

Case Report

The Outcome of Percutaneous Mitral Balloon Commissurotomy (PMBC) in Pregnant Women with Mitral Stenosis: An Evidence-Based Study

Luaran Komisurotomi Balon Mitral Perkutan pada Perempuan Hamil dengan Stenosis Mitral: Studi berbasis Bukti

Suskhon Djudad, Surahman Hakim, Raymond Surya, Hansens Yansah, Ali Sungkar

Department of Obstetrics and Gynecology
Faculty of Medicine Universitas Indonesia
Dr. Cipto Mangunkusumo General Hospital
Jakarta

Abstract

Objective : To review the outcome of percutaneous mitral balloon commissurotomy (PMBC) both to maternal and neonatal survivalability

Methods : The search was conducted on Pubmed®, Cochrane Library®, and Ovid® using MeSH. Critical appraisal determining the validity, importance, and applicability (VIA) was conducted by two independent authors. Pregnant women with MS with functional class grading based on NYHA

Results : Several studies showed that performing the PMBC had good outcome for pregnant women functional class based on NYHA. Most of them decreased from NYHA III/IV to I/II. For delivery outcome, all studies concluded that more than 80% pregnant women with mitral stenosis undergoing PMBC delivered at term, and no congenital anomalies found.

Conclusions : A decrease in NYHA functional class was observed after PMBC Percutaneous mitral balloon commissurotomy for pregnant women with severe MS is safe during pregnancy.

Keywords : mitral stenosis, outcome, percutaneous mitral balloon commissurotomy, pregnancy.

Abstrak

Tujuan : Mengulas luaran komisurotomi balon mitral perkutan (KBMP) baik pada maternal maupun neonatus.

Metode : Pencarian dilakukan melalui Pubmed®, Cochrane Library®, dan Ovid® menggunakan MeSH. Telaah kritis dilakukan oleh 2 penulis independen berdasarkan validitas, kepentingan, dan aplikabilitas.

Hasil : Beberapa studi memperlihatkan KBMP memiliki luaran yang baik di kalangan perempuan hamil berdasarkan kelas fungsional NYHA. Kebanyakan mereka mengalami penurunan NYHA dari III/IV menjadi I/II. Untuk luaran persalinan, seluruh studi menyimpulkan lebih dari 80% perempuan dengan mitral stenosis yang menjalani pembedahan KBMP melahirkan pada usia term dan tidak ditemukan kelainan.

Kesimpulan : KBMP aman dilakukan pada perempuan hamil dengan mitral stenosis berat.

Kata kunci : kehamilan, komisurotomibalon mitral perkutan, luaran, stenosis mitral.

Correspondence author. Suskhon Djudad, suskhon007@yahoo.com

INTRODUCTION

Normal pregnancy is associated with adaptational circulatory state including 40-50% increase in cardiac output and decrease in systemic vascular resistance.¹ The most common valvular heart lesion in child-bearing age women is Mitral Stenosis (MS).² It is associated with significant maternal and fetal morbidity and mortality.³ MS in pregnancy will cause an increase in the transmitral gradient with raised pressure in the pulmonary circulation. Thus, worsening signs of dyspnea, increase the risk of pulmonary edema and atrial fibrillation leading to thromboembolic

event. Additionally, there is also significant risk for fetal complications such as premature birth and intrauterine growth restriction.⁴

The management of severe MS can be divided into conservative, medical and surgical. All women with MS should reduce their activity and obtain β -blockers, diuretics, and anticoagulants. This regimen can reduce the New York Heart Association functional class III/IV to I/II.

Meanwhile, surgical management is indicated for patients with failure of aggressive medical therapy.⁴ Surgical commissurotomy as a choice

is relatively safe with maternal mortality rate of $\leq 2\%$, fetal mortality rate of 1.2% to 8% for closed commissurotomy.

Meanwhile, open valvotomy and extracorporeal cardiopulmonary bypass has fetal mortality rate of 15-33%.² Percutaneous mitral balloon commissurotomy (PMBC) Has become an effective alternative to surgical commissurotomy. However, the result of this intervention is still limited. Therefore, this study aims to review the outcome of PMBC both to maternal and neonatal survivalbility.

CASE

A 35-year-old woman, G4P3 with 39 weeks of gestational age came to hospital in labour. When 4 months of pregnancy, she complained continuously shortness of breath, dyspnoea on exertion (DOE), orthopnoea (OP), paroxysmal nocturnal dyspnoea (PND). There was also cough every day without fever. On physical examination, there was diastolic murmur on mitral valve and rales on both lungs. Complete blood count showed within normal limit. Electrocardiography revealed atrial fibrillation normal rapid response. Echocardiography showed left atrial dilatation, normal right atrium and ventricle, MS severe (mean PG 8, planimetry MVA 0.61, Wilkins score 10, MR mild, TR moderate, AR mild-moderate, good systolic LV function (EF 73%), hard to determine the diastolic LV function, good systolic RV function (TAPSE 20). She was diagnosed with mitral valve stenosis and undergoing PMBC. The procedure was performed on 19-20 weeks of gestational age by inserting the Inoue Balloon 24-26 mm through mitral valve to LV and running the PMBC 2 times. After procedure, the pressure gradient was around 7-8 mmHg. The clinical question is how does PMBC affect the survivalbility of pregnant woment with MS?

METHODS

To answer the clinical question, the search was conducted on Pubmed®, Cochrane Library®, and Ovid®. In PubMed, the search included keywords using the MeSH, namely "Mitral Valve Stenosis" AND "Pregnancy" AND percutaneous mitral commissurotomy. Meanwhile, in Cochrane, the MeSH descriptor consisted of [Mitral Valve Stenosis] AND [Pregnancy] AND percutaneous

mitral commissurotomy. The author used keywords of Mitral stenosis and Pregnancy and percutaneous mitral commissurotomy in Ovid. Of the searching strategy above performed in June 15th, 2018, there were 17, 0, and 26 studies in Pubmed®, Cochrane Library®, and Ovid® database; respectively. The articles were screened using the criteria consisting of abstracts answering the clinical question, written in English language, full-text paper availability, and omitting all duplication papers. After screening, there were 5 articles in appropriate to the inclusion criteria. Critical appraisal determining the validity, importance, and applicability (VIA) was conducted by 2 independent authors. The critical appraisal steps used in this article (figure 1)^{5,6}

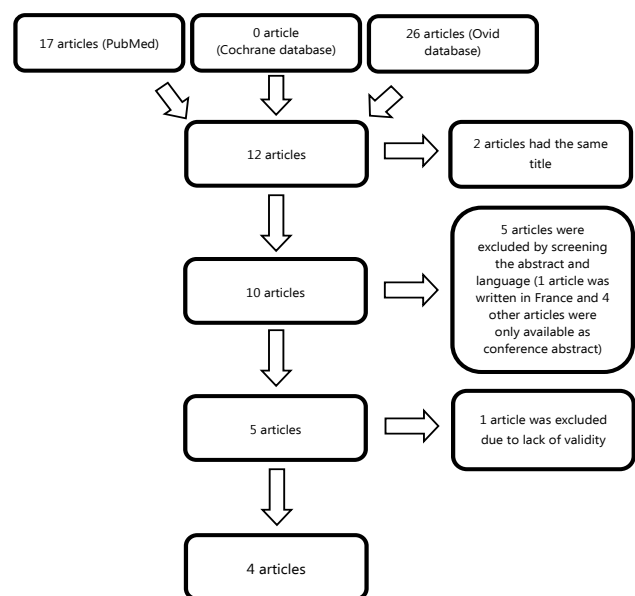


Figure 1. Flowchart of searching strategy

RESULTS

Of 5 studies appraised, all studies in appropriate with VIA criteria based on critical appraisal of prognostic study by Centre for Evidence-Based Medicine, University of Oxford, 2010. One study was considered less valid due to unclear baseline characteristics of samples. Besides, the samples underwent the PMBC was unclear. Other studies used the study samples as severe mitral stenosis not responding to standard medical therapy. Due to limited cases of severe MS in pregnancy, all studies did not run blind fashion for measuring the outcome and precision of the prognostic. Each study described the results by number of patients. Table 1 showed the result of appraisal prognostic studies.

Table 1. Result of VIA on each Prognostic Study

Study	Validity				Importance	Applicability		
	Representative sample	Sufficient follow-up	Outcome in a blind fashion	Adjustment for important prognostic factors		Results	Precision of the prognostic	Similarity of patients
Sananes, et al. ⁵	Yes (severe mitral valve stenosis refractory to optimal medical therapy)	Not clear	No	N/A	Delivery outcome 9 patients delivered at term wga 1 patient delivered preterm due to PROM 1 patient was still pregnant	N/A	Yes	Yes
Kalra, et al. ⁵	Yes (NYHA class IV and not responding to standard medical therapy of CHF)	Yes (monthly clinical and echocardiographic assessment and follow up 3 monthly intervals after that)	No	N/A	NYHA outcome All patients are in NYHA class I and no evidence of restenosis Delivery outcome 24 patients delivered at term 2 had abortion 2 patients are still pregnant	N/A	Yes	Yes
Farhat, et al. ¹	No	Yes (24 hours before and after balloon mitral commissurotomy, and four to six-month interval)	No	N/A	NYHA outcome 40 patients (91%) remain in NYHA class I 3 patients in NYHA class II 1 patient in NYHA class IV Delivery outcome 44 patients delivered at term wga (42 spontaneous and 2 cesarean section)	N/A	Yes	Yes
Abouzied, et al. ²	Yes (NYHA class III and IV; not controlled with conventional medical treatment)	Yes (every three months until delivery of infant)	No	N/A	NYHA outcome All improved to NYHA class I or II Delivery outcome 14 patients delivered 37 (2) wga 2 patients delivered (29 and 32 wga) 11 women had vaginal delivery 5 women with caesarean section	N/A	Yes	Yes
Dabrowski, et al. ⁶	Yes (symptoms of heart failure during pregnancy NYHA class III)	Yes (12-21 years)	No	N/A	No fetal congenital anomalies NYHA outcome 13 NYHA class I 2 NYHA class II Delivery outcome 12 patients delivered on time (10 spontaneous and 2 cesarean sections) 2 patients delivered prematurely (33 rd and 29 th wga) Mean AS 8.2 (2.9)	N/A	Yes	Yes

DISCUSSION

The limitation of this study was limited latest studies performed in the last 5 years. It might be due to limited MS cases in developed countries. The best recommendation study for prognostic was cohort; however, we could not find any literature related with this topic.

Mitral stenosis is the most common cause of acquired heart disease during pregnancy. Most of MS cases are caused by rheumatic heart disease.⁷ It is poorly tolerated in pregnancy due to the huge change of hemodynamic. The presence of MS in pregnancy with high cardiac output will cause an increase in left atrial and pulmonary pressure resulting in pulmonary oedema. The normal mitral orifice is 4 to 6 cm area by 2D echocardiography short axis. Patient usually complains after the valve area less than 2-2.5 cm with severe MS occurs in valve area less than 1 cm. Around 60% of moderate to severe MR cases will experience episode of pulmonary oedema in 30 weeks of gestational age. This risk will continue during and immediate postpartum period. The physiological of hypercoagulability in pregnancy in relation to increase in left atrial pressure will raise the risk of thrombus formation, atrial fibrillation (AF), and stroke.⁸

Surgical commissurotomy as management of MS during pregnancy was well-known since 1952.⁹ Closed or open mitral commissurotomy has shown to be an effective procedure during pregnancy but results in high fetal loss thus, percutaneous mitral balloon commissurotomy was an alternative effective treatment for symptomatic MS.¹⁰ Several studies showed that performing the PMBC had good outcome to pregnant women functional class based on NYHA. Most of them decreased from NYHA III/IV to I/II.^{2,3,6} It means that there would be a reduction from 6.8% mortality rate in NYHA III/IV to 0.4% in NYHA I/II.¹¹ ESC guideline for management of pregnant women with MS revealed that percutaneous mitral commissurotomy is preferably performed after 20 weeks' gestation. It should only be considered in women with NYHA class III/IV and/or estimated systolic pulmonary artery pressure (PAP) >50mmHg at echocardiography after optimal medical treatment.¹²

For delivery outcome, all studies concluded that more than 80% pregnant women with mitral stenosis undergoing PMBC delivered at term^{3,5,6} and² stated no fetal anomalies found.² It was corresponding to other studies where showed

lower incidence of preterm labor in women after percutaneous mitral commissurotomy (PMCT) before pregnancy compared with non-operated MS however¹³, there were no significant differences in mode of delivery, mean birth weight or neonatal complications. The radiation risk is balanced with the improvement of symptoms after procedure. The fluoroscopy operates in the range of 5 rads/minute and less than 20% of doses penetrate to the skin. A study measured that actual dose received by fetus will not more than 0.5 rads therefore, it is no increased risk for congenital malformation.¹⁴

Ideally, the procedure should be conducted before becoming pregnant. If MS is diagnosed in early pregnancy, the procedure should be delayed up to 12-14 weeks to minimize radiation exposure during organogenesis. The best interval time to perform is around 26 and 30 weeks to prevent complications such as preterm birth.¹⁵ Abdominal shielding is recommended during procedure. On mode of delivery, several studies above showed more vaginal delivery than caesarean section. Vaginal delivery can be offered to patients with mild MS or patients with moderate to severe MS in NYHA class I/II without pulmonary hypertension. Meanwhile, ESC guideline suggested caesarean section for patients with moderate to severe MS in NYHA class III/IV or having pulmonary hypertension in spite of medical therapy and PMCT failed to perform.¹²

CONCLUSION

Percutaneous mitral balloon commissurotomy for pregnant women with severe MS is safe during pregnancy; it decreases the NYHA for mother and imposes lower risk for preterm birth and congenital anomaly.

CONFLICT OF INTEREST

None declared

REFERENCES

1. Ben Farhat M, Gamra H, Betbout F, Maatouk F, Jarrar M, Addad F, et al. Percutaneous balloon mitral commissurotomy during pregnancy. *Heart*. 1997;77(6):564-7.
2. Abouziad AM, Al Abbady M, Al Gendy MF, Magdy A, Soliman H, Faheem F, et al. Percutaneous balloon mitral commissurotomy during pregnancy. *Angiol*. 2001;52(3):205-9.
3. Kalra GS, Arora R, Khan JA, Nigam M, Khalillullah M. Percutaneous mitral commissurotomy for severe mitral stenosis during pregnancy. *Cathet Cardiovasc Diagn*. 1994 ;33(1):28-30; discus 31.
4. Norrad RS, Salehian O. Management of severe mitral stenosis during pregnancy. *Circul*. 2011 13;124(24):2756-60.
5. Sananes S, Iung B, Vahanian A, Acar J, Salat-Baroux J, Uzan S. Fetal and obstetrical impact of percutaneous balloon mitral commissurotomy during pregnancy. *Fetal Diagn Ther*. 1994 ;9(4):218-25.
6. Dąbrowski M, Chmielak Z, Marek D, Rużyło W. Percutaneous mitral commissurotomy in pregnant women – long-term observations. 2011;1: 15
7. Roeder HA, Kuller JA, Barker PCA, James AH. Maternal valvular heart disease in pregnancy. *Obstet Gynecol Surv*. 2011 ;66(9):561-71.
8. Elkayam U, Bitar F. Valvular heart disease and pregnancy part I: native valves. *J Am Coll Cardiol*. 2005 ;46(2):223-30.
9. Aggarwal N, Suri V, Goyal A, Malhotra S, Manoj R, Dhaliwal RS. Closed mitral valvotomy in pregnancy and labor. *Int J Gynecol Obstet Off Organ Int Fed Gynecol Obstet*. 2005 ;88(2):118-21.
10. Inoue K, Owaki T, Nakamura T, Kitamura F, Miyamoto N. Clinical application of transvenous mitral commissurotomy by a new balloon catheter. *J Thorac Cardiovas Sur*. 1984;87(3):394-402.
11. Oron G, Hirsch R, Ben Haroush A, Hod M, Gilboa Y, Davidi O, et al. Pregnancy outcome in women with heart disease undergoing induction of labour. *BJOG* . 2004;111(7):669-75.
12. Care AC. ESC Guidelines on the management of cardiovascular diseases during pregnancy. *Eur Heart J*. 2011;32:3147-97.
13. Jain S, Maiti TK, Jain M. Fetomaternal outcome among women with mitral stenosis after balloon mitral valvotomy. *Int J Gynaecol Obstet Off Organ Int Fed Gynaecol Obstet*. 2013 ;121(2):119-22.
14. Gray JE. The radiation hazard--let's put it in perspective. *Mayo Clin Proc*. 1979;54(12):809-13.
15. Hameed AB, Mehra A, Rahimtoola SH. The role of catheter balloon commissurotomy for severe mitral stenosis in pregnancy. *Obstet Gynecol*. 2009 ;114(6):1336-40.