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 excertion 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 nearly holodiastolic 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 cm^2) 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

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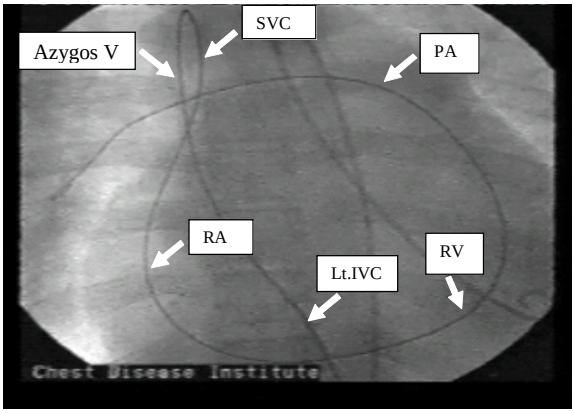

Fig. 1 Guide wire placing from the left inferior vena cava, the azygos vein ,the superior vena cava, the right atrium, the right ventricular, the main pulmonary artery to the right pulmonary artery: the pigtail catheter placing from the aorta to the left ventricle

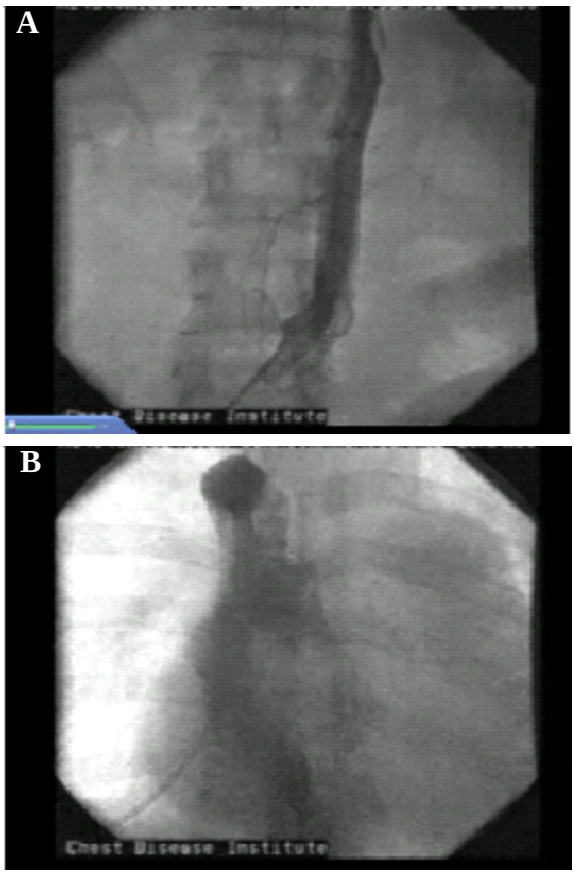

Fig. 2 (A) Venogram showing the left Inferior vena cava at the lumbar level. (B) Higher up, the left inferior vena cava continues as the azygos vein that drains in to the superior vena cava

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 pigtal 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 referance. 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[8].

After confirming needle entry in the left atrium using contrast media injection and contrast bubble apperance 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 cm^2 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 Table1. The postprocedural MVA was 2.32 cm^2 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.

Disscussion

The incidence of venous drainage anomalies in adults is unknown. However, anomalies of the

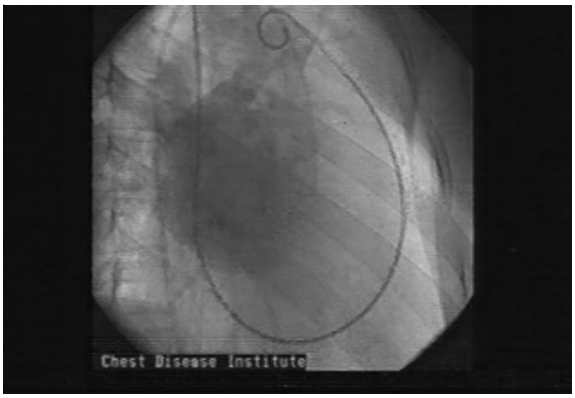

Fig. 3 Pulmonary angiogram showing levophase of the left atruim in 45° RAO view as a reference in septal puncture

Fig. 4 Transesophageal echocardiography guidance showing the tip of the needle in the left atrium: The shaft of the needle placing in the superior vena cava

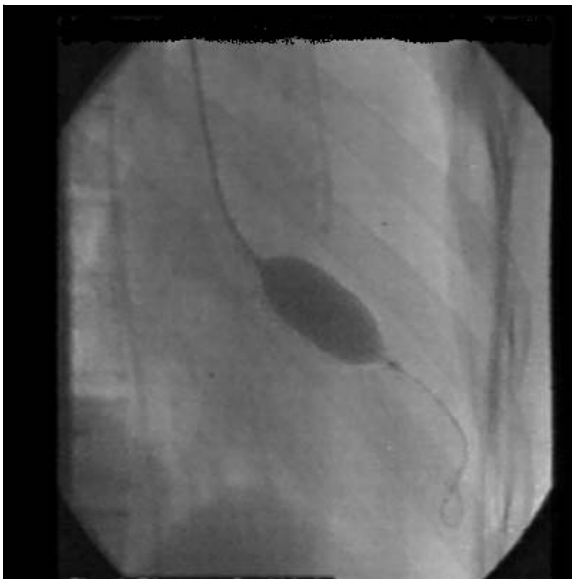

Fig. 5 Mitral valve dilation using single Mansfield balloon (20 mm)

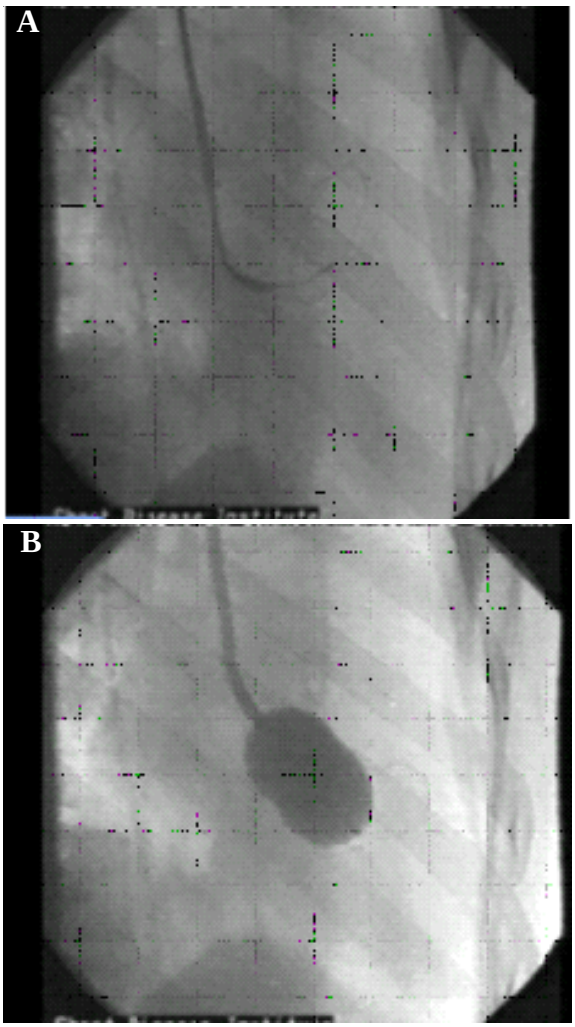

Fig. 6 Inoue-balloon mitral valve dilation. (A) The balloon catheter threaded along curved 0.025 guide wire into the left ventricle. (B) Full expansion of the balloon

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

Hemodynamic Data	Pre PBMV	Post PBMV
MPCWP (mmHg)	29	9
PA,M (mmHg)	77/35/49	36/16/24
MLAP (mmHg)	30/42/36	10/10/7
MTMVG (mmHg)	27	6
LVEDP (mmHg)	117/1/7	111/1/7
MRAP (mmHg)	9	2
MVA (Gorlin's) (cm^2)	0.5	1.5
MVA (area)	0.51	2.32

difficulties during cardiac catheterization and precludes completion of intervention via transfemoral approach[9].

Transjugular approach in PTMC has been reported in a limited number of cases worldwide[8,10-14]. 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[8,10].

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[8-10]. 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[8,10,11]. Transesophageal echocardiography guidance was

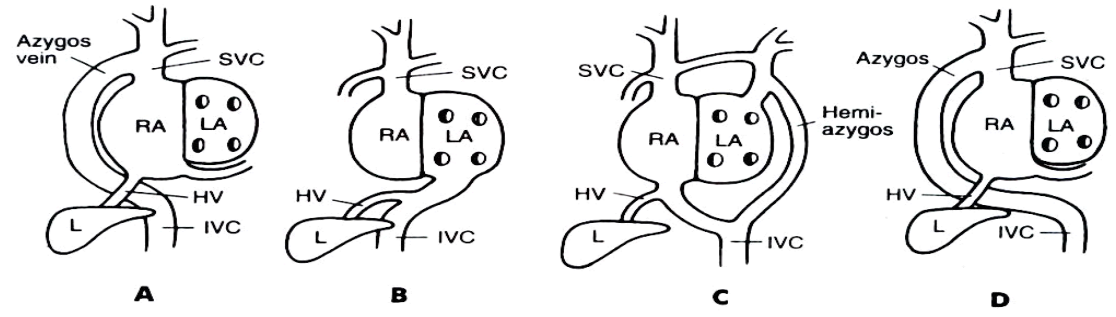

Fig. 7 Schematic diagram of selected abnormalities of the IVC. (A) Interrupted IVC with azygos continuation, the most common abnormality of the IVC. The hepatic veins (HV) connect directly to the RA. (B) Right IVC draining into the LA. (C) Absence of the lower right IVC. The IVC drains into the LA through the left SVC, and the RA through the hepatic portion of the IVC. (D) Complete absence of the right IVC with communicating vein draining to the azygos vein

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

1. National Heart, Lung, and Blood Institute Ballon Valvuloplasty Registry Participants. Multicenter experience with balloon commissurotomy: NHLBI Balloon Valvuloplasty Registry report on immediate and 30-day follow-up results. Circulation 1992: 85: 448-61.
2. Reyes VP, Raju BS, Wynne J, Stephenson LW, Raju R, Fromm BS, et al. Percutaneous mitral valvuloplasty compared with open surgical commissurotomy for mitral stenosis. N Engl J Med 1994; 331; 961-7.
3. Turi ZG, Reyes VP, Raju BS, Raju AR, Kumar DN, Rajagopal P, et al. Percutaneous balloon versus surgical closed commissurotomy for mitral stenosis. A prospective, randomized trial. Circulation 1991; 83: 1179-85.
4. Patel JJ, Shama D, Mitha AS, Blyth D, Hassen F, Le Roux BT, et al. Balloon valvuloplasty versus closed commissurotomy for pliable mitral stenosis: a prospective hemodynamic study. J Am Coll Cardiol 1991; 18: 1318-22.
5. Arora R, Nair M, Kalra GS, Nigam M, Khalilullah M. Immediate and long-term results of balloon and surgical closed mitral valvotomy: a randomized comparative study. Am Heart J 1993; 125: 1091-4.
6. Bueno R, Andrade P, Nercolini D. Percutaneous balloon mitral valvuloplasty vs open mitral valve commissurotomy. A randomized clinical trial (abstract). J Am Coll Cardiol 1993; 21: 429A
7. Farhat MB, Ayari M, Maatouk F, Betbout F, Gamra H, Jarra M, et al. Percutaneous balloon versus surgical closed and open mitral commissurotomy. Seven-year follow-up results of a randomized trial. Circulation 1998; 97: 245-50.
8. Joseph G, Baruah DK, Kuruttukulam SV, Chandy ST, Krish naswami S. Transjugular balloon mitral valvuloplasty. Cathet Cardiovasc Diagn 1997; 42: 219-26.
9. Myung K. Miscellaneous congenital cardiac condition: Pediatric Cardilolgy for Practioners. 3rd edition; Mosby-Year Book Inc., 1996: 266-7.
10. Joseph G, Oommen K, Assishkumar M, Sunil S. Transjugular approach to balloon mitral valvuloplasty helps overcome impediments caused by anatomical alterations. Cathet Cardiovasc Intervent 2002; 57: 353-62.
11. Sullebarger JT, Coto H, Lopez E, Sayad D, Fontanet HL. Transjugular percutaneous Inoue balloon mitral commissurotomy in a patient with inferior vena cava obstruction after liver transplantation. Cathet Cardiovasc Intervent 2003; 59: 261-5.
12. Hengrussamee K, Tansuphaswadikul S, Kehasukcharoen W. The advantages of intraprocedural transesophageal echocardiography in percutaneous transseptal mitral commissurotomy. Asian Heart Journal 1999; 7: 8-15.
13. Joseph G, Kumar S, George P, Dhanawade S. Right internal jugular vein approach as an alternative in balloon pulmonary valvuloplasty. Cathet Cardiovasc Intervent 1999; 46: 425-9.
14. Joseph G, Rajendiren G, Abhaichand R. Transjugular approach to concurrent mitral-aortic and mitral-tricuspid balloon valvuloplasty. Cathet Cardiovasc Intervent 2000; 49: 335-41.

การขยายลิ้นหัวใจไมตรัลโดยใช้หลอดเลือดดำ Internal jugular vein

บุญจง แซ่จึง, สุดารัตน์ ตันสุภสวัสดิกุล, เอนก กนกศิลป์, เกรียงไกร เฮงรัศมี, จรินทร์ อัศวหาญฤทธ์, ธรรมรัฐ ฉันทแดนสุวรรณ

การขยายลิ้นหัวใจไมตรัล (percutaneous mitral commissurotomy) ถือเป็นวิธีการรักษาผู้ป่วยลิ้นหัวใจไมตรัลตีบระดับรุนแรงที่ได้มาตรฐานเทียบเคียงการผ่าตัดใหญ่ (surgical commissurotomy) โดยส่วนใหญ่ หลอดเลือดดำ femoral vein เป็นหลอดเลือดดำที่นิยมใช้ในการใส่อุปกรณ์เพื่อแทงผนังกั้นหัวใจห้องบน (interatrial septum) และขยายลิ้นหัวใจ

บทความนี้เป็นการรายงานผู้ป่วยลิ้นหัวใจไมตรัลตีบระดับรุนแรงที่มีภาวะความผิดปกติแต่กำเนิดของหลอดเลือดดำช่วงล่างของร่างกาย โดยมีทางเดินของหลอดเลือดดำ inferior vene cava ต่อเข้ากับหลอดเลือดดำ azygos vein ก่อนระบายเลือดดำเข้าสู่ห้องหัวใจ (right atrium) ทำให้ไม่สามารถใช้หลอดเลือดดำ femoral vein ในการขยายลิ้นหัวใจได้ พบว่าการใช้หลอดเลือดดำ internal jugular vein แทนในการทำหัตถการ ก่อให้เกิดประสิทธิภาพดีในการรักษาและปลอดภัยโดยผู้ป่วยไม่ต้องได้รับการผ่าตัดใหญ่ จึงถือเป็นอีกทางเลือกหนึ่งในผู้ป่วยที่มีปัญหาหลอดเลือดดำช่วงล่างของร่างกายผิดปกติ