THE VALUE OF THERMOGRAPHY IN ASSESSMENT OF LOW BACK PAIN DUE TO PROLAPSED LUMBAR DISC

Thesis submitted in partial fulfilment for the doctorate degree in neurosurgery

By

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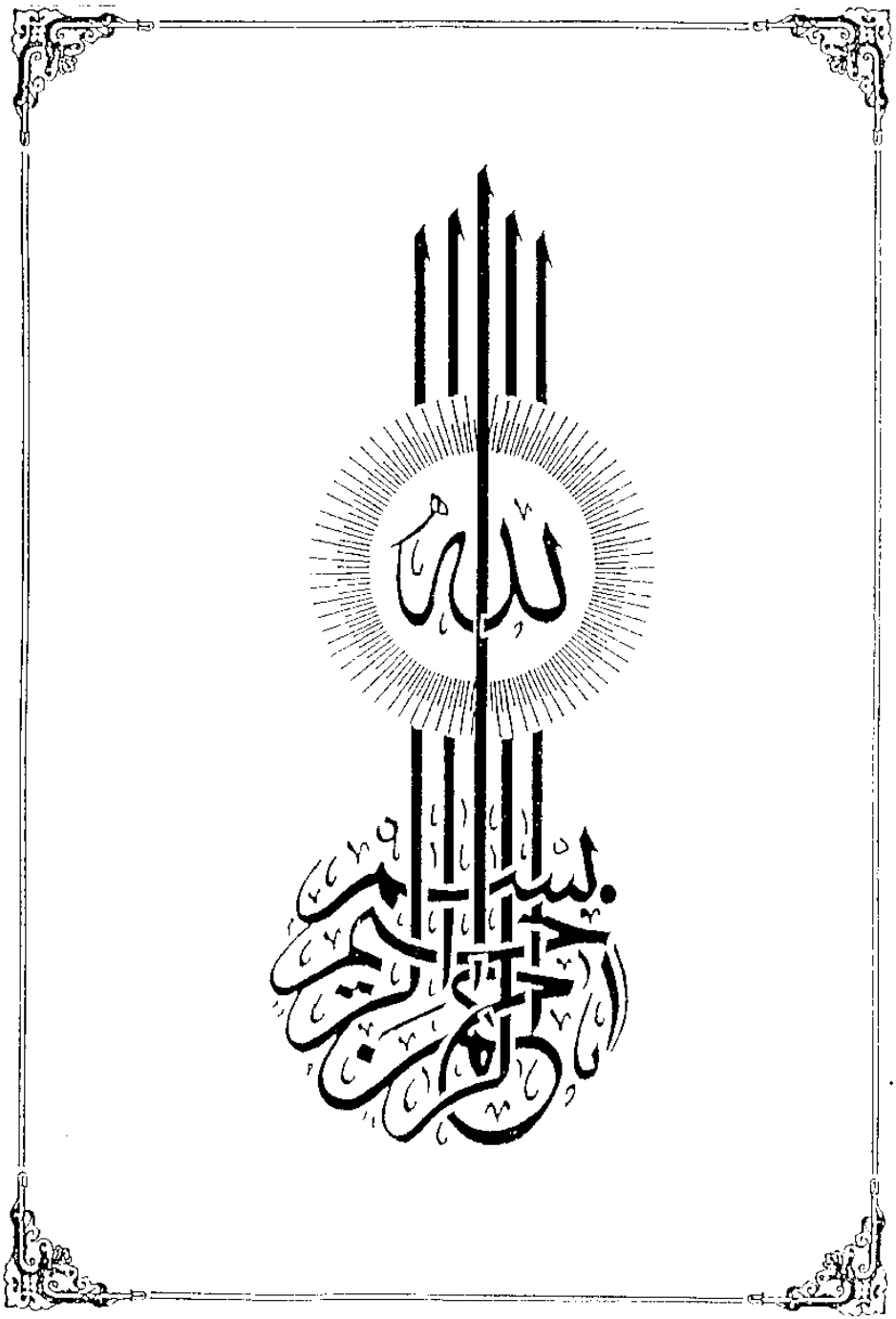
In THEE O'my GOD

I put my trust,



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INTRODUCTION

Low back pain syndromes are epidemiologic in population. Chronic pain affects nearly one third of the nation's population. Accurate diagnosis of low back pain syndromes is essential for effective treatment in order to return patients to productive lives within their impairments [88] . Burton [14] estemates that over one half of surgical procedures on the back fail to significantly relieve the problem.

New diagnostic imaging techniques, and specifically thermography, allow for improved diagnosis, and cost-effective management of this complex patients population [88].

Medical thermography is a diagnostic test that measures the body's radiant heat emission patterns. Thermography is not a picture of pain, but demonstrates thermal physiological and pathological changes in complex tissues, visualized on a controlled black-and-white or color scale. Pathophysiology due to variety of recognizable disorders can be diagnosed thermographically because of specific thermal pattern recognition in low back pain syndromes. Such disorders are also affected by or enfluenced by the neuropathic, vascular, and skeletal systems and connective

tissues [87]. Because thermography is non invasive, is without risk of radiation, and is painless; children and pregnant women with low back pain syndromes can be studied thermographically with no patient risk.

As thermography detect patholphysiological changes prior to detectable structure changes; thermography is ideal in back pain screening.

Historical Background :

Thermogrouphy represents the bridging of 2000 years of medicine and technology. Hippocrates said, about 400 B.C. "And in whatever part of the body heart or cold is seated, there is disease" [3]. Hippocrates claimed that a useful diagnostic tool was a large quantity of wet clay. His idea was that the physician rolled sleeves up and coated the patient liberally with the clay, and then waited for it to dry. If one part of the clay took longer, or dried sooner, than the rest; then that was the part of the body which was playing up.

Thermography has of course, been refined a little since then. But the prenciple-that the body is a near-perfect emitter of infra-red radiation, and that the emission pattern in the healthy body is symmetrical around the body vertical midline remain unaltered.

Within the past decade, researchers using infra-red thermography successfully demonstrated the appearance of abnormally high skin temprature over low back pain. Thermography's value in diagnosis of disc disease was first reported by Albert and colleagues in 1964 using infra-red thermography [4]. Edeiken. et al., in 1968 further documented the existence of abnormal thermographic results over herniated discs [40].

Unfortunately, the expense of infra-red equipment limited the wide spread application of this technique. In the early 1970s a new low cost thermographic system "Liquid crystal thermography" was introduced for clinical evaluation of sports injuries [142]. The liquid crystal is substance that behave mechanically like liquid, but have the optical properties of a crystal [78]. It selectively reflect polarized light in a narrow region of wavelengths [115]. This substance is imbeded in flexible, elastomeric material which is pressed against the desired site. Application of liquid crystal thermography in discogenic disease by Raskin et al., in 1974 show that if lumbar thermography is positive, the probability of obtaining a normal myelogram is small [125]. Prochazevsky [1982] support the finding that, the accuracy of thermography in pain patients with clinically positive back pain is the accurate as compared with the accuracy of myelography [118]. Le Roy. et al.,

[1983] showed high correlation between the clinical finding and thermographic one if compared with the finding of C.T. scan [88]. The higher correlation is because thermography demonstrates the pathophysiologic changes associated with low back pain and sciatica, neuropathies, reflex sympathetic dystrophy, or facetitis for example; whereas the C-T scan demonstrates only connective and structral and/or osseous abnormalities [87].

Frequently structural abnormalities and the severity of the anatomic lesion do not correlate with subjective complaints [136]. Comparative studies between thermography and electromyography found that the more accuracy of thermography in detecting nerve root irritation [164]. Newman. et al., in 1984 [110] supported this finding in comparative study of 155 patients who all underwent thermography, EMG, C.T scan evaluation of their low back pain complaints [110].

The Wide Application of Thermography :

Those who have heard of thermography generally associate it as a tool for breast scanning, because the early introduction of liquid crystal thermography for clinical evaluation of breast cancer [5,31,114]. But with improved equipment and extensive research, thermography's

diagnostic role become widly applied in different medical specialities.

In vascular surgery, thermography used to determine the periphral blood flow [126], because it reflects tissue perfusion [145], and so, it used for diagnosis of deep venous thrombosis [77.117,134], arteriovenous fistulas [144] and other peripheral vascular diseases [126, 145].

In orthopedic, thermography used to diagnose inflammatory [7,16], and degenerative [142] conditions in addition to the traumatic [89], and other disease of bone [142].

Thermography shows successful applicatin in rheumatology [43,157], podiatry [36,93], and sport medicine [33,85]. In pain clinic, thermography used to determine and diagnosis of some painful conditions, such as, reflex sympathetic dystrophy [39,150], myofascial pain syndromes [50] , Autonomic pain [54], and thalamic pain [149] .

Application of thermography in Neurosugery [86] as a method of investigation and diagnostic tool, take its place in many centers to determine carpal tunnel syndrome [56, 124], meralgia parasthetica syndrome [55], and other entrapment syndromes [108]. Also, to determine the impaired sympathetic function in peripheral nerve injuries [10, 123].

Thermography helps very much in diagnosis of thoracic outlet syndrome [130], and facet joint syndrome [99, 129].

Application of thermography as cerebrovascular investigation started recently to detect carotid artery stenosis [1], to evaluate carotid endarterectomy [137], to diagnose transient ischemic attacks [17], and stroke [71] .

In anesthesia, thermography have been used to evaluate sympathatic block [35] . Because thermography have showed great success in evaluation of pain conditions, it is used in psychiatric clinic to differenatiate the psychogenic pain [69] from the organic pain. Thermography used also for documentation of pain and it has medicolegal aspect [50,100,163].

AIM OF THE WORK

The aim of this work is to assess validity of thermography in diagnosis of low back pain due to prolapsed lumbar disc. Also to determine how well thermographic findings correlated with the symptoms of pain due to disc prolapse, and if it can differentiate between psychogenic or malingering pain from true organic pain, and if it can differentiate refarred and local pain. In addition, comparative study between the thermographic results and other convential radiological, or magnetic methods of investigation used to confirm the diagnosis of prolapsed lumbar disc. Intra-operative findings are also reported and compaired with the thermographic results. The work will show if thermography will reduce or replace radiological and magnetic investigation, and if it will add a new non invasive radiation free method of investigation for low back pain.

Review of Literatures

ANATOMY

Study of the anatomy of the lumbar region is very helpful to understand the changes that underlie low back pain, and the ways by which such changes give rise to symptoms.

Lumbar Vertebrae :

The lumbar segment accounts for 25% of the hight of the spinal column by virtue of its larger and heavier 5 vertebrae. The fifth vertebra may occasionally fuse wholly or in part with the sacrum (sacralization of the 5th lumbar vertebra) or more rarely the first segment of the sacrum may differentiate as a separate vertebra [68]. Its individual elements are united by a series of intervertebral articulation to form a firm but flexible shaft [131]. The lumbar segment are responsible for must flexion and extension movement of the lower spine, about 75% of the lumbar flexion-extension movement as well as 75% of the spinal bending occurs at the lumbosacral joints. i.e. L_5-S_1 level. Approximately 20% of the lumbar flexion-extension and binding occur at the L_4-$_5$ level [15]. Each vertebra has a body, neural arch, and processes.

The body of the lumbar vertebra consists largely of a centrum of softer cancellous bone, surrounded by a thin shell of more dense and firm cortical bone (FIG. 1). The massive lumbar vertebral bodies are developed to sustain greater weight and other stresses than the region above **[64].** The cancellous bone may collapse by trauma or osteoprosis, and the cortical outer layer may prolifrate to form marginal osteophyte in lumbar spondylosis **[161].**

The neural arch has a pair of pedicles and pair of lamina, to form a triangular vertebral foramen or spinal canal. The roof of the neural arch is formed by the two lamina, while pedicles form its sided (FIG. 2).

The pedicles are strong, short, thick and projected backward from the posterolateral aspect of the body just below its upper border (FIG.3). The pedicle bears a notch above and below, named the vertebral notches, which form with the notches of contiguous vertebrae the intervertebral foraminae, these formainae transmit the segmental spinal nerves and vessels.

The laminae are broad, short and strong plates directed backword and medially from the pedicles. They fuse in spinous process posteriorly. The laminae of the lumbar spine do not overlap one another to the same extend as those of the thoracic region.