Transjugular Approach as a Challenging Access in PTMC: Case Report

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Advantage of transjugular approach in percutaneous mitral commissurotomy (PTMC) of severe mitral stenotic patients with venous drainage anomalies was obtained as the authors’ first case experience. This approach should be considered whenever difficulties are encountered in the femoral approach in PTMC case before valve surgery.

Keywords: Transjugular Approach, PTMC

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Percutaneous mitral commissurotomy (PTMC) has been approved as a standard treatment in patients with severe rheumatic mitral stenosis with suitable valve score[1-2]. The results are comparable to surgical commissurotomy in acutely relieving the obstructed valve and maintaining a favorable outcome[2-7]. The majority of cases undergo the procedure successfully using traditional transfemoral approach. However, in some rare cases, venous drainage abnormalities or cardiac anatomic disorientation, either congenital or acquired, may cause impediments to successful completion of the procedure. In such cases, Transjugular venous approach is highly considered as a challenging alternative way to complete the procedure instead of valve surgery.

Case Report

A 24- year- old man presented with a 2 year history of dyspnea on exertion and was in the New York Heart Association (NYHA) functional class II. He denied any history of palpitation, syncope, fever, arthralgia, hemoptysis or embolic phenomenon. His past medical history was unremarkable. He was referred to the authors’ institute as a candidate for PTMC.

On physical examination, the blood pressure was 110/80mmHg, the pulse 80/min and regular, and respirations 18/min. His height was 157 cm and his weight was 45 kg. The jugular venous pressure was elevated up to the angle of the jaw. There were no carotid bruits. The chest had diffuse bronchial breath sounds. Nondisplaced apical beat and a right ventricular lift with palpable P2 were noted. Cardiac auscultation disclosed an accentuated S1, a loud P2 and a grade 3/6 low pitched rumbling near diastolic murmur at the apex with the opening snap. Trivial pitting edema in lower extremities was noticed. The electrocardiogram showed sinus tachycardia, right axis deviation, right atrial enlargement, right ventricular hypertrophy with strain and left atrial enlargement and the chest X-ray revealed mild cardiomegaly. Transthoracic echocardiography disclosed features of severe mitral stenosis (valve area of 0.51 cm²) with enlarged left atrium, right atrium and right ventricle and a favorable valve score of 8. No left atrial thrombus was seen.

PTMC via traditional femoral approach was scheduled. Right heart catheterization disclosed an accidental finding of anomalous venous drainage system (Fig. 1). Venogram also confirmed that the left inferior vena cava drained directly into the azygos vein which connected to the superior vena cava, running to the right atrium, the right ventricle and the pulmonary artery consecutively (Fig. 2).

After discussion, the patient preferred PTMC via transjugular approach to mitral valve surgery. The
procedure was performed under local anesthesia. Right heart catheterization and oximetry run were obtained using the right internal jugular vein. A pulmonary angiogram was performed in 45 degree RAO (right anterior oblique) projection with levophase imaging of the left atrium to as a roadmap during septal puncture (Fig. 3). A 6 French pigtail catheter was positioned in the aortic sinus via the right femoral artery as a landmark during transseptal puncture.

Transjugular septal puncture

An 8 French Mullin transseptal sheath was introduced into the right atrium. The levophase left atrium image was kept for ready reference. Using Brockenbrough needle, the site of the puncture was 2 cm below the roof of the left atrium and midway between imaginary vertical lines passing through the pigtail catheter tip at the aortic valve and the anterior border of the thoracic spine viewed in the 45 degree RAO view.

After confirming needle entry in the left atrium using contrast media injection and contrast bubble appearance in the left atrium, a curved 0.025 inch (Toray) wire was introduced into the left atrium followed by heparinization. The skin entry site and septum were dilated using a 14 french long dilator. Transesophageal echocardiography guidance was utilized during septal puncture (Fig. 4).

Mitral valve dilation

Inoue balloon was introduced into the left atrium. The balloon could not cross the valve orifice after several attempts. Predilatation using a single Mansfield balloon (20mm) was done with valve area of 1.23 cm² after inflation (Fig. 5). The curved 0.025 guide wire was introduced into the left ventricle via sheath with hemostatic valve. The Inoue balloon was introduced along the guide wire into the left ventricle. Mitral valve dilation was performed successfully by using a single inflation of balloon size 26 mm (Fig. 6).

Hemodynamic and echocardiographic results are presented in Table 1. The postprocedural MVA was 2.32 cm² by 2D planimetry with separation of both valve commissures. The patient underwent the procedure without complications and was discharged the following day in good condition. The excellent result was still maintained at one year follow-up.

Discussion

The incidence of venous drainage anomalies in adults is unknown. However, anomalies of the
inferior vena cava (IVC), interrupted IVC with azygos continuation, has been reported in about 3% of children with congenital heart disease. Mostly, the IVC below the level of the renal veins is normal but the hepatic portion of the IVC is absent. Instead of receiving the hepatic venous and entering the right atrium, the IVC drains via an enlarged azygos system into the right superior vena cava and eventually to the right atrium. The hepatic veins connect directly to the right atrium (Fig. 7A).

In the present patient, the lower end of the right IVC was absent and the left IVC drained through the right-sided azygos system (Fig. 7D). This type of IVC abnormalities is extremely rare and creates...
Table 1. Hemodynamic data pre and post PTMC

<table>
<thead>
<tr>
<th>Hemodynamic Data</th>
<th>Pre PBMV</th>
<th>Post PBMV</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAPWP (mmHg)</td>
<td>29</td>
<td>9</td>
</tr>
<tr>
<td>PAWP (mmHg)</td>
<td>77/35/49</td>
<td>36/16/24</td>
</tr>
<tr>
<td>MLAAP (mmHg)</td>
<td>30/42/36</td>
<td>10/10/7</td>
</tr>
<tr>
<td>MTAMVG (mmHg)</td>
<td>27</td>
<td>6</td>
</tr>
<tr>
<td>LVEDP (mmHg)</td>
<td>117/1/7</td>
<td>111/1/7</td>
</tr>
<tr>
<td>MRAAP (mmHg)</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>MVA (area)</td>
<td>0.5</td>
<td>1.5</td>
</tr>
<tr>
<td>MVA (area)</td>
<td>0.51</td>
<td>2.32</td>
</tr>
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difficulties during cardiac catheterization and precludes completion of intervention via transfemoral approach.

Transjugular approach in PTMC has been reported in a limited number of cases worldwide. The idea was generated to overcome some limitations of traditional transfemoral approach caused by venous drainage anomalies, failure to septal puncture (due to severe anatomical distortion of the huge left atrium from long standing suffering of disease) or even in failure of mitral valve crossing because of inappropriate septal puncture site.

When compared to the femoral venous approach, the jugular approach provides a more direct route to the mitral valve, without catheters having to bend over backward to cross the mitral valve. Dependence of procedural complexity and outcome on the site of septal puncture selected is considerably reduced by the jugular approach as long as high septum is punctured. Mitral valve crossing is consistently simple and quick.

In this severe mitral stenotic case, the patient had rare venous drainage anomalies and enlarged left atrium possibly from a long standing history of more than 2 years. Large left atrium is an important factor to determine outcome of PTMC. PTMC via transjugular approach was an attractive way to overcome both of these limitations instead of mitral valve surgery. Apart from its excellent results, PTMC is inherently much less traumatic, inflicting no unsightly thoracotomy scar, does not require general anesthesia or blood transfusion and entails a shorter hospital stay.

Transfemoral and transjugular PTMC complement each other well. Transfemoral approach is appropriate for patients who do not have significant anatomical distortion. Conversely, transjugular septal puncture is quite difficult to do if the left atrium is small or if the septum dose not bulge toward the right atrium. In this anatomical distortion, transjugular approach should be a better option.

The authors’ first experience in transjugular septal puncture faced some difficulty because a conventional septal set in transfemoral approach was used. The traditional equipment of puncture and balloon catheter is too long and unwieldy for the transjugular PTMC. Much shorter 30 cm-long catheter will make the procedure easier while reducing the working field considerably. In some reports, pediatric transseptal set and increased curvature given to needle were chosen and could achieve a good result.

Transesophageal echocardiography guidance was
utilized during septal puncture as the tradition to prevent serious complications\(^{(12)}\). The authors used both a single balloon and Inoue balloon dilation and they worked well together.

Expanding utility of transjugular approach has been reported in balloon pulmonary valvuloplasty in difficult cases when failure to cross the pulmonary valve from the femoral vein or in elective cases\(^{(13)}\). Even in cases of concurrent mitral-aortic and mitral-tricuspid balloon valvuloplasty, transjugular approach were performed successfully\(^{(14)}\). Up to now, transjugular approach should be classified as an alternative approach, not as a routine approach, in some specific groups of PTMC. The safety and efficacy of this approach need to be established in larger studies. Operators working closer to the X-ray source is the disadvantage of the transjugular approach. As with other interventional skill, going through a learning phase is really a key factor in successful performance. However, with further refinement of this technique and appropriate equipment, transjugular approach has a potential to be performed more frequently in the future.

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References

การขยายลิ้นหัวใจไมตรัลโดยใช้หลอดเลือดดำ Internal jugular vein

บุญจง แซ่จึง, สุดารัตน์ ตันสุภสวัสดิกุล, เอนก แก่งศิรินทัย, เงี้ยงไกร เรืองศิริ, จิรธน์ อัศวหาญฤทธิ์, อรรถพร แจ่มแคนสุวรรณ

การขยายลิ้นหัวใจไมตรัล (percutaneous mitral commissurotomy) ถือเป็นวิธีการรักษาลิ้นหัวใจบุกบุกด้วยการฉีกหรือมีดออกจากกระดูกที่มีมาตรฐานเทียบเคียงการผ่าตัดใหญ่ (surgical commissurotomy) โดยส่วนใหญ่ หลอดเลือดดำ femoral vein เป็นหลอดเลือดดำที่นิยมใช้ในการใส่อุปกรณ์เพื่อมอบน้ำผักผันหัวใจห้อง (interatrial septum) และขยายลิ้นหัวใจ

บทความนี้เป็นการรายงานผู้ป่วยลิ้นหัวใจไมตรัลระดับรุนแรงที่มีภาวะความผิดปกติแต่กันเนื่องจากหลอดเลือดดำ inferior vena cava คู่ขาถูกหลอดเลือดดำ azygos vein ถูกระบบหลอดเลือดดำเข้าสู่ห้องหัวใจ (right atrium) ทำให้ไม่สามารถใช้หลอดเลือดดำ femoral vein ในภาวะขยายลิ้นหัวใจได้ พบว่าการใช้หลอดเลือดดำ internal jugular vein แทนในการทำหัตถการ ก่อให้เกิดประสิทธิภาพในการรักษาและปลอดภัยโดยผู้ป่วยไม่ต้องได้รับการผ่าตัดใหญ่ จึงเป็นอีกทางเลือกหนึ่งในการรักษาผู้ป่วยที่มีปัญหาหลอดเลือดดำซึ่งบวกของการมีดปกติ