CASE REPORT

Accura balloon rupture during percutaneous trans-septal mitral commissurotomy: a rare and potentially fatal complication

Vivek Singla, Soumya Patra, Shivanand Patil, Rangaraj Ramalingam

Department of Cardiology,
Sri Jayadeva Institute of
Cardiovascular Sciences &
Research, Bangalore,
Karnataka, India

Correspondence to
Dr Vivek Singla,
drviveksingla98@gmail.com

SUMMARY

Percutaneous transseptal mitral commissurotomy (PTMC) is the treatment of choice in rheumatic mitral stenosis. The reuse of sterilised PTMC balloon catheters is widely practised to bring down the procedure cost and have proven safety and efficacy. The reused balloons may deform and are prone to rupture causing fatal complications like embolism either of the torn balloon material or air. We report a first case of Accura balloon rupture during PTMC to the best of our knowledge. Fortunately, there was no complication in our patient. Thus, during the balloon preparation it should be examined for any deformity or tear and air should be removed completely to prevent fatal outcome. The repeated use of the hardware should be limited and an informed consent regarding the possible complications of the reused hardware should be taken.

BACKGROUND

In developing countries, including India, rheumatic heart disease remains a major health concern, and is associated with increased morbidity and mortality.¹ Percutaneous transseptal mitral commissurotomy (PTMC) is the treatment of choice for selected patients with symptomatic rheumatic mitral stenosis (MS). Though the Inoue balloon is the most commonly used device for performing PTMC, Accura balloon which is as effective, but a cheaper alternative is used frequently. The reuse of sterilised balloon is widely practised, particularly in developing countries to bring down the cost of the procedure. The safety of the resterilized hardware for PTMC is reported.¹⁻² The reused balloons may deform and are prone to rupture. The rupture of the balloon during PTMC is a rare complication and is reported with Inoue balloon.³⁻⁶ The rupture of the Accura balloon is not reported in the literature to the best of our knowledge. We report a case of Accura balloon rupture during PTMC due to tear in both the inner and outer layer. This case report is an eye-opener and is the reminder of the lesion that preparation of the balloon should be meticulous.

CASE PRESENTATION

A 30-year-old man presented with dyspnoea on exertion (New York Heart Association functional class II) of 6 months duration. On examination, the jugular venous pressure was raised with prominent 'A' wave and regular pulse. Cardiac auscultation

revealed long mid-diastolic murmur with presystolic accentuation.

INVESTIGATIONS

Routine blood investigations were normal. Transthoracic echocardiography confirmed severe rheumatic MS with mitral valve (MV) orifice area of 0.8 cm², mean transmitral gradient of 24 mm Hg and peak pulmonary arterial pressure of 60 mm Hg. The MV morphology was suitable for percutaneous mitral commissurotomy.

TREATMENT

After informed written consent, the patient was taken for PTMC. After successful transseptal puncture using Brockenbrough needle-Mullin sheath assembly, 0.025 inch coiled guidewire was inserted into the left atrium (LA). A prechecked, slenderised 26 mm Accura balloon catheter (Vascular concepts, UK) was inserted over the wire in the LA and was crossed across the MV using a J-shaped stylet. The balloon was inflated with the 1:4 diluted contrast-saline mixtures at 26 mm volume. The distal segment of the balloon inflated first (figure 1A) followed by the proximal segment (figure 1B) after which the balloon suddenly collapsed and caved in (see online supplementary Video 1 and figure 1C). After inserting the coiled guidewire in LA, the ruptured balloon was removed. There was a rupture of the distal segment of the balloon (figure 2).

OUTCOME AND FOLLOW-UP

The PTMC was completed successfully using another balloon. Fortunately, there were no complications like air embolism, cardiac perforation despite tear in both the layers of Accura balloon.

DISCUSSION

PTMC, first introduced by Inoue *et al.* (1984), is the first line of treatment for selected patients of rheumatic MS.² PTMC has proven efficacy and safety, but the cost of the catheter is a limitation especially in developing countries like India. Owing to lower cost and similar proven safety and efficacy, the Accura balloon is increasingly being used as the preferred choice over Inoue balloon.¹⁻²

Both the Accura and Inoue balloon catheters are made from polyvinyl chloride with a balloon attached to the distal end. The trilayered balloon has a nylon micromesh layer sandwiched between the two latex layers. Unlike the Accura balloon, the Inoue balloon has an additional vent in the balloon

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Figure 1 Sequential inflation of Accura balloon distal segment (A) followed by proximal segment (B) and collapsed distal segment (C) of Accura balloon after rupture.

lumen and two small holes on the outer latex layer.⁷ The vent is to remove the air during the preparation. The holes are intended to prevent deflation failure. The blood can enter the space between the latex layers and can get embedded in the mesh layer, which is difficult to be cleaned during resterilisation. This may be one of the factors contributing to the rupture of the Inoue balloon. The balloons are usually sterilised using glutaraldehyde solution. The use of ethylene oxide for sterilisation is associated with increased wear and tear. The balloons are compliant and volume driven. It is known that Accura balloon can deliver more stable and higher pressures when the balloon is inflated within the stated diameter range.⁷ The mesh regulates the balloon diameter, shape, the inner pressure and resist the rupture of the balloon.² The breakage of the mesh is responsible for the abnormal balloon inflation. In the developing countries where the cost of the procedure is an important issue, the reuse of the balloon is almost necessary to reduce cost of the procedure.

The studies had shown that Accura balloons can be reused safely and effectively to reduce the cost of the procedure.^{1 2} The prevalence of balloon rupture was 0.4–4.5% with double-balloon technique.⁴ Although there are a few published reports of rupture (0.4%) of the Inoue balloon,^{3–6} there is no report of rupture of the Accura balloon in the literature. A higher (20%) than usual incidence is reported when Inoue balloons are reused.⁸ Balloon rupture during interventional procedures could occur owing to accidental or intentional use of high inflation pressures, abrasive effect of calcified MV, avulsing effect to balloon while squeezing through narrowed orifice or it can be due to suboptimal quality or fatigue of the nylon-rubber mesh

layer.⁴ The distal segment of Accura balloon being the most compliant inflates first, followed by the proximal and finally the middle segment. The rent in the inner layer of the distal segment does not change the order of inflation. In our case, there might be tear or abnormality in the distal segment of the balloon leading to the normal sequence of inflation. The luminal pressure remains about 2–3 atmosphere for initial two-third of inflation and increases to 4 atmosphere during the last couple of millimetres of inflation.² This explains the occurrence of balloon rupture at full inflation as in our case.

The rupture of the balloon may get complicated with air embolism, embolisation of torn latex and cardiac perforation.⁴ Fortunately, in our case, there was no complication. It is therefore important to be aware of the vulnerability of the Accura balloons to rupture, especially when reused to prevent the potential complications such as air embolism which can prove fatal. During the preparation, the balloon should be checked for abnormal shape or tear and meticulous care should be taken to completely remove the air from the balloon.

Learning points

- ▶ Percutaneous trans-septal mitral commissurotomy (PTMC) is the mainstay of treatment in selected patients with rheumatic mitral stenosis.
- ▶ PTMC balloon can be reused safely and effectively to bring down the cost of the procedure.
- ▶ The reused Accura balloon may rarely rupture and may lead to serious complications.
- ▶ The preparation of the balloon should be meticulous and every attempt should be made to remove the air completely.
- ▶ The reuse of the balloon should be limited and informed consent regarding the possible balloon rupture and associated complications should be taken.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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Figure 2 Ruptured distal segment of Accura balloon.

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