ASSESSMENT OF RIGHT VENTRICULAR FUNCTION BY MYOCARDIAL PERFORMANCE INDEX IN DIABETIC PATIENTS

Thesis

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List of Abbreviations

Abb.	Full term
2D	*Two dimensional*
3D	*Three dimensional*
ANOVA	*one way analysis of variance*
Ao	*Aorta*
ASD	*Atrial septal defect*
AT	*Acceleration time*
BMI	*Body mass index*
CAD	*Coronary artery disease*
CI	*Confidence interval*
CS	*Coronary sinus*
DAN	*Diabetic autonomic neuropathy*
DM	*Diabetes mellitus*
DMD	*Diabetic myocardial disease*
DT	*Deceleration time*
ECG	*Electrocardiography*
EF	*Ejection fraction*
ESRD	*End-stage renal disease*
ET	*Ejection time*
FAC	*Fractional area change*
GDM	*Gestational diabetes mellitus*
HDL	*High density lipoprotein*
IDDM	*Insulin-dependent diabetes mellitus*
IGT	*Impaired glucose tolerance*

IVA	*Isovolumic acceleration time*
IVC	*Inferior vena cava*
IVCT	*Isovolumetric contraction time*
IVRT	*Isovolumetric relaxation time*
IVV	*Peak myocardial velocity during isovolumic contraction*
LA	*Left atrium*
LADA	*Latent autoimmune diabetes of adults*
LDL	*Low density lipoprotein*
LRV	*Lower reference value*
LSD	*Least significance difference*
LV	*Left ventricle*
LVEDD	*Left ventricle end diastolic diameter*
LVESD	*Left ventricle end systolic diameter*
Mi	*Myocardial infarction*
MPI	*Myocardial performance index*
MRI	*Magnetic resonance imaging*
MV	*Mitral valve*
NIDDM	*Non-insulin-dependent diabetes mellitus*
NO	*Nitric oxide*
PA	*Pulmonary artery*
PFO	*Patent foramen ovale*
PH	*Pulmonary hypertension*
PM	*Papillary muscle*
PVD	*Peripheral vascular disease*
PWD	*Pulsed wave Doppler*
PW-TDI	*Pulsed wave tissue Doppler imaging*
RA	*Right atrium*

RIMP	*Right ventricular index of myocardial performance*
ROC	*Receiver operating characteristic curve*
RV	*Right ventricle*
RVH	*Right ventricular hypertrophy*
RVOT	*Right ventricular outflow tract*
RVSP	*Right ventricular systolic pressure*
SD	*Standard deviation*
SPSS	*Statistical package for social science*
TAM	*Tricuspid Annular Motion*
TAPSE	*Tricuspid annular plane systolic excursion*
TCO	*Tricuspid (valve) closure opening time*
TDI	*Tissue Doppler Imaging*
TR	*Tricuspid regurge*
U/S	*Ultrasound*
URV	*Upper reference value*
US	*United States*

INTRODUCTION

The right ventricle is neglected in clinical practice, because there is lack of awareness of its pivotal role in cardiac and pulmonary vascular disease ***(Coghlan and Davar, 2007).***

Right ventricular function is the primary determinant of prognosis and effort tolerance in many groups of patients. Clinicians require measures that are widely available, easily obtained, highly reproducible, and provide clear information on prognosis, likely response to therapy or provide feedback on the success of therapeutic interventions. However RV function is notoriously difficult to evaluate, given its geometry, interrelationship with the left ventricle and sensitivity to alteration in pulmonary pressure ***(Coghlan and Davar, 2007).***

In patients with left ventricular failure, myocardial infarction and pulmonary hypertension, RV function is an important predictor of mortality and quality of life ***(Marcu et al., 2006).***

The majority of proposed methods of echocardiographic assessment of RV function are based on volumetric approximations of the R V. Such approaches have inherent limitations, first as volume related measures such as ejection fraction (EF) are load dependent, second because of the complex geometry of RV ***(Lang et al., 2005).***

The issue of RV geometry is usually overcome using geometry independent parameters such as tricuspid annular velocity and Tei index. Tei index is calculated using Doppler as the ratio of the isovolumic contraction and relaxation times to the ejection time ***(Coghlan and Davar, 2007).***

The volume calculation and estimation of EF are not ideal for the clinical assessment of RV function; however regional myocardial wall motion detection by M-Mode and tissue Doppler velocities is probably the most useful method in clinical practice ***(Triantafyllou et al., 2010).***

Diabetes mellitus is a powerful risk factor for cardiovascular disease associated with high morbidity and mortality rates. Diabetic patients also have an increased incidence of heart failure which has been traditionally attributed to concurrent presence of ischemic or hypertensive heart disease. Yet, nowadays according to recent scientific evidence, diabetic myocardial disease (DMD) is more and more being considered as a distinct entity, independent of the co-existence of CAD, arterial hypertension or other risk factors, with the potential to lead to a self-existent progressive development of heart failure ***(Mytas et al., 2009).***

The vast majority of previous reports regarding myocardial dysfunction in patients with diabetes mellitus were dedicated to the left ventricle, ignoring the role of the RV. However, it is unlikely that the pathological sequel of metabolic disarrangements in diabetes spares the right sided myocardium ***(Kosmala et al., 2007).***

AIM OF THE STUDY

To assess the feasibility of pulsed wave tissue Doppler imaging and myocardial performance index (MPI) of the right ventricle in the assessment of right ventricular function in diabetic patients without coronary artery disease.

Chapter (1)

DIABETES MELLITUS

Definition:

The term diabetes mellitus describes a metabolic disorder of multiple aetiology characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both. The effects of diabetes mellitus include long–term damage, dysfunction and failure of various organs.

Diabetes mellitus, or simply **diabetes**, is a group of metabolic diseases in which a person has high blood sugar, either because the body does not produce enough insulin, or because cells do not respond to the insulin that is produced ***(Shoback et al., 2011)***. This high blood sugar produces the classical symptoms of polyuria (frequent urination), polydipsia (increased thirst) and polyphagia (increased hunger).

Fig. (1): Universal blue circle symbol for diabetes ***(International Diabetes Federation, 2006)***.

There are three main types of diabetes mellitus (DM). Type 1 DM results from the body's failure to produce insulin, and presently requires the person to inject insulin or wear an insulin pump. This form was previously referred to as "insulin-dependent diabetes mellitus" (IDDM) or "juvenile diabetes". Type 2 DM results from insulin resistance, a condition in which cells fail to use insulin properly, sometimes combined with an absolute insulin deficiency. This form was previously referred to as non insulin-dependent diabetes mellitus (NIDDM) or "adult-onset diabetes". The third main form, gestational diabetes occurs when pregnant women without a previous diagnosis of diabetes develop a high blood glucose level. It may precede development of type 2 DM.

Other forms of diabetes mellitus include congenital diabetes, which is due to genetic defects of insulin secretion, cystic fibrosis-related diabetes, steroid diabetes induced by high doses of glucocorticoids, and several forms of monogenic diabetes.

All forms of diabetes have been treatable since insulin became available in 1921, and type 2 diabetes may be controlled with medications. Both types 1 and 2 are chronic conditions that cannot be cured. Pancreas transplants have been tried with limited success in type 1 DM; gastric bypass surgery has been successful in many with morbid obesity and type 2 DM. Gestational diabetes usually resolves after delivery. Diabetes without proper treatments can cause many

complications. Acute complications include hypoglycemia, diabetic ketoacidosis, or nonketotic hyperosmolar coma. Serious long-term complications include cardiovascular disease, chronic renal failure, and diabetic retinopathy (retinal damage). Adequate treatment of diabetes is thus important, as well as blood pressure control and lifestyle factors such as smoking cessation and maintaining a healthy body weight

Epidemiology:

Prevalence of diabetes worldwide in 2000 (per 1,000 inhabitants) - world average was 2.8%.

Globally, as of 2010, an estimated 285 million people had diabetes, with type 2 making up about 90% of the cases. Its incidence is increasing rapidly, and by 2030, this number is estimated to almost double ***(Wild et al., 2004)***.

Diabetes mellitus occurs throughout the world, but is more common (especially type 2) in the more developed countries. The greatest increase in prevalence is, however, expected to occur in Asia and Africa, where most patients will probably be found by 2030 ***(Wild et al., 2004)***.

The increase in incidence in developing countries follows the trend of urbanization and lifestyle changes, perhaps most importantly a "Western-style" diet. This has suggested an