Intravascular Ultrasonographic Assessment Of Lumen Size And Wall Morphology In Patients With Coronary Artery Disease As Compared With Coronary Angiography

Thesis

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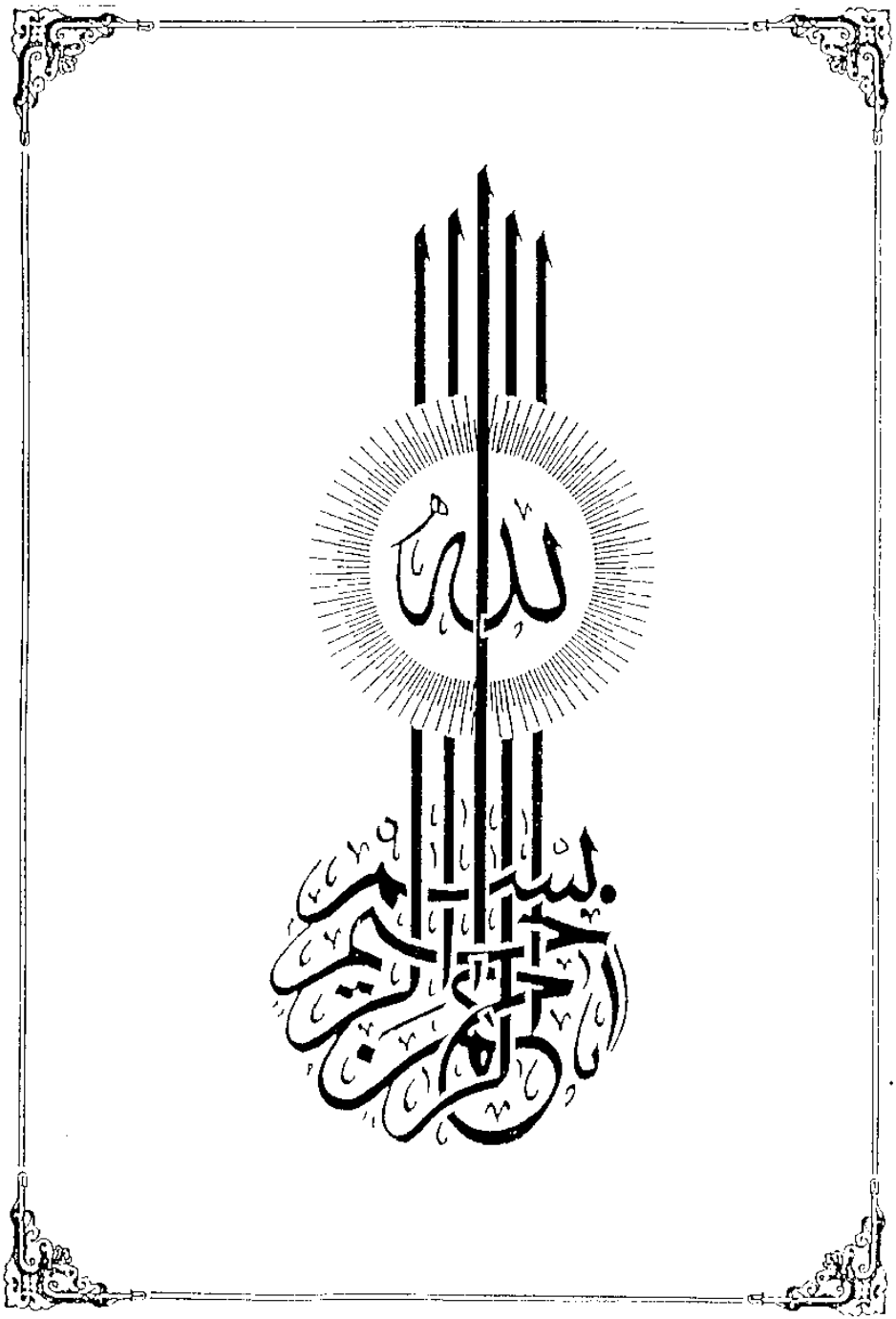

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Contents

REVIEW OF LITERATURE

Limitations Of Coronary Arteriography

The usefulness of coronary arteriography is related to how reliable it is in detecting coronary artery disease. The improvements in imaging systems have made possible the accurate delineation of lesions even in obese patients.[1]

The improved television systems allow for real time visualization and review by videotape that rivals the developed cine film.[2,3]

This capability enables the operator to make the informed decisions about the need for more views prior to completion of the procedure.

The use of the cranially and caudally angled X-ray beam was the most important development in that field.

This has allowed direct on site visualization of all coronary arterial segments without overlap or fore-shortening and has markedly improved the ability to accurately define the lesions.[1-5]

Despite these improvements in technical aspects of coronary arteriography, and despite that, coronary arteriography has been the gold standard for the diagnosis of coronary atherosclerosis in vivo based on successful localization of stenotic obstructions within a vessel's lumen, coronary angiography may be searching for atherosclerosis in the wrong place .. the lumen.[6]

Atherosclerotic coronary artery disease, is a disease of the vessel wall, and atherosclerotic lesions in the wall are merely profiled by angiographic techniques, whereas quantification of disease is expressed as the ratio of the diseased to the normal lumen diameter i.e. the percent stenosis. Thus, despite modern advancements in coronary angiography including quantitative coronary angiography, the assessment of atherosclerosis still ironically involves measurements of where the disease is not, the lumen.[6-7]

Furthermore, coronary angiography records only a silhouette of the vessel lumen, and thus, it will often misrepresent the extent of luminal narrowing.[7]

Visual interpretation of coronary angiograms has its acknowledged limitations, and results of intervention trials based on visual interpretation should be interpreted carefully.[8-11]

If all patients with manifestations of clinical coronary heart disease had one isolated lesion in one coronary artery, the problem of demonstrating that, there was no progression or even regression of that lesion after a period of treatment for hypercholesterolaemia would be simple. But this is not the case. [12]

Most patients have a number of lesions in a number of coronary arteries which are variable in obstruction, distribution, and pathological composition.[12]

The use of coronary angiography to measure progression or regression of atherosclerotic disease is based on the assumption that a change of volume of atherosclerotic plaque will have an effect on the size and shape of the contrast filled lumen, however, atherosclerotic changes of the arterial wall are not reflected precisely enough by changes in the lumen.[12]

Thus, limitations of coronary arteriography can be summarized in:[13-14]

1. Lack of complete anatomic-pathologic correlation.
2. Inter-observer and intra-observer variability.
3. Imperfect correlation with flow.
4. Poor interpretation of progression of disease.
5. Underestimation of severity of lesions.

Processes other than atherosclerotic changes such as arterial spasm, intimal dissection, thrombosis, or embolism that may cause abnormalities on the angiogram can not always be distinguished angiographically from atherosclerosis.[12]

The angiographic morphology of the atherosclerotic plaque was correlated with postmortem histopathology.[15-18] Postmortem angiograms with findings of smooth, hourglass lesions correlated with simple plaque of fatty or fibrous composition and intact intima, while complicated stenoses with irregular borders and filling defects correlated with plaque rupture, hemorrhage, superimposed thrombus, or recanalized thrombus.

In vivo angiograms, of course, do not have the fine details of postmortem studies. However, with improved visualization it is sometimes possible to classify lesions by morphology as well as, simply, by percent stenosis.[17]

Interobserver and intraobserver variability in the evaluation of coronary artery stenoses is another important limitation of the technique.

In a study[8] correlating cine-angiographic findings with those at necropsy, the coronary angiograms were reviewed separately by three experienced angiographers in order to incorporate the observer variability as a factor influencing accuracy of the method.

Using this approach the study was able to find out how often one or more angiographers significantly underestimate the degree of narrowing of the coronary arteries examined.

This study[8] proved that selective coronary angiography frequently fails to show severe coronary arterial luminal narrowing or greatly underestimates the degree of narrowing.

Of (61) coronary arterial segments compared both angiographically and histopathologically, at least one of the three angiographers missed a narrowing more than 75% in cross-sectional area in 17 of 42 segments. And of eight segments narrowed 51% to 75% in cross-sectional area, seven were missed by one or more angiographers.