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Percutaneous Transhepatic Mitral Commissurotomy

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A novel, transhepatic approach to mitral valvuloplasty is described in a patient with an inferior vena caval filter. After transhepatic transseptal puncture, an Inoue dilatation catheter was passed through the hepatic parenchyma and across the atrial septum. Balloon mitral valvuloplasty was performed without complications. This approach should be considered when femoral venous access is restricted or is not feasible.

Key words: mitral stenosis, mitral valve, mitral valvuloplasty

INTRODUCTION

Percutaneous balloon mitral commissurotomy is a viable alternative to surgical commissurotomy or mitral valve replacement. Access to the mitral valve for balloon dilatation is conventionally achieved using a transseptal approach via the right femoral vein [1]; a retrograde, transarterial approach also has been described [2]. We describe a novel approach used in a patient in whom a conventional transvenous approach was not possible because of the presence of an inferior vena caval Greenfield filter.

CASE REPORT

A 40-yr-old man with steroid-dependent systemic lupus erythematosis and juvenile rheumatoid arthritis was referred for consideration of balloon mitral valvuloplasty. Following a recent episode of bowel perforation and acute peritonitis, he had undergone colon resection and colostomy. His postoperative course was complicated by wound dehiscence, which was being allowed to heal by secondary intention, and by rapid atrial fibrillation with congestive cardiac failure. Clinical examination was consistent with underlying rheumatic mitral stenosis, and echocardiography showed a mean diastolic gradient of 17 mmHg across the mitral valve, pliable leaflets, no mitral regurgitation, and an estimated right ventricular systolic pressure of 67 mmHg. Mitral valve replacement surgery was considered inadvisable because of the presence of a persisting wound infection. Balloon mitral valvuloplasty via a femoral venous transseptal approach was not feasible because of the presence of an inferior vena caval Greenfield filter inserted several months previously after an episode of acute pulmonary embolism. Transseptal catheterization was therefore performed using a percutaneous transhepatic approach.

After informed consent was obtained, cannulation of a branch of the hepatic vein was performed under local anesthesia as previously described [3]. In brief, a 22-gauge Chiba needle (Cook, Bloomington, IN) was inserted under fluoroscopic guidance between the ribs in the right midaxillary line horizontally midway into the substance of the liver. As the needle was withdrawn, a small amount of angiographic contrast was injected until a venous radicle was identified. The vessel was cannulated using a 0.018″ guide wire (Cope wire, Cook) (Fig. 1A) over which a 5F coaxial dilator was inserted. The small caliber wire was then replaced by a 0.035″ J wire, which was advanced into the right atrium. Right heart catheterization was performed through an 8F sheath placed over the guidewire. The sheath and right heart catheter were then removed over a guidewire, and transseptal puncture was performed without difficulty under fluoroscopic guidance. The gradient across the mitral valve was measured using the left atrial catheter and a left ventricular catheter advanced retrogradely from the left femoral artery. A mean gradient of 10.5 mmHg was recorded with a cardiac output of 5.0L/min by thermodilution giving an estimated mitral valve area of 1.33cm^2.

After measurement of baseline hemodynamics and the administration of 3,000 units intravenous heparin, a 0.025″ stainless steel Inoue guidewire was introduced through the transseptal catheter into the left atrium and a 12Fr Inoue dilator was used to dilate the hepatic tract and atrial septum (Fig. 1B). A 28 mm Inoue balloon was then advanced unsheathed through the hepatic parenchyma and across the atrial septum. Difficulty was encountered in advancing the balloon across the mitral valve because of a relatively low atrial puncture site and a horizontal position of the catheter across the septum, which caused the curved catheter to be directed preferentially toward the right. The Inoue balloon was therefore removed, the transseptal catheter was replaced, and a 0.035″ J wire was used to cross the mitral valve. This wire was exchanged through an 8 French end-hole catheter for the

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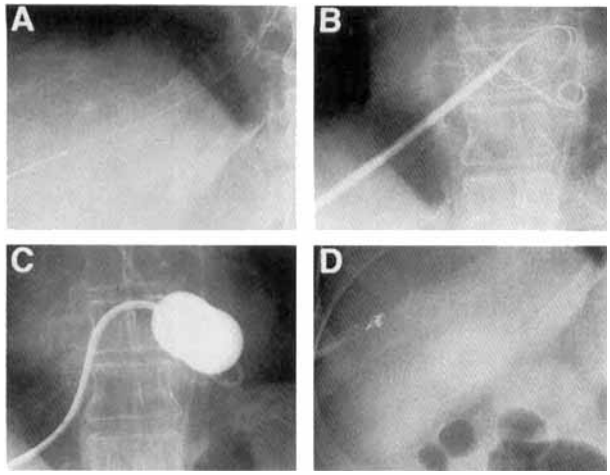

Fig. 1. A. Fluoroscopic image showing the position of the 0.018" guidewire, which was advanced through the Chiba needle and substance of the liver, into the right sided cardiac chambers, and pulmonary circulation. B. Inoue dilator and guidewire passing through the liver, across the atrial septum, and into the left atrium. A pigtail catheter is also apparent in the left ventricle. C. Inoue balloon fully expanded across the mitral valve. D. Fluoroscopic image showing placement of the first of two Gianturco coils in the hepatic tract to secure hemostasis at the completion of the procedure.

Inoue pigtail guidewire, which was coiled in the left ventricle. The Inoue balloon was then readily advanced to the left ventricle and inflated sequentially to a maximum balloon size of 28 mm (Fig. 1C). After removal of the Inoue balloon, right heart catheterization was repeated through a 12Fr sheath. The final mean mitral valve gradient was 5.4 mmHg with a cardiac output of 5.5L/min and estimated valve area of 2.33 cm^2. The sheath was then pulled back from the hepatic venous radicle, a small volume of nonionic contrast was used to confirm the position of the sheath, and two Gianturco coils (0.038· × 4 cm × 3 mm and 0.038" × 5 cm × 5 mm) were placed in the parenchymal tract between the hepatic vein and the capsule of the liver to secure hemostasis (Fig. 1D). The postprocedural course was uncomplicated with no evidence of bleeding or hepatic injury by ultrasound or biochemical analysis of hepatic enzymes.

DISCUSSION

This case illustrates an alternative approach for transvenous mitral valvuloplasty in the setting of femoral venous or inferior vena caval occlusion. In this patient, access to the right heart from the femoral vein was restricted by the presence of a caval filter. Although the Inoue balloon has a relatively low profile before and after inflation, the risk of entrapment of the device in the filter was considered prohibitive to a femoral venous approach. A retrograde, nontransseptal approach, described by Stefanidis and colleagues [2], was considered feasible. However, the procedure requires a specially modified, steerable dilatation catheter that is not readily available in the United States. A third potential approach, using transseptal catheterization through the caval filter and retrograde passage of a balloon dilatation catheter over a wire advanced from the femoral vein, was also considered. This technique, originally described by Babic [4], is limited by the need for large caliber sheaths in one or both femoral arteries to accommodate adequately sized balloon catheters. In our patient, femoral access on the right side was not possible because of contracture around a severely deformed and arthritic hip. Finally, a transjugular approach was considered but was rejected because of anatomic difficulties inherent in identifying and engaging the foramen ovale and in crossing the septum from the superior approach with transseptal equipment designed for an inferior approach.

We have previously reported a series of 18 children in whom diagnostic or therapeutic cardiac procedures were performed using a percutaneous transhepatic approach [3]. Sheath sizes up to 8Fr were used without vascular or hepatic injury for a variety of procedures including pulmonary valvuloplasty and closure of an atrial septal defect. Other investigators [5] have reported a small series of transhepatic procedures in which sheath sizes up to 14Fr have been successfully used for dilatation of hepatic vein stenoses in children. In this patient, transhepatic access to the right heart was achieved rapidly and allowed completion of the assessment of baseline hemodynamics as quickly as could have been achieved using a femoral venous approach. Transseptal puncture and left atrial catheterization were accomplished without difficulty. Modification of the Inoue technique was required to allow appropriate orientation of the dilatation catheter and its passage into the left ventricle. Following completion of the procedure, hemostasis was achieved using dacron-coated metal coils rather than the gelfoam pledgets used by other investigators [5], because of the theoretical potential for gelfoam embolization into the pulmonary circulation, or into the systemic circulation across the residual atrial septal defect. Hemostasis was immediate after the introduction of the second Gianturco coil.

CONCLUSIONS

Transhepatic transseptal access is a feasible and technically straightforward alternative for antegrade balloon mitral valvuloplasty in patients in whom femoral venous access is not possible or is limited by the presence of a caval filter. The excellent outcomes for transhepatic interventional procedures reported to date in small num-

bers of patients suggest that further evaluation of this approach is warranted not only in the pediatric population but also in appropriately selected adults. In these highly selected patients, use of the transhepatic approach should be limited to operators with extensive experience in transseptal catheterization, routine mitral balloon valvuloplasty, and transhepatic venous cannulation.

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