Intraventricular Conduction Defects In Acute Anterior Myocardial Infarction : Electrocardiographic And Electrophysiologic Diagnosis

Thesis Submitted For The Partial Fulfillment Of
M.S. Degree In Cardiology

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بسم الله الرحمن الرحيم

قالوا سبحانك لا علم لنا إلا ما علمتنا إنك أنت العليم الحكيم.

صدق الله العظيم

البقرة - ٣٢

بسم الله الرحمن الرحيم

Dedication

To My Beloved Parents

Acknowledgment

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INTRODUCTION AND AIM OF THE WORK

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Atrioventricular (AV) conduction defects are not rare in acute anterior myocardial infarction. Bundle branch block develops in 10% of acute cases. Thirty percent of bundle branch block will develop complete heart block (CHB) [1].

The development of bundle branch block during the course of acute infarction has an impact on the prognosis after infarction. It was found that the acute development of bundle branch block in association with transient 2nd degree or 3rd degree AV block increases the incidence of in-hospital mortality and increases the incidence of sudden cardiac death after discharge [2].

Sudden cardiac death occurring in such patients is due mostly to ventricular tachyarrhythmia [3]. The prognosis of patients who develop bundle branch block during acute anterior wall myocardial infarction and develop transient complete heart block is not known. Moreover, the use of permanent pacing in such patients is still controversial.

Electrophysiological studies have a role in detection of His--Purkinje disease and might help in those patients with bundle branch block complicating acute myocardial infarction who develop transient complete heart block. The detection of diseased His-Purkinje system will help to further plan for permanent pacemaker implantation.

Aim of the Work

The aim of this work was to study the prognosis of patients with acute anterior wall myocardial infarction who develop intraventricular conduction defects (IVCD) during the acute course of the infarction and also to assess the role of electrophysiologic study in the prediction of outcome of such patients.

REVIEW OF LITERATURE

Anatomy and Blood Supply of the Cardiac Conduction System

Sinus node

The human sinus node is a spindle shaped structure composed of fibrous tissue matrix with closely packed cells. It is 10 - 20 mm long, 2 to 3 mm wide and thick, tending to narrow caudally toward the inferior vena cava. It lies less than 1 mm from the epicardial surface, laterally in the right atrial sulcus terminalis at the junction of the superior vena cava and the right atrium [(4)].

Cellular structure

Cell types in the sinus node include nodal cells, transitional cells, and atrial muscle cells.

- ***Nodal cells***: also called P cells; thought to be the source of normal impulse formation in the sinus node, are small (5 to 10 um) ovoid, primative-appearing cells with cytoplasm that contains relatively few organelles and myofibrils. The few mitochondira are distributed randomly and are variable in size and shape. No transverse tubular system exists. Nodal sells stain poorly, have a pale appearance on light and electron microscopy and are grouped in elongated clusters located centerally in the sinus node [(4)].

- ***Trasitional cells***: also known as T cells, these are elongated cells intemediate in size and complexity between nodal cells and muscle cells. These plentiful cells have large numbers of myofibrillis myofibrils and are heterogeneous, with some T cells more organized and complex than others.T cells near nodal cells have simple intercellular connections, while more fully developed intercalated discs exist betweer Tcells and atrial myocardium. Since nodal cells make contact only with each other or T cells, the latter may provide the only functional pathway for distribution of the sinus impulse formed in the nodal cells to the rest of the atrial myocardium. Tcells constitute a spectrun of morphologies rangirng from " typical" nodal cells on one hand and " typical" working atrial myocardium on the other.

The third cell type psesent in the sinus node is the ***working atrial myocardial cells***. These cells extend as peninsulas into the nodal boundaries, with overlapping zones of sinus and atrial cells most prominent on the nodal surface that abuts the crista teminalis.

These three cell types have been identidied in freshly excised human myocardium. Very probably there is no single cell in the sinus node that serves as the pace maker. Rather, sinus nodal cells function as electrically coupled oscillatores discharging synchronously because of mutual entrainment. Thus faster discharging cells are slowed by cells firing more slowly, while they themselves are sped so that a "democratically derived" discharge rate occurs [(4)].

In humans, sinus rhythm results from impulse origin at widely separated sites creating two or three individual warefront [(5)], and shifts in the sinus node pacemaker complex occur spontaneously [(6)].

Internodal and Interatiral conduction:

Whether impulses travel from the sinus node to the AV node over preferentially conduction pathways has been contested. Anatomical evidence has been interpeted to indicate the presence of three pathways [4].

The anterior internodal pathway begins at the anterior margin of the sinus node and curves anteriorly around the superior vena cava (SVC) to enter the anterior interatrial band called Bachmann's bundle. This band continues to the left atrium with the anterior internodal pathway entering the superior margin of the AV node. Bechmann's bundle is a large muscle bundle that appears to conduct the cardiac impulse preferentially from the right to left atrium.

The middle intenodal tract begins at the superior and posterior margins of the sinus node and travels behind the SVC to the crest of the interatrial septum, descending in the interatrial septim to the superior margin of the AV node. The posterior internodal tract starts at the posterior margin of the sinus node and travels posteriorly around the SVC and along the cresta terminalis to the eustachian ridge and then into the interatrial septum above the coronary sinus, joining the posterior portion of the AV node.

Some filsres of from all three tracts bypass the crest of the AV node and enter its more distal segment. These groups of internodal tissue are best referred to as internodal atrial myocardium, not tracts because they do not appear to be histologically discrete specialized tracts, only plain atrial myocardium [4].

The Atrioventricular Juntional Area and Intraventricular Conduction System :

The normal AV jutational area can be divided into distinct regions; transitional cell zone, compact portion, or the AV node itself, and the penetrating part of the AV bundle (His bundle), which continues as a nonbranching portion. Some investigators consider the branching portion of the AV bundle (i.e. bundle branches) to be part of the AV junctional area anatomically, while others relying more on electrophysiological function, separate the branching from the non-branching portions [4].

Transitonal Cell Zone:

They are located in posterior, superficial, and deep groups of cells. They differ histologically from atrial myocardium and connect the latter with the compact portion of the AV node. Some fibers may pass from the posterior internodal tract to the distal portion of the AV node or His bundle and provide the anatomic substrate for conduction to bypass AV nodal slowing. However the importance of this structure is unclear [4].

The AV Node:

The compact portion of the AV node is a superficial structure, lying just beneath the right atrial endocardium, anterior to the ostium of the coronary sinus and directly above the insertion of the septal leaflet of the tricuspid valve. It is at the apex of a triangle formed by the tricuspid anulus and the tendon of Todaro, which originate in the central fibrous body, and passes posteriorly through the atrial septum to continue with the eustachian valve (4).

The compact portion of the AV node is divided from and becomes the penetrating portion of the His bundle at the point where it enters the central fibrous body. In 85 to 90 per cent of human hearts, the arterial supply to the AV node is a branch from the right coronary artery that originates at the posterior intersection of the AV node and interventricular grooves. A branch of the circumflex cororary artery provides the AV nodal artery in the remaining hearts. Fibers in the lower part of the AV node may exhibit automatic impulse formation electronically depressed by the connecting myocardium (4).

The Bundle of His or Penetrating Portion of The AV Bundle:

This connects with the distal part of the compact AV node and perforates the central fibrous body, continuing through the anulus fibrosus where it is called the non-branching portion as it penetrates the membranous septum. Proximal cells of the penetrating portion are heterogeneous, resembling those of the compact AV node, while distal cells are similar to cells in the proximal bundle branches. Connective tissue of the central fibrous body and membranous septum encloses the penetratiag portion of the AV bundle, which may send out extensions into the central fibrous body. Branches from the anterior and posterior