JACC: CASE REPORTS VOL. 29, 2024

VALVULAR HEART DISEASE

CASE REPORT: CLINICAL CASE

Successful Percutaneous Mitral Balloon Commissurotomy in a Pregnant Patient With Symptomatic Severe Rheumatic Mitral Stenosis

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ABSTRACT

This paper presents a case of a pregnant woman diagnosed with severe rheumatic mitral stenosis and pulmonary hypertension at 22 weeks. Using multimodality imaging and a multidisciplinary approach, prompt percutaneous mitral balloon commissurotomy resulted in symptom relief and a pulmonary artery pressure reduction of more than 50%. (JACC Case Rep. 2024;29:102622) © 2024 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

HISTORY OF PRESENTATION

A 22-year-old woman with 22 weeks of gestational amenorrhea reported shortness of breath for 2 months, which increased as the pregnancy progressed. She had orthopnea and hemoptysis at the beginning of the 21st week of her pregnancy. There was no history of fever, pedal edema, or blood loss.

LEARNING OBJECTIVES

- To highlight the importance of timely diagnosis for safe cardiac intervention in pregnant patients with severe mitral stenosis.
- To understand the role of a multidisciplinary team-based approach for good fetal and maternal outcomes.
- To illustrate that the high-risk PMBC can still be performed safely during pregnancy with acceptable risk when the benefits far outweigh the risks

Her antenatal checkups revealed normal baseline work-up and neonatal scanning. On examination, she was vitally stable; auscultation revealed bilateral crepitation at the bases of her lungs and a loud S_1 and P2 with a grade III mid-diastolic murmur at the apex.

PAST MEDICAL HISTORY

No significant prior medical history.

DIFFERENTIAL DIAGNOSIS

Our differential diagnosis includes mitral stenosis (MS) with pulmonary hypertension, primary pulmonary hypertension, bronchitis, and pulmonary embolism.

INVESTIGATIONS

Electrocardiography revealed normal sinus rhythm with evidence of left atrial (LA) enlargement. The laboratory examination revealed a hemoglobin level

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

Manuscript received April 19, 2024; revised manuscript received May 31, 2024, accepted June 4, 2024.

ISSN 2666-0849 https://doi.org/10.1016/j.jaccas.2024.102622

ABBREVIATIONS AND ACRONYMS

AML = anterior mitral leaflet

LA = left atrial

LV = left ventricle

MR = mitral regurgitation

MS = mitral stenosis

MVA = mitral valve area

MVR = mitral valve replacement

PASP = pulmonary artery systolic pressure

PMBC = percutaneous mitral balloon commissurotomy

of 10.2 mg/dL, a total leukocyte count of 6 × 10^9/L, and platelets of 239 × 10^9/L. Kidney function was likewise normal. Transthoracic echocardiography revealed a thickened mitral valve with restricted mobility of the posterior mitral leaflet and diastolic doming of the anterior mitral leaflet (AML), resulting in severe MS and mild mitral regurgitation (MR) (**Figure 1**, Videos 1 and 2). Both mitral commissures were fused, and mitral valve area (MVA) by planimetry was 0.5 cm^2 (**Figure 2**, Video 3) and MVA by pressure half-time was 0.8 cm^2 (**Figure 3**), with a mean pressure gradient of 27 mm Hg across the mitral valve at a heart rate of 92 beats/min (**Figure 4**), along with normal biventricular function. The rest of the valves were minimally thickened with normal mobility, but there was severe regurgitation at the tricuspid valve with pulmonary artery systolic pressure (PASP) of 130 mm Hg. The findings were suggestive of very severe rheumatic MS with severe pulmonary hypertension (**Figure 5**, Video 4).

MANAGEMENT

She was admitted to a tertiary cardiac care facility and treated with careful diuresis and low-dose beta-blockers; her symptoms improved slightly, but she still had blood-tinged frothy sputum. Despite having procedural challenges due to thickened leaflets and shortened chordae, the cardiac structural interventionist proceeded with the procedure with some modifications in the technique. Additionally, severe pulmonary hypertension at baseline secondary to severe MS was the primary motivator for this high-risk percutaneous mitral balloon commissurotomy (PMBC). We anticipated a reduction in the severity of tricuspid regurgitation postprocedure, which would lead to a decrease in PASP.

Because the patient had suprasystemic pulmonary pressures, the multidisciplinary team, which included a cardiac physician, an obstetrician, a cardiac imaging expert, and a cardiac structural interventionist, agreed on PMBC because continuing her pregnancy with such significant MS and high pulmonary pressure could result in fetal and maternal morbidity and mortality.

Prior to the PMBC, transesophageal echocardiography revealed severe rheumatic MS with mild MR (Video 5) and no thrombus in the left atrium or LA appendage. She was immediately sent to the catheterization laboratory for PMBC after the transesophageal echocardiography. She was vitally stable, and abdominal shielding was used throughout the procedure. After all aseptic measures, right femoral venous approach with local anesthesia was used. Invasive pressure monitoring of the cardiac chambers showed left ventricular (LV) systolic pressure of 100 mm Hg, LA mean pressure gradient of 40 mm Hg, and LV-LA pressure gradient of 29 mm Hg. Invasive PASP before the PMBC was 100 mm Hg that reduced to 75 mm Hg after ballooning the mitral valve. The calculated size of her Inoue balloon for PMBC was 26 mm, but we used an undersized balloon to reduce the risk of complications, starting with 22 mm and then 24 mm. After fluoroscopic-guided transseptal puncture PMBC was done with Inoue balloon technique (Videos 6 and 7), the LA mean pressure gradient decreased to 20 mm Hg, and the LV-LA pressure gradient was 8 mm Hg, with no increase in MR.

Postprocedural transthoracic echocardiography revealed normal biventricular function, MVA = 1.2 cm^2 with open medial commissure (Video 8), mean pressure gradient across mitral valve = 12 mm Hg, and mild MR (**Figures 6 and 7**, Video 9). There was a considerable decline in PASP after PMBC, and tricuspid regurgitation was moderate (Video 10), with a PASP of 65 mm Hg (**Figure 8**). She remained hemodynamically stable 24 hours after the procedure, with no complications, remarkable alleviation of her symptoms, and marked improvement in echocardiographic parameters (**Figure 9**). She was discharged after 48 hours with the continuation of beta-blockers and diuretics.

FIGURE 1 2-Dimensional Transthoracic Echocardiography

Parasternal long axis view showing diastolic doming of the anterior mitral leaflet with both leaflets thickened.

DISCUSSION

Rheumatic MS is the most frequent cardiovascular disease that causes complications during pregnancy in low-income nations. Significant hemodynamic alterations and increased cardiac output have negative effects throughout pregnancy and can lead to symptoms increasing by 30 weeks' gestation, during labor, and after delivery.[1]

PMBC, mitral valve commissurotomy (open or closed), or mitral valve replacement (MVR) are options for symptomatic MS that do not improve with medical treatment. Advances in management over time have included a move away from open surgery and toward minimally invasive procedures like PMBC. Its hospital death rate has been demonstrated to be significantly lower than that of MVR, and its event-free survival is comparable.[2-4]

PMBC is now deemed as a preferable alternative to open mitral surgery in patients with symptomatic severe MS with MVA ≤1.5 cm^2, NYHA functional class II to IV, favorable valve anatomy devoid of commissural calcification, no or mild MR, and no LA thrombus.[5]

In addition, it surpassed MVR in the therapy of pregnant patients with severe MS. PMBC should be performed in the second trimester to avoid radiation exposure in the first trimester. The radiation received during the procedure is 0.2 rads, which is significantly lower than the 5 rads recommended for safety.[6] The major consequences of PMBC include severe MR, stroke, systemic embolism, and cardiac tamponade. Pregnant patients with PMBC had a similar risk of perinatal mortality and premature labor when compared with healthy control patients.[7]

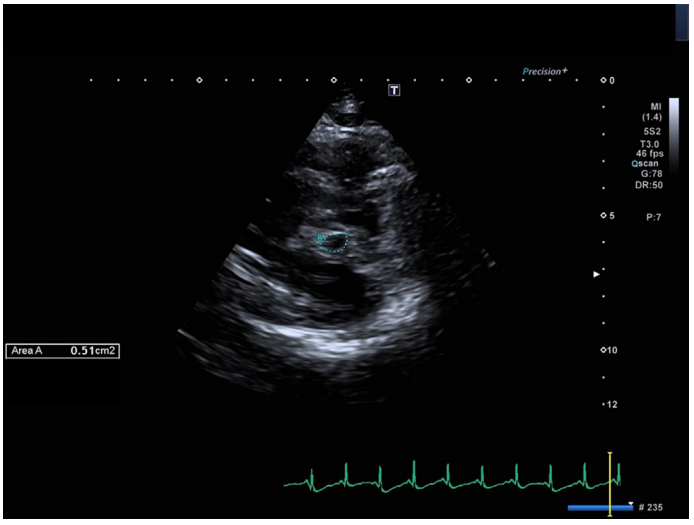
Echocardiography is the preferred test for determining the pattern of valvular involvement and degree of calcification, the severity of stenosis, coexistent MR, other valve lesions, and atrial chamber dilatation and function.[8] A Doppler investigation can then be used to determine the degree of stenosis and evidence of pulmonary hypertension. Pregnancy-related critical MS causes significant problems for both the mother and fetus.[9]

For patients with MS who are pregnant, PMBC has a 97% success rate. Significant improvements were observed in the postprocedural NYHA functional class, MVA, transmitral pressure gradient, and LA pressure.[10]

FOLLOW-UP

After 2 weeks, she visited the cardiac obstetric clinic; her functional class had improved significantly, with no hemoptysis or cough, and her antenatal scan was normal. She experienced no complications after the procedure and recovered without any issues.

FIGURE 2 Short-Axis View at the Mitral Valve Level Showing Planimetry of the Mitral Valve Area



CONCLUSIONS

This case study illustrates the prompt identification and well-thought-out treatment of a pregnant woman with severe pulmonary hypertension and critical MS.

FIGURE 3 Prepercutaneous Mitral Balloon Commissurotomy Mitral Valve Area by Pressure Half-Time

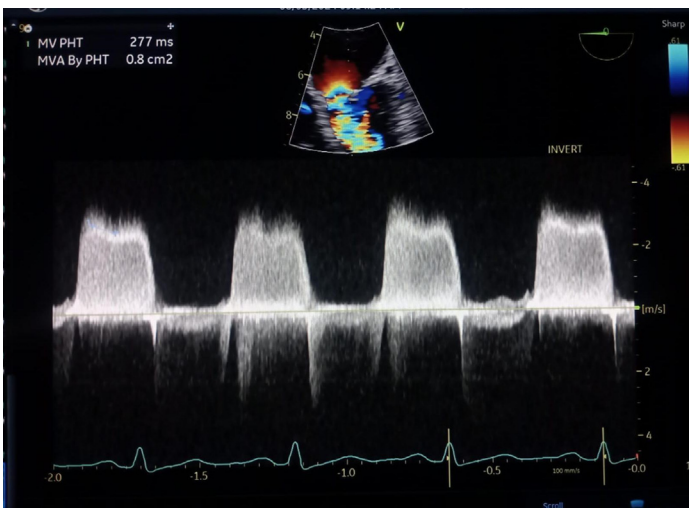


FIGURE 4 Continuous-Wave Doppler Across the Mitral Valve Showing Increased Gradients

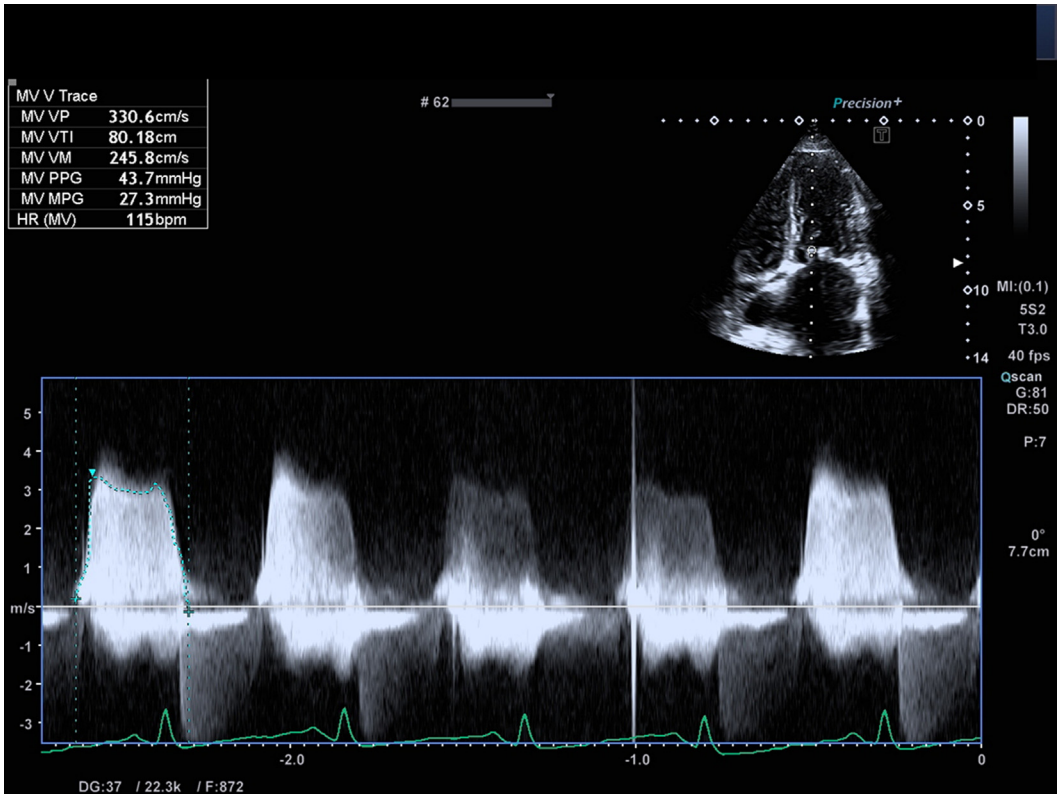


FIGURE 5 Continuous-Wave Doppler Across Tricuspid Valve Showing Increased Peak Gradient

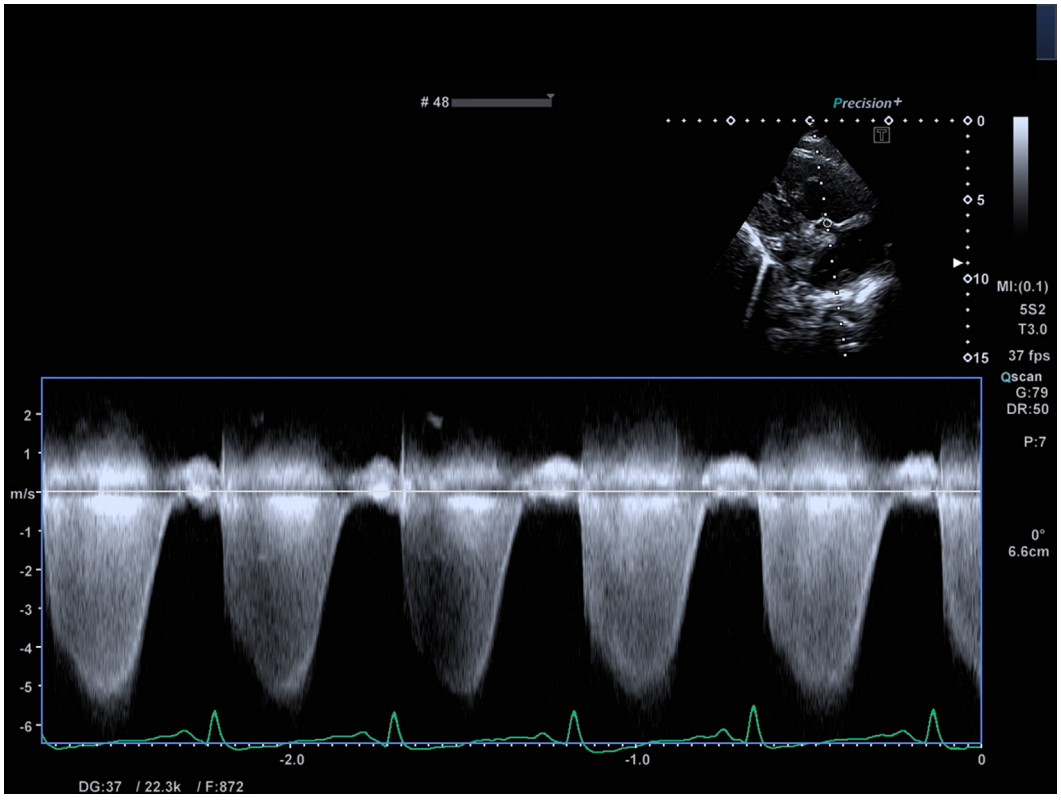


FIGURE 6 Decreased Gradients Across the Mitral Valve Postpercutaneous Mitral Balloon Commissurotomy

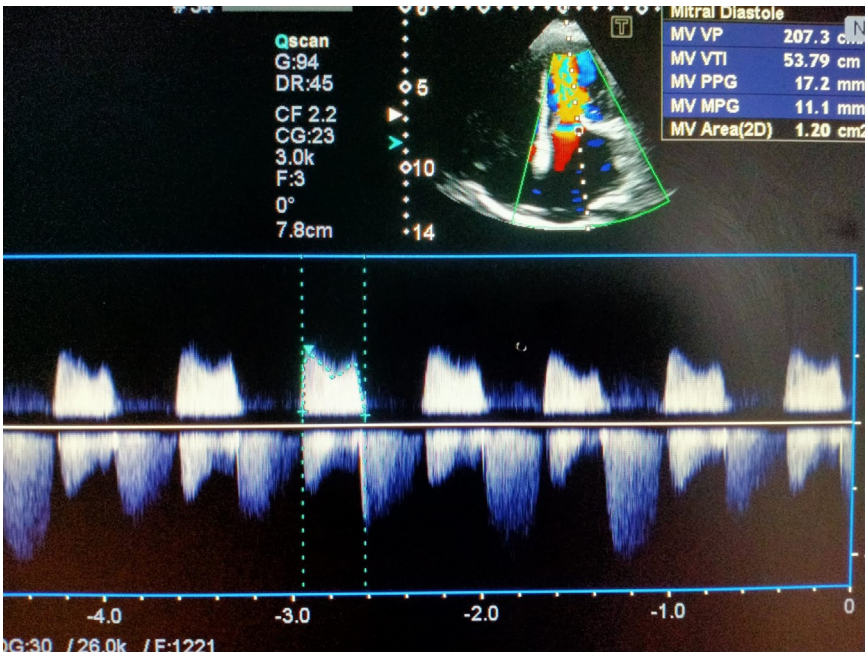
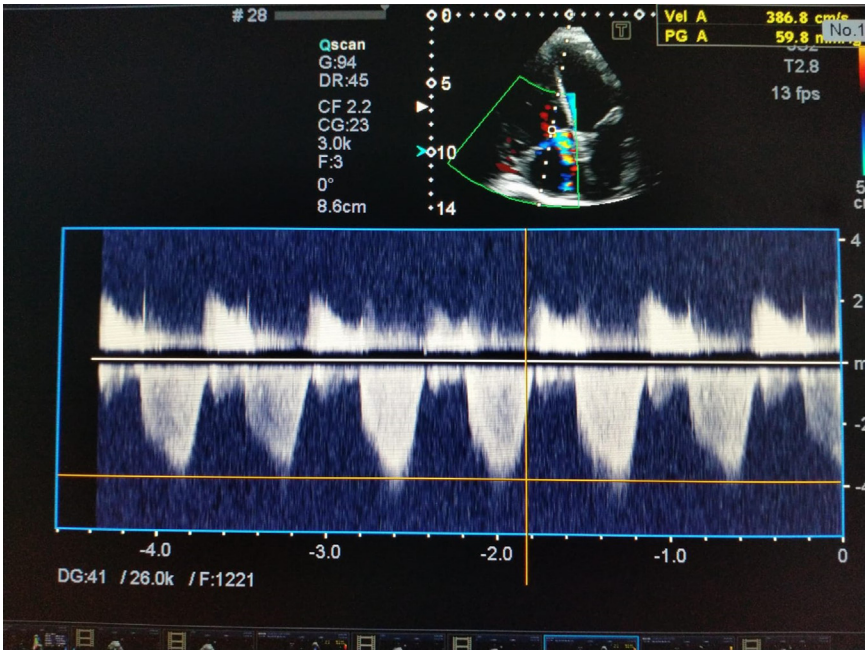


FIGURE 7 Increased Mitral Valve Area Postpercutaneous Mitral Balloon Commissurotomy

FIGURE 8 Decreased Pulmonary Artery Systolic Pressure Postpercutaneous Mitral Balloon Commissurotomy



In this complicated clinical circumstance, PMBC proved to be a safe and successful intervention that improved outcomes for both the mother and fetus, in addition to facilitating symptom relief. This positive result emphasizes how crucial it is to use a multidisciplinary team that includes cardiologists, obstetricians, and interventionists to manage the delicate balance between the health of the fetus and the mother.

FUNDING SUPPORT AND AUTHOR DISCLOSURES

The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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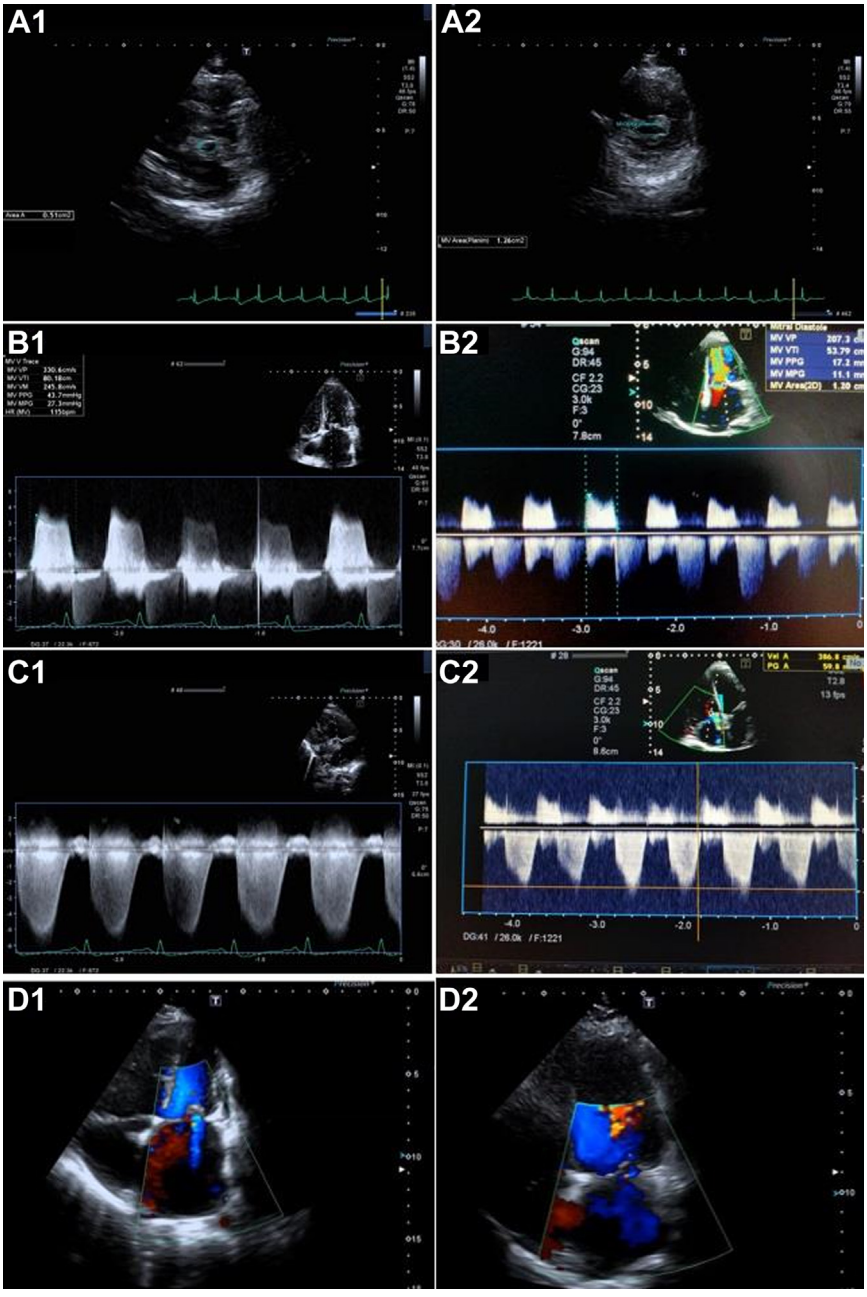
FIGURE 9 **Pre- and Post-Procedure Echocardiographic Parameters**



Pre (A1, B1, C1, D1) and post (A2, B2, C2, D2) procedure echocardiographic parameters demonstrating good percutaneous mitral balloon commissurotomy outcome.

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KEY WORDS **percutaneous mitral balloon commissurotomy, pregnancy, pulmonary hypertension, rheumatic mitral stenosis**

APPENDIX **For supplemental videos, please see the online version of this paper.**