ROLE OF M R ANGIOGLRAPHY IN EVALUATION OF PERIPHERAL VASCULAR SYSTEM

Thesis

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By

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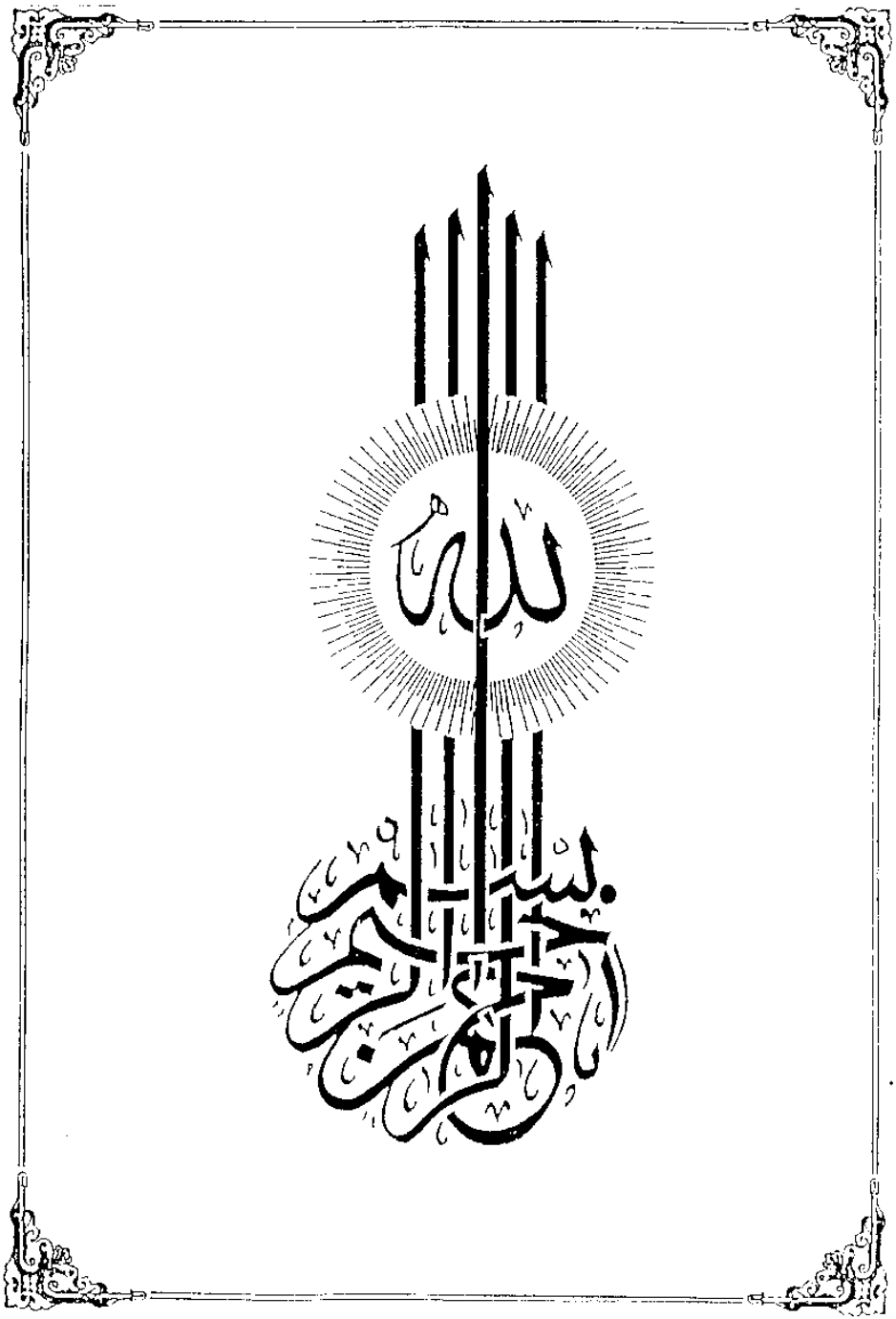
To

My Parents

And My Family

(Ghada, Karim & Farrah)



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CHAPTER I

INTRODUCTION AND AIM OF WORK

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Contrast angiography used to be the only method for evaluating vascular systems for decades. Recently, new noninvasive modalities as ultrasound duplex imaging and scintigraphy have joined contrast angiography in this task, however they could not totally replace it due to its high spatial resolution and high accuracy in reflecting any vascular lesion.

For more than 30 years it has been known that magnetic resonance (MR) could be used to study blood flow. The flow of blood through magnetic field gradients and radiofrequency fields produces signal changes that can be used to distinguish blood vessels from surrounding stationary tissue. Until recently, the clinical applications of MR flow imaging techniques have been hindered because tomographic MR images are of limited utility for evaluating complex vascular anatomy. The field of MR angiography attempts to overcome this limitation by creating images that depict blood vessels in a projective format similar to conventional invasive angiogram, but without the need for ionizing radiation or a contrast agent.

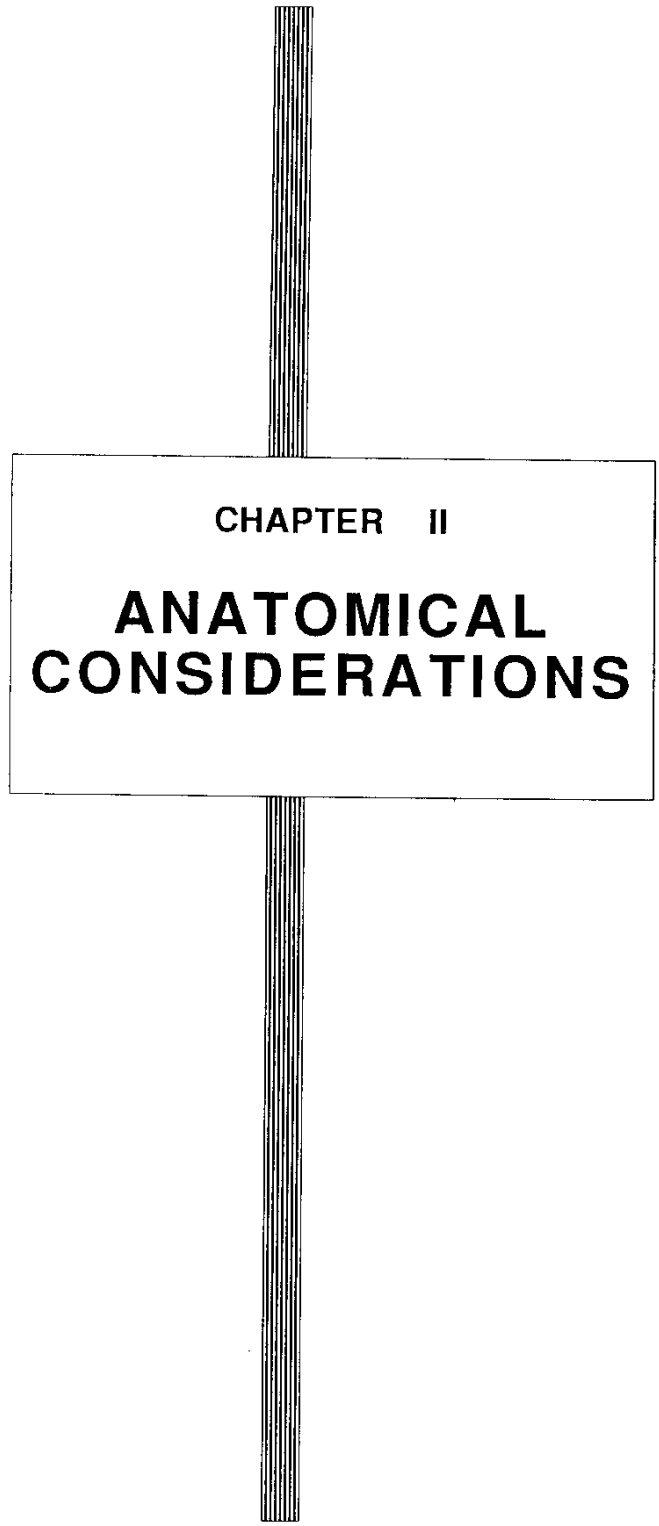
Magnetic resonance imaging has many of the advantages offered by other imaging modalities without some of the associated disadvantages. Similar to ultrasound, MR is nonionizing and capable of imaging in multiple planes. Unlike ultrasound , MR is not dependent

on operator's skills or the habitus of the patient , and can penetrate bone without significant attenuation such that the underlying tissue can be clearly imaged. MR provides excellent spatial resolution similar that of computed tomography (CT) and far better soft tissue contrast resolution. Intravenous injection of contrast media is unnecessary with magnetic resonance since flowing blood provides natural contrast between blood and cardiovascular structures.

Magnetic resonance angiography (MRA) was first applied in the mid 1980's on the carotid arteries, but its application on the peripheral vascular system is not well established due to the nature of blood flow in this high resistance vascular circuit making the imaging process difficult.

This work will include the ideal MRA methods for proper imaging of the peripheral vascular system. Moreover, accuracy, sensitivity and specificity of MRA in evaluating peripheral vessels will be discussed, with greater stress on arterial occlusive diseases being the most common lesions affecting this system. Reliability of MRA as a new method for evaluation of peripheral vascular system will be mentioned.

The aim of this work is to highlight the value of MRA as a new noninvasive modality for imaging the arteries of the upper and lower extremities and finding whether MRA could become the primary method for evaluation of peripheral vascular system in the future.



Diseases of the arterial vascular system of lower limbs are usually due to lesions affecting the arterial tree beginning from the abdominal aorta and more distally. Thus, in this section we are going to give a brief hint on the vascular anatomy of the aorta, iliac arteries and the arterial tree below the iguinal ligament from the angiographic point of view with no much details on the relationship of these vessels to the surrounding structures, unless essential to this study, and with more stress on the vascular branches that contribute in the formation collateral circulation in cases of arterial occlusion. Arterial branches which does not appear in MR angiography are mentioned briefly.

Abdominal Aorta: ***(Fig.II, 1)***

The abdominal aorta extends from the diaphragmatic hiatus (T_{12}-L_1 intervertebral disc space to the aortic bifurcation (L_4). In the young adult, the abdominal aorta follows relatively straight course. In older individuals there is often tortuousity and axial rotation that may displace the orifices of the aortic branches.

The abdominal aorta lies anterior to the upper four lumbar vertebral bodies and slightly to the left of midline. Values for the size of the lumen of the aorta in normal adult patients have been suggested by ***Goldburg and Lehman in 1970.*** The internal diameter at the xyphoid level should be about 25 mm. and it should decrease to approximately 15 mm at the bifurcation. Although the limits of normal are quite broad, any increase in the size move than 30 mm is abnormal.

Branches of the aorta may be classified into unpaired vessels *(visceral branches)* and lateral paired vessels *(parietal branches)*, with the

middle sacral artery as the terminal branch. ***Table (II,1)*** outlines the level of the origin and localization of these branches.

Name of Branch	***Level of Origin***	***Localization***
Inferior phrenic As.	D12	frontal, bilateral
Lumbar arteries	L1 - L4	dorsolateral bilateral
Celiac trunk	D12 - L1	frontal
Middle suprarenal A.	L1 - L2	bilateral
Superior mesenteric A.	L1 - L2	frontal
Renal A.	L1 - L2	bilateral
Testicular(ovarian) A.	L2 - L3	frontal, bilateral
Inferior mesenteric A.	L3 - L4	frontal

(Neiman and Yao, 1985)

Iliac Arteries: ***(Fig.II,2)***

At the level of the fourth lumbar vertebra, the aorta bifurcates into the left and right common iliac arteries. The left common iliac artery is usually shorter than the right. They do not give off any branches. The common iliac arteries divide into external and internal iliac arteries at the level of the first sacral vertebra.

External Iliac Artery:

The external iliac artery is larger than the internal iliac artery except in the fetus, in whom the internal iliac arteries give rise to the umbilical arteries.***(Kadir, 1986).***