

PHASE II CARDIAC REHABILITATION PROGRAM IMPROVES FUNCTIONAL CAPACITY IN ATRIAL FIBRILLATION AND NON-ATRIAL FIBRILLATION PATIENTS AFTER MITRAL VALVE SURGERY

REHABILITASI JANTUNG FASE II MENINGKATKAN KAPASITAS FUNGSIONAL PASIEN PASCA BEDAH KATUP MITRAL DENGAN FIBRILASI ATRIUM DAN NON-FIBRILASI ATRIUM

Risalina Myrtha¹, Ignatius Faizal Yuwono², Andi Mahavira³, Ade Meidian Ambari³,
Basuni Radi³, Anwar Santoso³, Budhi Setianto³.

¹Departemen Kardiologi dan Kedokteran Vaskuler, Fakultas Kedokteran, Universitas Sebelas Maret.

²Departemen Kardiologi dan Kedokteran Vaskuler, Fakultas Kedokteran, Universitas Diponegoro.

³Departemen Kardiologi dan Kedokteran Vaskuler, Fakultas Kedokteran, Universitas Indonesia- Pusat Jantung Nasional Harapan Kita

Korespondensi: dr. Risalina Myrtha, Sp. JP. Email: risalinamustarsid@staff.uns.ac.id.

ABSTRAK

Penurunan kapasitas fungsional banyak ditemukan pada pasien fibrilasi atrium (FA) dengan berbagai kelainan jantung termasuk pasien yang menjalani operasi dan intervensi katup. Penelitian ini bertujuan untuk mengevaluasi pengaruh FA terhadap kapasitas fungsional pasien pasca operasi katup mitral yang menjalani program rehabilitasi jantung fase II. Penelitian ini merupakan penelitian potong lintang yang dilakukan pada pasien-pasien yang mengikuti program rehabilitasi jantung pasca operasi katup mitral di Pusat Jantung X Jakarta pada Januari hingga Desember 2013. Kapasitas fungsional pada pasien FA dibandingkan dengan pasien non-FA. Kapasitas fungsional diukur dengan menggunakan six-minute walking test distance (6MWD). Sejumlah 134 pasien yang diikuti dalam penelitian ini, terdiri dari 61 pasien AF dan 73 pasien Non AF. Hasil penelitian ini menyatakan bahwa program rehabilitasi jantung fase II meningkatkan kapasitas total pada kelompok AF dan Non AF, secara signifikan ($p < 0,001$) pada kedua kelompok. Analisis regresi linear didapatkan bahwa 6MWD berkorelasi negatif dengan usia ($p = 0,001$). **Simpulan:** Pasien-pasien pasca operasi katup mitral dengan FA mempunyai kapasitas fungsional awal yang lebih rendah, tetapi program rehabilitasi jantung dapat meningkatkan kapasitas fungsional dan peningkatan yang terjadi sebanding dengan kelompok dengan non-FA.

Kata Kunci: Fibrilasi Atrium, 6MWD, Kapasitas Fungsional.

ABSTRACT

Reduced functional capacity is commonly found in atrial fibrillation patients (AF) with various pathological cardiac disorders including patients undergoing valve surgery and intervention. This study aimed to investigate the effect of phase II cardiac rehabilitation program in functional capacity among AF and non-AF patients undergoing mitral valve surgery. We conducted a cross sectional research among AF and non-AF patients undergoing mitral valve surgery from January to December 2013 in X Cardiovascular Center Jakarta. We assessed functional capacity in both groups before and after phase II cardiac rehabilitation program. We used six minutes walking distance (6MWD) to evaluate the functional capacity. There were 134 subjects involved in this study. The AF group consisted of 61 subjects, and 73 subjects of Non-AF group. The results of this study were the phase II cardiac rehabilitation program enhanced the functional capacity of AF and Non AF groups, with significantly difference ($p < 0,001$) on both groups. In linear regression analysis, age was negatively related with 6MWD ($p = 0,001$). We concluded that phase II cardiac rehabilitation program could enhance functional capacity of AF and non-AF group.

Keywords: Atrial Fibrillation, 6MWD, Functional Capacity.

How To Cite: Myrtha, R., Yuwono, I., Mahavira, A., Ambari, A., Radi, B., Santoso, A & Setianto, B. (2021). PHASE II CARDIAC REHABILITATION PROGRAM IMPROVES FUNCTIONAL CAPACITY IN ATRIAL FIBRILLATION AND NON-ATRIAL FIBRILLATION PATIENTS AFTER MITRAL VALVE SURGERY. Biomedika, 13(2), 153-159. doi:<https://doi.org/10.23917/biomedika.v13i2.13451>

DOI: <https://doi.org/10.23917/biomedika.v13i2.13451>

BACKGROUND

Atrial fibrillation (AF), the most popular arrhythmia leading to hospitalization, has a substantial effect on morbidity and mortality (Aliot et al., 2014). Atrial fibrillation is a very common arrhythmia in those with mitral valve disease and it has been known as an independent predictor of overall survival after mitral valve surgery (Lim et al., 2001).

Among both healthy subjects and those with various diseases, including those undergoing mitral valve surgery, atrial fibrillation is related with a reduced physical performance (Agostoni et al., 2008). The purpose of this study is to evaluate the role of phase II cardiac rehabilitation program in improving functional capacity in both AF and non-AF subjects after mitral valve surgery.

METHODS

We conducted a cross sectional study in mitral valve surgery patients that participated in a complete phase II cardiac rehabilitation program at division of rehabilitation and prevention, National X Cardiovascular Center, Jakarta, Indonesia. We evaluated 134 patients that joined the program in January to December 2013. Subjects were included if they participated in a complete series of phase II cardiac rehabilitation program. Subjects were excluded if they underwent another cardiac surgery simultaneously e.g. coronary artery bypass grafting (CABG) or they did not undergo complete phase II cardiac rehabilitation program.

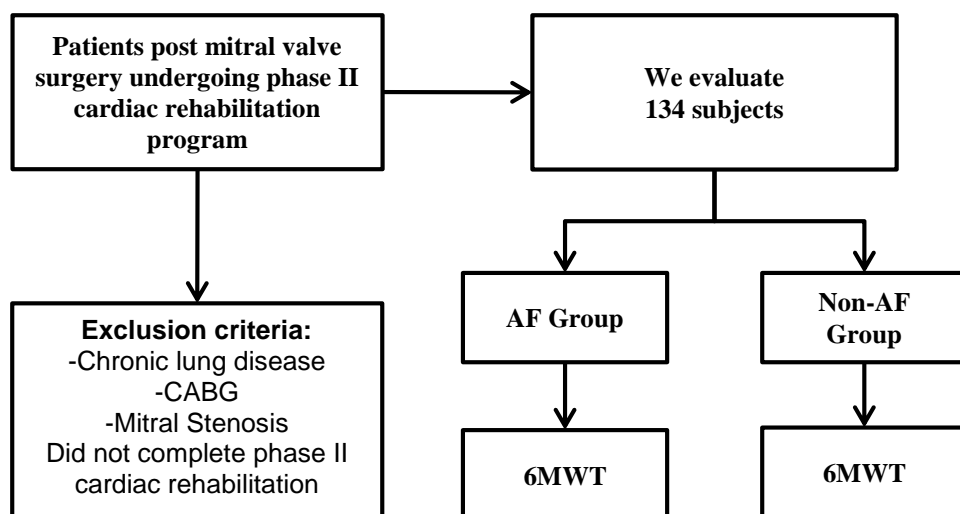


Figure 1. Study design

We used the six-minute walking test (6MWT) to measure functional capacity. 6MWT is a commonly simple and efficient technique to directly evaluate the functional capacity of those in the post cardiac surgery period (Oliveira et al., 2014). The 6MWT was conducted on a flat hard surface by a nurse who did not know the clinical background and results. Each subject undertook two examinations done in the first day and in the end of phase II cardiac rehabilitation. These examinations measured the walking distance that a patient can quickly do in a 6-minutes period (the 6MWD). The six-minute walking distance (6MWD) is negatively associated with functional class and quality of life (QoL) (Zielińska et al., 2013).

Continuous variables are stated as mean and standard deviation (SD). Categorical variables are stated as the number of subjects or percentage. For evaluating differences of categorical parameters between groups, we used Chi-square (χ^2) test, while unpaired t-test was performed to compare continuous variables between groups in AF and non-AF groups. Paired t-test was used to analyze 6MWD-1 and

6MWD-2 in both groups. Statistical differences with a p-value <0.05 were regarded as significant. Linear regression analysis was carried out with 6MWD as the dependent variable.

RESULTS AND DISCUSSION

From January to December 2013, 161 patients were included. 10 patients were excluded due to another cardiac surgery performed simultaneously (CABG, atrial septal defect (ASD) closure, ventricular septal defect (VSD) closure, and permanent pacemaker implantation). 1 patient was unable to walk in six minute duration at the final stage of phase II, 17 patients did not have complete 6MWD data or did not fully participate in phase II cardiac rehabilitation program. Finally, 134 patients were involved in this study. 49.3% of which were male. Of those 134 subjects, AF group consisted of 61 subjects (45.52%). Digitalis medication was more frequent in AF than in non-AF group ($p<0.001$). Differences in baseline characteristics of participants were summarized in **table 1**.

Table 1. Baseline Characteristics

	AF (n = 61)	Non-AF (n = 73)	p-value
Age	43.02±11.4	40.49±09	0.26
Gender, male sex	28 (45.9%)	38 (52.1%)	0.49
BMI	20.39±3.47	21.75±4.92	0.07

LVEF	56.36±12.29	56.75±14.59	0.87
Diuretics	41 (67.2%)	43 (58.9%)	0.37
Digitalis	23 (37.7%)	5 (6.8%)	<0.001*
Beta blocker	25 (41%)	39 (53.4%)	0.17
ACE inhibitor or ARB	38 (62.3%)	54 (74%)	0.19

*Values are mean±SD or number (%). p-value<0.05 was considered statistically significant.
ACE = angiotensin-converting enzyme; ARB = angiotensin receptor blocker.

In the beginning of the cardiac rehabilitation program, 6MWD of AF subjects was significantly lower than non-AF subjects (291.28±66.36 vs 323.92±83.71, p=0.02). Following phase II cardiac rehabilitation program, it was still considerably lower than non-AF subjects (363.75±71.22 vs 414.78±81.98, p<0.001). However, both AF and non-AF subjects revealed similar improvement after completing phase II cardiac rehabilitation program. In both groups, there were significant improvements in 6MWD-2 compared to 6MWD-1 (p<0.001) (Table 2). In linear regression analysis, age was negatively correlated with 6MWD (p=0.001) (Table 3).

Table 2. Six Minute Walking Distance (Outcome)

	6MWD1	6MWD2	p-value
AF	291.28±66.36	363.75±71.22	0.000*
Non AF	323.92±83.71	414.78±81.98	0.000*

*p< 0.001

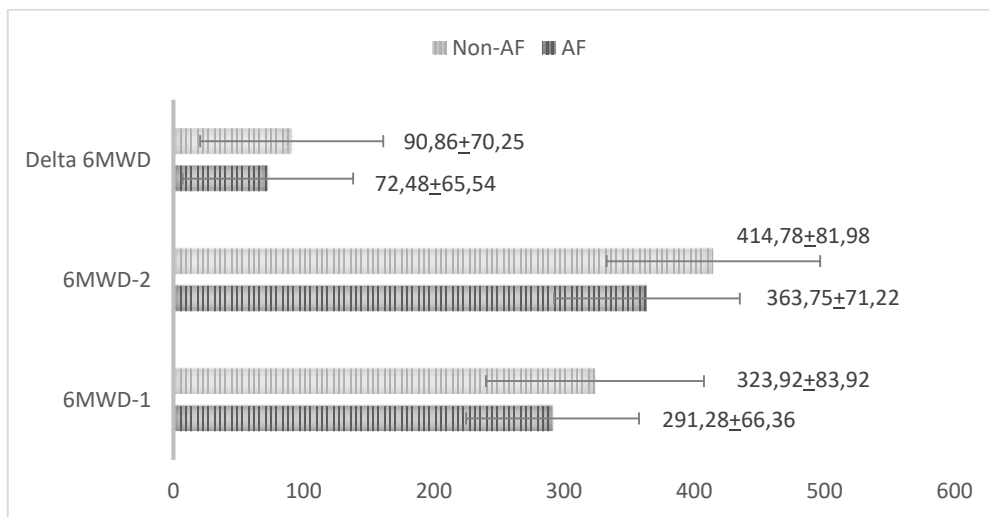


Figure 2. Comparison of 6MWD-1, 6MWD-2, and Δ6MWD between AF and Non-AF groups.

Table 3. Linear Regression Analysis for Change in 6MWD with Age and BMI.

	Regression Coefficient/ R²	SE	Beta
Intercept	334.01	35.98	
Age	-1.75	0.52	-0.29 (p= 0.001)*
BMI	2.25	1.57	0.13 (p= 0.15)

The incidence of AF in our study is 45.52%. It is approximate similar to the previous study in mitral valve surgery patients that reported 45% incidence of AF (Le Tourneau et al., 2000). Atrial fibrillation is related with a

worse VO_{2max} in patients with chronic heart failure, suggesting that either present atrial contraction or a regular rhythm, or both, are significant to preserve cardiac output and physical performance (Pardaens et al., 1997).

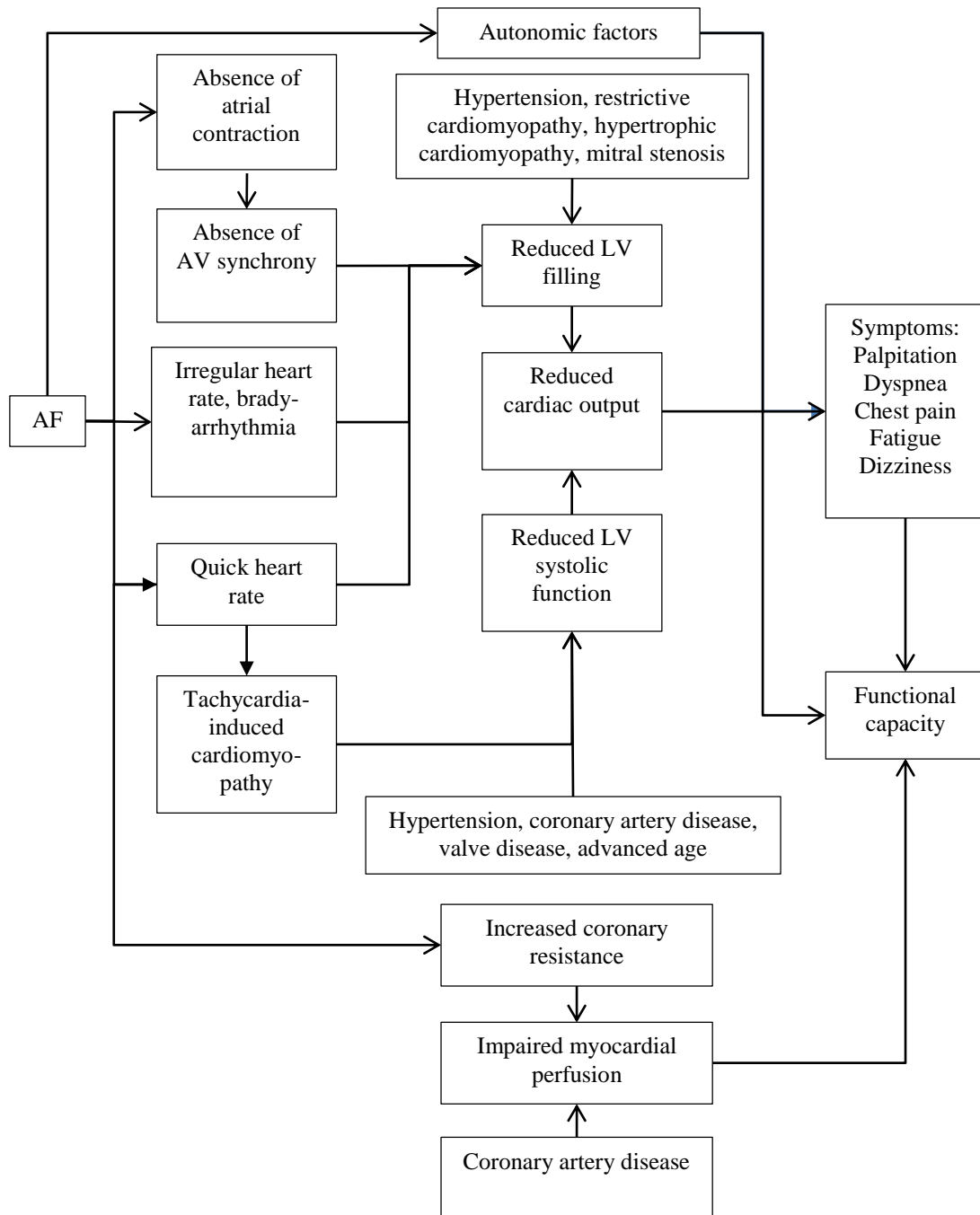


Figure 3. Patophysiological mechanism of atrial fibrillation and reduced functional capacity (Rienstra et al., 2012).

There is limited evidence to support the role of cardiac rehabilitation program in AF patients. Similar to previous study, our study shows that AF subjects have lower exercise capacity. However, the improvement of functional capacity in AF group is comparable to non-AF group. In a few studies, an exercise program could improve functional status and symptoms in AF subjects (Rienstra et al., 2012). Improvement in functional capacity carries a good prognostic factor in such population, since physical fitness capacity is a well-known independent predictor of cardiovascular events and mortality of all causes. Some studies show that mortality rate decreases 17% in men and 14% in women if the functional capacity increases one MET (Younis et al., 2018; Reed et al., 2013; Smart et al., 2018).

CONCLUSION

In this study, post-mitral valve surgery subjects with AF had lower functional capacity than non-AF group. However, after finishing phase II cardiac rehabilitation program, the functional capacity showed a good improvement (signifand it was comparable to non-AF peers).

This study had no data on the duration of atrial fibrillation and did not classify atrial fibrillation into paroxysmal, persistent, or

permanent AF. Besides, we did not analyze the data on the presence of pulmonary hypertension and anemia in post surgery period. A longer follow up period will be required to assess functional capacity after surgery more accurately.

ACKNOWLEDGEMENT

The author would like to thank National Cardiovascular Center Harapan Kita and Division of Cardiovascular Prevention and Rehabilitation, National Cardiovascular Center Harapan Kita for allowing this study to be conducted and also for the warm welcome.

REFERENCES

- Aliot, E., Botto, G.L., Crijns, H.J., and Kirchhof, P. 2014. Quality of Life in Patients With Atrial Fibrillation: How To Assess It And How To Improve It. *Europace*. Vol.16. Pp= 787–96.
- Lim, E., Barlow, C.W., Hosseinpour, A.R., Wisbey, C., Wilson, K., Pidgeon, W., Charman, S., Barlow, J.B., and Wells, F.C. 2001. Influence of Atrial Fibrillation on Outcome Following Mitral Valve Repair. *Circulation*. Vol. 104. Pp= 159–63.
- Oliveira, G.U., Oliveira Carvalho, V., de Assis Cacao, L.P., de Araújo Filho, A.A., de Cerqueira Neto, M.L., da Silva, W.M. Jr., Cerqueira, T.C., and de Santana Filho, V.J. 2014. Determinants of distance walked during the six-minute walk test in patients undergoing cardiac surgery at hospital discharge. *J Cardiothorac Surg*. Vol. 9(95). Pp= 1–6.
- Pardaens, K., Van Cleemput, J., Vanhaecke, J., and Fagard, R.H. 1997. Atrial fibrillation is associated with a lower exercise

- capacity in male chronic heart failure patients. *Heart*. Vol. 78. Pp= 564–8.
- Reed, J.L., Mark, A.E., Reid, R.D., and Pipe, A.L. 2013. The Effect of Chronic Exercise Training in Individuals With Permanent Atrial Fibrillation: A Systematic Review. *Can J Cardiol*. Vol. 29(12). Pp= 1721–8.
- Rienstra, M., Lubitz, S.A., Mahida, S., Magnani, J.W., Fontes, J.D., Sinner, M.F., Van Gelder, I.C., Ellinor, P.T., and Benjamin, E.J. 2012. Symptoms and Functional Status of Patients With Atrial Fibrillation: State of the Art and Future Research Opportunities. *Circulation*. Vol. 125. Pp= 2933–23.
- Smart, N.A., King, N., Lambert, J.D., Pearson, M.J., Campbell, J.L., Risom, S.S., and Taylor, R.S. 2018. Exercise-based cardiac rehabilitation improves exercise capacity and health-related quality of life in people with atrial fibrillation: a systematic review and meta-analysis of randomised and non-randomised trials. *Open Heart*. Vol. 5 (2). Pp= 1–11. DOI: 10.1136/openhrt-2018-000880.
- Le Tourneau T., de Groote P., Millaire A, Foucher C, Savoye C, Pigny P, Prat A, Warembourg H, and Lablanche JM. 2000. Effect of Mitral Valve Surgery on Exercise Capacity, Ventricular Ejection Fraction, and Neurohormonal Activation in Patients With Severe Mitral Regurgitation. *J Am Coll Cardiol*. Vol. 36. Pp= 2263–9.
- Agostoni, P., Emdin, M., Corrà, U., Veglia, F., Magri, D., Tedesco, C.C., Berton, E., Passino, C., Bertella, E., Re, F., Mezzani, A., Belardinelli, R., Colombo, C., La Gioia, R., Vicenzi, M., Giannoni, A., Scrutinio, D., Giannuzzi, P., Tondo, C., Di Lenarda, A., Sinagra, G., Piepoli, M.F., and Guazzi, M. 2008. Permanent Atrial Fibrillation Affects Exercise Capacity In Chronic Heart Failure Patients. *EHJ*. Vol. 29. Pp= 2367–72.
- Younis, A., Shaviv, E., Nof, E., Israel, A., Berkovitch, A., Goldenberg, I., Glikson, M., Klempfner, R., and Beinart, R. 2018. The role and outcome of cardiac rehabilitation program in patients with atrial fibrillation. *Clin Cardiol*. Vol. 41. Pp= 1170–6.
- Zielińska D, Bellwon J, Rynkiewicz A, Elkady MA. 2013. Prognostic value of the six-minute walk test in heart failure patients undergoing cardiac surgery: a literature review. *Rehabil Res Pract*. Pp= 1-5