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Abstract: Research Articles

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Survival Rate Of Atrial Septal Defect With Pulmonary Hypertension

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Background and aims: Congenital heart diseases such as atrial septal defect (ASD) which developed into pulmonary hypertension (PH) had increased risk of mortality over the years. Data about prognostic status in those population is still scarce, especially in the developing country. Therefore, this study aims to investigate the survival status in ASD patients with pulmonary hypertension.

Materials and methods: This observational study data was collected from the Registry of Congenital Heart Disease and Pulmonary Hypertension (COHARD) study from 2012-2021. Pulmonary hypertension was determined using right heart catheterization with mean pulmonary arterial pressure >20 mmHg and classified into three categories: normal (mPAP ≤20mmHg), mild PH (21-40mmHG), moderate PH (41-60mmHg) and severe PH (>60mmHg). The primary end point of this study is mortality during time of follow up. Kaplan Meier curve with log rank test was used to assess survival rate of each PH categories. P-value<0.05 was considered significant.

Results: A total of 273 patients with ASD were enrolled in the analysis. Those patients were categorized into, no PH 3.7%, mild PH 31.5%, moderate PH 37.4% and severe PH 27.5% based on RHC. Mortality occurred in 32 patients (11%) of total population. Kaplan Meier curve displayed that the patients with moderate to severe PH had lower probability of survival compared to those with no PH or mild PH, although the difference is not statistically significant (log rank test p=0.175).

Conclusion: ASD patients with moderate to severe PH exhibited higher probability of mortality. This finding suggested the importance of early screening to reduce the adverse event associated with PH.

Keywords: Pulmonary Hypertension, Atrial Septal Defect, Mortality

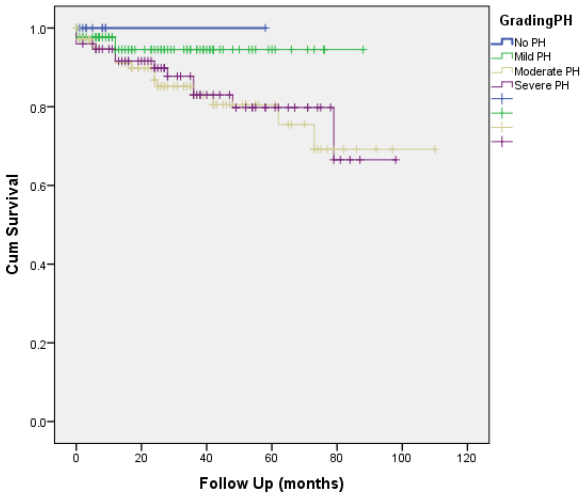

Figure 1. Kaplan Meier Curve of ASD patient with Pulmonary Hypertension

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RESEARCH ARTICLES

Risk Factors for Medical Bleeding after Warfarin Initiation in Patients with Post Mechanical Prosthetic Heart Valve Replacement Surgery

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Background and aims: Bleeding is a significant complication post-cardiac surgery, which relates to re-exploration and transfusion needs, prolong hospitalization, and death. Bleeding risk may associate with anticoagulant therapy and various factors related to patient conditions. Determining loading dose post-cardiac surgery in the Asian population is more difficult due to surgery-related factors and ethnic specificity, which is under- publishing. The aim of this research study is to determine factors that influenced medical bleeding after warfarin initiation in patients who underwent mechanical prosthetic valve replacement surgery during treatment at Dr. Kariadi General Hospital.

Materials and methods: A retrospective study with a case-control design was performed in post mechanical prosthetic heart valve replacement surgery patients at Dr. Kariadi General Hospital from January 2018 until August 2021, with data collected from the medical health records. Risk factor identification, which influences post-surgical bleeding after initiation of oral anticoagulant warfarin was analyzed by multivariate analysis logistic regression method.

Result: Fifty-nine patients (17.7%) from the total of 333 respondents experienced medical bleeding after warfarin initiation post mechanic prosthetic valve replacement surgery. Two (2) deaths occurred in patients with recurrent medical bleeding. Independent medibleeding risk factors after warfarin initiation post mechanic prosthesis valve replacement surgery included thrombocyte count ≤150000/ul (OR 2,37; p=0,030), overlapping with heparin period ≥5 days (OR 2,56; p=0,004), and INR initiation value ≥3 (OR 2,00; p=0,042).

Conclusion: Thrombocyte count, overlapping duration with heparin, and INR initiation value are risk factors for medical bleeding after warfarin initiation post mechanical prosthetic heart valve replacement surgery.

Keywords: medical bleeding, cardiac surgery, mechanical prosthesis valve, international normalized ratio (INR), warfarin

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RESEARCH ARTICLE

Transient Ischemic Dilatation as Prognostic Factor for Future Cardiovascular Events in Patient with Stable Coronary Artery Disease

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Background and Aim: Transient ischemic dilatation (TID) measures left ventricle (LV) volume changes which can be associated with combination of myocardial and endocardial ischemia. Patients with stable coronary artery disease (CAD) may have a normal myocardial perfusion value but still have different outcomes in the future. This study evaluated the prognostic value of TID of the LV in patients with stable CAD from myocardial perfusion single photon emission computed tomography (SPECT).

Materials and Methods: This is a cohort retrospective study of 100 stable CAD patients who underwent SPECT procedure at RSUP HAM from July 2018 to June 2019. We identified the TID values of each patient after the exercise stress test and then divided them into TID < 1.2 and TID ≥1.2 groups. We followed up the composite outcome for any cardiovascular events including myocardial infarction, stroke, hospitalization because of heart failure and cardiovascular death for 1 year via telephone calls, clinical visits, and medical records.

Result: The number of subjects was 100 stable CAD patients consist of 39 (39%) patients with TID < 1.2 and 61 (61%) patients with TID ≥1.2. Total cardiovascular events were 29 patients and higher in TID ≥1.2 group than TID < 1.2 group (79.3% vs 20.7%, p = 0.03). Survival analysis from Kaplan-Meier curve showed mean survival of TID ≥1.2 group was lower than TID < 1.2 group (8.55 vs 10.74 months, log-rank = 0.014). TID is an independent and incremental prognostic factor of cardiovascular events with HR 2.85 (95% CI 1.16 – 7.02).

Conclusion: TID as one of the SPECT parameters is not only useful for predicting the severity of cardiac ischemia but also proven capable to determine future events in stable CAD patients.

Keywords: TID, cardiovascular events, prognostic

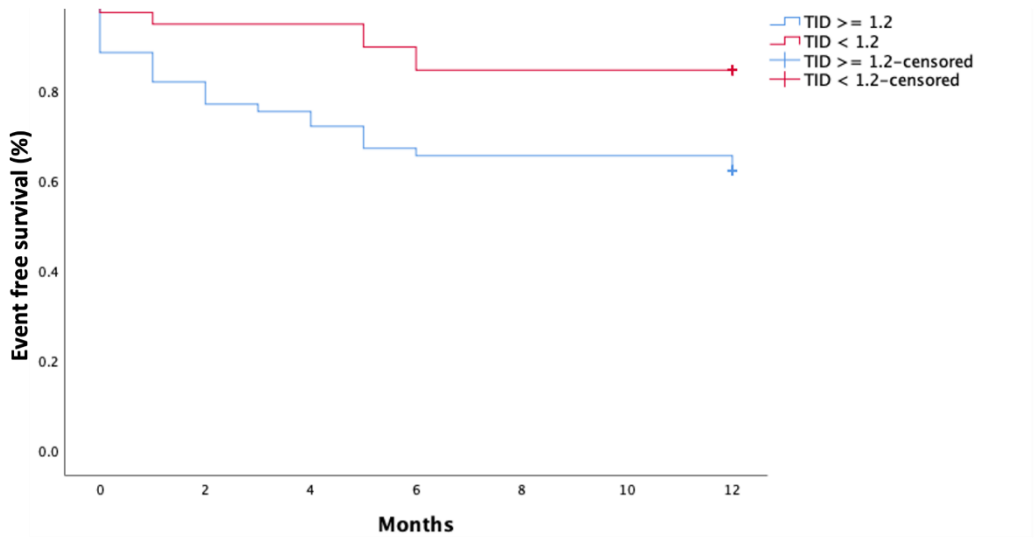

Figure 1. Kaplan-Meier Curve for event free survival from cardiovascular events in stable CAD patients with TID ≥ 1.2 (blue line) and TID < 1.2 (red line)

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RESEARCH ARTICLE

Normalization of Right Heart Function after Surgical Closure of Atrial Septal Defect: A Single-Center Retrospective Study

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Background and Aim: Atrial septal defect (ASD) is one of the most common congenital heart diseases (CHD) associated with the decrease of right heart function when left untreated. The surgical closure of ASD usually has a significant impact on right heart remodelling and functions. This study aimed to evaluate the normalization of right heart function using mean pulmonary arterial pressure (mPAP) and tricuspid annular plane systolic excursion (TAPSE) after ASD closure by surgery.

Materials and Methods: This retrospective cohort study is a part of the Congenital Heart Disease and Pulmonary Hypertension (COHARD-PH) registry. The patients were enrolled consecutively from January 2019 until October 2021. The patients were over 18 years who had undergone surgical closure of ASD in our institution. Data were collected from medical records and case reports form such as baseline demographic data and several morphological and functional parameters before, pre-discharge, and 6-months after the surgical procedure of ASD closure.

Results: This study enrolled 61 subjects who underwent surgical closure of ASD. The mean age of the patients was 36.5 ± 11.0 years. The majority of subjects were female (85.2%). The mPAP (23.8 ± 13.3 mmHg vs. 32.9 ± 15.9 mmHg, $p<0.001$) and TAPSE (12.1 ± 3.1 cm vs. 25.6 ± 5.1 cm $p<0.001$) showed a significant decline on pre-discharge following surgical closure compared to pre-closure, respectively. In 6-months follow-up, we also observed a significant improvement on the mPAP (18.8 ± 11.0 mmHg vs. 32.9 ± 15.9 mmHg, $p<0.001$) and TAPSE (17.4 ± 7.8 cm vs. 25.6 ± 5.1 cm $p<0.001$) compared to pre-closure.

Conclusion: Functional normalization of the right heart occurs at pre-discharge and 6-months following surgical closure of ASD marked by the decrease of mPAP and TAPSE as evaluated by transthoracic echocardiographic.

Keywords: COHARD-PH, atrial septal defect, ASD closure, right heart function, echocardiographic

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1. **Standard transthoracic echocardiographic measurements at baseline, pre-discharge, and 6 month post-ASD closure**

Basic parameters	Pre-closure	Post-closure 1	Post-closure 2	p-value1	p-value2	p-value3
RA Area, cm² (mean ± SD)	24.4 ± 5.6	16.9 ± 5.2	15.7 ± 3.9	**<0.001**	**<0.001**	**0.027**
RV diameter, cm (mean ± SD)	48.6 ± 7.4	38.6 ± 7.25	35.6 ± 6.6	**<0.001**	**<0.001**	**0.005**
TVG, mmHg (mean ± SD)	54.3 ± 26.2	27.9 ± 21.6	27.5 ± 12.4	**<0.001**	**<0.001**	0.519
LA diameter, cm (mean ± SD)	34.3 ± 7.8	34.3 ± 7.5	34.4 ± 7.9	0.99	0.90	0.882
LAVI, ml/m² (mean ± SD)	34.7 ± 18.2	35.0 ± 20.9	30.5 ± 15.7	0.49	0.25	0.09
LVIDd, mm (mean ± SD)	36.3 ± 5.7	40.9 ± 4.7	43.9 ± 5.34	**<0.001**	**<0.001**	**<0.001**
Septal e', cm/s (mean ± SD)	10.3 ± 5.54	7.9 ± 2.7	8.5 ± 1.9	**<0.001**	**0.016**	0.158
RVSP, mmHg (mean ± SD)	60.1 ± 27.1	34.5 ± 22.4	32.2 ± 10.3	**<0.001**	**<0.001**	0.147
mPAP, mmHg (mean ± SD)	32.9 ± 15.9	23.8 ± 13.3	18.8 ± 11.0	**<0.001**	**<0.001**	**0.008**
TAPSE, mm (mean ± SD)	25.6 ± 5.1	12.1 ± 3.1	17.4 ± 7.8	**<0.001**	**<0.001**	**<0.001**
LVEF, % (mean ± SD)	65.4 ± 7.2	64.5 ± 9.1	66.2 ± 7.8	0.64	0.52	0.235

P-value1: ASD data (pre-discharge) in comparison with Pre-closure
P-value2: ASD data (6 month after closure) in comparison with Pre-closure
P-value3: ASD data (6 month after closure) in comparison with Pre-discharge

Continuous data was expressed as mean ± SD. P-value<0.05 was considered as significant value, and p-value<0.001 was considered highly significant. Paired two-tailed t-test was used to compare the data between different stages. Pre-closure before Atrial septal defect (ASD) closure by surgery, post-closure 1: pre-discharge evaluation after ASD closure, Post-closure 2: 6 month after the surgical closure. RA : right atrium, RV : Right ventricle, LA : Left atrium, LAVI : Left atrium volume index, TVG: transvalvular gradient, LVIDd: Left ventricular internal diameter in diastolic, Septal e' : early diastolic velocity of septal mitral annulus motion, RVSP : right ventricular systolic pressure, mPAP : mean pulmonary arterial pressure, LVEF : left ventricular ejection fraction.

Table 1. Standard transthoracic echocardiographic measurement at baseline, pre-discharge, and 6 months post-ASD closure

RESEARCH ARTICLES

Relationship of Homocysteine Levels with Carotid Intima Media Thickness in Patients with Acute Myocardial Infarction

D. J. K. Rejosaputro[1], E. L. Jim[1], R. L. Lefrandt[1], A. L. Panda[1], J. A. Pangemanan[1], S. H. Rampengan[1], H. Wijaya[1]
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Background and Aims: Atherosclerosis still a major problem in the world and Acute Myocardial Infarction (AMI) is one of the fatal manifestations of atherosclerosis. Homocysteine is a biochemical marker related to atherosclerosis, and also cause endothelial dysfunction through increment of free radical production, cell apoptosis, and induction of a prothrombotic environment. Endothelial dysfunction is believed to be an important process for the initiation of atherosclerotic pathogenesis. Carotid Intima-Media Thickness (CIMT) can assess the presence of atherosclerosis in peripheral arteries. This study aims to determine the correlation between homocysteine levels and CIMT in patients with AMI.

Materials and Methods: The design of this study was observational with cross sectional approach and was carried out in June - August 2018. The number of samples in this study was 47 patients. All study subjects who met the inclusion criteria were taken history and physical examinations including age, sex, weight, height, blood pressure, dyslipidemia history, diabetes history, hypertension history, and routine laboratory examinations. After that, the subject of the study was taken blood samples for homocysteine levels, and underwent vascular doppler examination to assess CIMT.

Results : From total 47 subjects, 30 patients (60%) were male with an average age of almost 60 years old ± 10 years. Most of the patients with AMI have a history of smoking, alcohol consumption, and approximately half of the total population have a hypertension history. The average value of the entire serum homocysteine of the patient is 12 mmol/L with a deviation of about 3 mmol/L. There was a strong positive relationship between blood homocysteine levels and thickness of the carotid intima media dextra ($r = 0.960$, $p < 0.001$) and sinistra ($r = 0.958$, $p < 0.001$).

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Conclusion :
There was a significant positive correlation between homocysteine levels and carotid intima-media thickness dextra and sinistra in patients with acute myocardial infarction.

Keywords: Acute myocardial infarction, Homocysteine, Carotid intima media thickness

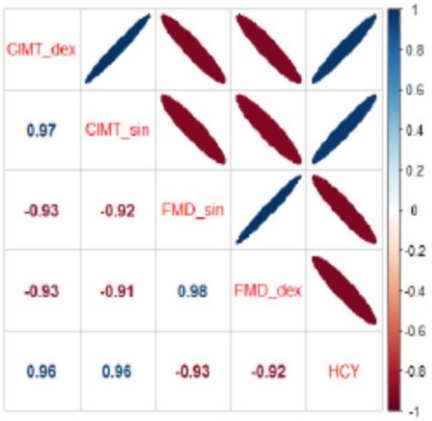

Figure 1 : Correlation between Homocysteine Level and CIMT

Figure 1 : Correlation between Homocysteine Level and CIMT

RESEARCH ARTICLES

Association between Level of Vitamin D and modified Gensini score in Coronary Artery Disease Patients

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Background and Aims : Lack of vitamin D is related to cardiovascular diseases, hypertension, atherosclerosis, cancer, infectious diseases, autoimmunity, musculoskeletal diseases, increased insulin resistance, and lipid profile deterioration. On its development, vitamin D is often associated with the severity of Coronary Artery Disease (CAD). Potential mechanisms explaining the direct protective effect of vitamin D include effects on myocardial contraction, regulation of natriuretic hormone, extracellular matrix remodeling, decreasing left ventricular hypertrophy, and proinflammatory cytokines regulation. This study aims to analyze the correlation between vitamin D and modified Gensini scores in patients with CAD.

Materials and Methods: The design used in this study was observational analytic with cross sectional approach which took place from September 2015 until January 2016. The number of samples in this study was 94 patients with CAD who underwent coronary angiography procedures. For all research subjects, it was conducted data collection including age, gender, hypertension history, diabetes mellitus, dyslipidemia, smoking, laboratory test including the levels of vitamin D, routine hematology, lipid profile, fasting blood sugar, and echocardiography. After conducting coronary angiography examination, modified Gensini scoring was performed. The correlation between levels of vitamin D and modified Gensini scores were analyzed.

Results : There were 94 patients with coronary artery disease involved in this study, with 72 patients (76.6%) male, 69 patients (73.4%) having hypertension, 25 patients (26.6%) with diabetes mellitus, 46 patients (48.9%) smoking, 61 patients (64.9%) dyslipidemia. It was found in 56 patients with levels of vitamin D ((25OH)D3)

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below 30 ng/mL (59.5%). To assess the correlation between levels of 25(OH)D3 with modified Gensini score, Pearson correlation coefficient analysis was performed. From the analysis it was found a correlation coefficient r = - 0.832 ($p < 0.05$). It was found a significant negative correlation between vitamin D and modified Gensini score.

Conclusion :
There was a significant negative correlation between levels of vitamin D and modified Gensini score in coronary artery disease patients.

Keywords: Vitamin D, Coronary Artery Disease, Gensini

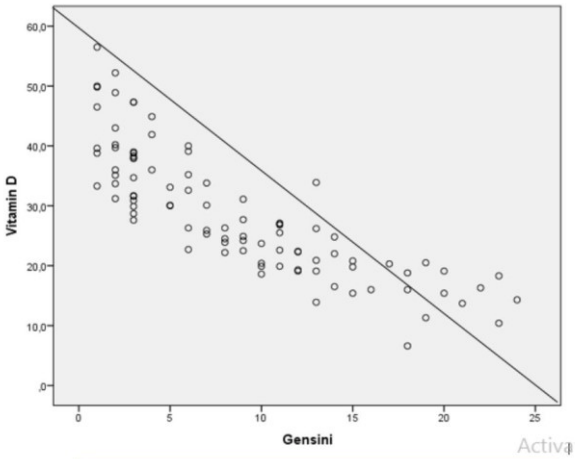

Figure 1 : Relationship Vitamin D with modified Gensini score

Figure 1 : Relationship Vitamin D with modified Gensini score

RESEARCH ARTICLE

Resolution of Right Heart Enlargement After Surgical Closure of Atrial Septal Defect

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Background and Aims: Atrial septal defect (ASD) can cause volume overload of the right side of the heart with the potential for development of right heart enlargement and little is known about reduction in right heart enlargement after closure of ASD. The purpose of this study was to characterize the time course of right heart structural resolution in patients undergoing surgical closure of ASD.

Materials and Methods: We performed a retrospective analysis of patient with ASD that was closured by surgery from the Congenital Heart Disease-Pulmonary Hypertension (COHARD-PH) registry between January 2019 to June 2021. Transthoracic echocardiography was performed for all patient undergoing surgical closure of ASD. The RA area and RV diameters were measured pre-closured, pre-discharged and 6-month after closure of ASD. Change over time within the study group was assessed.

Results: This prospective observational study enrolled 61 patients ASD closured by surgery with mean age 36.5 ± 11 years and most of patient was female (85.2%). Transthoracic echocardiography evaluation showed significant decreased of mean RA area at pre-closured compared to pre-discharged evaluation (24.4 ± 5.6 cm^2 vs 16.9 ± 5.2 cm^2, $p < 0.001$), and pre-closured compared to 6-month evaluation (24.4 ± 5.6 cm^2 vs 15.7 ± 3.9 cm^2, $p < 0.001$).

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Evaluation of RV diameter also showed a similar trend where was a significant decrease in RV diameter with mean RV diameter pre-closured compared to pre-discharged (48.6 ± 7.4 cm vs 38.6 ± 7.25, p<0.001) and prior closured compared to 6-month evaluation (48.6 ± 7.4 cm vs 35.6 ± 6.6 cm, p<0.001).

Conclusion: Resolution of right heart enlargement occurs at pre-discharge and 6-month transthoracic echocardiography evaluation marked by normalization of RA area and RV diameter.

Keywords: Atrial septal defect (ASD), right atrium (RA), right ventricle (RV)

Table 1. Analysis of transthoracic echocardiographic measurement

Basic parameters	Pre-closure	Post-closure 1	Post-closure 2	p-value1	p-value2	p-value3
RA Area, cm^2 (mean ± SD)	24.4 ± 5.6	16.9 ± 5.2	15.7 ± 3.9	**<0.001**	**<0.001**	**0.027**
RV diameter, cm (mean ± SD)	48.6 ± 7.4	38.6 ± 7.25	35.6 ± 6.6	**<0.001**	**<0.001**	**0.005**

P-value1: ASD data (pre-discharge) in comparison with Pre-closure
P-value2: ASD data (6 month after closure) in comparison with Pre-closure
P-value3: ASD data (6 month after closure) in comparison with Pre-discharge

Continuous data was expressed as mean ± SD. P-value<0.05 was considered as significant value, and p-value<0.001 was considered highly significant. Paired two-tailed t-test was used to compare the data between different stages. Pre-closure before Atrial septal defect (ASD) closure by surgery, post-closure 1: pre-discharge evaluation after ASD closure, post-closure 2: 6 months after the surgical closure. RA: right atrium, RV: Right ventricle

Table 1. Analysis of transthoracic echocardiographic measurement

RESEARCH ARTICLE

Brain Derived Neurotrophic Factor Level as a Modifying Factor for Trans Fat Intake and Hypertension

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Background & Aim: As one of the major cause of hypertension, direct effect of trans fat intake and hypertension is not yet illuminated. Long-term consumption has been linked with trans fat incorporation in brain neural membrane that could lead into alteration of signaling pathways, including Brain Derived Neurotrophic Factor (BDNF). As an ubiquitous neurotrophin, BDNF is believed to play a role in the regulation of blood pressure but has shown conflicting results to its effect. This study aimed to investigate the role of BDNF and its association between trans fat intake and hypertension.

Materials & Methods: This analytical cross-sectional study is using a secondary data including demographic data, physical examination, and food recall obtained from Natuna district population in July 2019. Primary data of BDNF level was obtained through analysis of blood samples stored in National Cardiovascular Center Harapan Kita (NCCHK) in September 2019.

Results: A total of 181 samples were obtained in this study. Compared to normontesive subjects, median of daily trans fat intake of hypertensive subjects was higher (0,013: 0,0003 – 0,07 vs 0,010: 0,0006 – 0,06, p 0,021).

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Statistitical analysis showed that plasma BDNF level has a modyfing effect in relationship of trans-fat intake and hypertension (p 0,011). In cumulative subjects, trans-fat showed an odds ratio (OR) of 1,81 95%CI 1,10-2,99 p 0,020, while the OR for those with low-middle tertile BDNF level was 3,63 95%CI 1,69-7,77 p 0,001. Further multivariate analysis showed that the interaction was statistically significant after adjustment to confounding factors.

Conclusion: Plasma BDNF level has a modifying effect in the relationship between trans-fat intake and hypertension. Increased probability of hypertension in accordance with trans-fat intake only occurred in subjects with lower plasma BDNF level.

Keywords: Hypertension, Trans Fatty Acid, BDNF, Natuna

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RESEARCH ARTICLES

Beta-Blockers Administration in Beta-Blocker Indicated Heart Failure with Preserved Ejection Fraction Was Associated with Reduction of Ventricular Arrhythmia Risk That Depicted by Improvement of T-peak to T-end and Corrected QT Interval

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Background and aims: The benefits or disadvantages of beta-blockers in HFpEF patients are still debated. However, previous studies have not explicitly examined its use in populations that indicate treatment with beta-blockers. At the same time, sudden cardiac death due to ventricular arrhythmias (VA) is the most common cause of death in HFpEF patients.

Materials and methods: This retrospective study of patients diagnosed with HFpEF is based on the 2021 ESC diagnostic approach, which includes signs and symptoms of heart failure, ejection fraction >50%, and objective evidence of structural and functional cardiac abnormalities characterized by diastolic dysfunction based on echocardiographic data. ECG parameters, including QTc and TPTE, were measured before and after beta-blocker administration, measured by three general practitioners and then validated by cardiologist. TPTE was calculated from the peak of the T-wave to the end of the T-wave that determined by the Lepeschkin method. QTc was measured by the Bazzet formula for patients with heart rate <100bpm and Fridericia Formula for heart rate >100bpm. As a secondary analysis, the cut-off value for TPTE to predict VA was evaluated using receiver operating characteristics. Finally, the progression of VA based on the cut-off value of TPTE was calculated and compared using the Kaplan-Meier method.

Results: Total of 192 HFpEF patients was approximately equal between male (n=49.51%) and female (n=47.49%), with a mean age of 49.21 years. The mean of LVEF was 61.39±6.42%. The baseline QTc was 486.75±75.61ms, the baseline TPTE interval was 107.81±15.35ms, and the optimal TPTE cut-off value as predictors of VA was 112.5ms (sensitivity 74.1% and specificity 68.1%). The Kaplan Meier curve also showed the optimal cut-off of TPTE was associated with earlier VA progression (95% CI=6.20-8.33; P=0.008). Within six months after beta-blocker administration, the mean TPTE value was 86.19±13.91ms, and the mean QTc value was 449.15±72.30 ms. Using the Wilcoxon test, the significance was seen in the variables of heart rate, QTc, and TPTE before and after using beta-blockers (p-value<0.05).

Conclusion: TPTE can be a predictor of VA in the HFpEF population. The use of beta-blockers in this population at risk has the potential to provide good outcomes.

Keywords: Beta-blocker, Heart failure with preserved ejection fraction, T-peak T-end intervals, Corrected QT intervals

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Comparison of Mean Pre and Post BB ECG Parameters on HFpEF

Variable	Pre BB Mean±SD	Post BB Mean±SD	*p*-Value
Heart rate	82.51±20.86	73.11±15.19	<0.05 (0.000)*
PR Interval	105±16.88	109±11.24	0.708
QRS duration	88.10±23.64	86.63±23.61	0.091
Cornell Product	1772.6±429	1703±523	0.063
QTc	486.75±75.61	449.15±72.30	<0.05 (0.000)*
TPTE	107.81±15.35	86.19±13.91	<0.05 (0.000)*

*=Statistically Significant (p-value <0.05)

Table 1. Comparison of Mean Pre and Post BB ECG Parameters on HfpEF.

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RESEARCH ARTICLES

Correlation Between Soluble Suppression of Tumorigenicity 2 (sST2) and Left Ventricular Sphericity Index in Heart Failure with Preserved Ejection Fraction

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Background and aims: Heart Failure (HF) causes high mortality and morbidity. Half of HF patients have preserved ejection fraction (HFpEF). Left ventricular (LV) can transform from ellipsoid to spherical as a result of remodeling. The 3-dimensional (3D) sphericity index is a new parameter to assess the geometric modification of the left ventricle. Soluble Suppression of Tumorigenicity 2 (sST2) is a member of the interleukin-1 receptor (IL-1) family which can be detected in ventricular remodeling.

Materials and Methods: A cross-sectional study was conducted from April to May 2021 on HFpEF patients who came to Dr. Moewardi General Hospital. Blood tests for sST2 and 3D echocardiography to measure LV sphericity index was performed in all patients.

Results: A total of 40 patients (21 females, mean age 61.75 ± 8.33 years) were included. Soluble ST2 levels and LV sphericity index in HFpEF patients had a significant positive and strong correlation ($r=0.629$, $p<0.001$). The odd ratio reached 17.00 (95% CI 3.03 – 95.25). The ROC curve generated from the sST2 variable to identify the high sphericity index resulted in an Area Under Curve (AUC) value of 0.79. Based on the ROC curve, the cut-off point value of the sST2 level variable is 10.57. The results of the 2 mean difference tests showed that there was a significant difference between the average sST2 values in the high and low sphericity index sample groups at a significant level ($p < 0.05$).

Conclusion: Increased sST2 level is associated with an increased degree of myocardial fibrosis, left ventricular remodeling, and poor prognosis**.** Patient with a higher level of sST2 has a higher remodeling process that can be assessed by change in LV geometric to be more spherical. There is a correlation between sST2 levels and left ventricular sphericity index in HFpEF and also a significant difference between HFpEF patients with higher and lower sphericity indexes.

Keywords: heart failure with preserved ejection fraction, sST2, left ventricular sphericity index

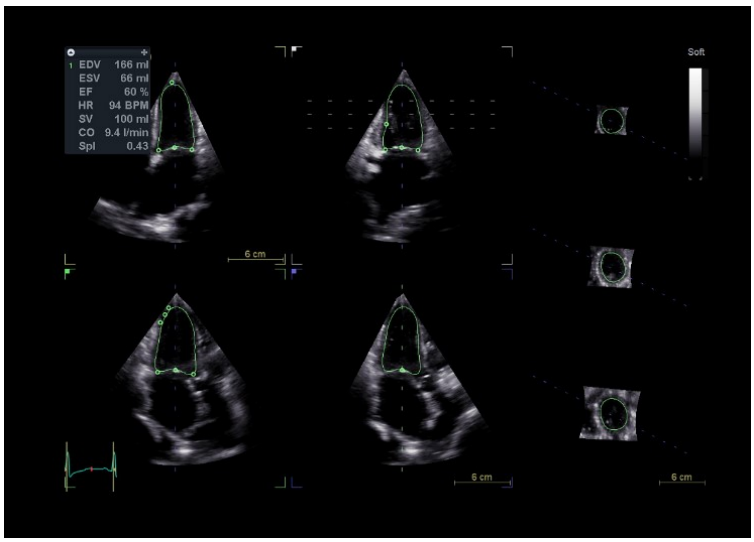

Figure 1. 3D Echocardiography.

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RESEARCH ARTICLE

Echocardiographic Parameters Associated with Worsening Renal Function in Acute Heart Failure Patients Admitted to Intensive Cardiac Care Unit of Sanglah General Hospital: An Observational, Retrospective Study

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Background and aims: Acute heart failure (AHF) is a medical emergency with a high rate of mortality. Previous studies have found worsening renal function (WRF) to be an independent predictor of mortality in AHF patients. Identification of factors associated with WRF may help guide clinicians in choosing the best treatment for each patient. This study attempted to identify such factors by analyzing data obtained from point-of-care, bedside echocardiography performed in AHF patients.

Materials and methods: Medical records were obtained retrospectively for all AHF patients admitted to Intensive Cardiac Care Unit (ICCU) of Sanglah General Hospital from August 2020 through April 2022. Inclusion criteria included patients which point-of-care bedside echocardiography were performed. Relevant patient characteristics were extracted, as well as echocardiographic data. Primary outcome was WRF, defined as a rise of serum creatinine $\geq$ 0.3 mg/dL over baseline during hospitalization. Secondary outcome was mortality during hospitalization. Statistical analysis was performed using chi-squared method and simple regression for categorical and continuous data respectively. Statistically significant findings were defined as $p < 0.05$.

Results: 140 patients were enrolled in this study with median age 62 (53.3 – 70.8), of which 52.9% were male. Median ejection fraction (EF) of all patients was 38.5% (31% – 52%). There were forty (28.6%) incidents of WRF, with thirty-seven (26.4%) in-hospital mortalities. Higher estimated right atrial pressure (eRAP) was associated with higher incidence of WRF (OR 6.0, 95% CI 1.8 – 20.4, $p = 0.014$). Estimated RAP is an indirect measure of right heart function; thus, this finding was in accordance with previous studies which showed an association between WRF and right heart function. For in-hospital mortality, WRF was associated with higher in-hospital mortality (OR 2.72, 95% CI 1.1 – 6.5), as well as valve-related etiology (OR 3.3, 95% CI 1.4 – 8.2). However, when additional analysis was performed in the subgroup for valve-related etiology, no specific valvular pathology was associated with higher mortality in the subgroup ($p > 0.05$).

Conclusion: Higher eRAP was associated with higher incidence of WRF. WRF and valve-related etiology were associated with higher in-hospital mortality.

Keywords: acute heart failure, point-of-care echocardiography, worsening renal function, in-hospital mortality

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Parameter	p Value	OR (95% CI)
Right atrial enlargement	0.063	
Right ventricular enlargement	0.3	
TAPSE	0.38	
Estimated RAP	**0.014**	6.0 (1.8 – 20.4)
Significant TR	0.18	

Table 1. Factors associated with worsening renal function during hospitalization.

RESEARCH ARTICLE

Predictive Value of P-Wave Peak Time and P-Wave Dispersion as Novel Initial Predictors of New-onset Atrial fibrillation Insidence in Early Onset Hypertension and the Role of Hypertension Control Status

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Background and aims: Atrial fibrillation (AF) is one of the most common arrhythmias in hypertensive patients due to anatomical remodelling, but it's often detected too late. Several recent studies have hypothesized that electrophysiological remodelling contributes to various arrhythmias, and the ECG is a widely available diagnostic tool that can detect cardiac electrical abnormalities.

Materials and methods: This retrospective cohort study included hypertensive patients with onset of <5 years and no previous history of atrial fibrillation from 2016-2021. ECG parameters: P-wave Peak Time (PWPT) is measured from the start of the P-wave to the peak of the P-wave. P_{max} is the longest P-wave duration in any lead, and P_{min} is the shortest P-wave duration in any lead, then P-wave dispersion (PD) is obtained from P_{max}-P_{min}. ECG and echocardiography parameters were compared between patients with and without AF. The cutoff value in predicting incidence of AF based on significant parameters was tested with receiver operating characteristics. We also looked for the association of hypertensive control status with the incidence of AF.

Results: Of the 105 subjects, 46.7% were women, 45.7% were obese and 18.1% patients had CHF. At baseline ECG, patients who experienced AF during follow-up had significantly higher QRS (79.34±8.5 vs 74.48±10.16; p=0.006), P_{max} (114.15±10.32 vs 100.53±8.58; p=0.000), P_{min} (69.49±4.5 vs 65.71±4.6;p=0.003), PD (44.66±11.9 vs 30.81±9.4; p=0.000), PWPT (53.9±3.8 vs 50.98±3.1; p=0.000). In the baseline echocardiography parameters, only LAVi was significantly different between groups (4.10±0.8 vs 3.47±0.6; p=0.024). PWPT with cutoff ≥57.95 (sensitivity 60.3%, specificity 80.9%; AUC=0.701[0.601-0.801]; HR=3.279[1.925-5.585]) and PD ≥38.7 (sensitivity 72.4%, specificity 83%; AUC=0.816[0.735-0.898]; HR=5.202[2.886-9.379]) can be a predictor of AF, while LAVi ≥36.78 (sensitivity 48%, specificity 76%; AUC=0.653; HR=2.335[1.509-4.232]). The Kaplan-Meier curve showed patients with controlled hypertension status at the end of follow-up had a protective effect against the occurrence of AF.

Conclusion: P-wave parameters in the form of PWPT and PD are early electrophysiological parameters that are good and simple to predict the incidence of AF in hypertensive patients. Blood pressure control is crucial in prevention.

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Keywords: P-wave peak time, P-wave dispersion, Hypertension, Atrial fibrillation., echocardiography, electrocardiography

RESEARCH ARTICLES

Profile Of Chronic Limb Threatening Ischemia Patients In Dr. Soetomo General Hospital Surabaya: Retrospective Observational Study

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Background and aims: Chronic limb-threatening ischemia (CLTI) is a spectrum of peripheral artery disease (PAD). The underlying mechanism of PAD is atherosclerotic changes, similar with coronary artery disease (CAD) and stroke. While CAD and stroke is prevalent and widely known as the prime culprit of global mortality cause, little is known about PAD incidence and its clinical characteristics, especially in Indonesia. This study is aimed to investigate the features of CLTI patients in Dr. Soetomo General Hospital Surabaya.

Materials and methods: This study is a retrospective descriptive study. It involved patients who were hospitalized in Dr. Soetomo General Hospital in January – December 2021. Data was obtained from medical records which include age, gender, length of stay, symptoms, ankle-brachial index (ABI), peripheral perfusion and skin color, wound, and risk factors (diabetes mellitus type 2, smoking, hypertension, coronary arterial disease, dyslipidemia, stroke, chronic kidney disease, and COVID-19).

Results: Among 24 patients that we obtained, most prevalent CLTI patients are male (70.8%). The age group suffering most from CLTI is 60 – 69 years (41.7%). We found that our patients possessing risk factors such as diabetes mellitus type 2 (62.5%), smoking (45.8%), hypertension (45.8%), coronary heart disease (33.3%), dyslipidemia (16.7%), stroke (4.2%), chronic kidney disease (4.2%), and COVID-19 (4.2%). Mostly our patients need 3 – 5 days of hospitalization (45.8%). There were patients who present with gangrene (25%), ulcer (16.7%), and no wound at all (58.3%). The ABI of most patients is <0.9 (80%) and the rest is 0.9 – 1.4 (20%). Peripheral perfusion was impaired in several patients; wet-cold (12.5%) and wet-dry (58.3%). The skin color appearance was pale in 50% patients. Mostly affected arterial segment is common femoral artery (50%), followed by superficial femoral artery (21.4%).

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Conclusion: we found that CLTI patients are mostly dominated by male and age group 60 – 69 years. Primary risk factors are diabetes mellitus type 2, smoking, and hypertension. This study provides a reference of CLTI distribution in eastern-region of Indonesia and potentially may lead to further study.

Keywords: Patient profile, Peripheral artery disease, Chronic limb-threatening ischemia.

RESEARCH ARTICLE

Impact Of The COVID-19 Pandemic On Acute Myocardial Infarctions Admissions And Outcomes: Report From Large Tertiary Cardiac Centre In Bangladesh

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Background and aim: There is little South Asian data on the COVID-19 pandemic's impact on acute MI (AMI) admissions and outcomes. We aimed to assess the impact of the pandemic and compare AMI admissions and outcomes over two time periods at a Bangladesh tertiary cardiac centre.

Materials & methods: In this cohort study, we compared AMI admissions and outcomes over two time periods: March-August 2020 vs March-August 2021. Patient demographics, treatment and in-hospital outcomes were statistically analysed and compared by the student's t test and chi-square tests.

Results: A total 380 AMI admissions were included, 82 (21.6%) in 2020 and 298 (78.4%) in 2021. More men presented in both years (69.5% and 83.2% in 2020 and 2021 respectively; p=0.005). No differences in risk factors or AMI type were seen (49.7% vs 52.4% STEMI in 2020 vs 2021). Late STEMI presentation was 30.5% vs 23.2% in 2020 and 2021 respectively (p=0.13). 35.9% were vaccinated against COVID19 in 2021 (p<0.001). More patients developed cardiogenic shock (40.2% vs 23.8% (OR & 95% CI 2.15 (1.29-3.61); p=0.003); heart failure (OR 2.46 (1.40-4.32); p =0.001), cardiac arrest (1OR 2.25 (1.15-4.38); p=0.015) or required ventilation OR 2.43 (1.24-4.78); p=0.008) in 2020, compared to 2021. In-hospital mortality was numerically higher in 2020 (17.1% vs 9.7%; OR 1.91 (0.96-3.81); p=0.063). AMI patients were less likely to undergo coronary angiography (54.9% vs 71.1% for 2020 vs 2021; p=0.005) and PCI (35.4% vs 44%; p=0.001) during index admission in 2020. 45% of STEMI patients were given fibrinolysis, with fewer in 2020 as compared with 2021 (20.9% vs 47.2%).

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Conclusions: Fewer patients presented with AMI in 2020, compared with similar time periodic 2021. AMI patients had improved outcomes in 2021, alongside better guideline directed therapeutic strategies implemented, potentially owing to improved knowledge on managing AMI in the SARS-Cov-2 era, and rapid and improved SARS-Cov-2 testing.

KEYWORD: COVID

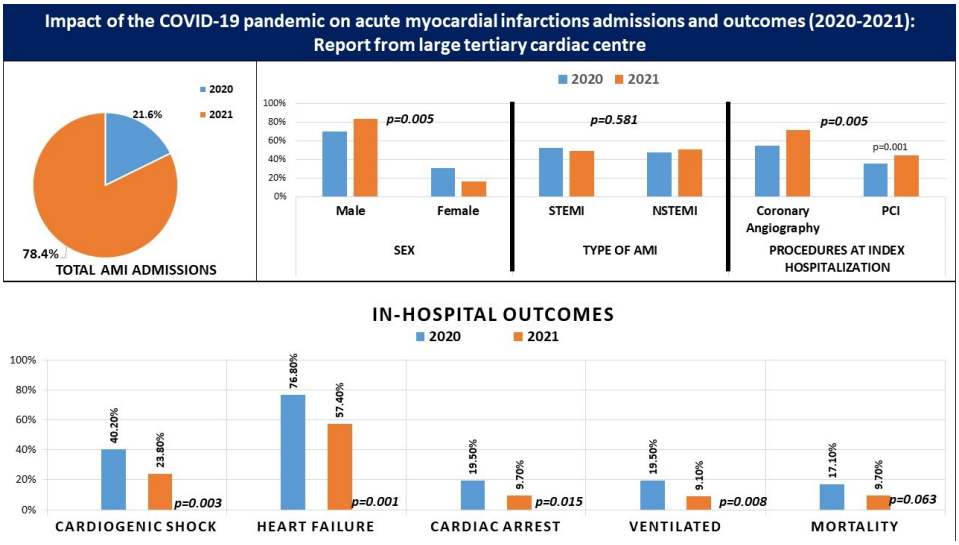

Figure 1. Comparison of the impact of the COVID-19 pandemic on acute myocardial infarctions admissions: Total AMI admissions, demographic variables and outcomes

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RESEARCH ARTICLE

Trends In Cardiovascular Services And Procedure Volumes Across Different Phases Of The COVID-19 Pandemic: An Analysis Of 2019- 2022

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Background and aims: The COVID-19 pandemic's impact on cardiovascular (CV) services globally was variable, with little data on trends from South Asia. We aimed to assess the pandemic's impact at a Bangladesh tertiary cardiac centre in terms CV services delivery and procedure volumes from 2019-2022.

Materials and methods: Data on patient visits, admissions, procedures and catheterization volumes were collected from January 2019 to February 2022. Differences for each month of the preceding year were expressed as a percentage (%Δ). Trends (2019 to 2022) were graphically depicted via line diagrams.

Results: Significant reductions of cardiology services occurred in 2020, especially ER visits (Δ-59.5%; p<0.001). Patient and procedure volumes reached almost pre-pandemic levels by Q1 of 2021. A decline of admissions and procedures was seen in March-April 2021 as compared with 2020, coinciding with the Delta variant. By Q4 of 2021, patient visits, outpatient procedures and catheterization volumes had reached near pre-pandemic levels again. During the Omicron surge (Q1 of 2022), a small decline in outpatient visits (Δ-10.9%) and procedures (Δ-6.83%) was seen. However, in-patient admissions (Δ4.39%) and catheterization procedures (Δ5.7%) showed a rise in February 2022, compared to January, with ER visits showing the steepest rise (Δ 41.9%). Although ER visits remained relatively blunted post-pandemic (2020-2021), this trend was not reflected in outpatient visits/procedures, admissions and catheterization procedures, which all increased to pre-pandemic levels by end 2021.

Conclusion: Two years on from the pandemic, cardiology services and catheterisation laboratory volumes have reached almost pre-pandemic levels in 2022, except for ER visits which remained low, albeit gradually rising. Procedure volumes reduced during the Delta variant, but not during the Omicron surge, a positive indication of the learning and adaptability of healthcare system to surges.

Keywords: Cardiovascular services, COVID-19, catheterization laboratory volumes

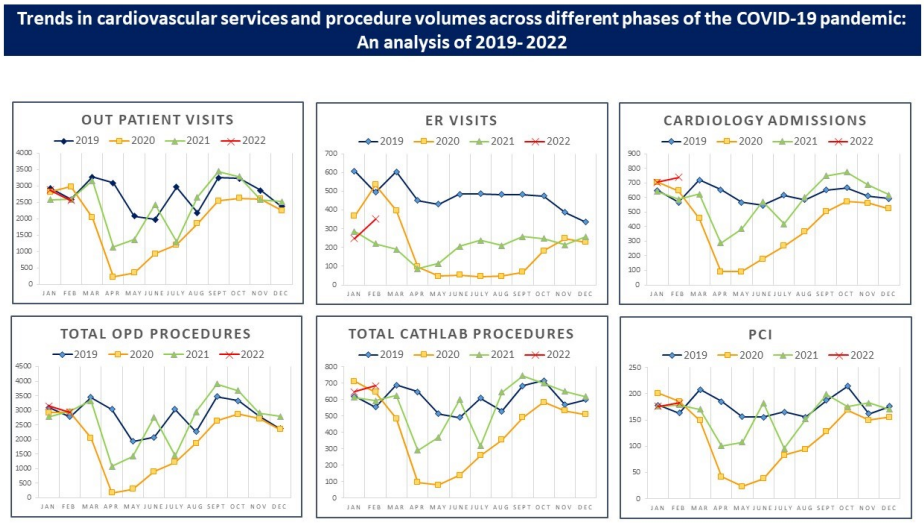

Figure 1. Comparison of the impact of the COVID-19 pandemic on acute myocardial infarctions admissions: Total AMI admissions, demographic variables and outcomes

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RESEARCH ARTICLE

The Clinical Impact of Baseline Echocardiographic Parameters in Heart Failure with Improved Ejection Fraction Versus Non-recovery of Ejection Fraction, Prognosis Value, and its Outcomes

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Background and aims: Ejection fraction is often used as a prognosis and classification of patients with heart failure. This particular population remains at risk of adverse outcomes in the future. This study was to evaluate the outcome of the echocardiographic parameters associated with Heart Failure for heart failure with improved ejection fraction (HFimpEF).

Materials and methods: This single-centre retrospective cohort study uses medical records with a diagnosis of heart failure with reduced ejection fraction (HFrEF) at Sanglah Central General Hospital, 2019-2020. Patients were grouped based on whether there was improvement in ejection fraction based on the Universal Definition and Classification of HFimpEF. The control group that did not meet the criteria was categorized as non-recovered HFrEF. Follow-up for a history of rehospitalization and all cause of death until January 2022. Pearson's chi-square test for categorical variables and t-test or Mann-Whitney's U test for metric variables.

Result: Total of 176 patients with HFrEF were included, 96 patients identified as HFimpEF and most were male at 65.9%. Coronary heart disease was the most common comorbid non-recovered HFrEF significantly (65.0%vs41.7%;p=0.029) than HFimpEF. HFimpEF group showed a significant mean increase in EF (15.04%,p<0.05), significantly lower baseline LAVi (39.08±18.32mLvs49.54±15.96mL;p=0.000), TAPSE was substantially higher (19.2mmvs13.5mm;P=0.000) than other groups. HFimpEF patients, had a mean increase in LVEF of 15.04% (p=0.000) and a mean TAPSE of 16 mm (p=0.000) from the baseline. Multivariate analysis on parameters baseline echocardiography, TAPSE (OR3.409; 95%CI 1.742-6.752; P=0.008), LAVI (OR1.071; 95%CI1.018-1.127; P=0.008) and IVC Diameter (OR3.071; 95%CI 1.487-19366; P=0.02), have a big influence on the occurrence of HFimpEF. During follow-up, 36.6% of the subjects underwent rehospitalization. Mean survival from all-cause death was 9.8 months and 8.5 months in HFimpEF and HFrEF non-recovered, respectively (p=0.003)**.** Baseline IVC diameter, TAPSE was a predictor of improvement ejection fraction (p=0.001) with the AUC was 0.916, 0.828 respectively.

Conclusion: Baseline echocardiographic parameters such as IVC and TAPSE can be predictors of HFimpEF, whereas larger LAVi can be non-recovered HFrEF. HFrEF patients who are already HFimpEF have better survival when compared to non-recovered HFrEF. This early risk stratification is important to improve therapy and monitoring of patients.

Keywords: Echocardiography, Heart Failure, Ejection Fraction, Outcome

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RESEARCH ARTICLE

Hypertensive Response to Exercise and Its Connection with Cardiometabolic and Cardiac Remodelling in the Development of Hypertension and Hospitalization of Major Adverse Cardiac Event Patients

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Background and aims: Hypertensive response to exercise (HRE) is one of a risk for future development of hypertension and reveals high blood pressure (BP) not detected at rest. HRE is associated with functional and structural abnormalities.This study is intended to determine the structural and metabolic factors associated with HRE in non-hypertensive patients and the role of HRE in predicting the development of hypertension and predicting hospitalization due to major adverse cardiac events (MACE).

Materials and methods: This cross-sectional retrospective study using cardiac treadmill stress test (CTST) data at Sanglah General Hospital, Bali, 2016–2020. Subjects were divided into positive HRE and negative HRE. Pearson chi-square test and Mann-Whitney test were used to compare categorical variables and mean echocardiographic parameters based on the presence of HRE. In addition, the development of essential hypertension during follow-up and history of hospitalization after cardiac TST due to MACE until April 2022 based on HRE was evaluated.

Result: We evaluated 202 non-hypertensive patients (47,1% with HRE) who underwent cardiac TST. During follow-up, 19.8% experienced hospitalization, and 26.1% developed hypertension. Obesity (PR 1.727; 95%CI 1.235–2.413), smoking status (PR 1.773; 95%CI 1.170–2.687), T2DM (PR 2.29; 95%CI 1.16–3.37), HbA1C (PR 3.13; 95%CI 2.31-4.22), high LDL level (PR 1.853, 95%CI 1.229-2.794) and history of kidney disease (PR 1.985; 95%CI 1.478–2.665), were significantly associated with positive HRE (all p-value <0.05). Regarding the clinical outcomes, patients with HRE were associated with an increased risk of developing essential hypertension (PR 1.72; 95%CI 1.235–2.413 p=0.05) and hospitalization due to MACE (OR 2.27, 95% CI 1.62–3.16, p=0.0001) during follow up, with a sensitivity of 76.7% and specificity of 93.6%. In addition, subjects with HRE had higher LV mass index (82.34±15.05 vs 70.62±9.76), higher E/E' ratio (16.31±2.95 vs 16.01±13.23), higher LAVI (39.75±15.21 vs 34.27±11.15) with all p-value were <0.05.

Conclusion: Patients with impaired cardiometabolic and cardiac remodeling commonly have HRE that could be detected by cardiac TST examination, which may predict the development of hypertension and major adverse cardiac events in the future. Early treatment in this population is potentially beneficial.

K: Hypertension, Rehospitalization, Exercise, Echocardiography

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RESEARCH ARTICLE

Association of Lipid Lowering Therapy to Reduce New-Onset Atrial Fibrillation and Ischemic Stroke in Hypertensive Patients: A Retrospective Study of Pleiotropic Effects in Statin

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Background and aims: Hypertension the most critical risk factor for stroke and the most common comorbidity in patients with atrial fibrillation (AF). Statin drugs have potent anti-inflammatory and antioxidant effects that have the potential to prevent AF. In addition, patients with ischemic stroke complications due to episodes of AF are usually asymptomatic. Thus, primary prevention of AF in hypertensive patients is essential. This study was to determine the effectiveness and safety of statins in reducing the incidence of new-onset AF and ischemic stroke complications in hypertensive patients.

Material and methods: This was a retrospective cohort study using medical records at Sanglah General Hospital from 2018 to 2020, and 180 subjects were included. Subjects were divided into hypertensive subjects who were treated with a statin and hypertensive subjects who were not given statins. Then we tracked the incidence of new-onset AF. The Pearson chi-square test was used to determine the association of baseline characteristics, comorbidities, and medications, including statin, on the outcome of new-onset AF, ischemic stroke, and side effects of statin. The progression of new-onset AF between groups was also compared with the Kaplan Meier curve.

Results: Our subjects with a statin were 39.4%, and the mean age for all was 51.51±12.31 with 28,3% new-onset AF, 7,2% ischemic stroke, and 2.2% all-cause death. We found that statin administration significantly reduced the incidence of new-onset AF in hypertensive patients (PR 0.174; 95%CI 0.079–0.38; P<0.001) with a longer AF-free period (19.16±2.57vs13.68±0.67 months; 95%CI 5.01-5.84; P=0.014) and ischemic stroke-free period (23.72±0.71vs16.57±1.06 month; 95%CI 5.01-5.84; P=0.003) if given statin, without a significant relationship with the adverse effect of statin. AF was also significantly high in hypertensive subjects with comorbid heart failure (HF); however, the AF-free period remains longer if hypertensive patients with HF are given a statin (19.16±2.57 vs 13.68±0.67 month; 95%CI 5.01-5.84; P=0.014).

Conclusion: Statin administration can be an effective treatment for primary prevention of the incidence of new-onset AF and ischemic stroke in hypertensive patients without significant side effects.

Keywords: Statin, Atrial Fibrillation, Stroke, Outcome

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RESEARCH ARTICLE

Association Between Reversine Dose And Increased Plasticity Of Dedifferentiated Fat (Dfat Cells) Into Cardiac Derived Cells

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Background and Aim: To analyze the association between reversine and increased plasticity of DFAT into cardiac derivative cells.

Materials and Methods: The cultured DFAT cells were divided into four groups based on reversine dose: control (no reversine), 10 nM, 20 nM, and 40 nM reversine. Each group will go through several stages of passage before further differentiation into cardiomyocytes (marked by cTnT expression), VSCMs (marked by alpha-SMA expression), and vascular endothelial cells (marked by alpha-SMA expression) (marked by CD31 expression).

Result: There was significant differences in the expression of cTnT, alpha-SMA, and CD31 ($p = 0.003$, <0.001, and <0.001 respectively) in each group of DFAT cells that received reversine. From post-hoc analysis with Tukey test, it was found that only the 10 nM reversine group produced a significant difference compared to the control group ($p = 0.002$) for cTnT expression and reversine 10 nM and 20 nM group for α-SMA expression and CD31 expression ($p=0.028$ and <0.001 respectively).

Conclusion
This study proves that there is a relationship between reversine and increased plasticity of DFAT cells into cardiac derived cells in the form of cardiomyocytes (cTnT), VSMCs (alpha-SMA), and vascular endothelial cells (CD31).

Keywords: DFAT, reversine, cardiomyocyte, VSMCs, vascular endothelial cells.

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RESEARCH ARTICLE

Transforming Growth Factor-Beta Correlates with Left Ventricular Ejection Fraction in Patients Following ST-Segment Elevation Myocardial Infarction

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Backgrounds and Aims: ST-segment elevation myocardial infarction (STEMI), a life-threatening severe type of coronary heart disease, greatly affects global morbidity and mortality. STEMI is an emergency requiring timely reperfusion to improve quality of life. STEMI-induced myocardial injury can lead to left ventricular remodeling, which in turn leads to changes in left ventricular function, structure, and ultimately signals a poor prognosis and low quality of life. Cytokine transforming growth factor beta (TGF-β) has been described to influence these remodeling processes, such as promoting myocardial fibrosis, cardiomyocyte apoptosis or cardiac hypertrophy. In addition, upregulation of TGF-β after myocardial infarction has been described by several studies and a significant association was found between decreased ejection fraction in patient and increased TGF-β levels after acute myocardial infarction event. This study aims to determine the relationship between TGF-β and LVEF in STEMI patients.

Materials and methods: This study is a cross-sectional study that investigated a total of 20 STEMI patients. TGF-β was measured at emergency unit admission and LVEF was assessed within 6 months post Primary PCI. Quantitative data were presented as mean ± standard deviation (SD) or median (min-max) or number (%) and qualitative data were presented as frequencies. Bivariate analysis was performed to determine correlation between TGF-β and LVEF using Spearman's Correlation test.

Results: Analysis showed this study population had mean age 57.90 ± 8.91 years, was dominated by male (90%) and about 80% had smoking as a cardiovascular risk factor. All of our subjects received medication based on current STEMI guideline. Our study showed a moderate negative correlation between serum level of TGF-β with LVEF (p-value 0.013, correlation coefficient -0.543).

Conclusions: Our analysis suggests that there is a negative correlation between admission circulating TGF-β level with LVEF in STEMI patients.

Keywords: Left Ventricular Ejection Fraction, ST-Segment Elevation Myocardial Infarction, Transforming Growth Factor-Beta

Table 2 Spearman's Correlation between TGF-Beta and LVEF

Correlations

			TGF-Beta	LVEF
Spearman's rho	TGF-Beta	Correlation Coefficient	1.000	-.543*
		Sig. (2-tailed)	.	.013
		N	20	20
	LVEF	Correlation Coefficient	-.543*	1.000
		Sig. (2-tailed)	.013	.
		N	20	20

*. Correlation is significant at the 0.05 level (2-tailed).
TGF-Beta Transforming Growth Factor-Beta, *LVEF* Left Ventricular Ejection Fraction

Figure 1. Spearman's Correlation between TGF-Beta dan LVEF

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RESEARCH ARTICLE

A Novel Peptide Elabela Levels Is Lower In Higher Stage Of Hypertension And Is Associated With Subclinical Atherosclerosis In Hypertensive Patients

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Background and aims: Elabela is a newly discovered peptide which, alongside apelin, acts as an endogenous ligand that activates the angiotensin receptor-like 1 receptor. The impact of elabela on the cardiovascular system has received substantial attention in recent years, but information about the role of elabela in hypertension and hypertension-related atherosclerosis is scarce. We aim to determine the elabela levels in hypertensive patients and reveal its association with subclinical atherosclerosis.

Materials and methods: A total of 104 subjects with hypertension were included in a cross-sectional study. Elabela levels were measured using enzyme-linked immunosorbent assay, by extracting the peptide following the manufacturer's instructions. The subclinical atherosclerosis was assessed by measuring the carotid intima-media thickness (IMT) using ultrasound.

Results: Compared to Stage 1, elabela levels decreased in Stage 2 hypertension (0.23 [0.13, 0.45] ng/ml *vs.* 0.14 [0.09, 0.23] ng/ml; $P = 0.000$), and in the group with increased carotid IMT compared to normal IMT (0.24 [0.13, 0.38] ng/ml *vs.* 0.15 [0.10, 0.23] ng/ml; $P = 0.005$). Additionally, a linear correlation analysis showed that elabela had a significant negative correlation with systolic blood pressure ($r = -0.340$, $P = 0.000$) and carotid IMT ($r = -0.213$; $P = 0.030$). In multivariate analysis, lower elabela levels (cut-off 0.155 ng/ml) were associated with higher cardiovascular risk group in this study (OR 5.0, 95% CI 1.8-13.5, $P < 0.001$).

Conclusion: This study demonstrated for the first time that circulating elabela were declined in higher stage of hypertension and in hypertensive patients with increased carotid IMT, implicating that elabela might be involved in the pathogenesis of hypertension-associated subclinical atherosclerosis.

Keywords: Elabela, hypertension, subclinical atherosclerosis, carotid intima-media thickness

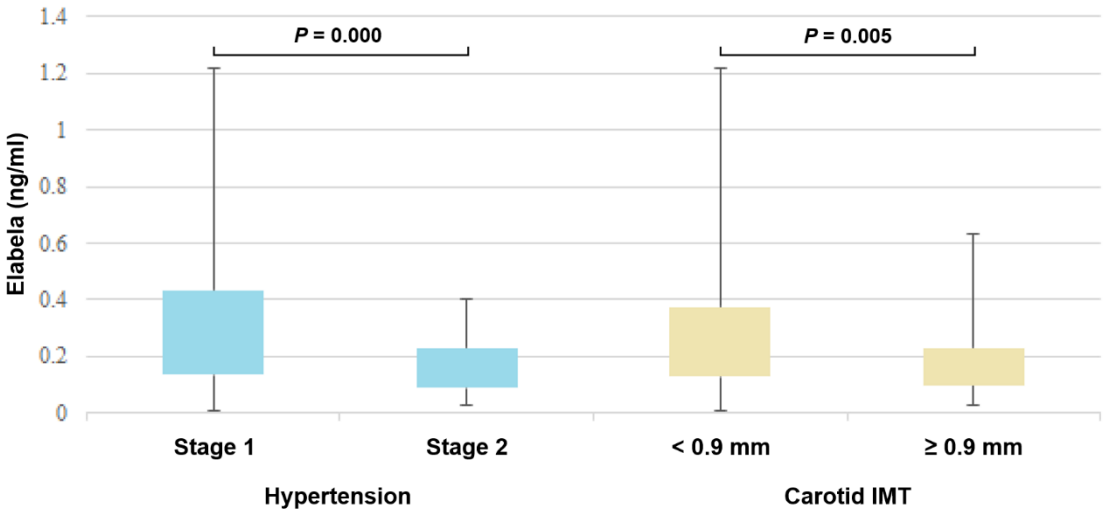

Figure 1. Comparison of elabela concentrations with hypertension and carotid IMT groups. IMT, intima-media thickness.

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RESEARCH ARTICLES

Predictors of Acute Heart Failure in COVID - 19 Patients

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Background and Aim: COVID-19 infection is a disease with multi-organ complications, including cardiovascular organ. As heart failure is one of COVID – 19 complications that has high morbidity and mortality, we need to identify factors that can predict acute heart failure in COVID – 19, especially in moderate to severe patients. This study aimed to determine predictors of acute heart failure in hospitalized COVID -19 patients.

Materials and Methods: This was a retrospective cohort study. The primary outcome was acute heart failure that happened during hospitalization. There were total of 16 clinical (age, sex, body mass index, hypertension, diabetes, smoking history, coronary artery disease, chronic kidney disease, chronic heart failure, chronic obstructive pulmonary disease, PaO2/FiO2 ratio, non-cardiogenic shock at admission, use of ACE-inhibitors/ARBs during hospitalization, ejection fraction, TAPSE) as well as 6 laboratory parameters (neutrophil - lymphocyte ratio, platelet - lymphocyte ratio, eGFR, D-Dimer, procalcitonin, CRP) that were used in statistical analysis.

Results: From total of 208 subjects with moderate – severe COVID-19, 73 (35%) had acute heart failure. The median time of developing heart failure is 4 (1 - 27) days. On multivariate analysis, patients with history of chronic heart failure exhibited a 5.39-fold higher risk of acute heart failure compared with no history of chronic heart failure (95% CI: 1.76 – 16.51; p = 0.003). The risk of acute heart failure was multiplied by 4.25 in patients that was presented with TAPSE <17 mm (95% CI: 1.13 – 16.07; p= 0.033). In contrast, use/continuation of ACE-inhibitors/angiotensin receptor blockers during hospitalization showed reduced risk of acute heart failure (16% of the risk developing acute heart failure compared with patients with no use of ACE-inhibitors/angiotensin receptor blockers). In subjects developing acute heart failure, the mortality rate was 67%, compared with 57% in subjects without acute heart failure (p = 0,028).

Conclusion
History of chronic heart failure, TAPSE <17 mm, and the use of ACE-inhibitors/angiotensin receptor blockers were identified as predictors of acute heart failure in hospitalized COVID-19 patients.

Keywords: heart failure, COVID

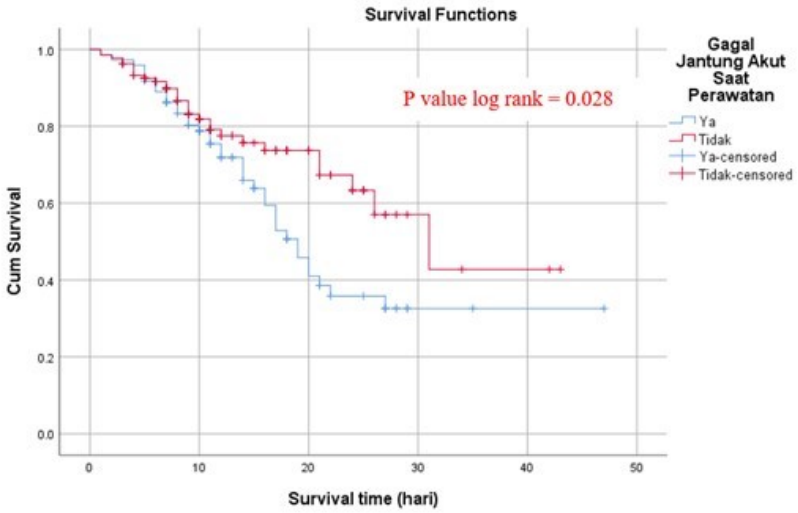

Figure 1. Log - rank test of survival between acute heart failure subjects vs. non - acute heart failure subjects.

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RESEARCH ARTICLES

Progression of Tricuspid Regurgitation After Mitral Valve Surgery

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Background and aims: Tricuspid valve (TV) is an inseparable part of mitral valve (MV) both functionally and hemodynamically. In the past, tricuspid regurgitation (TR) progression would revert over time after surgical MV replacement (MVR). Current guidelines recommend routine tricuspid repair in patients with severe TR with annular enlargement but not for mild or moderate TR. Several recent reports have reported that TR can occurred and evolve postoperatively over time and lead to worsening of the outcome. The purpose of this study was to assess the progression of TR after MVR surgery.

Materials and methods: This prospective cohort study data was collected from our Registry from 2019-2022. Patients who did not undergo tricuspid repair during MVR then followed for 12 months to saw the incidence and progression of TR. Diagnostic criteria and grading of TR was based on 2017 American Society of Echocardiography criteria. Primary end points of this study was incidence and progressivity of TR. Wilcoxon and Friedman test were used respectively with p-value <0.05 was considered significant.

Results: A total 53 patients are enrolled in this study. From preoperative echocardiography are categorized into, mild TR 57%, moderate TR 32%, severe TR 11%. In 6 months follow up of 30% are considered as normal TV, mild TR 58%, moderate TR 6%, severe TR 6% with 56% show improvement of TR, 41% not changed and 2% show worsening of TR (p-value = 0.000). A total 17 patients were followed in 12 months are categorized ad normal 5 %, mild TR 63%, moderate TR 21%, severe TR 11% with 63% show improvement, 31% not changed, 5% show worsening of TR (p-value = 0.001).

Conclusions: Based on follow up for 12 months showed improvement in TR progression in patients undergoing MVR. However, the number of worsening TR following MVR should be considered for concomitant TV repair due to the risk of right heart failure.

Keywords: Tricuspid Regurgitation, Mitral Valve Replacement

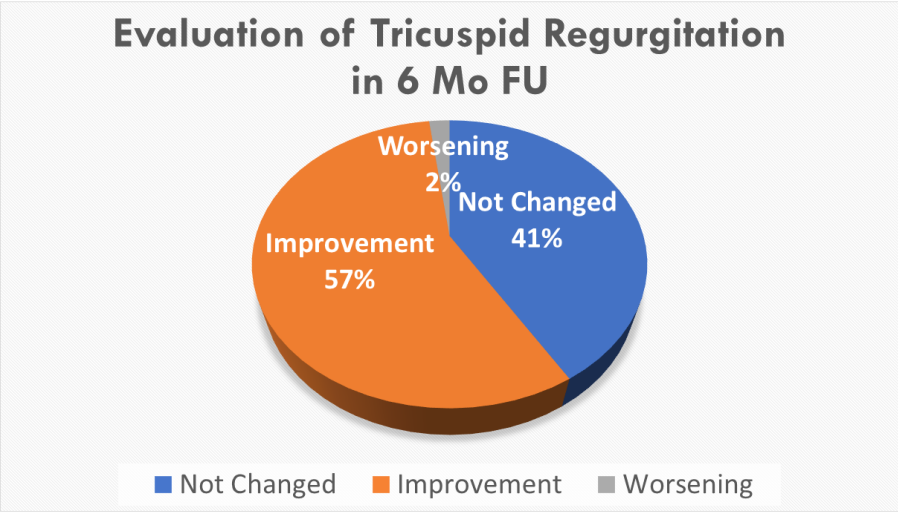

Figure 1. Evaluation TR in 6 Months.

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RESEARCH ARTICLE

Factors Associated With In-Hospital Mortality In Acute Coronary Syndrome Patients In dr. Iskak General Hospital Tulungagung

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Background and Aims: Mortality due to Acute Coronary Syndrome (ACS), in particular, ST Elevation Myocardial Infarction (STEMI) in dr. Iskak General Hospital Tulungagung remains high despite the utilisation of current coronary revascularisation strategies. This study aims to elaborate on the clinical characteristic of in-hospital mortality cases of ACS patients registered in ISTEMI Registry of dr. Iskak General Hospital, Tulungagung, East Java, Indonesia in 2019.

Materials and Methods: This is a single-center, registry-based study. This study included ACS cases recorded in dr. Iskak General Hospital ISTEMI registry during the period of January to December 2019. Patients were further grouped into survivor and non-survivor groups for analysis.

Results: A total of 729 patients (including 502 STEMI patients and 227 NSTEMI patients) were enrolled in this study. Patients were divided into 607 in the survivor and 122 in the non-survivor group. The factors associated with higher mortality were older age (60.6 ± 11.2 vs 65.1 ± 11.6, p <0.001), female sex (20.8% vs 35.6%, p = 0.007), higher CKMB on admission (82.3 ± 101.8 vs 124.7 ± 167.2, p = 0.018), higher hs-Trop-T on admission (6555 ± 12699 vs 16243 ± 16767, p<0.001), and Killip class IV (12.5% vs 53.0%, p < 0.001), in survivor and non-survivor group, respectively. The presence of complications on admission was also associated with higher in-hospital mortality, including heart failure (16.8% vs 29.5%), renal failure (1.3% vs 11.4%), and shock condition (9.4% vs 64.4%) with p<0.001 in survivor and non-survivor group, respectively.

Conclusion: This study suggested that older age, female gender, Killip class IV, higher level of the cardiac enzyme, and presence of complications on admission were associated with increased in-hospital mortality of ACS patients in dr. Iskak General Hospital, Tulungagung. Further study is needed to elaborate on the prediction value of these factors. However, these findings would provide valuable information to guide cardiologist decisions on ACS management, especially in Tulungagung.

Keywords: Acute Coronary Syndrome, Registry, Risk Factors

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RESEARCH ARTICLE

Correlation Between Neutrophil-to-Lymphocyte Ratio and Thrombolysis In Myocardial Infarction Risk Score in ST Elevation Acute Myocardial Infarction Non Revascularization in Bangka Tengah Hospital

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Background and Aims : Coronary atherosclerosis is the main cause of ST elevation acute myocardial infarction (STEMI) and it is the most life threatening condition of acute coronary syndrome. Multiple scoring systems have been developed to predict in-hospital mortality. Both Neutrophil- to-lymphocyte ratio (NLR) and The thrombolysis in myocardial infarction (TIMI) risk score for STEMI can be used as a predictive value in predicting of Major Adverse Cardiac Events. This study aims to investigate the association between NLR and TIMI-STEMI risk score in STEMI who undergo non revascularization.

Materials and Methods: This is an observational analytic study with cross sectional study design using data from medical records contains of STEMI patients from Bangka Tengah Hospital, Bangka Belitung, Indonesia. We evaluated 30 patients between January 2022- March 2022 who presented with STEMI within 12 hour of symptom onset. Patients with severe liver disease, autoimmune diseases, cancer, hematological disorders, severe valvular disease, inflammatory, and infectious diseases were excluded from the study. Data analysis was performed using SPSS 22.

Results : We enrolled 30 patients mean age 58.23 ± 8.7 Years and 53.3 % were man and 46.7% were woman. Spearman's correlation test revealed a significant positive correlation between NLR and TIMI-STEMI risk scores (r= 0.952; p <0.001 respectively). We found that NLR very strong associated with TIMI-STEMI risk score. These positive correlations mean that higher NLR will be followed by higher TIMI STEMI risk score.

Conclusions: NLR are simple and cost-effective inflammatory markers as an additional prognostic tool in myocardial infarct and we found correlations between NLR and TIMI STEMI risk score. We believe that these significant findings can guide further clinical practice.

Keywords: STEMI, Neutrophil to lymphocyte ratio, TIMI risk Score

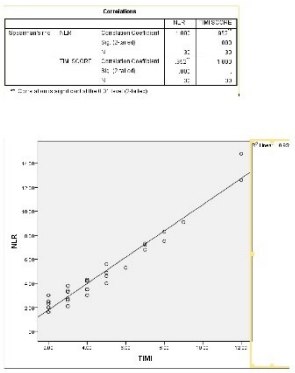

Figure 1. Table and Scatter Plot about Correlation Between NLR and TIMI Risk Score in STEMI Patients

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RESEARCH ARTICLE

Performance of SARDJITO Risk Score in Predicting Mortality in Intensive Care Unit: an External Validation Study

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Background and aims: SARDJITO score provides an estimation of the probability of in-hospital death among patients in Intensive Cardiovascular Care Unit (ICVCU). Although this scoring system has been used in cardiac center ICVCU, it has not been applied in general ICU in regional hospitals with varying levels of resources. We aim to externally validate promising previously published risk scores that predict in-hospital death among ICU patients with cardiovascular disease.

Materials and methods: From November 2020 to November 2021, 426 ICU patients with cardiovascular disease enrolled in this trial. Retrospectively, secondary data were collected, analyzed, and matched with SARDJITO Score variables. Multivariate analysis with logistic regression was conducted to evaluate the significance of the parameters in predicting mortality. Discrimination was assessed by area under the receiver operator characteristic curve (AUC-ROC). By using the Hosmer-Lemeshow goodness-of-fit test, the calibration was evaluated.

Results: A total of 232 patients were eligible with inclusion criteria and divided into a survivor and non-survivor group. The observed in-hospital death was 16,8% (39/232). Bivariate analysis revealed age> 60 y.o, Arrhythmia, Pneumonia, Ventilator utilization, Haemoglobin <10 g/dL, Creatinin >1,5 mg/dL, SGPT> 50 U/L, LVEF <40%, TAPSE <17 mm, were significantly different between each group (P<0,05). The multivariate logistic regression was conducted on variables that were significantly different for each group in bivariate analysis. We discovered that the use of a ventilator (OR 0,001, p= 0,001 (CI 95%: 49,46-2509,4)) was a protective factor against in-hospital death whereas the LVEF<40% was an independent risk factor (OR 21,4, p= 0,011 (95% CI: 1,99-29,79)). In comparison to the survivor group (1±1), the SARDJITO Score was considerably higher in the non-survivor group (6±2) (p< 0,001). The AUC-ROC for SARDJITO Score was 0,950 (95% CI: 0,913-0,987). The Hosmer-Lemeshow goodness-of-fit test for SARDJITO Score demonstrated a Chi-square test score of 0,626, p=0,960.

Conclusions: SARDJITO Score showed satisfactory performance for predicting in-hospital death in patients with cardiovascular disease treated in general ICU. It also demonstrated effectiveness for forecasting in-hospital death in terms of calibration and discrimination.

Keywords: Hospital mortality, Intensive care, Scoring, Prognosis, Hosmer-Lemeshow, AUC-ROC

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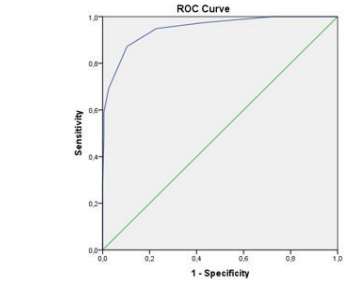

Area Under the Curve

Test Result Variable(s): SCIENCEScore

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
,950	,019	,000	,913	,987

The test result variable(s): SCIENCEScore has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.
a. Under the nonparametric assumption
b. Null hypothesis: true area = 0.5

Figure 1. The discriminative power, assessed using the AUC-ROC, demonstrated excelent discrimination (AUC> 0.8)

RESEARCH ARTICLE

Correlation P Wave Peak Time with Left Atrial Volume Index in Heart Failure Patients

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[1]M. Djamil General Hospital

Background and aims: Left ventricular myocardial ischemia or infarction would rise left ventricular filling pressure including LVEDP. That mechanism rose left atrial pressure then stretch the left atrium myocard. These stretch inactivated sodium channels thereby reducing upstroke and slowing conduction in left atrium. Reduced velocity of conduction would cause prolongation P wave peak time (PWPT) on the electrocardiogram.

Material and methods: This study was a cross-sectional prospective study in heart failure with coronary heart disease patients at dr. M. Djamil General Hospital from May – September 2021. The patients underwent an echocardiography examination then followed by electrocardiography to assess left atrial pressure and measure PWPT, respectively.

Result: Among 32 patients, the majority were male (78.1%) and age of 58±11 years. The main risk factors for CHD were hypertension (62.5%) and smoking (50%). Mean PWPT and LAVi values were 63±6,6 msec and 49±9,8 mL/m^2, respectively. Using the Pearson correlation test, a moderate positive correlation was found between the duration of PWPT and LAVi (r = 0.389; p = 0.02).

Conclusion: There was a moderate positive and significant correlation between PWPT duration and LAVi in heart failure with coronary heart disease patients with elevated left atrial pressure.

Keywords: P Wave Peak Time, Left Atrial Volume Index, heart failure

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RESEARCH ARTICLE

Losartan Has Similar Effect to Human Recombinant ACE2 in Attenuating SARS-CoV-2 Infection in Human Adipocytes

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Backgrounds and aims: Obesity is an independent risk factor for developing severe symptoms of COVID-19. This is caused by a high expression of ACE2 in adipocytes that facilitate SARS-CoV-2 infection, causing cytokine storm. Since the discovery of ACE2 as a SARS-CoV-2 receptor, there has been controversy whether the use of cardiovascular drugs, such as Angiotensin II Receptor Blockers (ARBs), is beneficial or harmful in the setting of COVID-19. Not all types of ARBs have a consistent effect on the expression of ACE2 and inflammatory cytokines production in cells, particularly in adipocytes. Determine and compare the effect of losartan and human recombinant ACE2 on the expression of ACE2 and pro-inflammatory cytokines (IL-6, IL-1β, and TNF-α) in human adipocytes exposed to S1 spike protein of SARS-CoV-2.

Material and Methods: Losartan and human recombinant ACE2 were tested on human adipocytes extracted from subcutaneous fat tissue, 24 hours after exposure of SARS-CoV-2 S1 spike protein. 2 hours after treatment, ACE2, IL-6, IL-1β, and TNF-α levels were measured using ELISA.

Results: SARS-CoV-2 S1 spike protein exposure significantly increase ACE2, IL-6, and TNF-α levels, but not IL-1β, in human adipocytes. Addition of losartan and human recombinant ACE2 are both lower ACE2 levels and its binding to S1 spike protein of SARS-CoV-2 as well as IL-6 levels. Losartan and human recombinant ACE2 had no measurable impact on IL-1β and TNF-α levels.

Conclusion: This study highlights the putative important role of adipocytes in SARS-CoV-2 infection. Losartan and human recombinant ACE2 have a similar protective effect of preventing cytokine storms, mainly due to IL-6.

Keywords: SARS-CoV-2, obesity, ARB, ACE2, IL-6

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RESEARCH ARTICLE

Factors Affecting Left Ventricular Thrombus Formation in Anterior Myocardial Infraction Patients After Primary Percutaneus Coronary Intervention at M Djamil General Hospital

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Background and aims: Left Ventricular Thrombus (LVT) is a complication of myocardial infarction, causing systemic embolism and increasing morbidity and mortality. LVT formation after Anterior STEMI patient treated with PCI has not been well characterized. This study was conducted to assess the characteristics and determinants formation of LV thrombus in anterior STEMI patients.

Materials and methods: This study included patients of Anterior STEMI admitted to the M Djamil Hospital between 2019 to 2022. Patients were divided into two groups defined by the presence or absence of LV thrombus. LV thrombus was diagnosed by transthoracal echocardiography. Clinical characteristics and factors associated with LV thrombus were analyzed statistically.

Results: There were 34 patients included in this study with 17 patients with LV thrombus. Mean age for patients with LVT was 54.94 years old and without LVT was 56,47 years old. There was no significant difference in baseline characteristics and procedure data between two groups. The ejection fraction was found as the only significant factor affecting LV thrombus formation between LVT and non LVT group (33.41 % vs 42.29 %, p = 0.044).

Conclusion: This study showed ejection fraction was significant risk factor of LVT in post anterior MI patient who already underwent primary PCI. Future studies with more subjects are needed to evaluate independent predictors and further management.

Keywords: ST-Elevation Myocardial Infarction, Left Ventricle Thrombus, Percutaneous Coronary Intervention

Table 1. Variables Prediciting LV Thrombus

Variables	With LV Thrombus	Without LV Thrombus	P value
Age years (Mean)	54.94	56.47	0.675
Gender Male	15	17	0.485
Gender Female	2	0	
Comorbidities			
DM II	2	4	0.398
Smoking	12	15	0.398
Hypertension	3	6	0.438
Family History	1	0	1.000
Procedural Data			
1 Stent	16	16	0.368
2 Stent	0	1	
3 Stent	1	0	
CAD VD			
1 VD	10	13	0.432
2 VD	5	2	
3 VD	2	2	
Onset			
Mean onset (hours)	6.21	8.71	0.338
> 12 hours	4	3	1.000
< 12 hours	13	14	
Therapy			
Aspilet + Ticagrelor	11	14	0.438
Aspilet + Clopidrogel	6	3	
Previous Anticoagulant	3	2	1.000
Echocardiography			
Ejection Fraction (mean)	36.41	42.29	0.044

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Table 1. Factors Affecting Left Ventricular Thrombus

RESEARCH ARTICLE

THE RELATIONSHIP BETWEEN THE DEGREE OF DIASTOLIC DYSFUNCTION AND THE OUTCOME OF HEART FAILURE PATIENTS PRESERVED EJECTION FRACTION WITH SEVERE COVID-19 INFECTION

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[1]Airlangga University

Background and Aim: The pandemic caused by COVID-19 infection is still showing an increasing number of infections and mortality rates. Cardiovascular comorbidities are often associated with a higher incidence of HFpEF and worse outcome of COVID-19 infection. The degree of diastolic dysfunction assessed with echocardiography was associated with higher mortality of HFpEF. This study aims to analyze the association between the degree of diastolic dysfunction with outcomes in HFpEF accompanied with severe COVID-19 infection.

Material and method: An observational, single-center prospective cohort study design. The study was performed during the period February 1st – July 31st,2021 in the ICU (Isolation) RSUD Dr. Soetomo. A total of 81 HFpEF subjects were included according to WHO criteria for severe COVID-19 infection. The HFpEF was defined as subjects with signs and symptoms for HF with LVEF≥50% and objective evidence of cardiac structural and/or function abnormalities. Basic data collected from medical record and anamnesis consisted of age, BMI, and cardiac risk factor. The blood sample was carried out for examining the presence of cardiac injury by evaluating the increase of NT-proBNP and hs-Troponin. Echocardiography examination was carried out by evaluating diastolic function (E/A ratio, E/E' average, LAVI, LVdMI, and RWT) and categorizing based on its severity according to the recommendations of American Society of Echocardiography. Patients were then followed to assess their mortality and length of stay.

Result: A higher degree of diastolic dysfunction was associated with a higher mortality rate (p-value 0.006) and a lower length of stay (p-value 0.034). There was a higher mortality rate among patients with increasing creatinine serum (p-value 0.008) in HFpEF subjects with severe COVID-19. A lower length of stay (p-value 0.022) was also associated with higher mortality rate.

Conclusion: Patients with HFpEF who are older, having comorbidities, and having elevated cardiac markers associated with higher mortality rate. There is an association between increased creatinine serum and length of stay with increased mortality. There is also a relationship between a higher degree of diastolic dysfunction with lower length of stay and increased mortality of HFpEF subjects suffering from severe COVID-19 infection.

Keywords: COVID-19, SARS-CoV-2, Heart Failure preserved Ejection Fraction, HFpEF, Echocardiography, Diastolic Dysfunction, Outcomes

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RESEARCH ARTICLE

The Association Between The Degree Of Diastolic Dysfunction And The Outcome Of Heart Failure Patients Preserved Ejection Fraction With Severe Covid-19 Infection

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Background and Aim The pandemic caused by COVID-19 infection is still showing an increasing number of infections and mortality rates. Cardiovascular comorbidities are often associated with a higher incidence of HFpEF and worse outcome of COVID-19 infection. The degree of diastolic dysfunction assessed with echocardiography was associated with higher mortality of HFpEF. This study aims to analyze the association between the degree of diastolic dysfunction with outcomes in HFpEF accompanied with severe COVID-19 infection.

Materials and Methods An observational, single-center prospective cohort study design. The study was performed during the period February 1st – July 31st,2021 in the ICU (Isolation) RSUD Dr. Soetomo. A total of 81 HFpEF subjects were included according to WHO criteria for severe COVID-19 infection. The HFpEF was defined as subjects with signs and symptoms for HF with LVEF≥50% and objective evidence of cardiac structural and/or function abnormalities. Basic data collected from medical record and anamnesis consisted of age, BMI, and cardiac risk factor. The blood sample was carried out for examining the presence of cardiac injury by evaluating the increase of NT-proBNP and hs-Troponin. Echocardiography examination was carried out by evaluating diastolic function (E/A ratio, E/E' average, LAVI, LVdMI, and RWT) and categorizing based on its severity according to the recommendations of the American Society of Echocardiography. Patients were then followed to assess their mortality and length of stay.

Result A higher degree of diastolic dysfunction was associated with a higher mortality rate (p-value 0.006) and a lower length of stay (p-value 0.034). There was a higher mortality rate among patients with increasing creatinine serum (p-value 0.008) in HFpEF subjects with severe COVID-19. A lower length of stay (p-value 0.022) was also associated with higher mortality rate.

Conclusion Patients with HFpEF who are older, having comorbidities, and having elevated cardiac markers associated with higher mortality rate. There is an association between increased creatinine serum and length of stay with increased mortality. There is also a relationship between a higher degree of diastolic dysfunction with lower length of stay and increased mortality of HFpEF subjects suffering from severe COVID-19 infection.

Keywords: COVID-19, SARS-CoV-2, Heart Failure preserved Ejection Fraction, HFpEF, Echocardiography, Diastolic Dysfunction, Outcomes

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RESEARCH ARTICLES

Relationship Of Red Blood Cell Distribution Width Value With Coronary Microvascular Flow in ST Segment Elevation Acute Myocardial Infarction Patients Who Went Primary Percutaneous Coronary Intervention

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Background and aims: The success of Primary Percutaneous Coronary Intervention (PPCI) in the treatment of STEMI depends on the functional and structural integrity of the coronary microcirculation. Coronary Microvascular Obstruction (MVO) can occur in 50% of cases of STEMI performed PPCI. Quantitative Myocardial Blush Score (QuBE) examination performed immediately after coronary angiography can predict the incidence of MVO. A high coronary thrombus burden in STEMI patients is associated with impaired post-procedural epicardial and myocardial perfusion, higher incidence of no reflow and distal embolization. Red Blood Cell Distribution Width (RDW) is a parameter that is routinely measured in modern hematology. Higher RDW values reflect greater variation in red blood cell volume. An increase in the RDW value was associated with poorer reperfusion in acute coronary syndromes treated with PPCI. RDW can be used as a prognostic marker in patients with myocardial infarction, patients undergoing PPCI, patients with stable coronary artery disease, heart failure patients, peripheral arterial disease patients, renal failure patients and COPD patients.

Materials and Methods: This study was a cross-sectional study on STEMI patients who was performed PPCI at the Cardiac Center Installation at M. Djamil Hospital, Padang from August to October 2021. To determine the relationship between RDW and microvascular obstruction, an analysis was carried out using the Pearson correlation test.

Results: The research subjects were 44 STEMI patients with a mean age of 56.3 ± 9 years. The mean value of RDW was 14.4 ± 0.9%, while the mean value of QuBe was 11.9 ± 2. Based on the Pearson correlation test, there was a moderate and statistically significant negative correlation between the RDW value and the QuBe value ($r = -0.588$; $p < 0.001$).

Conclusions: There was a moderate and statistically significant negative correlation between the RDW and QuBE values in STEMI patients undergoing PPCI.

Keywords: Red blood Cell Distribution Width (RDW), Microvascular Obstruction (MVO), Quantitative Myocardial Blush Score (QuBE), Primary Percutaneous Coronary Intervention (PPCI).

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