VOLUME-6 | ISSUE-4 | APRIL - 2017 • ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46

RELATIONSHIP BETWEEN MITRAL REGURGITATION SEVERITY AND LEFT VENTRICULAR SYSTOLIC FUNCTION IN CHILDREN RHEUMATIC HEART DISEASE

Medicine

KEYWORDS: RHD, mitral regurgitation, left ventricular systolic function, LVESD, ejection fraction

Silvia Yasmin Lubis — Department of Child Health, Faculty of Medicine, University of Sumatera Utara / Haji Adam Malik Hospital, Medan-Indonesia

Muhammad Ali — Department of Child Health, Faculty of Medicine, University of Sumatera Utara / Haji Adam Malik Hospital, Medan-Indonesia

Tina CL Tobing — Department of Child Health, Faculty of Medicine, University of Sumatera Utara / Haji Adam Malik Hospital, Medan-Indonesia

ABSTRACT

Background Rheumatic Heart Disease (RHD) is the most frequent heart disease in children of developing countries, with mitral valve is often affected. Chronic mitral regurgitation causes progressive left ventricular dysfunction, and mitral valve surgery should be performed before the change in left ventricular function. One of the indication for surgery is ejection fraction (EF) < 60% and left ventricular end-systolic diameter (LVESD) ≥ 40 mm.

Objective To evaluate the relationship between mitral regurgitation severity and left ventricular systolic function

Methods A cross sectional retrospective study was conducted by obtaining medical record data from Haji Adam Malik Hospital during January 2011 to January 2015. Subject were children with RHD, aged 5 to 18 years old that met the criterias. Complete echocardiography was done in all subjects to evaluate severity of mitral regurgitation, ejection fraction and LVESD. Data were analyzed by calculating Anova, Mann Whitney and Spearman correlation.

Results There was a significant relationship between mitral regurgitation severity and left ventricular systolic function, which only LVESD that showed a significant relationship (P=0.0001), but not in EF (P=0.968). Age was correlate with LVESD in children RHD with mitral regurgitation (P=0.04, r=0.303), but not in sex (P=0.08).

Conclusion There was a significant relationship between mitral regurgitation severity and left ventricular systolic function, which was only seen in LVESD. Age was correlate with LVESD in children PJR with mitral regurgitation.

Introductions

Rheumatic heart disease (RHD) remains the major cause of cardiovascular disability in school children and young adults from developing countries, and represent a high burden for public health.[1] Rheumatic heart disease is due to an immunological response sequelae of Acute Rheumatic Fever (ARF) that occurs after Streptococcus hemolyticus group A infection that cause valve damage.[2]

The mitral valve is often affected, whereas chronic mitral valve regurgitation causes progressive left ventricular dysfunction.[2,3] Mitral valve surgery should be performed when there is early left ventricle (LV) systolic impairment.[3] Delayed in performing surgery when left ventricular dysfunction already persist, can lead to increased risk of surgery such as irreversible left ventricular systolic function, increasing heart failure and death.[4]

One of the indication of mitral valve surgery is ejection fraction below 60% and left ventricular end systolic diameter more or equal to 40 mm.[4] The aim of our study was to evaluate the relationship between mitral regurgitation severity and left ventricular systolic function in children RHD by assessing ejection fraction and left ventricular end systolic diameter.

Methods

A cross sectional retrospective was conducted in January 2005 by obtaining medical record data from Haji Adam Malik Hospital during January 2011 to January 2015. Subjects were children with RHD, aged 5 to 18 years old that met the criterias, was collected by consecutive sampling. Complete echocardiography with GE Logic 400 CL and 3.5 MHz tranducer device was done in all subjects to evaluate severity of mitral regurgitation, EF and LVESD.

We exclude children with congenital heart disease, mitral stenosis, moderate to severe aorta regurgitation, aorta stenosis and moderate to severe tricuspid regurgitation. The study was approved by the Research Ethics Committe of the Faculty of Medicine, University of Sumatera Utara.

Statistical Analysis

Analyses were performed with the SPSS statistical program (Version 18.0). The relationship between mitral regurgitation severity with fraction ejection and LVESD were analyzed by Anova test. The relationship between sex with ejection fraction and LVESD were analyzed by Mann Whitney test, while the relationship between age and EF and LVESD were analyzed by Spearman correlation test. P < 0.05 was considered statisticaly significant.

Results

Total of 90 children were found that met the criterias, the percentage of girls more than boys, the mean age children was 11.2 years old and severe mitral regurgitation more than other degrees (Table 1).

Table 1. Demographic characteristics of subject

Subject characteristics	n = 90
Sex, n (%)	
male	39 (43.30)
female	51 (56.70)
Age, mean (SD), years	11.2 (3.06)
Mitral regurgitation, n (%)	
severe	38 (42.20)
moderate	33 (36.70)
mild	19 (21.10)
LVESD, mean (SD), mm	30.1 (6.26)
EF, mean (SD), %	64.7 (6.13)
Fraction shortening, mean (SD), %	35.4 (4.93)

Results of analysis with Anova test showed a significant relationship between mitral regurgitation severity with left ventricular systolic function, but only in LVESD that showed a significant relationship (P=0.0001), was not in EF (P=0.968) (table 2).

Table 2. Relationship between mitral regurgitation severity with LVESD and ejection fraction

Mitral regurgitation severity	LVESD, mean (SD), mm	P	EF (SD) %	P
severe	34 (5.98)	0.0001[a]	64.5 (5.57)	0.968[a]
moderate	29.5 (4.91)		64.7 (6.83)	
mild	25.9 (4.28)		64.9 (6.51)	

[a] Anova test

There was not found significant relationship between sex with EF (P=0.08) and LVESD (P=0.678), while age was found a significant correlation with LVESD (P=0.04, r=3.03), but was not in EF (P=0.75) in children RHD with mitral regurgitation (table 3).

Table 3. Correlation between sex with LVESD and EF in children RHD with mitral regurgitation

variable	LVESD mean (SD) mm	r	P	EF mean (SD) %	r	P
Sex male	31.4 (6,11)		0.08[a]	65 (6.26)		0.678[a]
female Age	29.1 (6,25)	0.303[b]	0.04	64.5 (6.08)	0.34[b]	0.75

[a] Mann Whitney test, [b] Spearman correlation test

Discussion

Mitral regurgitation is the most common anomaly in RHD. In our study we found from 90 children with RHD during study periode, pure mitral regurgitation as 28 children (31,1%) and mixed mitral regurgitation as 62 children (68,9%). Our finding is similar with a study in Pakistan that showed mixed mitral regurgitation more than pure mitral regurgitation. They found among 58.59% of children with mitral regurgitation 13.7% was pure and 86.3% was mixed type. This is probably because the patient comes to the hospital with complete facilities after the initial detection of advanced disease or rheumatic fever are missdiagnosed.[5] Another study in Nepal found more patients with mitral regurgitation.[6]

In our study, mitral regurgitation was common found in female (56.7%) than male (43.3%). Our study is similar with prior studies which showed more female having mitral regurgitation, such as study in Yemen (54.5% vs 45.7%),[7] and study in Pakistan (59.01% vs 40.99%).[5] In contrary, a study on school children in Nepal found mitral regurgitation more common in male (52.9%) than female (47.05%).[8]

Our study found severe mitral regurgitation (42.2%) was more common than mild (21.1%) and moderate (36.7%) mitral regurgitation. This is consistent with the results obtained in the study in Uganda who have shown that severe mitral regurgitation (73.9%) more than another degree.[9] This is probably due to patients did not come to the hospital on early stage or delayed diagnosed, that causes patients late to receive secondary prophylaxis Benzathin penicillin and finally increase mitral regurgitation severity. However, our results was in contrast to study in Pakistan which mild mitral regurgitation (49.7%) more common than moderate (27.7%) and severe (22.5%) mitral regurgitation.[5]

Chronic mitral regurgitation causes progressive left ventricular dysfunction,[3] in which ventricular dysfunction is one of the main determinants of cardiac arrest in mitral regurgitation in addition to severe mitral regurgitation.[10] Ejection fraction is frequently used to determine a patient will get mitral surgery.[11] Ejection fraction below 60% is recommended to surgery performed.[12,13] However, study in France reported the value of ejection fraction higher than 64% in mitral regurgitation can reduce the occurrence of ventricular dysfunction after surgery.[14]

We found that the mean EF in children RHD with mitral regurgitation is 64.7%, the result is higher than prior studies with the mean about 61%.[3] Our study shows mitral regurgitation severity was not significantly associated with EF (P=0.968), although the result shows increased mitral regurgitation severity, the value of EF is getting smaller. This is consistent with the another study who have shown that EF was not significantly associated with mitral regurgitation severity, with the mean value of EF in each mitral regurgitation severity shows grade I and II is 67.7% and grade III-IV is 69.5%.[10] The reason probably caused patients in compensation phase, which the combination of an augmented preload and reduced or normal afterload with maintained intrinsic contractility, preserve LV ejection, so that the value EF will remain normal during this phase.[11,15] Our study found that the mean value of EF in each mitral regurgitation severity has a value above 60%, so that the EF can not be a good parameter in determining left ventricular dysfunction in mitral regurgitation. However, EF before surgery is a good predictor in determining the occurrence of heart failure and survival after surgery.[13]

Left Ventricular End Systolic Diameter (LVESD) is also a determinant in surgery performed, which LVESD more or equal to 40 mm is an indication for surgery.[12,13] We found a mean value of LVESD was 30.1% with the analysis result shows a significant relationship between mitral regurgitation severity and LVESD. This result in accordance with the study conducted in Turkey which showed a significant correlation between moderate to severe mitral regurgitation.[15] Another study in India showed that even though patients with LVESD below 45 mm, changes in LVESD can determine the damage significantly.[11] This shows the use LVESD is more sensitive in determining the onset of left ventricular dysfunction in children with mitral regurgitation. Left ventricular end systolic diameter also can predict the optimal time to perform surgery, in order to get left ventricular function result better after surgery.[11] This is consistent with the results obtained in South Africa who have shown LVESD more than 50 mm before the surgery resulted in poor outcomes, but if LVESD was less or equal to 40 mm can predict a good outcome.[16]

We also did not found significant relationship between sex with EF and LVESD in children RHD with mitral regurgitation, likewise in relationship between age and EF (P=0.750), whereas relationship between age and LVESD was found a significant correlation (P = 0.04), although with a weak correlation (r = 0.303). This suggests that LVESD will increase in children RHD with mitral regurgitation if age of children increased. This is because mitral regurgitation severity is influenced by age.[10]

There is a limitation in our study, design is a cross sectional study that takes data from medical records were not monitoring left ventricular function in children RHD with mitral regurgitation serially, so that our study can not assess the progression of left ventricular function.

Conclusion

There was a significant relationship between mitral regurgitation severity and left ventricular systolic function, which was only seen in LVESD. Age was correlate with LVESD in children RHD with mitral regurgitation.

References

1. Araujo FDDR, Goulart EMA, Meira ZMA. Prognostic value of clinical and Doppler echocardiographic findings in children and adolescents with significant rheumatic valvular disease. Ann Ped Cardiol. 2012;5:120-6
2. Awad SMM, Felten DE. Rheumatic fever and rheumatic heart disease. In: Abdulla R, editors. Heart disease in children. New York: Spinger. 2011.p.317-23
3. Timmis SBH, Kirsh MM, Montgomery DG, Starling MR. Evaluation of left ventricular ejection fraction as a measure of pump performance in patients with chronic mitral regurgitation. Cathet Cardiovasc Intervent. 2000; 49:290–6
4. Walsh W, Brown A, Carapetis J. The diagnosis and management of chronic rheumatic heart disease an Australian guideline. Heart, Lung and Circulation. 2008; 17:271-89
5. Faheem M, Hafizullah M, Gul A, Jan H, Khan MA. Pattern of valvular lesions in rheumatic heart disease. JPMI. 2007;12:99-103
6. Shrestha NR, Pilgrim T, Karki P, Bhandari R, Basnet S, Tiwari S, at al. Rheumatic heart disease revisited : patterns of valvular involvement from a consecutive cohort in eastern Nepal. J Cardiovasc Med. 2012;13:755-9
7. Saleh HK. Pattern of rheumatic heart disease in Southern Yemen. Saudi Med J. 2007;28:108-13
8. Prajapati D, Sharma D, Regmi PR, Khanal H, Baidya SG, Rajbhandari S, at al. Epidemiological survey of rheumatic fever, rheumatic heart disease and congenital heart disease among school children in Kathmandu valley of Nepal. NHJ. 2013;10:1-5
9. Lubega S, Aliku T, Lwabi P. Echocardiographic pattern and severity of valve dysfunction in children with rheumatic heart disease seen at Uganda Heart Institute, Mulago hospital. Afr Health Sci. 2014;14:617-25
10. Nasr G, Moselhy MS, Elattar G, Zaghlool S, Murayeh MA. Usefulness of Tei index in patients with rheumatic mitral regurgitation and apparently normal left ventricular ejection fraction. J Saudi Heart Assoc. 2011;23:147-50
11. Gunjan M, Kurien S, Tyagi S. Early prediction of left ventricular systolic dysfunction in patients of asymptomatic chronic severe rheumatic mitral regurgitation using tissue doppler and strain rate imaging. Indian Heart Journal. 2012;6403:245-8
12. Lancellotti P, Moura L, Pierard LA, Agricola E, Popescu BA, Tribouilloy C, at al. European Association of Echocardiogrphy recommendations for the assesment of valvular regurgitation. Part 2: mitral and tricuspid regurgitation (native valve disease). Eur J Echocardogr. 2010;11:307-32
13. Gaasch WH, Meyer TE. Left ventricular response to mitral regurgitation. Circulation. 2008;118:2298-303
14. Tribouilloy C, Rusinaru D, Szymanski C, Mezghani S, Fournier A, Levy F, at al. Predicting left ventricular dysfunction after valve repair for mitral regurgitation due to

VOLUME-6 | ISSUE-4 | APRIL - 2017 • ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46

leaflet prolapse: additive value of left ventricular end systolic dimension to ejection fraction. Eur J Echocardiogr. 2011;12:702–10
15. Elbey Ma, Arslan S, Aksakal E, Senocak H, Karakelleoglu S, Ariturk Z, at al. Relationship between the severity of mitral regurgitation, left ventricular dysfunction and plasma brain natriuretic peptide plasma: an observational strain imaging study. J Clin Exp Invest. 2012;2(4):451-6
16. Wisenbaugh T, Skudicky D, Sareli P. Prediction of outcome after Valve replacement for rheumatic mitral regurgitation in the era of chordal preservation. Circulation. 1994;89:191-7