2. Senning Å. Alterations in valvular surgery: biologic valve. In: Cohn LH, Gallucci V, editors. Cardiac bioprostheses: proceedings of the second international symposium on cardiac bioprostheses. New York: Yorke Medical Books; 1982. p. 140-53.
3. Love JW. Biological and engineering problems of tissue heart valves. In: Love JW, editor. Autologous tissue heart valves. Austin (TX): R. G. Landes, Inc; 1993. p. 25-31.
4. Guide for the care and use of laboratory animals. Washington (DC): National Academy Press; 1996.
5. Couetil JA, Berrebi A, Ferdinand FD, Fornes P, Adamopoulos C, Filsoufi F. New approach for reconstruction of the pulmonary outflow tract during the Ross procedure. *Circulation*. 1998;98(suppl II):II368-71.
6. Hvass U. Aortic valve replacement in children using a pulmonary artery wall [in French]. *Presse Med*. 1985;14:1926-7.

Stapled excision of the left atrial appendage

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The left atrial appendage (LAA) has been termed "our most lethal human attachment."¹ Excision or exclusion of the LAA is a component of most operations to treat atrial fibrillation (AF) and reduces late thromboemboli in patients with AF undergoing mitral valve surgery.² However, surgical technique affects results, and incomplete suture ligation increases risk of thromboembolism.^{2,3} We report our experience with stapled excision and pericardial buttressing of the LAA.

Methods

From January 2002 through December 2004, several suture and stapling techniques were used to excise the LAA in more than 500 patients. Incomplete ligation and recanalization with suture techniques and bleeding with unbuttressed staplers led us to the procedure described here.

Before manipulation of the heart, the LAA is examined by intraoperative transesophageal echocardiography. If there is thrombus, standard cut-and-sew technique is used to excise the LAA. Otherwise, after cardioplegic arrest the Endo GIA II stapler (United States Surgical Corporation, Norwalk, Conn) with 4.8-mm staples is used to excise the LAA. Bovine pericardial strips (Peri-Strips Dry; Synovis Surgical Innovations, St Paul, Minn) buttress the staple line. The stapler is positioned parallel to the base of the LAA and 3 to 5 mm from the

circumflex coronary artery, leaving a buttressed staple line on the heart (Figure 1). The staple line and the region beneath the staple line are examined for tears; any tears are repaired with pledget-supported suture. Hospital charges are \$317 for the stapler and \$246 for buttressing material.

Results

This buttressed stapling technique was used for LAA excision in 222 patients. The most common indication for surgery was mitral valve dysfunction (78%); in addition, 90% of patients underwent a procedure for AF. Patients undergoing AF ablation received 3 months of postoperative warfarin. All patients underwent both intraoperative and pre-discharge echocardiograms.

There was no staple line bleeding; however, 10% of patients required additional sutures beneath the staple line to repair tears. There were 5 perioperative strokes (2%). In 1 of these patients, there was laminar left atrial thrombus adjacent to a mitral bioprosthesis. No other patient had left atrial thrombus seen on pre-discharge echocardiography. Reoperation for bleeding was required in 7 cases (3%). In no case was the LAA the source of bleeding.

Discussion

In patients with AF, 90% of emboli responsible for strokes arise from the LAA.¹ It has been suggested that ligation of the LAA reduces the risk of stroke in cardiac surgical patients with and without preexisting AF.^{1,2,4} A variety of techniques have been used for excision or exclusion of the LAA, but there are few surgical devices designed specifically for this purpose.^{1,2,4,5}

Suture ligation of the LAA is frequently incomplete, leaving a communication that increases the risk of embolism.^{2,3} Non-cutting staplers may be used to exclude the LAA; however, staple lines frequently bleed, and we have observed late recanalization of the lumen. Cutting staplers ensure excision of the trabeculated portion of the LAA, and pericardial buttressing prevents staple line bleeding; however, fragile tissue beneath the staple line may tear. Our current practice is to use a cutting stapler with pericardial buttressing for excision of the LAA. As instrumentation improves, we anticipate extension of LAA excision or exclusion to virtually all patients undergoing cardiac surgery.

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Figure 1. Stapled excision of LAA. A, Stapler is loaded with pericardial strips. B, LAA is excised, and area beneath the buttressed staple line is examined. Published with the permission of The Cleveland Clinic Foundation.

References

1. Johnson WD, Ganjoo AK, Stone CD, Srivyas RC, Howard M. The left atrial appendage: our most lethal human attachment! Surgical implications. *Eur J Cardiothorac Surg*. 2000;17:718-22.
2. Garcia-Fernandez MA, Perez-David E, Quiles J, Peralta J, Garcia-Rojas I, Bermejo J, et al. Role of left atrial appendage obliteration in stroke reduction in patients with mitral valve prosthesis. *J Am Coll Cardiol*. 2003;42:1253-8.
3. Rosenzweig BP, Katz E, Kort S, Schloss M, Kronzon I. Thromboembolism from a ligated left atrial appendage. *J Am Soc Echocardiogr*. 2001;14:396-8.
4. Blackshear JL, Odell JA. Appendage obliteration to reduce stroke in cardiac surgical patients with atrial fibrillation. *Ann Thorac Surg*. 1996; 61:755-9.
5. DiSesa VJ, Tam S, Cohn LH. Ligation of the left atrial appendage using an automatic surgical stapler. *Ann Thorac Surg*. 1988;46:652-3.

Acute mitral regurgitation caused by papillary muscle rupture in the immediate postpartum period revealing Ehlers-Danlos syndrome type IV

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Ehlers-Danlos syndrome (EDS) type IV, the vascular type, is a rare autosomal dominant inherited disorder of connective tissue resulting from mutation of the *COL3A1* gene encoding type III collagen.¹⁻³ Affected patients often have life-threatening cardiovascular complications.¹⁻³ We report here a

case of EDS type IV diagnosed 1 week after delivery in a patient with a severe mitral regurgitation caused by papillary muscle rupture requiring emergency surgical intervention.

Clinical Summary

A 36-year-old female patient was admitted to the intensive care unit with a diagnosis of severe mitral regurgitation caused by papillary muscle rupture. She had a medical history of pneumothorax at birth. One week before, the patient had been delivered spontaneously of her first pregnancy at 37 weeks' gestation. Delivery was complicated by vaginal bleeding from severe perineal tears. Five days later, the patient had respiratory distress with circulatory collapse. Chest radiography showed pulmonary edema. Transesophageal echocardiography revealed an acute mitral regurgitation with posterior leaflet mitral valve prolapse caused by papillary muscle rupture. The surgeon confirmed the diagnosis (Figure 1) and repaired the mitral valve by valvuloplasty after posterior leaflet mitral valve resection. Even though the tissues were friable, the surgical procedure did not pose technical diffi-

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