobility while the stapidius limits the movement of stapes, i.e. both have a protective function.

Chordatympani nerve:

It is a branche of the facial nerve passing just above the stylomastoid foramina **(Fig. 11)**. It ascends in a bony