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Case Report

Transjugular balloon mitral valvotomy in a patient with severe kyphoscoliosis

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ABSTRACT

Balloon mitral valvotomy (BMV) performed by the conventional transfemoral approach can be difficult or even impossible in the presence of structural impediments such as severe kyphoscoliosis, gross cardiac anatomic distortion and inferior vena caval anomalies. A 25-year-old woman with severe thoracolumbar kyphoscoliosis due to poliomyelitis presented with symptomatic rheumatic mitral valve stenosis. After the failure of transfemoral BMV, the procedure was attempted from the right jugular access, using a modified septal puncture technique. The left atrium was entered from the jugular access and the mitral valve was crossed and dilated successfully using over the wire balloon technique. Transjugular BMV is an effective alternative in patients with kyphoscoliotic spine that preclude transfemoral approach. The detailed technique used for the procedure, its advantages as well as the other percutaneous treatment options are also discussed.

1. Introduction

Balloon mitral valvotomy (BMV) is well-established as the standard of care for treatment of rheumatic mitral stenosis with suitable valve morphology. However, in situations such as grossly distorted cardiac anatomy, abnormalities of the inferior vena cava and severe kyphoscoliosis, successful completion of the BMV procedure using the conventional transfemoral approach may not be possible due to technical difficulties, especially when performing transseptal puncture and during delivery of the valvuloplasty balloon across the mitral valve. A jugular venous transseptal approach provides a more direct approach to the mitral valve and can help in overcoming many of the anatomical impediments encountered when using a transfemoral approach.[1] We report a case where transfemoral BMV could not be performed because of severe thoracolumbar kyphoscoliosis; however, the transjugular approach allowed successful completion of the procedure.

2. Case report

A 25-year-old woman presented with complaints of progressive exertional dyspnea and palpitations for the past 2 years, and was currently in New York Heart Association functional class II. She became paraplegic at the age of 4 years when she had paralytic poliomyelitis, and has been wheelchair-bound since then. Physical examination showed severe thoracolumbar kyphoscoliosis, lower motor neuron paralysis of both lower limbs and severe muscle wasting. An apical mid-diastolic

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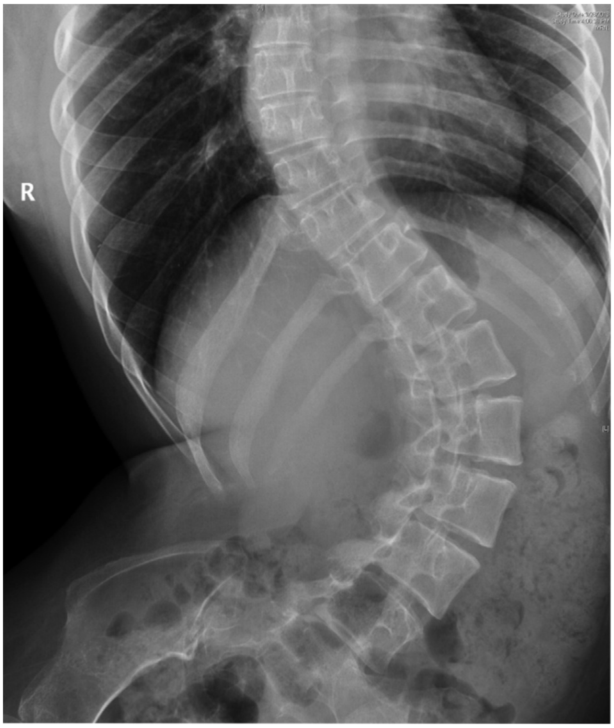

Fig. 1 – Plain X-ray of the thoracolumbar spine taken in anteroposterior view showing severe scoliosis.

murmur and a loud opening snap were heard on auscultation over the precordium. Severe scoliotic deformity of the thoracolumbar spine was seen on plain radiography (Fig. 1). The electrocardiogram showed sinus rhythm and left atrial enlargement. Echocardiography revealed the presence of severe rheumatic mitral stenosis, with Wilkins mitral valve score[2] of 7, without mitral regurgitation, indicating suitability for BMV. Other investigations, including blood tests, were unremarkable. The risks and benefits of open surgery and percutaneous valvuloplasty were discussed with the patient, including the anticipated technical difficulty of performing transfemoral BMV in this case; the patient opted for percutaneous valvuloplasty.

After obtaining written informed consent and under mild sedation, BMV was attempted using conventional femoral venous access. However, atrial septal puncture could not be successfully performed due to the gross spinal deformity which made manipulation of the transseptal needle difficult and proper engagement of the septum at the optimal location impossible even with increased curvature of the needle; the femoral approach therefore had to be abandoned. It was then decided to attempt BMV using jugular venous approach. As described previously,[1,3] the right internal jugular vein was cannulated percutaneously and a Berman angiographic catheter (Arrow, Reading, PA, USA) was positioned in the right pulmonary artery. A 5-French pigtail catheter introduced from right radial access was positioned in the non-coronary aortic sinus to serve as a landmark during transjugular septal puncture. Pulmonary angiography in 45° right anterior oblique projection was performed to obtain a levophase image of the left atrium (Fig. 2A). In this view the atrial septum is viewed *en face*, and there is maximal separation between the anteriorly located ascending aorta and the posterior heart border. Septal puncture was performed using a pediatric transseptal needle (Cook, Bloomington, IN, USA) introduced through a short 5F catheter placed in the right atrium. The optimal site of transjugular septal puncture (Fig. 2A) is higher than that for transfemoral BMV – it is superior to the fossa ovalis, about 2 cm (one vertebral body height) below the upper border of the left atrium and midway between the aorta anteriorly and the anterior border of the spine posteriorly. After confirming needle entry into the left atrium, the 5F catheter is advanced over the needle into the left atrium, and the needle is removed. A curved 0.025-in. guidewire (Toray, Woodlands, TX, USA) was introduced into the left atrium through the 5F catheter and the patient was heparinized. The skin and atrial septal puncture sites were dilated using a 14 French dilator. A 20-cm-long 14 French J-shaped sheath with hemostatic valve (Cook) was advanced into the left atrium over the 0.025-in. guidewire (Fig. 2B). The mitral valve was crossed from the left atrium using a balloon floatation catheter (Arrow), after which left atrial and left ventricular pressures were recorded simultaneously; a mean mitral valve gradient of 22 mmHg was recorded, indicating severe mitral stenosis. A 0.035-in. Amplatz guidewire with 3 cm soft J-tip (Cook) was positioned

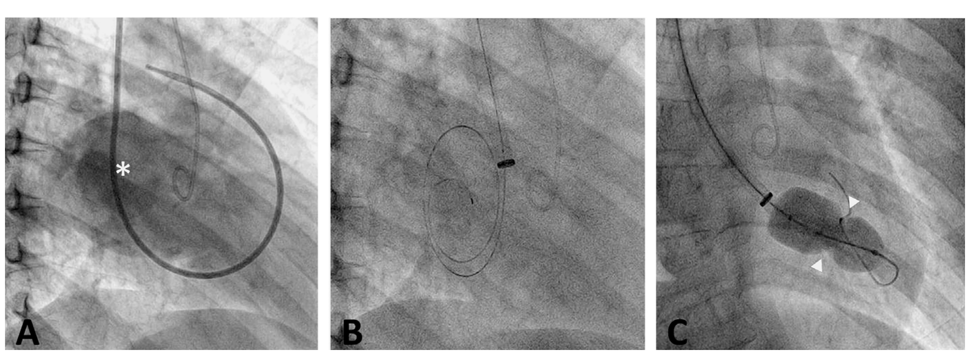

Fig. 2 – (A) Levophase of pulmonary angiogram in right anterior oblique projection outlining the left atrium; the optimal site for transjugular septal puncture is marked by an asterisk. (B) A 14F 30-cm-long jugular sheath has been advanced into the left atrium over a curved wire. (C) Transjugular mitral valvuloplasty using an over-the-wire balloon; arrowheads mark the indentation produced on the balloon by the stenotic mitral valve.

at the left ventricular apex. Mitral valvuloplasty was performed (Fig. 2C) using a 24 mm × 40 mm Jomiva balloon (Numed, Hopkinton, NY, USA) which has a 11-French 100-cm-long catheter shaft. This reduced the mean mitral valve gradient to 3 mmHg. The transjugular part of the procedure was completed in 53 min. Post-procedure echocardiography revealed an increase in mitral valve area from 0.7 cm^2 to 1.8 cm^2, albeit with the development of moderate mitral regurgitation that was well tolerated by the patient. The patient's symptoms improved to New York Heart Association functional class I, which was sustained at 6-month follow-up.

3. Discussion

Gross kyphoscoliosis can be a serious impediment to successful transfemoral septal puncture. In this situation the transseptal needle may not engage the atrial septum despite increasing its curvature and manipulation of the needle to orient it appropriately may be impossible. A search of the literature revealed only two reports, by Ramasamy et al.[4] and Lau et al.,[5] of BMV being performed in the presence of severe kyphoscoliotic spinal deformity; these patients underwent transfemoral BMV successfully, although with major adjustments to the technique such as making the patient lie in a semi-recumbent position during the procedure. However, aggressive hardware manipulation in difficult anatomic situations is best avoided as it could increase the risk of complications.

Alternative approaches that can be used for mitral valvuloplasty are retrograde transarterial, transhepatic and transjugular. The retrograde transarterial approach[6] is technically demanding, needs specialized hardware that may not be readily available and may require lengthening of the balloon catheter shaft. The transhepatic approach[7] needs hepatic puncture at a site sequestered by the rib cage and not externally visible; percutaneous closure of this access is required at the end of the procedure, failure of which could lead to difficult-to-control intra-peritoneal bleeding. Both these approaches would have been difficult in our patient due to the presence of severe kyphoscoliosis. On the other hand, the jugular approach[2,4] is not affected by the presence of thoracolumbar kyphoscoliosis as the route from the right internal jugular vein to the atrial septum is short and direct; this enabled successful completion of BMV in our case without much difficulty. Achieving hemostasis at the jugular venous access site is simple, and requires only manual compression for a few minutes, which can be made even shorter by making the patient sit up.

In addition to technical feasibility in anatomically difficult cases, transjugular BMV offers some other advantages.[1,3] Septal puncture for transjugular BMV is performed above the fossa ovalis and the limbic ledge; this results in a smaller residual left-to-right shunt as in this location the septal tissue is thicker and tends to recoil more than the thin fossa ovalis septum. Another advantage is that since the left atrium is traversed in superior–inferior direction (Fig. 2B and C), inadvertent entry into the left atrial appendage is less likely and the potential for embolic complications is therefore lower; also, crossing the mitral valve is easier as the jugular method offers an almost straight-line approach to the mitral valve and the crossing catheter does not have to bend over backwards as in the femoral approach. Early ambulation is another advantage, as the groin is not used for large diameter percutaneous access. In a large series of 1407 patients, who underwent BMV, the jugular approach was used in 130 patients and the outcome, in terms of both efficacy and safety, compared favorably with the femoral approach.[8]

A limitation of the transjugular approach is difficulty in performing septal puncture when the left atrium is small; in this situation the right atrial aspect of the septum faces inferiorly, and the transseptal needle tends to slide down the septum without puncturing it. On the other hand, when the left atrium is large and the atrial septum bulges toward the right, the jugular transseptal needle is more likely to engage the atrial septum perpendicularly and puncture it at the desired location. Other limitations of the transjugular approach to BMV are the unfamiliarity of most operators with this technique and the necessity of appropriate hardware that may not be readily available.[8]

Jugular approach to BMV may be used as the first line approach in certain conditions other than spinal deformities such as dextrocardia, inferior venacaval anomalies and also in patients with giant left atrium due to advanced rheumatic mitral valve disease, all of which make transfemoral approach technically demanding. Further, this can be useful in patients, in whom, initial transfemoral BMV was unsuccessful.[1]

4. Conclusion

Transjugular BMV is an effective alternative in patients with kyphoscoliotic spine deformities that preclude transfemoral BMV. Familiarity with transjugular BMV can prove handy to the interventionist whenever anatomical impediments make transfemoral BMV difficult.

Informed consent

Informed consent was obtained from the patient for the procedure as well as for possible publication.

Conflicts of interest

The authors have none to declare.

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