gained wide popularity because of the lack of clinical evidence.

Tracheal wound closure requires meticulous training and can be difficult with recently reported endoscopic devices. In contrast, BioGlue has the characteristic of facilitating wound sealing immediately after application. BioGlue has been used to treat postoperative bronchopleural fistula after surgery for lung cancer and to seal the tracheal and bronchial anastomoses after segmental resection.⁵

The tracheal wound cannot be left to heal spontaneously because of complications such as massive air leaks and tension pneumothorax. The BioGlue technique was successful in that it provided an effective and quick method of tracheal incision closure and obviated the need of removal of any wound closure device.

The potential benefits of NOTES include minimizing wound discomfort and improving cosmetic effect. Once the technique matures in the future, the application may further include lung cancer staging, mediastinal masses biopsy, and diffuse lung disease biopsy. However, potential shortcomings of this approach include mediastinitis and emphysema. It is essential to ensure tracheal wound healing with this approach. In future studies, we would carefully examine the trachea wound tissue after the NOTES approach in different stages. Ensuring that the tracheal wound has a smooth healing process is essential before introducing the new approach into clinical application. According to our previous experience,

we believe it is possible, perhaps with an adjuvant method such as glue application on the wound, to have a good wound healing after the transtracheal NOTES approach.

CONCLUSIONS

The use of BioGlue in the closure of tracheal incision of NOTES performed for thoracic exploration is a feasible technique for both explanted tracheal experiment and animal studies. This technique is simpler than previously reported techniques. However, further survival animal series investigations with respect to safety and efficacy are needed.

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A simplified technique for caval occlusion in reoperative small thoracotomies

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Several approaches have been used for redo mitral and tricuspid valve surgery, including repeat median sternotomy, right thoracotomy, and minimally invasive accesses. Reoperative cardiac surgery through a median sternotomy is technically demanding and can be associated with complications, including injuries to the right ventricle, injuries to patent coronary artery bypass grafts, and adherence bleeding.¹ A small right thoracotomy is an effective

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FIGURE 1. A Fogarty 8F occlusion catheter with a 14F balloon.

FIGURE 2. Caval occlusion with Fogarty catheters. SCV, Superior vena cava; ICV, inferior vena cava.

approach in such patients. Minimizing surgical access in re-operative cardiac surgery allows limited tissue dissection, resulting in reduction of blood loss, re-explorations for bleeding, and injuries to the cardiac structures.²

Tricuspid surgery requires the snaring of venae cavae before opening the right atrium. Dissection of adherent tissue around the caval veins can be risky in patients undergoing redo operations and difficult to perform through a minithoracotomy.³

We describe a simple and effective means for caval occlusion, avoiding tissue dissection and tourniquet placement around the superior and inferior vena cavae.

CLINICAL SUMMARY

Two patients were admitted to our department for severe tricuspid regurgitation with lower limb edema and dyspnea on exertion (New York Heart Association class IV). A 70-year-old man (patient A) underwent an operation 1 year before for coronary artery bypass grafting. An angiogram revealed the patency of the Y graft with bilateral thoracic arteries. A 75-year-old woman (patient B) underwent surgical intervention 20 years ago for mitral and aortic replacement.

The operation described below was the same for both patients. The patient was placed in the supine position with slight elevation of the right side. After intubation with a single-lumen tube with a bronchial blocker, the superior vena cava was cannulated percutaneously with a 15F cannula through the right internal jugular vein before draping. The tip of the venous cannula was positioned with use of transesophageal echocardiographic analysis for guidance.

A 3- to 4-cm transverse incision was made in the right groin, and the right femoral artery and vein were exposed.

The femoral vein was cannulated with a 21F cannula (Biomedicus, Inc, Eden Prairie, Minn), and the femoral artery was cannulated through a transverse arteriotomy with an 18F cannula (Medtronic EOPA; Medtronic, Inc, Minneapolis, Minn). A small right anterolateral thoracotomy 10 cm in length was performed in the fourth intercostal space. The skin incision was placed below the nipple in the man and in the submammary fold in the woman. A reusable chest retractor provided good exposition. Pleural adhesences were dissected, and extracorporeal circulation was instituted after minimal pericardial dissection. Total venous drainage was accomplished with vacuum assist. A 5-0 polypropylene purse-string suture was placed at the basis of the superior vena cava, and a Fogarty 8F occlusion catheter with a 14F balloon (Edwards Lifescience, Irvine, Calif; Figure 1) was inserted through the purse string. The balloon was inflated with 10 mL of saline solution until caval occlusion was obtained. Another Fogarty 8F occlusion catheter with a 22F balloon was inserted through a purse-string suture located on the femoral vein distal to the venous cannula insertion site. After advancing the tip of the Fogarty catheter proximally to the tip of the venous cannula, the balloon was inflated with 40 mL of saline solution until occlusion of the inferior vena cava was achieved (Figure 2). The right position of the Fogarty catheters was ensured by means of combined transesophageal echocardiographic analysis and direct visualization assessment.

A right atriotomy was performed on the beating heart. A flexible vent was positioned on the coronary sinus to obtain a bloodless field. The correct position and adequate inflation of the Fogarty catheters were adjusted to avoid blood return from the caval veins, creating a dry surgical field. The tricuspid valve was exposed, with stay sutures retracting the

edges of the atriotomy, and the valve replacement was completed. After right atrial closure, the balloons were deflated, and the catheters were withdrawn. The operation was concluded in the standard fashion.

DISCUSSION

In our center a small right thoracotomy on the beating heart is the preferred technique for patients undergoing redo operations requiring a tricuspid or mitral valve operation. Excellent exposure is crucial for a successful valve procedure, particularly when the operation is conducted through small incisions. In addition, this approach offers a good exposure to the atrial valves and minimizes the mediastinal dissection, playing a key role in reduction of blood loss and cardiac injuries.⁴

The use of vacuuming without caval occlusion allows a bloodless surgical field; however, air aspiration on venous drainage can cause some problems in the extracorporeal circulation. Our technique of caval occlusion represents a useful alternative in reoperative surgical intervention. Although

we have now used this approach only twice, we strongly believe that it is attractive for several reasons. First of all, it reduces mediastinal dissection and the relative risk of injuries to the great vessels. Moreover, it allows a bloodless working environment. Last, but not least, the technique is safe and easy to perform. We think that it should be kept in the armamentarium of the cardiothoracic surgeon and should be considered in all reoperative operations performed with minithoracotomies.

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Axillary cannulation for endo-occlusion and antegrade flow during complex reoperative mitral valve surgery

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A 54-year-old man had severe paravalvular leak 10 years after a second mitral valve replacement and third mitral valve operation. As a child, the patient had a congenital partial atrioventricular canal defect. He underwent patch repair of the septum secundum atrial septal defect and had a cleft mitral repair at age 16 years. This repair was durable until the age of 28 years, when he required mitral valve replacement with a 31-mm Björk–Shiley mechanical valve (Shiley, Inc, Irvine, Calif) for severe mitral regurgitation. At 44 years of age, although this valve was functioning well, he had it replaced owing to failure risk. The patient underwent mitral valve re-replacement with a 29-mm CarboMedics valve (Sulzer

CarboMedics, Inc, Austin, Tex) approximately 10 years ago. During that operation, he had a perioperative stroke and a 1-month hospital stay. Nonetheless, he made a full recovery and now returned for a fourth mitral valve procedure.

During the previous year, symptomatic severe mitral regurgitation had developed. Echocardiography demonstrated mitral regurgitation along a 160° dehiscence along the previous P1–P2 region. The valve was not “rocking.” He had an 8-cm left atrium, normal left ventricular function, along with mild aortic insufficiency and moderate tricuspid regurgitation. Right heart catheterization demonstrated elevated pulmonary pressures (55 mm Hg/21 mm Hg) and a mean wedge pressure of 20 mm Hg. Comorbidities included Childs–Pugh class A cirrhosis owing to long-standing congestive hepatopathy and chronic obstructive pulmonary disease on 2 L of supplemental oxygen.

Given the hostile mediastinum, the decision was made to approach the mitral valve by a right thoracotomy. Evaluation of the aortoiliac system with computed tomography demonstrated severe disease. As a result, axillary cannulation was chosen for antegrade flow. Given the aortic valve insufficiency, we decided against cold fibrillatory arrest, and the Port Access Minimally Invasive Valve System

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