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MYOCARDIAL PERFORMANCE INDEX IN PATIENTS OF SICKLE CELL DISORDER

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ABSTRACT--Sickle cell disorder is a group of diseases where shape of erythrocytes changes to sickle shape and the fragility of cell membrane increases due to deoxygenation. It is caused by a point mutation at sixth position in beta globin chain, where valine is replaced by glutamic acid. Sickle cell cardiomyopathy includes 4-chamber dilation and in some patient's myocardial fibrosis, diastolic dysfunction, abnormal perfusion reserve and very rarely myocardial iron overload maybe present. Myocardial performance index (MPI) is a numeric value which is obtained by measuring cardiac time interval, obtained by a Doppler echocardiogram that expresses systolic and diastolic function both, and is used to investigate right and left ventricular function. Due to the geometric shape of right ventricle, its function is crucial to analyse using non-invasive methods, so it may be a specifically useful index. On extensive search, no such study has been done in India till now, that's why we have decided to undertake this study as MPI may be a useful non-invasive and sensitive tool for assessing the subclinical cardiac LV and RV dysfunction in patients with sickle cell disorder. - To compare the myocardial performance index in sickle cell patients and age and sex matched healthy controls. To compare the myocardial performance index in sickle cell crisis v/s stable sickle cell disease patients. Prospective cross sectional study with control group was carried out at AVBRH , a tertiary care teaching hospital situated in the rural area of Wardha District. Patients ≥ 18 years of age with diagnosed/newly detected cases of sickle cell anaemia admitted in Medicine Department and those attending medicine OPD both males and females were included. Normal healthy males and females with age and sex match were taken as controls. Out of 61 cases 22.95% of patients had MPI ≤0.40 and 77.5% had MPI >0.40 whereas in control group 93.85% had MPI ≤0.40 and 6.15% had MPI >0.40. Out of 10 patients with sickle cell crisis 30% had MPI ≤0.40 and 70% had MPI >0.40 and amongst stable sickle cell disease patients 13.73% had MPI ≤0.40 and 86.27% had MPI >0.40. This Doppler echocardiographic study will be helpful to identify early abnormalities in systolic and diastolic function in Sickle cell disorder more commonly in sickle cell crisis patients.

Keywords-- Left Ventricular Dysfunction, Myocardial performance index, Sickle cell disorder

I. INTRODUCTION

Sickle cell disorder is a group of diseases where shape of erythrocytes changes to sickle shape and the fragility of cell membrane increases due to deoxygenation. It is caused by a point mutation at sixth position in beta globin chain, where valine is replaced by glutamic acid. (1-4)

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Sickle cell cardiomyopathy includes 4-chamber dilation and in some patient's myocardial fibrosis, diastolic dysfunction, abnormal perfusion reserve and very rarely myocardial iron overload maybe present. Factors which play an important role in patients of sickle cell disease for cardiac involvement are, iron overload, chronic anemia and thrombotic occlusion of coronary vessels. (5-9)

Left ventricular diastolic dysfunction is mainly correlated with diastolic dysfunction, increased aortic stiffness, and pulmonary hypertension which may develop alone, and each of them contribute independently to higher rate of mortality, and patients with both of these risk factors have poor prognosis. Whereas, Myocardial fibrosis and Left ventricular dilation are associated with increased blood transfusion requirements. (10)

Myocardial performance index (MPI) is a numeric value which is obtained by measuring cardiac time interval, obtained by a Doppler echocardiogram which expresses systolic and diastolic function both, and is used to investigate left and right ventricular function. Because the geometric shape of right ventricle makes its function crucial to analyse using non-invasive methods, it may be a specifically useful index (11-12).

left ventricular systolic function is commonly being measured by Ejection phase indices. These measures are highly influenced by and dependent upon heart rate and myocardial loading conditions, both of them are abnormal in sickle cell anemia. These indices of systolic function when used in this population may explain broad spectrum of results and apparent discrepancies which are documented in literature.

II. METHODOLOGY

Setting

The study was conducted at Acharya Vinoba Bhave rural Hospital (AVBRH), a tertiary care teaching hospital situated in rural area of Wardha District. Wardha district has a population of around 1.2 million.

Sample Size

Sample Size of the study will be 100

Study Design

Prospective cross sectional study with control group.

INCLUSION CRITERIA-

CASES: Patients ≥ 18 years of age with diagnosed/newly detected cases of sickle cell anemia admitted to Medicine Department and those who attended medicine OPD.

CONTROLS

Normal healthy individuals with age and sex match were taken as controls.

EXCLUSION CRITERIA

Patient < 18 years of age.

Patients who did not give consent

Rheumatic heart disease, angina pectoris or documented myocardial infarction , CKD were excluded.

HbS/Beta –Thalassemia disease,

Other anemias – Hemorrhagic anemia, hemolytic anemia, aplastic anemia.

III. METHODS

Assignment of interventions (for controlled trials): Documents showing patients with sickle cell disease

Sickle cell crisis - : A number of acute syndromes, termed “crises” and chronic organ damage results when sickle cells having shortened survival enter the microcirculation and plug the vessels.

- Sequestration crisis
- Vaso-occlusive crisis
- Aplastic crisis.
- Sickle chest syndrome

Newly detected sickle cell disorder patients-

SCD would be detected by peripheral blood smear and confirmed by Hb electrophoresis.

Sickle cell slide test-

A drop of capillary or anticoagulated venous blood is mixed on a glass slide with a drop of 2 percent sodium metabisulphite. A coverslip is placed over the mixture and sealed with petroleum jelly paraffin wax .Preparation is examined under the microscope after 30 minutes.

If the sickle cells are not seen. Examine the slide again after 2 hours and 24 hours.

The test is reported as negative if the red cell remains round and as positive if red cell become sickle/holly leaf shaped.

Hemoglobin Electrophoresis-

Hemolysates are prepared from EDTA anticoagulated blood (both control and patients sample) to obtain hemoglobin solutions. The controls consist of controls of hemoglobin A F S C

A)samples are applied near the one end of cellulose acetate strip (point of origin) in separate lanes

B)cellulose acetate strips are placed in electrophoresis chambers containing the Tris-EDT-Borate buffer(ph 8.5)with point of lesion towards the cathode.

C)The chamber is connected to power supply and electric current is applied till adequate separation of hemoglobin is obtained.

D)The strips are removed from the chambers and the results are read visually. If permanent record is required, strips are stained in protein stain

Myocardial Performance Index:

Myocardial performance index is derived from ratio of time intervals which is obtained with the help of pulsed Doppler echocardiography.

For measurement of IVRT and IVCT, sample volumes are located at tips of the leaflets of mitral valve, in the apical 4-chamber view.

LV ejection time is measured by the sample volume placed in Left Ventricular outflow tract, which is just below the aortic valve (apical 5-chamber view).

Myocardial performance index (MPI) – isovolumic relaxation time + isovolumic contraction timeejection time. In adult values of LV MPI greater than 0.40 are considered as abnormal

Analysis methods: Prospective cross sectional study with control group

IV. RESULT

Out of 61 cases 22.95% of patients had MPI ≤0.40 and 77.5% had MPI >0.40 whereas in control group 93.85% had MPI ≤0.40 and 6.15% had MPI >0.40. Out of 10 patients with sickle cell crisis 30% had MPI ≤0.40 and 70% had MPI >0.40 and amongst stable sickle cell disease patients 13.73% had MPI ≤0.40 and 86.27% had MPI >0.40.

V. DISCUSSION

This Doppler echocardiographic study will help in early abnormalities in systolic and diastolic function can occur in Sickle cell disorder more commonly in sickle cell crisis patients. Relevant related studies in this region were explored for additional information related to geographic context (13-35). Few studies related to other related non-communicable entities(36-58) and sociocultural aspects (59-84) were reviewed.

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