Neurological Disorders of the Larynx in the 21st Century

Essay submitted for partial fulfillment of the
Master Degree in Phoniatrics

Presented by

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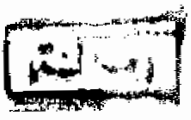

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بسم الله الرحمن الرحيم

(قال رب أشرح لي صدري (٢٥) ويسر لي أمري (٢٦)

واحلل عقدة من لساني (٢٧) يفقهوا قولي (٢٨))

صدق الله العظيم

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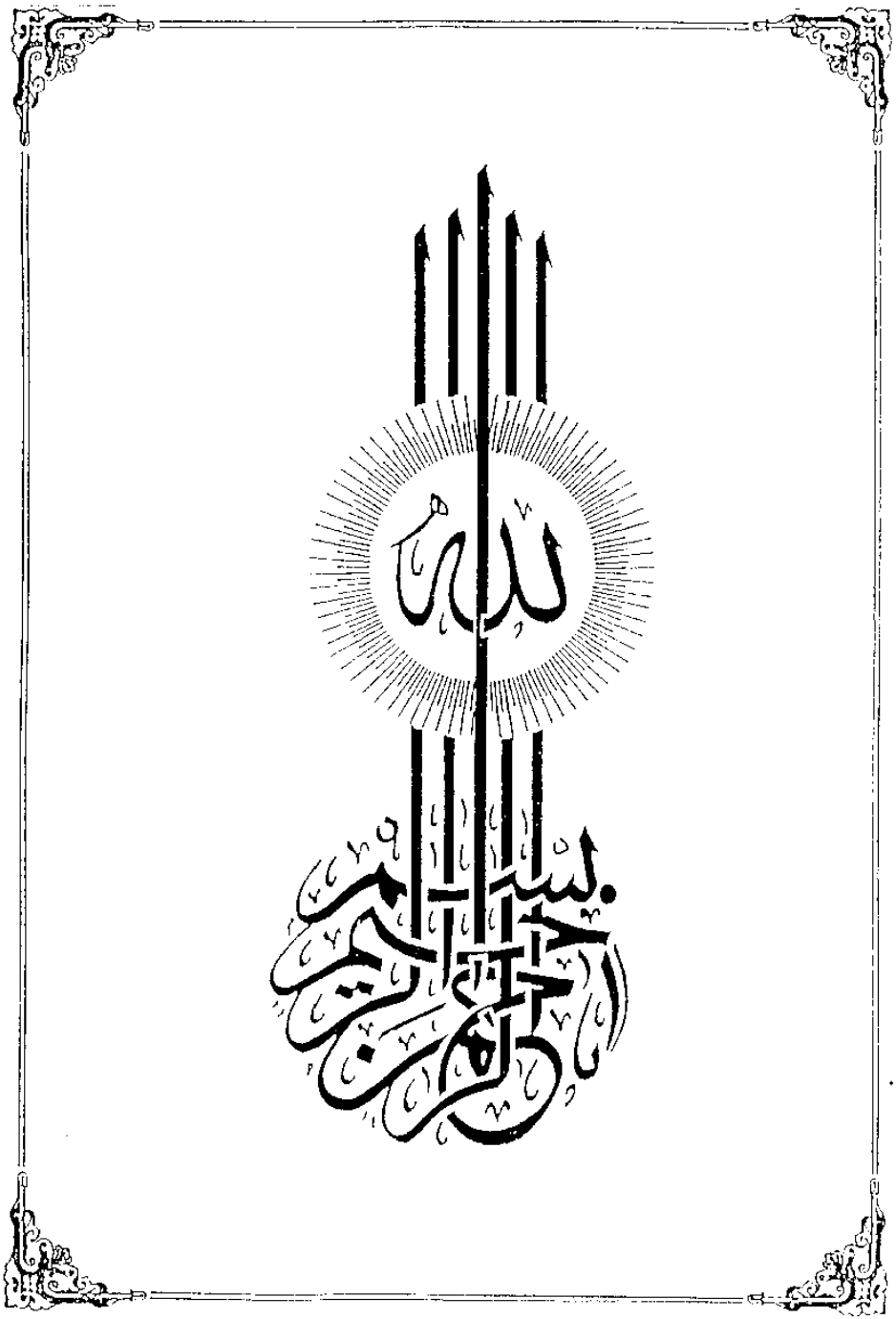

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List of Abbreviations

ABSD: abductor spasmodic dysphonia
ADSD: adductor spasmodic dysphonia
ALBD: adductor laryngeal breathing dystonia
AMB: nucleus ambiguus
APA: auditory perceptual assessment
BOTOX: botulinum toxin
BVFD: Bilateral vocal fold dysfunction
BVFD: bilateral vocal fold dysfunction
BVFP: bilateral vocal fold paralysis
BVFP: bilateral vocal fold paralysis
CGRP: Calcitonin gene related peptide
CNS: Central nervous system
CP: cricopharnygeal muscle
CT: computed tomography
CT: cricothyroid
CTBG: cholera toxin B conjugated gold
DS: disseminated sclerosis
EGG: electroglottography
EMG: electromyography
Enk: Enkephalin
GI: general intelligibility
IA: interarytenoid
ILN: Inferior laryngeal nerve
Int-SLN: internal branch of superior laryngeal nerve
LASER: Light amplification by stimulated emission of radiation
LCA: Lateral crico-arytenoid
LEMG: laryngeal electromyography
MFR: mean flow rate

MPT: maximum phonatory time
MRI: magnetic resonance imaging
MTD: muscle tension dysphonia
MUAPs: motor unit action potentials
MXSD: mixed spasmodic dysphonia
NG: Nodose ganglion
NTS: nucleus tractus solitarius
PCA: Posterior crico-arytenoid
PGG: photoglottography
P_{sub}*: subglottic pressure*
PVFM: paradoxical vocal fold motion
RF: Reticular formation
RLN: Recurrent laryngeal nerve
SD: spasmodic dysphonia
SLN: Superior laryngeal nerve
SP: Substance P
SQ: speed quotient
T_3*: tri-iodothyronine*
T_4*: thyroxine*
TA: Thyro-arytenoid
UVFP: unilateral vocal fold paralysis
VC: vital capacity
VOT: voice onset time
WGA-HRP: Wheat germ agglutinin horse radish peroxidase

Review of Literature

INTRODUCTION

The larynx situated at the top of the trachea and opening into the lower part of the pharynx is structurally and functionally linked with structures involved in many different functions, such as respiration, voice production, swallowing, coughing, choking, vomiting, breath holding and elevation of subglottic air pressure to remove the contents of the abdomen. In terms of nervous system, this coordination occurs through the interaction and integration of sensory input to the central nervous system (CNS) from the various structures and with outputs to the muscles involved in the movements of the structures ***(Yoshida et al, 1992).***

Unanswered questions regarding laryngeal neuro-anatomy include possible cross innervation from side to side in the larynx and between the superior and recurrent laryngeal nerve (SLN and RLN) system. In addition, the distribution of the nerves within the muscle is almost completely unknown. For example, there is a question of motor unit size in the different muscles. Also, little is known about distribution of sensory neurons to the joints and muscles. These questions are not only of basic scientific interest but bear directly on understanding phonation and many clinical issues in neurolaryngology ***(Sanders et al, 1993).***

Notes on patho-physiology of some neurological disorders of the larynx have a value on our concept as, dysarthrophonia with its different types; Parkinson's disease, suprabulbar, bulbar and dyskinetic dysarthrophonias ***(Kotby et al, 1995).***

Spasmodic dysphonia is a neurological disorder of the larynx that has been subjected to a lot of controversies. Regarding its etiology and treatment it is mainly characterized by laboured voice and hard glottal attacks ***(Peak woo et al, 1992).***

Recurrent laryngeal nerve injury (without injury to the superior laryngeal nerve) is a common traumatic neuro-laryngological lesion. Unilateral vocal fold dysfunction is commonly caused by thyroidectomy and virus infection. The acute effects are immediate flaccidity of ipsilateral vocal fold, loss of abduction and adduction, severe dysphonia to complete paralytic aphonia and frequently aspiration of food and drink into the trachea ***(Crumley, 1994).***

Involvement of the internal branch of superior laryngeal nerve, isolated sensory loss is unusual but can occur in the absence of motor deficit. Throat clearing, paroxysmal coughing and vague foreign body sensations can be seen in unilateral sensory loss ***(Tucker and Lavertu, 1992).***

Bilateral sensory loss is uncommon, fortunately since it often leads to severe aspiration and pneumonia. In superior laryngeal nerve paralysis most the sensory losses described above with weakness or paralysis of the cricothyroid muscles, which is innervated by its external branch. Diplophonia and easy fatigability of the voice are common, due to rotation of the posterior commissure toward the side of paralysis during phonatory effort ***(Abelson and Tucker, 1981).***

Bilateral vocal fold dysfunction (BVFD) could originate from neurological, myogenic or articular causes. Neurological lesions are common causes of in adults.

BVFDs are classified into 2 types; abductor and adductor paralysis. Patients with abductor paralysis usually suffer from airway obstruction without significant voice problems.

In adductor paralysis, the vocal folds are often found in their maximum abducted position. Patients with adductor paralysis suffer from aphonia and aspiration without airway obstruction ***(Yin et al, 1997).***

Laryngospasm is defined as prolonged occlusion of the glottis caused by contraction of the intrinsic laryngeal muscles. Laryngospasm is more likely found in the presence of excessive secretions or in patients who are extubated in an inappropriate plane of anesthesia. It can be differentiated form reflex laryngeal spasm ***(Secarz et***

al, 1995), which is shorter in duration, and can be elicited by a wider variety of stimuli. According to Suzuki and Sasaki ***(1977)*** laryngospasm is elicited only by repetitive supra-threshold stimulation of SLN afferents. Secarz et al ***(1994)*** obtained evidence for the presence of RLN afferents and showed their possible role in laryngospasm. Future basic research will help to verify these preliminary observations in the human larynx and further elucidate the patho-physiology of laryngospasm.

Kotby ***(1995)*** adopted assessment protocol which includes; a) elementary diagnostic procedures, b) clinical diagnostic aids and c) additional instrumental measures for evaluation of these disorders.

Magnetic resonance ***(Ludlow et al, 1994)*** and videokymography ***(Svec and Schutte, 1995)*** have been recently introduced as non-invasive diagnostic measures for laryngeal disorders.

The management of these neurological disorders presents a challenge to the clinician. The lines adopted depend on the nature of the condition and the degree of the ailment. The line of treatment may vary from nerve resection to nerve graft, it may be purely rehabilitative in nature (voice therapy) or it may need meticulous surgery.

AIM OF THE WORK

To review the recent advances, current research and investigations in the field of neurological disorders of the larynx in order to give us an insight into the new horizons of neurological disorders of the larynx in the next century.