HEARING PROFILE
IN CERVICAL SPONDYLOSIS

THESIS

Submitted in patial fulfilment
of Master Degree
in Audiology

By

Mohamed Ibrahim Shabana

Supervised By

Prof. Dr. SALAH M. SOLIMAN
Professor and head of Audiology Unit,
ENT Department, Ain Shams University Hospitals.

Prof. Dr. NADIA ABD EL SALAM
Asst. Professor of Physical Medicine,
Ain Shams, University Hospitals.

AIN SHAMS UNIVERSITY

1986

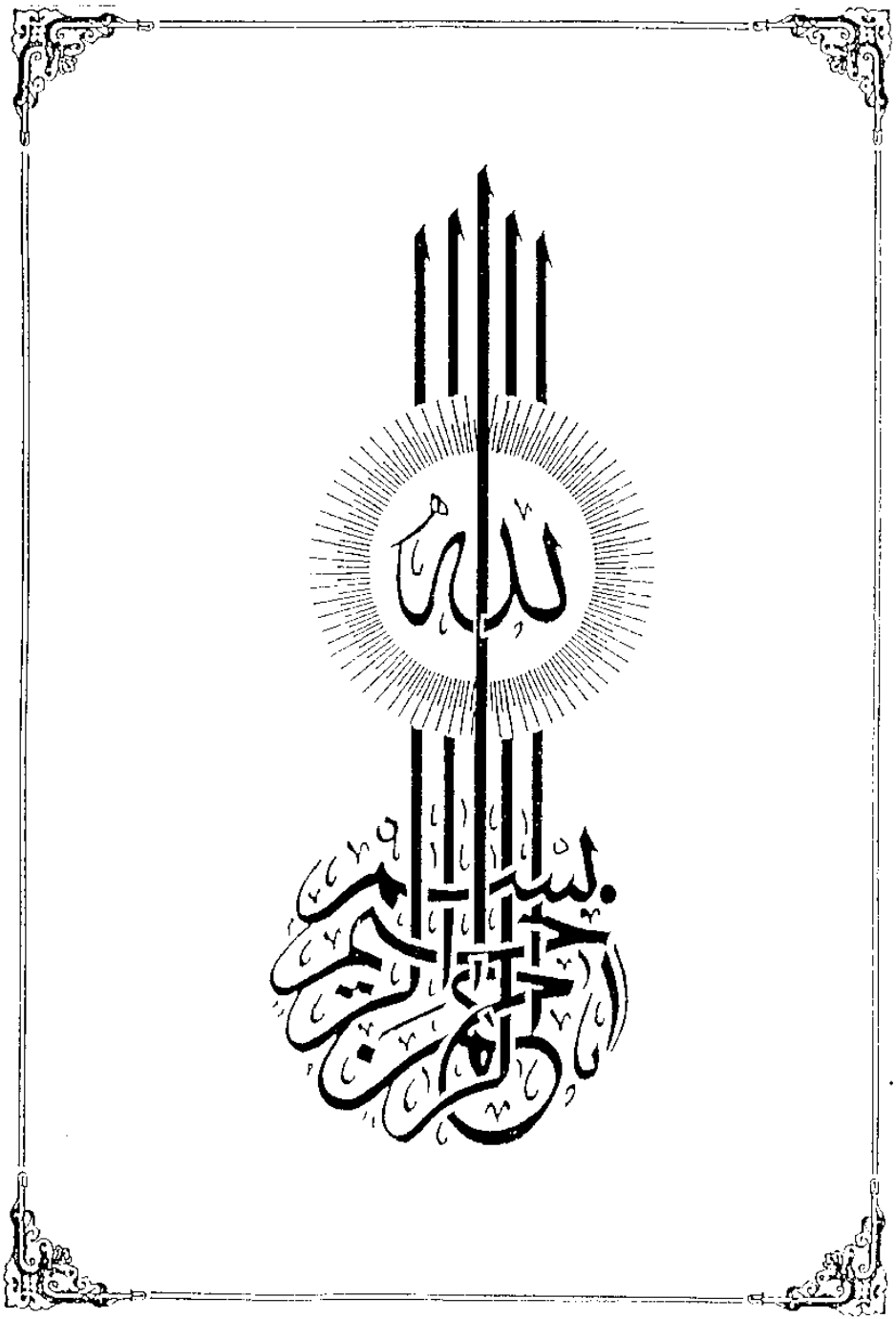
ACKNOWLEDGEMENT

I would like to express my deepest gratitude and thanks to Prof. Dr. *SALAH SOLIMAN*, Prof. and Chairman of the Audiology Unit. He offered me the greatest care, and valuable guidance throughout this work.

I'm also indebted to Prof. Dr. *NADIA ABDUL SALAM*, Ass. Prof. of Physical medicine whose advice and useful notes brought this work into existence.

Many thanks to Dr. *NADIA KAMAL*, Lecturer of Audiology for her great help and encouragement.

Finally, I express my thanks to all members of the Audiology Unit and Physical Medicine Department for their co-operation.



CONTENTS

INTRODUCTION AND AIM OF WORK

INTRODUCTION

The neck is the most mobile segment of the spine (Bland, 1981). It connects the head to the thorax, through which pass important structures, namely; carotid arteries, vertebral arteries, spinal cord, and spinal nerves. They require the greatest protection and having the least.

The head rests on top of seven vertebra form the cervical lordotic portion of the vertebral column. They are held together by 14 apophyseal joints, 5 intervertebral discs, 12 joints of luscka, and ligaments and muscles. They allow maneuverability and range of motion designed for mobility at the expense of stability.

Degenerative changes occurring in peripheral synovial joints are referred to as osteoarthritis. However, similar process takes place in the spine known as spondylosis.

The cervical spondylosis is the most common disorder of the cervical spines (Spillane, 1969). It involves the inter-vertebral discs, joints of luscka, and the apophyseal joints.

The cervical spondylosis has many bizarre, unexpected and secondary clinical reflections in the cervical spinal nerves, the spinal cord, and vertebral artery. However, most individuals pass through life unaware of symptoms due to cervical spondylosis.

Spondylosis is more common in males than in females, and commonly in labourers, because they are predisposed to neck trauma (Elwan and Taher, 1975).

There is a high incidence of cervical spondylosis in the second half of life, increasing in severity with advancing age and becoming almost universal beyond the age of 70 (Elias, 1958). Cervical spondylosis is commonly silent and asymptomatic, even with those having radiological evidence of spondylosis.

Symptomatic cervical spondylosis includes both local and general manifestations. The local neck symptoms consist of pain, spasm, and limitation of neck movement, while general symptoms depend on the area affected.

In cervical root involvement, there is sensory and motor changes, with symptoms of irritation or paralysis, or both.

Cervical spondylotic myelopathy is the most common disease of spinal cord after middle-age (Bland, 1981). It causes motor disturbances predominantly in the lower limb. While sensory changes, of varying degree, are more marked in the upper limb.

Vertebral artery involvement was first described in 1926 by Barre. He reported a new syndrome of hemicranial headache radiating from the neck, ear-noises, and giddiness, associated with rheumatic arthritis of the cervical spine.

This pleomorphic syndrome has since been proved to be due to vertebral artery changes due to cervical spondylosis.

The disturbance in the vestibular system in cases of cervical spondylosis, had been studied by several investigators. Ryan and Cope (1959) reported that it may be due to an alteration in the proprioceptive impulses from the end organs in the neck. Frykholm (1951) attributed vestibular affection to the alteration in the cervical afferents due to involvement of cervical nerve roots by root sleeve fibrosis.

On the other hand, few have reported about presence, pathogenesis, and incidence of hearing loss in cases of cervical spondylosis. Laskiewicz (1960) reported that ischemic changes within the inner ear with resultant disturbance of hearing are due to irritation of the periarterial neural plexus within the vertebral artery which would show spastical contractions.

RATIONALE

There is a significant number of patients with nystagmus attributable to cervical spondylosis (Mangat, 1973). Some of those patients complained of hearing impairment together with vertigo. However, few have reported about hearing loss due to cervical spondylosis.

This work is designed to study such effects and to determine the site of lesion that results in hearing loss, if any.

AIM OF THE WORK

1. To study the effects of cervical spondylosis on hearing, and to identify the degree and configuration of hearing loss, if any.

2. To correlate the degree of hearing loss with the severity of spondylosis.

3. To correlate spondylosis with other inner ear symptoms.

FUNCTIONAL ANATOMY OF CERVICAL VERTEBRAE

The cervical spine is placed between the relatively immobile thoracic spine and the skull. The extent, direction, and variation of movement of this portion of the spine has the greatest range of the entire spinal column (Calliet, 1978).

The cervical spine is composed of seven cervical vertebra. They are atlas, axis, 4 typical cervical vertebra and the seventh cervical spine (vertebra prominence).

The cervical vertebra are identified by their transverse processes which are perforated by a foramen. The latter is called the foramen transversum. It transmits the vertebral artery, the vertebral veins, and a sympathetic plexus.

The cervical spine is an aggregate of functional units (Calliet, 1978). Each two adjacent vertebra and their interposed tissues form a functional unit.

The first two functional units are unique and dissimilar from the rest, namely; the occipito-atlantic and the atlanto-axial units. Each of these units forms a synovial joint, by which, they are adopted to provide freedom of the head movement (Last, 1973).

Atlanto-occipital unit

A synovial joint is formed between the convex occipital condyle and concave facet on the lateral mass of the atlas. The latter is characterized by absence of its body. Its root is grooved above by the vertebral artery and first cervical nerve.

The movement between the occiput and the atlas occurs in the form of nodding up and down in a sagittal plane. Flexion occurs in the range of ten degrees and extension twenty five degrees (Fielding, 1957; Werne, 1959; and Jones, 1960). In lateral flexion and rotation of the head and neck, the occiput (skull) and the atlas (C_1) move as one piece.

Atlanto-axial joint

There is a synovial joint between the odontoid process of the axis and the atlas. The axis forms a pivot around which the atlas turns and carries the skull.

The greatest movement of the entire cervical spine occurs between the atlas (C_1) and the axis (C_2) (Calliet, 1978). Ninety degrees of rotation is possible from extreme right to extreme left between these vertebrae. It accounts of about fifty percent of the total neck rotation. Also, some flexion and extension is possible. This kind of movement occurs in the form of a "rocker" action of C_1 on C_2.

The stability of the atlanto-axial joint is almost entirely dependent upon ligamentous structures.

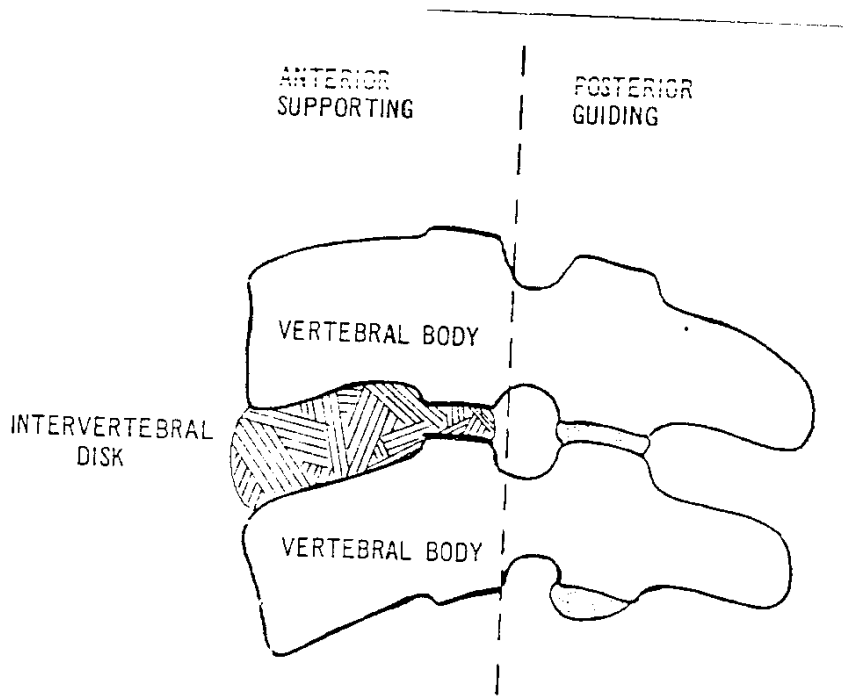


Fig. 1 : The functional unit in cross section (Calliet, 1978).

The cervical units (C_2 to C_7)

The remainder of the neck is formed by similar functional units, with anterior weight bearing portion, and posterior guiding-gliding section.

The anterior portion comprises two vertebral bodies separated by shock absorbing system called the intervertebral disc. The intervertebral disc is not a true joint, and described as secondary cartilagenous joint (Last, 1973). The outer wall of the disc is formed of the annulus fibrosis. The annulus is a wall of interwined fibro-elastic mesh, that entraps the gelatinous matrix of the disc. These interlaced fibres permit movement of one vertebra upon the other in a rocker, a rotatory, and a horizontal motion.

Inside the annulus fibrosus. there is a semiliquid gelatinous substance known as nucleus pulposus. It lies nearest the back of the disc, and if it herniates through the annulus, it will be most likely to do so posteriorly. There, it may press on the roots of the spinal nerves near the intervertebral foramina, or on the spinal cord itself.

The disc acts as a hydraulic shock absorber. Its center contains the nucleus, which exerts intrinsic pressure to maintain separation of the two vertebral bodies. The nucleus undergoes compression and deformation during flexion and extension (Calliet, 1978).

The annulus supplies the elasticity of the unit and maintains the intradiscal pressure. It is reinforced by the anterior and posterior longitudinal ligaments and neck muscles. These two ligaments limit the degree of transverse gliding motion between vertebrae as well as the extent of flexion and extension.

Between the cervical vertebrae, the disc does not extend completely to the lateral margin of the bodies, but are bounded laterally by joint of luscka. It lies between the lipped edge of the vertebra below and the beveled edge of that above (Copeman, 1970). It does not contain articular cartilage or synovial fluid (pseudoarthrosis). However, it is capable of degenerative changes.

The posterior portion of the functional unit is composed of two vertebral arches, two transverse processes, a central posterior spinous process, and paired articulations.

The transverse processes and the posterior spinous process are bony sites to which neck muscles and ligaments are attached, to support the head and neck.

The paired articulations are termed apophyseal joints. They are true synovial joints, capable of degenerative changes referred to as osteoarthritis joint changes (Jackson, 1958). The apophyseal joints are in a position and degree of inclination as to permit and guide the movement of the two adjacent vertebrae.