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Percutaneous Mitral Balloon Valvuloplasty: Technique and Results

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Background: Percutaneous balloon mitral valvuloplasty is a procedure used to dilate the mitral valve in cases of rheumatic mitral stenosis. The catheter is inserted into the female vein to the right atrium and atrial septum. The mitral valve is then passed through the inflated balloon to facilitate effective integration of mitral adhesions, which increases the area of the mitral valve and decreases the rate of mitral stenosis. Mitral regurgitation is a potential problem, and thus balloon percutaneous mitral valvuloplasty (PBMV) is prevented in moderate to severe relapse. The Wilkins score studies mitral valve morphology and evaluation by echocardiography to assess the viability of PBMVs based on specific echocardiographic conditions.

Conclusion: There are many factors in the immediate and long-term outcomes of patients undergoing PMV. Echo-Sc can be used in combination with other clinical and morphological predictions of PMV effects to identify patients who experience the best effects on PMV.

Keywords: Mitral stenosis; percutaneous mitral balloon valvuloplasty; mitral valve surgery.

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ABBREVIATIONS

PMC : Percutaneous mitral Commissurotomy
MR : Mitral regurgitation
SMR : Significant mitral regurgitation
MS : Mitral stenosis
MVA : Mitral valve area
NYHA: New York Heart Association
TEE : Transesophageal echocardiography
LA : Left atrial
MVA : Mitral valve area.

1. INTRODUCTION

Prior to 1984, Inoue et al described the clinical use of percutaneous mitral balloon valvuloplasty (PMBV) (or percutaneous mitral commissurotomy [PMC], percutaneous mitral valvotomy [PMV]) for patients. Stenosis (MS). Since its inception, percutaneous mitral balloon valvuloplasty has shown immediate and moderate positive effects and has replaced mitral commissurotomy as a popular MS treatment for rheumatic MS unqualified individuals (Fig. 1) [1].

1.1 Indications

American College of Cardiology/American Heart Association (ACC/AHA) guidelines. Indications for percutaneous mitral balloon valvuloplasty.

1.2 Class I Recommendations

Transthoracic echocardiography (TTE) is indicated for the diagnosis of patients with signs or symptoms of mitral stenosis (MS), hemodynamic measurements (measurement of blood pressure, mitral valve area, and pulmonary artery pressure), parallel valve ulcers, and display valve diagnosis. Goes Morphology (determination of the suitability of a mitral commissurotomy) (level of evidence: B). Transesophageal echocardiography (TEE) should be performed to assess the presence or absence of left atrial thrombus in patients undergoing percutaneous balloon mitral commissurotomy and to further assess the severity of mitral regurgitation (MI) (level of evidence: B). In the absence of left atrial thrombus or moderately severe MI, percutaneous mitral balloon commissurotomy is recommended in patients with severe symptoms of MS (Maternal Valve Area ≤ 1.5 cm2, Category D) with positive valve morphology. Level of proof: A). Percutaneous mitral balloon valvotomy applies to symptomatic patients (New York Heart Association [NYHA] Active Class II, III, or IV) with moderate or severe multiple sclerosis and valve morphology in the absence of left atrium or middle atrium percutaneous, Mitral balloon allows valvotomy, and thrombus MR (level of evidence: A) [2].

Mitral valve surgery (valve correction, commissurotomy, or inversion) is indicated in patients with severe symptoms (NYHA stage III to IV) with severe MS (mitral valve area ≤ 1.5 cm2, section D) It is not a major risk factor for surgery and it is not a risk factor. candidates for a failed anterior percutaneous mitral commissurotomy (level of evidence: B). Percutaneous balloon mitral valvotomy is effective in patients with moderate or severe MS and valve morphology in favor of percutaneous balloon mitral valvotomy with pulmonary hypertension (systolic pulmonary artery pressure> 50 mmHg at rest or> 60 mmHg deprived of exercise) left atrium or thrombus medial on severe MRI (level of evidence: C). Concomitant mitral valve surgery is indicated in patients with severe MS (mitral valve area ≤1.5 cm2, grade C or D) cardiac surgery based on other indicators (level of evidence C). Percutaneous mitral balloon commissurotomy is recommended before pregnancy in patients without severe MS symptoms (mitral valve area ≤1.5 cm2, section C) with valve morphology corresponding to percutaneous mitral balloon commissurotomy (level of evidence C) [3].

1.3 Class IIa Recommendations

Percutaneous balloon mitral valvotomy is appropriate in patients with moderate or severe MS with unresponsive calculous valves, who are in NYHA Phase III – IV operation, and cannot be operated on for surgery or at high risk (Level of Evidence: c) Percutaneous mitral balloon commissurotomy is appropriate in patients with severe MS (mitral valve area 1.0 cm, section C) and positive valve morphology in the absence of a left atrial thrombus or moderate to severe MR on MRI (level of evidence: c) Mitral valve surgery is appropriate for patients with severe symptoms (NYHA stage IV) with severe MS (mitral valve area 1.5 cm2, grade D), as long as there are other signs (eg, aortic valve disease, coronary artery disease), tricuspid regurgitation, aortic aneurysm) (level of evidence c) [4].

1.4 Class IIb Recommendations

Absence of atrial thrombus with strong MR (surface) with new atrial fibrillation in symptomatic patients with percutaneous mitral balloon commissurotomy with acute MS (mitral valve area 1.5 cm, section C) and percutaneous mitral balloon commissurotomy in valve morphology can be considered a cancellation. Evidence: c). Percutaneous mitral balloon commissurotomy may be considered in patients with symptoms of mitral valve area greater than 1.5 cm2 if there is a hemodynamically significant MS based on pulmonary artery wedge pressure 25 mmHg during exercise or mitral valve gradient 15 mmHg. (Level of evidence: c) Percutaneous mitral balloon commissurotomy may be considered in patients with severe symptoms (NYHA functional class III – IV) including acute MS (mitral valve area 1.5 cm2, category D) with low valve anatomy and Excellent for surgery. Surgery (level of evidence: C) [5].

Mitral valve surgery compatible with cardiac surgery may be considered for some parameters (level of evidence: C) in patients with MS (1.6 to 2.0 cm2). Moderate non-invasive surgery in patients with appropriate intraoperative and postoperative hemodynamic monitoring may be appropriate for patients without severe MS symptoms if the valve morphology does not match the percutaneous balloon mitral commissurotomy (level of Evidence: C) (Table 1) (Fig. 2) [6].

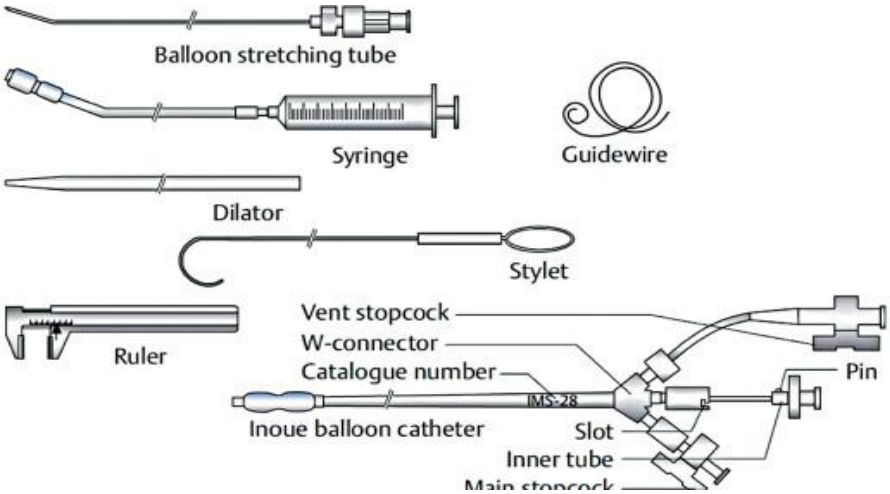

Fig. 1. Percutaneous Mitral Balloon Valvuloplasty [1]

Table 1. Wilkins score [7]

Score	Leaflet mobility	Valve thickness	Subvalvular thickening	Valvular calcification
1	Highly mobile with little restriction	Normal thickness (4- 5mm)	Minimal chordal thickening	A single area of calcification
2	Decreased mobility in midportion and base of leaflets	Midleaflet/margial thickening	Chordal thickening 1/3 up chordal length	Confined to leaflet margins
3	Forward movement of valve leaflets in diastole	Total leaflet thickening (5-8min)	Chordal thickening 2/3 up chordal lenth	Up to mid-leaflet
4	No or minimal forward movement of leaflets in diastole	Severe thickening >8min)	Complete chordal thickening to papillary muscle	Throughout most of the valve leaflets

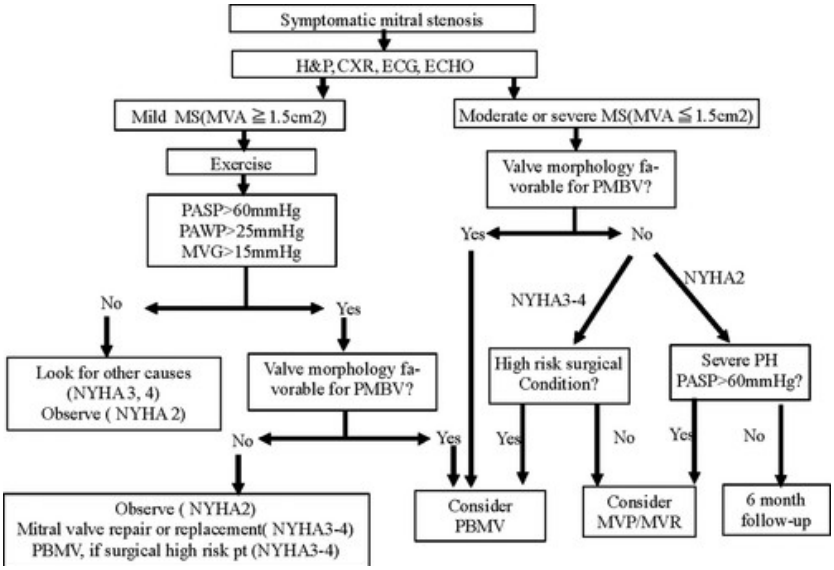

Fig. 2. Indications for Percutaneous Mitral Balloon Valvuloplasty [8]

2. CONTRAINDICATIONS

2.1 American College of Cardiology / American Heart Association (ACC/AHA) Guidelines

The controversy of percutaneous mitral valve plasticity (i.e., class III recommendations). Percutaneous mitral valve balloon resection is not indicated for patients with mild mitral stenosis (MS) (evidence level: C). Do not perform percutaneous mitral valve balloon resection in patients with severe mitral regurgitation (MR) or left atrial thrombosis (evidence level: C). It is advisable to perform transesophageal echocardiography before the procedure to determine the presence of the left atrial thrombus, with special attention to the left atrial appendage. If a blood clot is detected, 3 months of anticoagulation with warfarin may clear the blood clot. Predictive models have been proposed for the predictable resolution of left atrial thrombosis in candidates for percutaneous mitral valve resection [9].

European Society of Cardiology/European Association for Cardio-Thoracic Surgery (ESC/EACTS) guidelines. The ESC guidelines have the following contraindications for percutaneous mitral commissurotomy.

Mitral valve greater than 1.5 cm2; If the symptoms cannot be explained by another cause and if the anatomy agrees, the procedure may be considered for those with a valve location greater than 1.5 cm. 2. Presence of a left arterial thrombus, the presence of mitral regurgitation. Presence of complex. Lack of commissural fusion. The presence of severe disease is associated with the aortic valve or tricuspid stenosis of the joints that require surgery. Presence of concomitant coronary artery disease requiring bypass surgery [10].

2.2 Complications of the Procedure

The mortality of the process in most series is between 0-3%. The main causes of death are left ventricular perforations and the general condition of the patient. The frequency of active MI is between 2% and 19% in different series. Surgical evidence suggests that the problem is related to the illegal tear of the anterior or posterior tract. Also, if there are significant asymmetric commissure stones, an unspecified commissure may break, resulting in a strong MI. The frequency of atrial septum alterations after mitral valve surgery is between 10% and 90% in various series. They are usually small and limited leads. Major right-to-left transplants occur in rare cases in patients with high pulmonary hypertension and high right coronary artery disease [11].

The reported incidence of hemopericardium ranges from 0.5% to 12.0%. This problem may be due to trans-septal catheterization or a puncture of the guidewire or balloon.

In case of pericardial hemorrhage, immediate pericardiocentesis should be performed at Keith Lab to stabilize the patient's condition and allow cardiac surgical transfer. The frequency of embolic events associated with mitral valvuloplasty is between 0.5% and 5.0%. In rare cases, such events can lead to severe paralysis or even death. Because of the potential side effects of this problem, drivers need to take every precaution to prevent it from happening. The incidence of heart block is 1.5%. This is particularly temporary; In rare cases, patients need a permanent pacemaker [12].

Failure rates range from 1% to 17%. Failure can result in unpleasant anatomy (eg, severe atrial enlargement or subvalvular stenosis, or difficulty in the calculation), but most failures are usually due to atrial failure or balloon failure. , Occurs in the first part of the user's learning curve. In the right direction of the mitral valve. Restenosis after percutaneous mitral valve repair is usually defined as a loss of more than 50% of the initial gain when the valve cavity is less than 1.5 cm2. The incidence of restenosis after effective treatment ranges from 2% to 40% in various studies, and in some cases from 3 to 10 years. Depending on the anatomy, restenosis can be treated by repeating PMBV or mitral valve replacement [13].

3. METHODS (TECHNIQUE)

3.1 Double-Balloon Technique

The double-balloon method is one of the two main methods currently in use. In this way, after insertion of the transseptal catheter, a catheter with a balloon catheter develops in the left ventricle. One or two guide cords are developed by a catheter head with a balloon head and placed in the upper part of the left ventricle or gradually in the ascending aorta. Remove the catheter with the balloon-shaped head from the guide cord and enlarge the atrial septum using a peripheral angioplasty balloon (6-8 mm wide). Finally, a valvulotomy balloon (15-20 mm in diameter) is created on the directional cords and placed across the mitral valve [14].

3.2 Multitrack Technique

Bonhoeffer et al described the use of a multi-track system, which is the development of a double-balloon system using a monorail system that requires only one cable. This method allows easy expansion in the normal way. However, medical experience with multi-track systems is still limited (figure 3) [15].

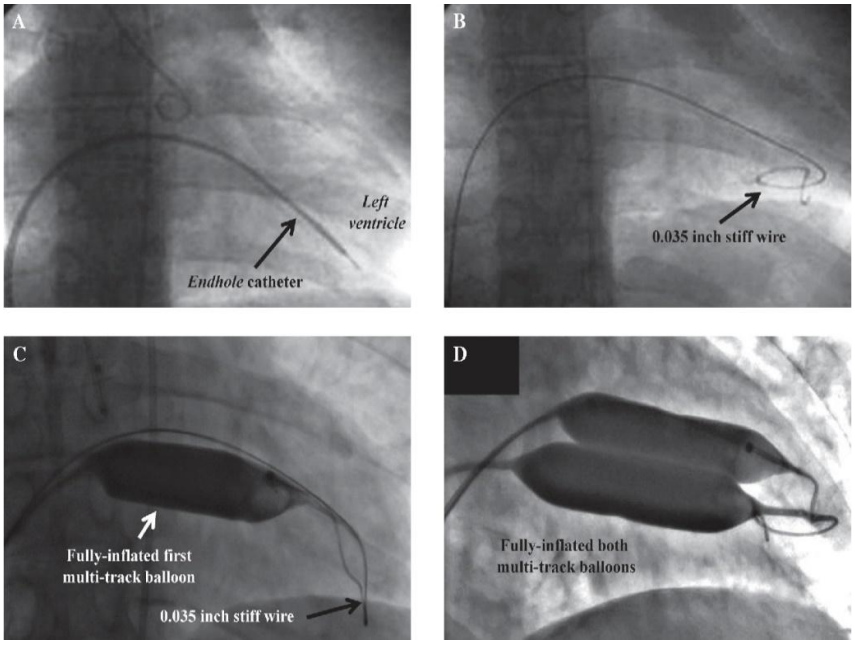

Fig. 3. Multitrack technique steps [16]

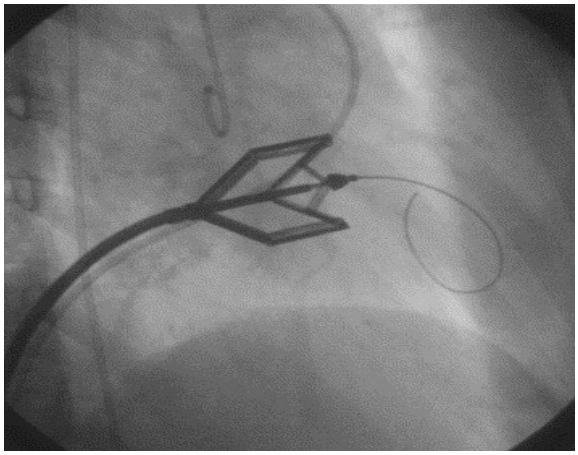

Fig. 4. Metallic commissurotomy [18]

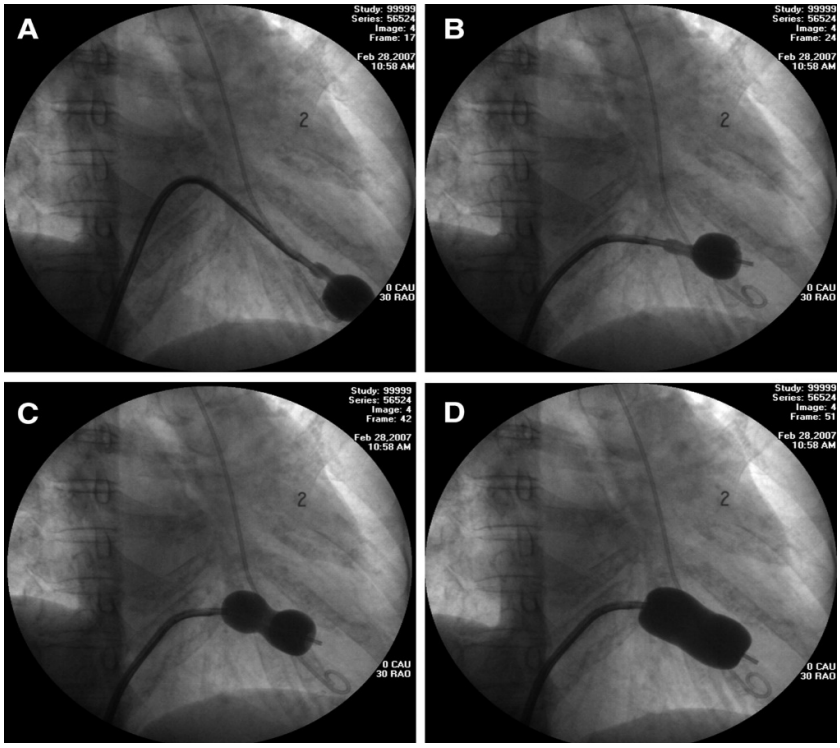

Fig. 5. Inoue Balloon Technique [20]

3.3 Metallic Commissurotomy

Cribier et al introduced a metal commissurotomy in the mid-1990s. This procedure works like a balloon commissurotomy but is more demanding on the operator than the Inoue method, and it seems that there is a higher risk of hemopericardium. It can be reused, and the potential benefit of this process is its cost-effectiveness (Fig. 4) [17].

3.4 Inoue Balloon Technique

The Inoue-Balloon Catheter is made of PVC with a balloon attached to the distal end. Between them, apply two layers of latex-containing polyester microparticles. The catheter is supplied with a diameter of 12F and a length of 70 cm; The length of each ball is 2.5 cm (Fig. 5) [19].

4. RESULTS

44/990 indicators met the inclusion process representing 6537 patients. Findings suggest that PMBV leads to a significant increase in MVA (MD = 0.81 cm2; 0.76–0.87, p <0.00001), LVEDP (MD = 1.89 mmHg; 0.52–3.26, p = 0.007), LVEDV EDV (MD = 5.8). ; 2.65–8.97, p = 0.0003) and MPG reduction (MD = −7.96 mmHg; −8.73 to 20 7.20, p <0.00001), LAP (MD = −10.09 mmHg; −0 09 </ </ <and SPAP (MD = −15.55 mmHg; −17.92 to − 13.18, p <0.00001) .In short, combined incidence of recurrent PMBV episodes, mitral valve surgery, post-PMBV MR severe, and post-PMBV stroke, and systemic thromboembolism were 0.5%, 2%, 1.4%, 0.4%, and 0.7% respectively. mitral valve, strong post-PMBV MR, and post-PMBV stroke, systemic thromboembolism were 5%, 11.5%, 5.5%, 2.7%, and 1.7% respectively [21].

5. DISCUSSION

About 40 percent of all patients with RHD are estimated to include MS and MR especially patients with severe MS who are symptoms most closely related to moderate MR. Since the simultaneous presence of moderate MR is considered a PMBV contraindication, surgery to replace the mitral valve is a common practice in these patients thus exposing them to the risks of surgical complications, infectious endocarditis, and anticoagulation. For that reason, Desabandhu et al. 2016 thought that maintaining a traditional valve with PMBV could be another safe and effective way to provide continuous symptom relief. Therefore, they compared the safety and efficacy of PMBV in patients with severe MS with moderate MR (group I, n = 17) and those with low or moderate MR (group II, n = 208). The primary safety effect (defined as a combination of cardiovascular mortality and the development of severe MR with or without the requirement of mitral valve replacement within 30 days of the procedure) showed no significant difference [2 (11.7%) in Group I vs. 8 (3.85%) in Group II, p = 0.36]; but this may be due to the small number of patients in Group I. Decreases in MR after PMBV have been reported in several reports including Palacios et al. 1989 outlining three mechanisms that may explain the decline, 1) a mitral valve that is “extended” by PMBV; 2) fibrosis and end-to-end healing of commissures, which may reduce MR due to excessive separation of commissures; and 3) the development of papillary muscle dysfunction caused by balloon trauma during PMBV. However, in many patients, the presence of intermediate mitral regurgitation should still be considered contraindicated in PMBV [22].

Patients with multiple sclerosis are 40-70% more likely to develop AF due to electrical heterogeneity and valve occlusion, and proliferation of the left and arteries due to inflammatory and fibrotic changes. Due to the process of arthritis. AF significantly blocks blood flow to the left atrial appendage and can cause thromboembolic complications such as ischemic stroke. Previous studies have reported different success rates for PMBV in AF and MS patients. In a study reported by Maatouk et al, the rapid success rate of PMBV was 195 AF pairs. The 195 patients with sinus rhythm SR were statistically similar (89.7% vs. 92.3%, respectively). However, AF patients had a 10-year lower survival rate (99.4%; 91.4 compared to p = 0.018), non-event survival (60.3 vs. 70%; p = 0.02), and resting relaxation levels. .. (40% compared to 66%; p = 0.048). Meanwhile, Alsnaba di et al. In 2016, PMBV was shown to be successful in 554 (94.7%) SR patients and 281 (67.7%) AF patients [23].

6. SUMMARY AND CONCLUSION

In conclusion, this is the first large international meta-analysis of PMBV and, despite the diversity of data; there is strong support for the development of echocardiographic variables, with mitral valve location, mitral pressure gradient, ventricular end-diastolic pressure, and volume. Repeat PMBV, short-term mitral valve surgery (repeat 6 months in the world) with generally low-level complications, including pulmonary artery pressure for more than 24 to 72 hours after PMBV, and severe MR, stroke, systemic thromboembolism, tamponade. It affects many people each year and progress in treating and preventing this condition should always be a constant goal.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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