

Dysrhythmias in Congestive Heart Failure

Ledi Iksarina¹ and Halimuiddin²

¹Nursing Science Program, Faculty of Nursing, Universitas Syiah Kuala Banda Aceh, Indonesia

²Department of Emergency and Critical Care Nursing, Faculty of Nursing, Universitas Syiah Kuala Banda Aceh, Indonesia

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Abstract: Dysrhythmias is a clinical critical event which aggravate congestive heart failure. Dysrhythmia might be caused the main heart failure nursing diagnose, decreased of cardiac output occurred, then early dysrhythmia identification will help nurse to determine etiology and planning that will be given. Rhythm identification can be done by electro-cardiogram (ECG). The study was to aim an illustration on congestive heart failure dysrhythmia. This descriptive qualitative study was designed with secondary data retrospective study (medical record) on 282 congestive heart failure patients who were hospitalized in dr. Zainoel Abidin Hospital Banda Aceh. Data collection used ECG strip in first 24 hours and the result were written in the research sheet. After whole data collected, it was found that Sinus Dysrhythmia was in 68 respondents (24,10%), Supraventricular dysrhythmias in 51 respondents (18,10%), Ventricular Dysrhythmias in 10 respondents (3,60%), Atrioventricular Block Conduction in 14 respondents (5,00%), Interventricular Block Conduction in 18 respondents (6,40%), whereas 121 respondents (42,90%) had Normal Sinus Rhythm. Dysrhythmia finding should not be the main indicator on detect problem that caused decrease of cardiac output, so nurse is recommended to identify another condition that underlying the nursing diagnose has been labeled. Cardiovascular nurse is suggested not to ignore normal rhythm in heart failure, meanwhile the nurse have to identify another dysfunction underlying decreased of cardiac output.

1 INTRODUCTION

Cardiovascular diseases are the top cause of death in the world. Based on data from WHO 2015 which report in Top Ten Causes of Death 2017, heart disease is in the top position with 54% of all causes mortality in the world. Congestive heart failure is a condition which increase high mortality rate caused by cardiovascular. The clinical event that worsening congestive heart failure is dysrhythmia. According to the study conducted in Prof. Dr. R. Kandou Hospital, Manado showed that 119 from 376 coronary artery disease cases are belonging dysrhythmia, and 6 are congestive heart failure with dysrhythmia. Mortality rate caused by dysrhythmia also high, 35% dysrhythmia was among 51-60 years old, 29% in 61-70 years old, and 1% in 71-80 year old. It shows that only 1% patient with dysrhythmia can survive up to 80 years old. (Kalangi, Jim and Joseph, 2016, p. 2).

Dysrhythmia is an emergency case as it conduction disorder can influence cardiac output which can change every second, then leading on

nutrient and oxygen circulation until critical condition. An examination that can be done by nurse to detect dysrhythmia is Electrocardiogram (ECG) tapping.

Dysrhythmia which influences cardiac output findings can direct the nurse to establish etiology of nursing diagnose which has labeled, where the exchange of heart beat and rhythm is one of criteria in nursing diagnose, decreasing of cardiac output. Accuracy in rhythm interpretation is very determined patient's live related intervention that will be given. The dysrhythmia treatment purpose is to return the rhythm and heart contraction effectivity, decrease of anxiety, and also reduce high mortality rate caused by cardiovascular (Smeltzer and Bare, 2003, p. 698; Solikhah, 2015, p. 36).

The study aimed to identify rhythm illustration that can occur in congestive heart failure, so the result can give basic data regarding the possible dysrhythmia in heart failure, facilitate nurse to recognize the problem which makes hemodynamics worse and determine the best treatment. Therefore,

the author is interested in discussing the possible rhythm in congestive heart failure.

2 METHODS

The study was a descriptive quantitative study with retrospective design, which total sampling on 282 congestive heart failure patients aged between 57 to 60 years who were hospitalized around July and December 2017 in the Intensive Cardiovascular Care Unit and Integrated Cardiac Treatment Ward of dr. Zainoel Abidin General Hospital, Banda Aceh. Ethical approval was accepted from the Research Ethic Committee of Nursing Faculty, Syiah Kuala University.

3 RESULTS

3.1 Sample Characteristics

Sample characteristics are described in Table 1. The table shows that male has higher risk of congestive heart failure (63,80%) than female (36,2%), heart rate mostly in normal range (66,90%). The sample of this study are mostly congestive heart failure caused by hypertension heart disease (32,3%).

Table 1: Characteristics of Congestive heart failure patients (n=282).

Characteristics	f	%
Gender		
Male	180	63,80
Female	102	36,20
Heart Rate (bpm)		
<60	19	6,80
60-100	188	66,90
>100	75	26,70
Causes of Heart Failure		
Valvular Heart Disease	54	19,10
Systolic Heart Failure	1	0,40
Diastolic Heart Failure	20	7,10
Coronary Artery Disease	88	31,20
Hypertension Heart Disease	91	32,30
Rheumatic heart Disease	2	0,7
Dilatative Cardiomyopathy	13	4,6
Unidentified	13	4,6

3.2 Rhythm Congestive Heart Failure Patients

Table 2 shows normal rhythm take 42,90% from whole samples. In Sinus Dysrhythmia the most

rhythm is tachycardia (16,7 %), than bradycardia (4,60%) and arrhythmia (2,80%). Atrial fibrillation is the most rhythm in supraventricular dysrhythmia (14,20%), while premature ventricle contraction is the most rhythm in ventricle dysrhythmia. In other dysrhythmia, first degree AV block is the most rhythm in AV block conduction (4,60%) and right bundle branch block is the most rhythm in interventricle block conduction (3,90%).

Table 2: Congestive heart failure patient based on rhythm (n=282).

Type of Rhythm	f	%
Normal Sinus Rhythm	121	42,90
Sinus Dysrhythmia	8	2,80
Arrhythmia sinus		
Tachycardia sinus	47	16,70
Bradycardia sinus	13	4,60
Supraventricular Dysrhythmia		
Paroxysmal Supraventricular Tachycardia (PSVT)	4	1,40
Premature Atrium Contraction (PAC)	4	1,40
Atrial Fibrillation (AF)	40	14,20
Atrial Flutter	3	1,10
Ventricular Dysrhythmia		
Premature Ventricle Contraction (PVC)	9	3,20
Ventricle Tachycardia (VT)	1	0,40
Ventricle Fibrillation (VF)	0	0
Atrioventricular Block Conduction		
1st degree AV Block	13	4,60
2nd degree AV Block, Wenckebach	0	0
2nd degree AV Block, Mobitz Type II	1	0,40
3rd degree AV Block	0	0
Interventricular Block Conduction		
Right Bundle Branch Block (RBBB)	1	3,90
Left Bundle Branch Block (LBBB)	7	2,50

4 DISCUSSIONS

The result shows that the higher age makes the higher risk of congestive heart failure. The result is supported by an epidemiology study which state that the average age of congestive heart failure patients in South East Asia is 60 years old (Sakata and Shimokawa, 2013, p. 2211). On the study conducted by Rusinaru et al in France, the average of age from 368 samples were in late elderly group that is 69-85 years old. The range of age on its study is higher because France has high rate of life expectancy and the criteria of samples is patients whose low of ejection fraction significantly (Rusinaru *et al.*, 2008, p. 568). Higher of age cause heart valvular stiffness and hypertrophy, decreasing myocardium and blood

vessels elasticity and worsening calcium and lipid calcification in the artery and vein. Even function is maintained in normal condition, cardiovascular system is unable to survive in responding high of load on compensating circulation needed for long time. Cardiac output maximum will reduced up to 20% since 20 until 80 year old (Smeltzer and Bare, 2003, p. 191).

Risk of congestive heart failure was higher in male than female (i.e 63,2% on male and 36,8% on female). The percentage was widely caused by cigarette and caffeine consumption in male is higher than female, especially in Aceh. Similarly with the study conducted by Maulidta (2014) where male has 63,3% encounter coronary artery disease which trigger heart failure, this was caused by male not having estrogen hormone which effect atherosclerotic formation, meanwhile female had estrogen hormone that prevent atherosclerotic formation or other harm condition to the blood vessels (Maulidta, 2014, p. 58). An epidemiology study by Sakata & Shimokawa showed that 50-70% congestive heart failure patient in Asia were male (Sakata and Shimokawa, 2013, p. 2211).

In other ways, based on the study was conducted by Fachrunnisa, Nurchayati, and Arneliwati (2015) showed that female was more widely in risk on congestive heart failure (53,3%). In the study most of respondents were female whose age more than 45 years old which were dominantly menopause. Menopause caused the reduction of estrogen hormone and High Density Lipoprotein (HDL) which leading atherosclerosis was easier to form in blood vessels. Moreover female psychological is tend to maladaptive and makes them easier attack to disease (Fachrunnisa, Nurchayati and Arneliwati, 2015, p. 1099). In terms of etiology that underlying heart failure, both coronary artery disease or hypertension, male was higher on percentage that is 81,9%, so risk of heart failure is higher than female (Farissa, 2012, p. 37).

Samples' heart rate in this study was dominantly in normal range, that is 192 samples (67,1%). Even though some kind of dysrhythmia such as supraventricular dysrhythmia or ventricular dysrhythmia were frequently happen, the heart rate was possible in normal range. The result of the study also showed heart rate can increase over normal rate (24,8%) or decrease under normal rate (6%).

Normal heart rate is including in compensatory system to maintain cardiac output in normal levels. One of compensation system is enhances sympathetic activity reflexively to the heart which makes effectivity of heart contractibility increase

(Sherwood, 2013, p. 353). Sympathetic and epinephrine stimulation will increase heart contractibility through increased contraction strength in each end diastolic volume. It makes heart contraction stronger and eject more blood out of heart. Furthermore, sympathetic stimulation will enhance vein back flows where the vein constriction and let the higher blood volume from vessel to the heart, then increasing end diastolic volume and subsequently cardiac output will increase (Sherwood, 2013, p. 351).

Hypertension and coronary artery disease are two highest causes congestive heart failure. This statement is supported by some studies that show both conditions enhance the risk of heart failure. Based on study which was conducted by Halimuddin (2010), 33,3% congestive heart failure patients from his samples are caused by hypertension and coronary artery disease. As a study conducted by Kaneko et al (2014) in Japan, there was 60% from 17.517 samples were hypertension and coronary artery disease (Halimuddin, 2013, p. 98; Kaneko et al., 2014, p. 188). In another study which conducted by Kaneko to see the relation between clinical characteristics with morbidity and mortality rate of congestive heart failure through fraction and ejection shows that hypertension is one of some factors that aggravate ejection fraction of congestive heart failure besides aging, dyslipidemia, and adherent of treatment (Kaneko *et al.*, 2013, p. 108).

Normal Sinus Rhythm (NSR) is the most widely rhythm in this study, with normal ejection fraction and heart rate. Most of heart failure especially congestive heart failure show a normal maintained condition from any compensatory system (asymptomatic heart failure). Continuously compensation episode will cause remodeling structural of heart and culminate to symptomatic heart failure. Symptomatic heart failure will arise if it is followed by precipitations factors such as infection (bacteria or virus), arrhythmia, infarct, anemia, hyperthyroid and pregnancy, over of activity, emotional, imbalance of salt diet, and disease progressivity (Panggabean, 2014, p. 1132).

Normal rhythm in congestive heart failure shows compensation system work to maintain cardiac output. Continuously compensation makes heart work heavier and leading the changes of cardiac structure. Normal rhythm findings are not showing a safe condition because it is temporally. This normal condition also caused by effect of recent treatment and medicine consumption. Pharmacological such as anti-arrhythmias are used as front liner to prevent left ventricle dysfunction. However considering drug

utilization is needed since the side effect makes patient worsen (Hsu, 2007, p. 46).

Sinus dysrhythmia is a rhythm disorder that widely happen in congestive heart failure patients. Rhythm of sinus dysrhythmia is dominantly sinus tachycardia. Mostly caused by hypertensive heart disease and coronary artery disease with decreasing ejection fraction.

Sinus tachycardia signed by heart rate rapidity over than 100 and reach 180 beat per minute (bpm). During sinus tachycardia, Sino Atrium Node (SA Node) release impulse between 100 and 180 beat per minute, but the rapidity can slower along with aging and activity. Sinus tachycardia is divided into two, appropriate tachycardia and inappropriate tachycardia. Appropriate tachycardia is caused by body stress response such as activity, anxiety, fever, thyrotoxicosis, hypovolemia, or drug toxicities to maintain cardiac output. Meanwhile inappropriate tachycardia is caused by vagal system dysfunction or disorder in the SA node (Yamin, Harun and Makmun, 2014, p. 1346).

Sinus tachycardia in congestive heart failure is supported by some factors such as structural abnormality, metabolic dysfunction, and medication. Structural abnormalities for instance myocardium injury which disturb electricity current impulse toward ventricles and cardiomegaly which increase preload and afterload that cause prolonged repolarization cyclic. Metabolic dysfunction that underlying tachycardia in congestive heart failure involves neurohormonal activation which conduce increasing of adrenaline and noradrenaline hormone plasm, also be responsible of beta-blocker and Angiotensin Converting Enzyme (ACE) effect on sudden death, the study explained that significantly enhancement of norepinephrine is related to arrhythmias cases (Masarone *et al.*, 2017, p. 2).

Sinus tachycardia commonly found in heart failure patients caused by hypertension and coronary artery disease (Raka, Danes and Supit, 2015, p. 755). It is supported by a study was conducted by Kalangi, Jim, and Joseph (2016) where the high risk causes arrhythmias is hypertension (41%), meanwhile the study mention that sinus bradycardia rhythm is the most commonly sinus dysrhythmias in congestive heart failure (65%) especially heart failure ed causa coronary artery disease (Kalangi, Jim and Joseph, 2016).

Heart failure as a clinical syndrome regarding heart inability to supply adequate of blood to systemic will execute compensation effort to maintain cardiac output by many ways, one of them is with enhance heart contractility. By increasing heart contractility,

the heart rate will be accelerated, but this sympathetic stimulation could not persist since heart no more responsive to the nor-epinephrine stimulation. Continuously compensation makes heart works heavier and will contort heart structure, it be worsening by aging which causes heart inability to compensate well, it is showed by even heart rate and contractility increase but ejection fraction still low. In other side, bradycardia is commonly happen in congestive heart failure, it is caused by any dysfunction on SA node that makes inadequate amount of impulse to the atrium or caused by obstacle which makes the impulse cannot reach the ventricles (Masarone *et al.*, 2017, p. 4).

Supraventricular dysrhythmias in congestive heart failure is most widely Atrial Fibrillation (AF) rhythm that is 40 respondents (14,2%). The dysrhythmia is mostly caused by valvular heart disease (20 respondents) and have low ejection fraction on 28 respondents who were examined their echocardiography.

Impulse deliver synchronization is the most important to create an effective heart blood pump. In fibrillation, heart cells contraction and excitation are randomly and unsynchronized. Atrial fibrillation is signed with rapid, irregular, and uncoordinated atrial depolarization (unclear P wave) which leading disruption of atrium contraction. The irregularity of atrial contraction induces the irregularity impulse to the AV node and causes ventricles rhythm is irregular. Some ventricle pulsation will be closer and also elongate, when two ventricle pulsations are closer than the ventricle preload will getting shorter and the product of preload decrease, if the preload decrease so the next contraction will be weak. Sometimes, the ventricle contractions is too weak to pump out blood from heart and causes brachialis vein is impalpable (Sherwood, 2013, p. 335,340).

Atrial fibrillation findings in congestive heart failure patients is also reported in study conducted by Velderrabano *et al* (2016), there were 20 respondents (33,3%) from 60 samples with supraventricular dysrhythmia were atrial fibrillation and closely related to high risk of chronic kidney disease. They also explained that AF will impact on long of stay especially in intensive care unit (Valderrábano *et al.*, 2016, p. 7). Hsu (2007) and Kaneko *et al* (2014) mentioned that AF is highly responsible to congestive heart failure and the hospitalization duration, but it is not as main factor the high of mortality rate in congestive heart failure. AF also influence the left ventricle dysfunction and its ejection fraction, specifically on AF with Rapid Ventricular Response (AF RVR) which the pulse is over than 100 bpm. Low

ejection fraction on AF RVR is caused by left ventricle dysfunction as impact of atrial contractility dysfunction which is leading Atrioventricular desynchronizing or the irregularity of ventricles (Hsu, 2007, p. 46; Kaneko *et al.*, 2014, p. 187). Desynchronizing impulse deliver from SA node causes impulse deliver to the ventricles worse. It will make ventricle pump moves randomly, signed by irregular QRS waves, leading the blood volume is not sufficient to fulfill body circulation need.

Premature Ventricle Contraction (PVC) is most ventricular dysrhythmia which occur in congestive heart failure. Ventricular dysrhythmia dominantly on congestive heart failure which caused by coronary artery disease and valvular heart disease and have low ejection fraction level.

Ventricular extrasystole/premature ventricle contraction/PVC is mostly caused by ischemia, acute myocardial infarction, heart failure, prolonged QT syndrome, digitalis toxicity, hypokalemia, myocarditis, cardiomyopathy or mitral valve relapse. Emergence of this rhythm should threatened based on the etiology, even it is asymptomatic, because this rhythm aggravation cause ventricular fibrillation (VF) or ventricular tachycardia (VT) (Yamin, Harun and Makmun, 2014, p. 1360). The worsening of PVC dysrhythmias becomes VT / VF is significantly influences cardiac output because of fast heart rate and loss of synchronization mechanism between atrial and ventricle contraction. Not only that, ventricle fibrillation causes effective contraction stop spontaneously and ventricle will vibrating uncoordinatedly. (DeBeasi, 2003, p. 598).

Recent study which is conducted by Kalangi, Jim, and Joseph proves that premature ventricle contraction could happen in almost all coronary artery disease such as stabled angina pectoris (SAP) 21%, old myocardial infarction (OMI) 33%, unstable angina pectoris (UAP) 25%, and NSTEMI (15%), it is dominantly on male in above 50 year old. (Kalangi *et al.*, 2016, p. 4 – 5).

Ventricular dysrhythmia presents in congestive heart failure belonging kidney disorder can increase the glomerulus filtration rate (GFR) and hemoglobin amount in blood. In cardiac structure, this condition causes left ventricle mass index and coronary calcium enhancement which leading diastolic dysfunction, ventricular hypertrophy, also coronary artery calcification. The increasing hemoglobin and decrease of ejection fraction such condition above is need to identify the relations between clinical data, laboratory, and another cardiovascular parameters (Bonato, Lemos, Cassiolato, & Canziani, 2013, p. 3 - 4). PVC presents can asymptomatic so control the

balances of electrolyte and exposure of infection agents, and pharmacological optimization are very suggested (Masarone *et al.*, 2017, p. 8).

Ventricular dysrhythmia is a rhythm disorder which the impulse source possibility from ventricular ectopic pulse and produce the premature pulsation or irregular high rapidity. High rate of ventricle pulse (ventricle tachycardia) in long time can ending with ventricle fibrillation, therefore filling and emptying ventricle episode will be ineffective.

In this study, atrioventricular block conduction (AV) dysrhythmia is dominantly with first degree atrioventricular block conduction that is 13 respondents or 4,6% from sample. AV block conduction is widely experienced by congestive heart failure with coronary artery disease and low ejection fraction. This dysrhythmia is very important because can leading severer block heart conduction (Smeltzer and Bare, 2002, p. 762). Meanwhile Yamin in Sudoyo (2014) explained that first degree AV block is not need early treatment and have a good prognosis. In another study shows that the patient with UAP, NSTEMI, and STEMI have first degree AV block (Kalangi *et al.*, 2016, p. 5 – 6). First degree AV block also experienced by inferior myocardial infarct. Electrically, conduction line obstacles from sinus node to AV node causes impulse cannot separately well to the next conduction line.

Interventricular block conduction in congestive heart failure is dominantly with Right Bundle Branch Block (RBBB). Samples are mostly caused by valvular heart disease and have low of ejection fraction. Conduction block on RBBB is a conduction disorder condition in right branch conduction system. Patients with RBBB commonly asymptomatic, but if it find the syncope and other conduction disorder like AV block, so additional pacemaker is need to considered (Yamin *et al.*, 2014, p.1362).

Conduction deceleration which caused by obstacles in bundle his branch makes ventricle muscles unable to pump out the blood effectively, sometimes the deceleration also causes the ventricle pacemaker take over the role to produce its own impulse and makes premature contraction or vibrating of ventricle.

5 CONCLUSIONS

Based on the result of this study, we can conclude that congestive heart failures are dominantly on male; mostly caused by hypertension and coronary artery disease, have sinus rhythm with heart rate, and

ejection fraction in normal range. The rhythm finding in congestive heart failure are as follows:

- a. Sinus dysrhythmias is the most widely dysrhythmia in congestive heart failure. The dominant rhythm is sinus tachycardia,
- b. Supraventricular dysrhythmia is dominantly with atrial fibrillation
- c. Rhythm of ventricular dysrhythmia is premature ventricle contraction (PVC)
- d. Rhythm of atrioventricular block conduction is dominantly with first degree atrioventricular block conduction, and
- e. Rhythm of interventricular block conduction is dominantly with *Right Bundle Branch Block* (RBBB)

It is recommended to nurses that not to make a rhythm as a main indicator to determine the etiology decrease of cardiac output, in addition nurses are expected not to ignore the normal rhythm and more assess the underlying causing the cardiac output decrease. For further research is expected to study further regarding dysrhythmia in congestive heart failure and the effective nursing interventions to return heart pump effectively.

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