Original Research Paper

Volume - 11 | Issue - 06 | June - 2021 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Cardiology

ASSESSMENT OF LV FUNCTION BY 2D STRAIN IN PATIENTS UNDERGOING CANCER CHEMOTHERAPY WITH ANTHRACYCLINES

Thangamalar V.	Department of cardiology, Government Rajaji Hospital, Madurai, Tamilnadu, India.
Saravanan R.R.	Department of cardiology, Government Rajaji Hospital, Madurai, Tamilnadu, India.
Balasubramanian. S.*	Department of cardiology, Government Rajaji Hospital, Madurai, Tamilnadu, India. *Corresponding Author
Veeramani S.R.	Department of cardiology, Government Rajaji Hospital, Madurai, Tamilnadu, India.
Selvarani G.	Department of cardiology, Government Rajaji Hospital, Madurai, Tamilnadu, India.
Sivakumar G.S.	Department of cardiology, Government Rajaji Hospital, Madurai, Tamilnadu, India.
Ramesh R.	Department of cardiology, Government Rajaji Hospital, Madurai, Tamilnadu, India.
N agasundar G.	Department of cardiology, Government Rajaji Hospital, Madurai, Tamilnadu, India.
Sathishkumar S.	Department of cardiology, Government Rajaji Hospital, Madurai, Tamilnadu, India.
Hemanath T.R.	Department of cardiology, Government Rajaji Hospital, Madurai, Tamilnadu, India.
Rajesh B.	Department of cardiology, Government Rajaji Hospital, Madurai, Tamilnadu, India.
Nisamudeen K	Department of cardiology, Government Rajaji Hospital, Madurai, Tamilnadu, India.

ABSTRACT **Background:** cardiovascular disease and cancer are the two disease states causing great public health burden. Despite advances in treatment options cardiotoxicity associated with cancer chemotherapy are growing day by day. Among chemotherapeutic agents, anthracyclines used widely in adults and children, are associated with increased risk of cardiotoxicity manifested as heart failure and LV dysfunction. Global longitudinal strain helps in assessing patients who develop subclinical LV dysfunction along with our routine 2D echocardiogram

Materials & methods: 75 patients with newly diagnosed malignancy, treatment naïve patients who get admitted in oncology ward and receive anthracycline group of chemotherapeutic agents in Government Rajaji hospital were analysed by conventional & 2D strain ECHO before chemotherapy, immediately after chemotherapy, 3months and at end of 6 months. Data was analyzed by using SPSS software.

Results: Out of 75 patients who received chemotherapy with anthracyclines, 11 patients developed significant decreased in LVEF < 50% (> 10% fall from baseline value), which correlated with drop in mean GLS, few patients developed drop in GLS well before decrease in LVEF. Hence GLS helps in assessing patients prone to develop subclinical LV dysfunction and aid in earlier treatment.

KEYWORDS : Anthracyclines, GLS(Global Longitudinal strain), chemotherapy

INTRODUCTION:

cancer therapies are rapidly evolving in past decade, new drug development leads to increasing use of targeted strategies, many of which affect fundamental signaling pathway that are necessary for cardiomyocyte and endothelial cell function. Cardiovascular disease related to cancer chemotherapy encompass diseases like heart failure and LV dysfunction which is termed as 'Cancer Therapy Related Cardiac Dysfunction(CTRCD)'

Anthracyclines are clearly associated with increased risk of cardiotoxicity. American college of cardiology and American Heart Association Heart Failure Guidelines have classified exposure to cardiotoxic chemotherapeutic agents as Stage A Heart failure. Cardiotoxicity is defined as decrease in LV ejection fraction of > 10% from baseline to less than 50%. Usually the median time between last dose of anthracyclines and development of cardiotoxicity is 3months.

All patients who undergo treatment with cancer chemotherapy with cardiotoxic agents like anthracyclines should have assessed their baseline LV ejection fraction at baseline and post chemotherapy and have serial follow up. Global longitudinal strain by 2D speckle tracking helps in assessing patients prone to develop subclinical LV dysfunction.

OBJECTIVE:

To assess LV systolic function by Global longitudinal strain in patients undergoing cancer chemotherapy with anthracyclines group(daunorubicin, doxorubicin, epirubicin, idarubicin) .comparision of conventional and GLS in early detection of LV systolic dysfunction in such patients

MATERIALS & METHODS:

Study Design: prospective observational study conducted in cardiology department, Government Rajaji Hospital, Madurai.

Sample Size: 75 patients

Study population: All in patients with newly diagnosed malignancy, treatment naïve patients who get admitted in oncology ward and receive anthracycline group of chemotherapeutic agents in Government Rajaji hospital were analysed by conventional & 2D strain ECHO before chemotherapy, immediately after chemotherapy, 3months and at end of 6 months

INCLUSION CRITERIA:

Age > 18 years with newly diagnosed Cancer planned for chemotherapy(either palliative, adjuvant or neoadjuvant) with anthracycline group with normal baseline LV systolic and diastolic function

EXCLUSION CRITERIA: Subjects who had

1. prior structural or functional heart disease
2. previous history of ischemic heart disease
3. who underwent percutaneous transluminal angioplasty and/or prior coronary artery bypass grafting
4. received radiotherapy
5. LV dysfunction at baseline and with
6. baseline LBBB

were excluded from the study

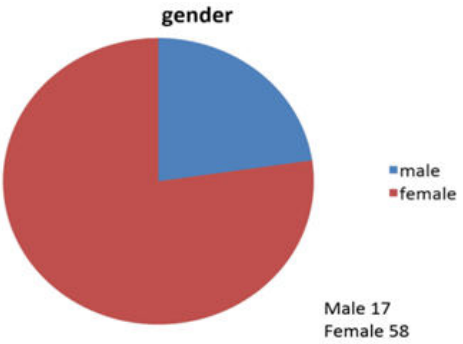
Data collection: baseline charecteristics like age, sex, clinical history, conventional risk factors, cancer diagnosis, chemotherapy regime,

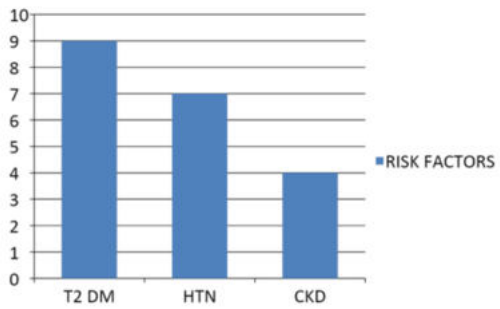
dosage of anthracycline in each chemotherapy, 2D Echo and GLS were obtained from all 75 patients at baseline, post chemotherapy, 6 months after chemotherapy.

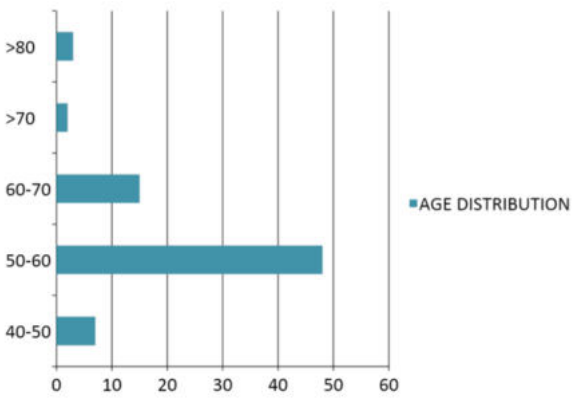
Colloborating department: department of cardiology & Oncology, Governement Rajaji Hospital Madurai.

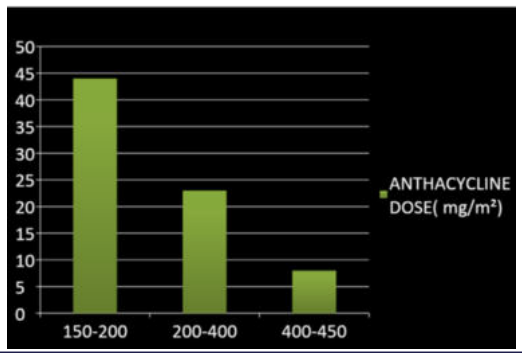
STATISTICALANALYSIS:

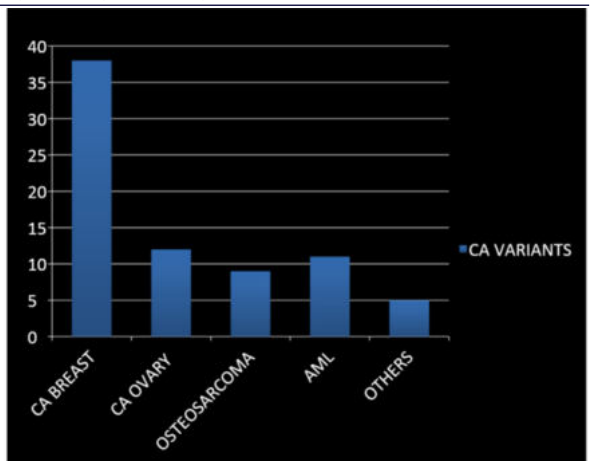
- All analysis will be performed using SPSS 15 for windows
- All results expressed as mean +/- SD
- The baseline values and and those at end of 3, 6months were compared by use of one-way analysis of variance(ANOVA)
- Cox regression analysis used to identify individual echo variables predictive of cardiotoxicity
- Receiver operating charecteristics (ROC) used to define most accurate cutoff points
- Significance defined as p< 0.001

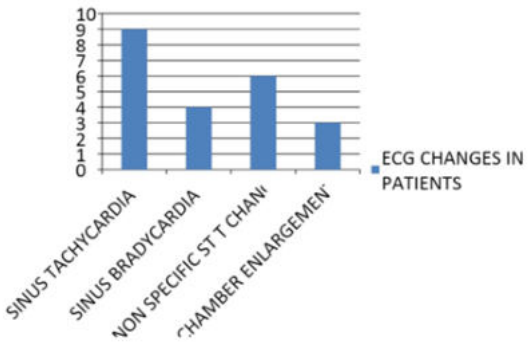












Post chemotherapy Drop in GLS

7	-16 TO -14
2	-14 TO -11
2	-11 TO -9

RESULTS:

Among 75 patients, 58 were females and 17 patients were males. Age group of affected patients mostly fall under 50 to 60 years, few patients had diabetes, hypertension and Chronic kidney disease as their comorbid illness. Most of the patients were receiving anthracyclines predominantly for solid tumours like ca breast, ca ovary, osteosarcoma and as a induction chemotherapy in AML. All 75 patients had their baseline LV EF more than 50% and normal GLS (mean -19). After chemotherapy with anthracyclines like doxorubicin and daunorubicin and 1st and 6 month post chemotherapy both LV EF and GLS was reassessed. Out of 75 patients, 11 patients showed significant fall in GLS much earlier than decrease in LVEF. 7 patients had decrease in GLS in range of -16 to -14, 2 patients had decrease in GLS -14 & -11, 2 other patients had parallel fall in both LVEF < 50% and significant GLS drop to -11 & -9. Patients who had significant fall in GLS received cumulative anthracycline dose > 400 mg/m2., 2 patients developed class III NYHA Heart failure symptoms & showed immense improvement once treated with ACE inhibitors and B blockers thereby improving longevity and survival.

DISCUSSION:

Anthracyclines have been in use since 1950s. It is one of the commonly used chemotherapeutic agent. Risk factors for cardiotoxicity in patients receiving anthracycline include dosage of anthracycline particularly when the cumulative dose exceeds 400mg/m2. Genetic variations in single nucleotide polymorphism modify the association and confer increased risk at lower dosage.

Several basic mechanism have been proposed. The first is formation of reactive oxygen species and increased oxidative stress via redox cycling of quinone moiety of doxorubicin, formation of anthracycline-iron complex. Also anthracyclines affect calcium signaling pathways,

intracellular sequestration affecting myocardial relaxation. This leads to injury to cardiac myocytes and endothelial cells.

Patients who undergo chemotherapy with cardiotoxic agents like anthracyclines show significant reduction in GLS and LV dysfunction which was detected post- chemotherapy much earlier than conventional LV systolic function estimation methods, hence patients shall be reassessed and cardiac complications shall be prevented earlier.

Currently, global longitudinal strain (GLS) is considered the most accurate and sensitive parameter for the assessment of early left ventricular dysfunction

Basic principle of Strain and strain rate: Deformation of myocardium on application of stress. Defined as the change in length normalized to the original length. The rate at which this change occurs is called strain rate- provides high resolution evaluation of regional myocardial function

GLS reduction in patients treated with anthracycline or doxorubicin anticipates changes in LVEF, providing fundamental information for an early risk stratification of these subjects. On this basis, the same guidelines state that a relative percentage reduction in LVEF of >10% from baseline/ fall in GLS should be considered abnormal and a marker of early LV subclinical dysfunction in patients treated by chemotherapy

CONCLUSION:

Patients receiving chemotherapy with cardiotoxic agents like anthracycline should have serial assessment by 2D strain as it is an easy, noninvasive tool to detect early subclinical left ventricular dysfunction comparative with routine 2D echocardiogram. When the cumulate dose of anthracycline exceeds 400mg/m2 risk of development of cardiotoxicity and LV dysfunction increases and is predicted sooner with this 2D speckle tracking system hence patients are treated earlier improving survivial.

REFERENCES

1. Siegel, R. L., Miller, K. D. and Jemal, A. (2017), Cancer statistics, 2017. CA: A Cancer Journal for Clinicians, 67: 7–30. doi:10.3322/caac.21387
2. Ferlay, J., Soerjomataram, I., Dikshit, R., Eser, S., Mathers, C., Rebelo, M., Parkin, D. M., Forman, D. and Bray, F. (2015), Cancer incidence and mortality worldwide: Sources, methods and major patterns in GLOBOCAN 2012. Int. J. Cancer, 136: E359–E386. doi:10.1002/ijc.29210
3. International Agency for Research on Cancer. World Cancer Fact Sheet. Geneva, Switzerland: World Health Organization; 2012. Available at:, http://gicr.iarc.fr/files/resources/20120906-WorldCancerFactSheet.
4. Minami M, Matsumoto S, Horiuchi H. Cardiovascular side-e ects of modern cancer therapy. Circ J 2010;74:1779-86.
5. Hooning MJ, Botma A, Aleman BM, et al. Long-term risk of car- diovascular disease in 10-year survivors of breast cancer. J Natl Cancer Inst 2007;99:365–75.
6. Felker GM, Thompson RE, Hare JM, et al. Underlying causes and long-term survival in patients with initially unexplained cardiomyopa- thy. N Engl J Med 2000;342:1077–84.
7. TanC.,TasakaH.,YuK.P.,MurphyM.L.,KarnofskyD.A.Daunomycin,anantitumor antibiotic, in the treatment of neoplastic disease. Clinical evaluation with special reference to childhood leukemia, Cancer 20 (1967) 333 – 353.