

# Successful balloon valvuloplasty of rheumatic mitral valve stenosis in a pregnant patient without fluoroscopy: a case report

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## Introduction

Rheumatic mitral stenosis (MS) is the most common rheumatic heart disease that complicates pregnancy. Percutaneous transvenous mitral commissurotomy (PTMC) has become the first-choice treatment, but is routinely performed with fluoroscopic guidance, which bears risks from ionizing radiation for the embryo when performed in pregnant patients.

## Case presentation

A pregnant patient was referred to our department for therapy of severe MS after she suffered from cerebral artery infarction. The patient underwent successful PTMC under exclusive echocardiographic imaging and showed stable results throughout the pregnancy. The patient showed an improvement in functional capacity from dyspnoea New York Heart Association (NYHA) III to I and delivered a healthy child without any complications.

## Discussion

This case shows that PTMC of MS under exclusive echocardiography guidance without fluoroscopy is feasible and appears to be safe without causing radiation damage to the embryo.

## Keywords

Case report • Rheumatic mitral stenosis • Pregnancy • PTMC • Valvuloplasty

## Learning points

- Percutaneous transvenous mitral commissurotomy (PTMC) under exclusive transoesophageal echocardiography guidance without fluoroscopy is feasible and appears to be safe without causing radiation damage to the embryo.
- This approach seems to be appropriate for patients in need of PTMC during the vulnerable phases of pregnancy.

## Introduction

Rheumatic heart disease is rare in developed countries, but common in the rest of the world with more than 15.6 million cases worldwide.<sup>1</sup> Rheumatic mitral stenosis (MS) is the most frequent rheumatic heart disease that complicates pregnancy. It is often first diagnosed during

pregnancy and occurs even in patients who were asymptomatic before.

Percutaneous transvenous mitral commissurotomy (PTMC) has become the treatment of first choice for MS and is favoured over surgical therapy,<sup>2</sup> but when performed under fluoroscopic guidance it holds carcinogenic and non-carcinogenic risks from ionizing radiation for the embryo.

## Timeline

Day	Events
1	Patient arrives with acute right-sided hemiparesis in the emergency room Cerebral computer tomography is performed: left cerebral artery infarction Diagnosis of pregnancy (6th gestational week) In-patient treatment in the Department for Neurology
4	Echocardiography performed: Diagnosis of severe rheumatic mitral stenosis
8	Referral to Department of Cardiology
9	Percutaneous transvenous mitral commissurotomy is performed under 3D transoesophageal echocardiography guidance only
11	Discharge of patient

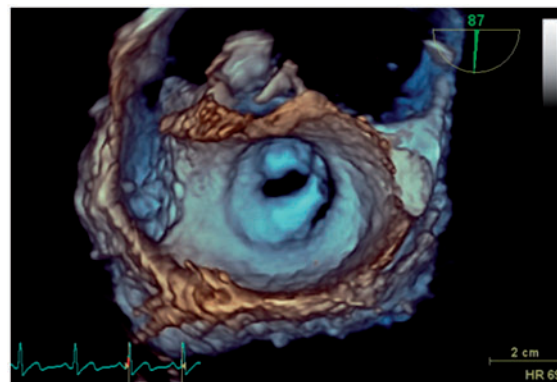
## Case presentation

We present the case of a 39-year-old pregnant patient (160 cm; 62 kg; body mass index 24.22 kg/m<sup>2</sup>) who suffered from middle left partial cerebral artery infarction. Pregnancy was first detected in the emergency room by blood test, but cranial computer tomography was performed in the emergency condition. Aspirin was started immediately after diagnosis of cerebral infarction. The patient reported dyspnoea classified as New York Heart Association (NYHA) III. During the diagnostic workup echocardiography revealed severe MS, consequently the stroke was interpreted as cardio-embolic and anticoagulation was started. Electrocardiogram showed a sinus rhythm and rhythm monitoring revealed no evidence of atrial arrhythmia.

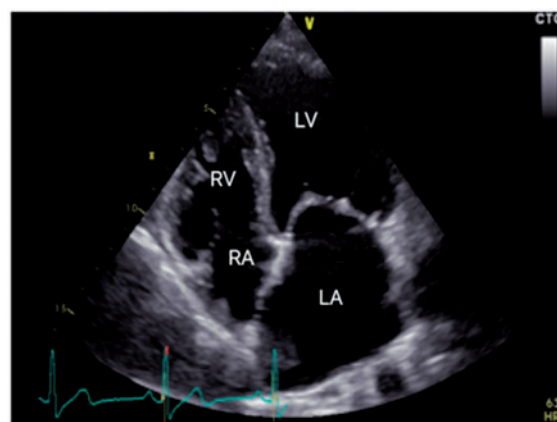
In physical examination the patient presented regular rate and rhythm with a loud S1 and a mid-diastolic murmur with a point of maximal impulse at 5th left intercostal space in midclavicular line.

When referred to our department to evaluate further treatment options, the gestational age (GA) was 6 weeks and the patient still showed right-sided hypaesthesia, hypalgesia and mild hemiparesis as residual deficits. Transthoracic echocardiography (TTE) and transoesophageal echocardiography (TOE) confirmed the severe rheumatic MS with doming of the anterior mitral leaflet and a mitral valvular area (MVA) of 0.79 cm<sup>2</sup> assessed in TOE by planimetry (Figure 1). The mean gradient (Pmean) was 15.9 mmHg, the left atrium showed a dilatation of 47 mm without thrombus (TTE, Figure 2). Valve anatomy was suitable for PTMC, corresponding to a Wilkins score of 6.<sup>2,3</sup> Systolic pulmonary pressure was not increased (26 mmHg), left ventricular function was good.

The case was discussed within our local heart team and the specialists for radiology, neurology, and gynaecology. All members agreed the predicted deterioration over the course of pregnancy, when due to physiological haemodynamic changes the increased cardiac output raises the transmitral gradient and left atrial pressure. Interventional therapy was indicated due to the distinctive symptoms and PTMC was considered to be the best treatment option. The procedure was planned with TOE-guidance only, but X-ray protective



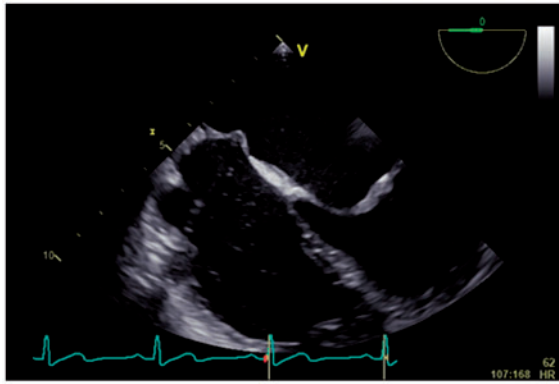
**Figure 1** 3D transoesophageal echocardiography before valvuloplasty. Mitral valve area was 0.79 cm<sup>2</sup> by planimetry.



**Figure 2** Apical four chamber view with severe dilatation of the left atrium.

aprons were used to protect the uterus in case of needed fluoroscopy.

PTMC was performed under general anaesthesia. Heparin was used with an ACT >250 s during the whole procedure. After right venous femoral access, a SL-1 wire (St. Jude Medical, Minnesota, USA) was introduced to the superior vena cava. The sheath was advanced over the wire and trans-septal puncture was successfully performed (Figure 3). After trans-septal access was established, an Inoue 28 mm balloon (Toray Inc., Japan, Tokyo) was positioned in the mitral valve and single dilatation was performed under 3D-TOE guidance (Figure 4). The Pmean decreased from 14 to 8 mmHg and MVA increased from 0.7 to 1.3 cm<sup>2</sup> (Figure 5). A new mild mitral regurgitation (MR) was observed and the procedure was terminated with sufficient reduction of the transvalvular gradient. No fluoroscopy was necessary during the procedure. The patient was discharged on the 2nd day after the procedure. No complication was observed during the hospital stay. Pre-discharge TTE confirmed a moderate MS (Pmean 6 mmHg, MVA 1.3 cm<sup>2</sup>) and mild MR (VC 4 mm). The patient



**Figure 3** Successful transseptal puncture was performed under transoesophageal echocardiography guidance.



**Figure 4** Inoue 28 mm balloon is positioned in the mitral valve under 3D transoesophageal echocardiography guidance.

had a high risk for thromboembolic events and received full-dose low molecular weight heparin (LMWH) twice daily during the first trimester, while the use of Vitamin K antagonist (VKA) was advised for the second and third trimester and then indefinitely after pregnancy.

Follow-up consultations including TTE were performed every 2 months. Pmean and MVA remained stable during the whole follow-up period. The MR was still mild and left ventricular ejection fraction (LVEF) was normal. During the second trimester, when loading conditions are the greatest, the patient negated limitations of physical activity (NYHA I) and echocardiography showed stable results with a Pmean of 9 mmHg and MVA of 1.3 cm<sup>2</sup>. The pregnancy as well as the

delivery proceeded without any complications. Residual neurological deficits were still present but regressive.

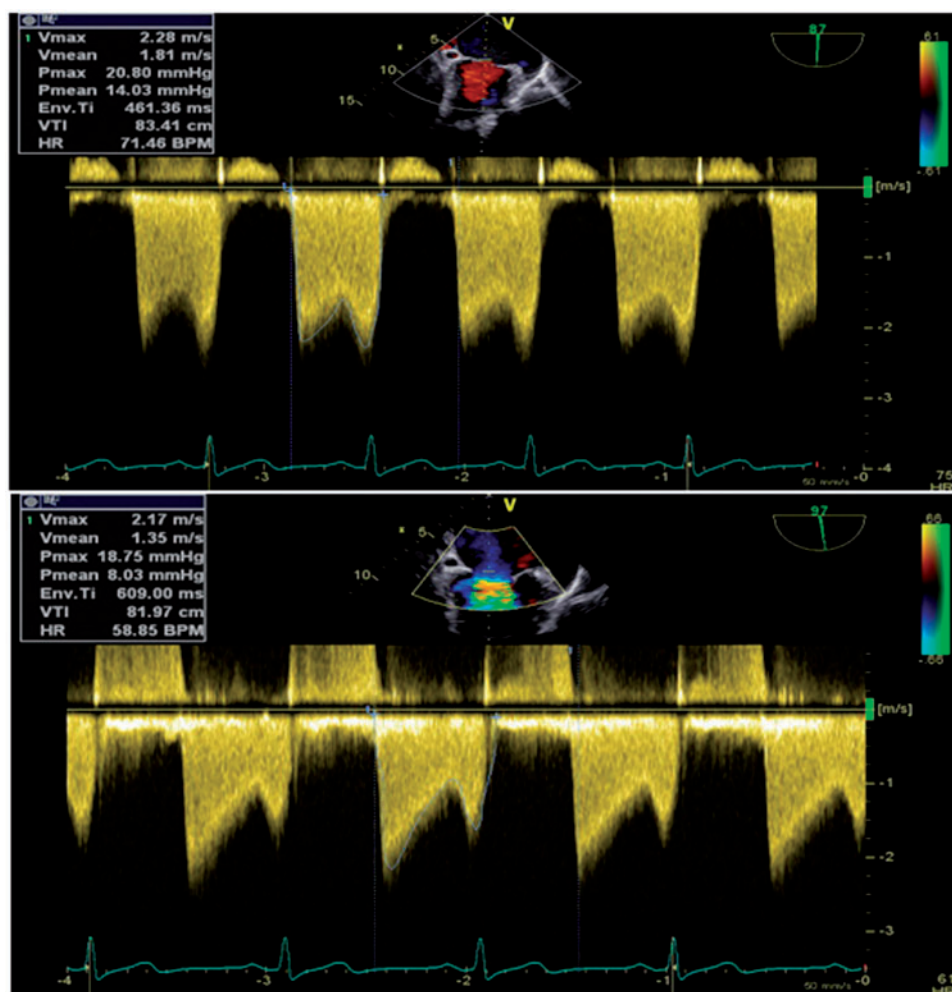
## Discussion

PTMC has demonstrated good immediate and midterm results and is favoured over open surgery.<sup>2</sup> PTMC during pregnancy has a maternal mortality rate of less than 2% and the foetal mortality rates range between 1% and 8%, while open surgery has a foetal mortality rate of up to 40% and a maternal mortality of 13%.<sup>4,5</sup> PTMC holds a class I recommendation for patients, who are not pregnant and a class IIa recommendation for pregnant patients presenting with severe MS with favourable valve morphology in the current ESC guidelines.<sup>2,6</sup> Patients with severe or moderate MS should be treated before pregnancy to avoid high-risk pregnancies.<sup>2</sup> In case of pregnancy, PTMC is preferably performed after the 20th gestational week. Despite this, we performed PTMC in the 6th gestational week because the patient was highly symptomatic and consequently the risk of worsening was high.

The risk for the embryo from ionizing radiation depends on the GA and dose. Growth restriction and intellectual disability are common non-cancer effects and are observed when the foetal radiation exposure exceeds 0.05 Gy.<sup>7</sup> In addition, childhood cancer can occur with an incidence of 1–6%, when a dose of 0.05–0.5 Gy is applied.<sup>8</sup> Radiation exposure of 25.3 Gy cm<sup>2</sup> for PTMC is known, but specific exposure on the foetus has never been studied.<sup>9</sup> Another case series observed no radiation injuries after a mean follow-up of 28 months after PTMC,<sup>10</sup> but the sequelae of radiation may occur later. One work about PTMC under exclusive TOE-guidance showed higher complication rates.<sup>11</sup> Aware of these potential dangers, it was our aim to minimize radiation exposure to the foetus.

Current ESC guidelines on valvular heart disease and cardiovascular disease during pregnancy recommend the use of VKA in patients with moderate to severe MS and atrial fibrillation (AF).<sup>2,12</sup> Even patients with moderate to severe MS and sinus rhythm with a history of a prior systemic embolic event or left atrial thrombus are given a class I recommendation for VKA.<sup>2,12</sup> The efficacy of novel oral anticoagulants (NOACs) in reducing thromboembolism in patients with rheumatic mitral valvular AF has not been directly evaluated and consequently the use is not recommended.<sup>2</sup> For patients with MS during pregnancy, heparin/LMWH or Warfarin (if a dose of 5 mg daily is not exceeded) should be preferred in the first trimester, VKA in the second and third trimester and heparin/LMWH in the peripartum period.<sup>6,13</sup> Increased rates of thromboembolic events were described under heparin, while embryonic loss, embryopathy and bleeding were observed under VKA.<sup>14</sup> Therefore, we recommended indefinite anticoagulation with VKA in our patient with a prior stroke, although PTMC reduced the MS from severe to moderate and the patient was in sinus rhythm.

Cardiologists are used to operating with fluoroscopy in addition to echocardiography. Since only TOE was used, more attention was needed for orientation during trans-septal puncture and positioning of the balloon. Intracardiac echocardiography (ICE) could have been a potent alternative or addition to TOE. ICE showed to be a safe alternative in a case series of 20 patients, but was not used in this case.<sup>15</sup> TOE including 3D-TOE was sufficient for a successful procedure in this case.



**Figure 5** CW Doppler echocardiography before (above) and after (below) valvuloplasty. The mean gradient was reduced from 14 to 8 mmHg.

This case shows that PTMC of MS under exclusive TOE-guidance without fluoroscopy is feasible and seems to be safe to avoid potential radiation damage to the embryo. This approach seems to be appropriate for patients in need of PTMC during the vulnerable phases of pregnancy, but has to be prepared carefully by a team of cardiologists including interventionalists and echocardiographers as well as heart surgeons, gynaecologists, radiologists, and neurologists.

**Consent:** The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

**Conflict of interest:** none declared.

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