New ideas - Cardiac general

Use of tissue welding technology to obliterate left atrial appendage – novel use of LigaSure™

David Jayakar*, Felix Gozo, Erwin Gomez, Cris Carlos

Community Health Services, St. Catherine’s Hospital, East Chicago, IN, USA

Received 3 August 2004; received in revised form 11 April 2004; accepted 25 April 2005

Abstract

The left atrial appendage is one source of thromboembolus. Complete occlusion of this appendage is required to sever communication with the left atrium; however, current ligation techniques can potentially leave residual communication. A novel technique of occluding the appendage has been developed using a bipolar device and radiofrequency energy. Twelve patients underwent an off-pump, epicardial Maze procedure using radiofrequency ablation. As an adjunct to the procedure, ligation of the left atrial appendage was completed using the LigaSure Xtd™ (Valleylab, Tyco Healthcare, Boulder, CO) with a modified application technique. Patients were followed to ensure sinus or paced rhythm. All twelve patients are in sinus or paced rhythm upon follow-up. Four patients required pacemakers for sick sinus syndrome. To date there have been no incidents of strokes, thromboembolic events, postoperative bleeding or deaths in all patients. Complete occlusion of the left atrial appendage is necessary to eliminate communication, which is accomplished by this radiofrequency, bipolar device. Extensive studies are necessary to verify the efficacy of this novel occluding technique.

© 2005 Published by European Association for Cardio-Thoracic Surgery. All rights reserved.

Keywords: Radiofrequency; Left atrial appendage; Occlusion

1. Introduction

The left atrial appendage (LAA), located in the left atrium (LA), is speculated to be one source of thromboembolus [1]. Occlusion of this appendage is included during mitral valve repair or the Maze procedure for atrial fibrillation (AF). Simple neck ligation, purse string techniques, surgical staplers [2] and endocardial suturing [1] are used to occlude the appendage. When stapled from the outside, residual communication can exist between the appendage and LA causing stagnated blood to form, potentially causing a stroke. This can also occur with suture occlusion [3]. Complete excision of the LAA at the base alone will prohibit this communication and cease thrombus creation. Due to the LAA’s friable nature and its close proximity to the circumflex artery, safe and complete excision epicardially, on or off pump, is technically challenging. A novel technique of occluding the LAA for excision during off pump, epicardial Maze procedures has been developed utilizing the LigaSure™ Vessel Sealing System (LVSS; Tyco Healthcare, Valleylab, Boulder, CO). This simple, fast technique can be applied both on and off pump.

LVSS uses radiofrequency (RF) energy produced from a micro-processor controlled, closed loop generator utilizing advanced algorithms. Energy is transferred to tissue through the bipolar device creating histological amalgamation with minimal thermal spread. LVSS has FDA approval for systemic vessel sealing up to 7 mm, sustaining three times systolic pressure [4]; and has been applied in general, gynecological and urological procedures but not this specific cardiovascular application.

2. Patients and methods

Twelve patients consented to and underwent a stand-alone AF procedure starting in November 2003. The patients were not part of a clinical trial and therefore institutional approval was not necessary. An off pump, sternotomy approach using RF epicardial ablation was employed in all twelve cases (Cobra, Electrophysiologic Technologies–Boston Scientific, San Jose, CA). The LigaSure Xtd™ device fused the LAA lumen together, occluding it for amputation. The surgeons elected to use the LigaSure Xtd™ for LAA isolation because of problems with residual communication when using sutures or staples. It is instructed that the device is closed on targeted vessels until the handle ratchet engages prior to activation. Due to the thickened structure of the LAA, a modified application technique was utilized. The open jaws of the device were placed at the base of the appendage. The footswitch was depressed activating the generator and the jaws were slowly closed over the appendage allowing time for amalgamation. A reaplication was applied frequently to ensure seal completeness. The appendage was fused using one seal across the proximal section; however, a second seal with reaplication was employed on three cases due to the size of the pedunculated base. Once isolated, the LAA was removed using...
In one initial case, due to the modified clamping technique, excessive LAA compression created a tear in the atrium wall prior to RF application. This tear was corrected by further application of the LVSS and secured with a running 4-0 Prolene suture with no further complications or adverse affects.

4. Discussion

Complete occlusion of the LAA is necessary to eliminate any residual communication between the LA and appendage. Due to the friability of LAA tissue and residual communication factor, surgical staplers are not optimal isolation devices. LVSS offers complete isolation, facilitating excision of the appendage and extinguishing communication. Furthermore, though not quantified, with the elimination of suture back-up and LAA removal, this application would save time versus previous suture and excision management based on previous surgical time observations when using conventional methods for LAA isolation.

The cost of the reusable LigaSure Xtd™ device is US$936.00. The single use electrodes are US$187.17 each and are sold in a case of 12. The total cost of using the LigaSure Xtd™, not including the generator and resterilization, for these 12 cases is US$265.17 per case.

To date, all 12 cases have been successful. However, extensive studies are necessary to verify techniques used and efficacy of LVSS through burst strength testing, chronic healing studies and histological evaluations including thermal spread. The LigaSure Xtd™ is not optimized for this particular application as evident by a modified clamping technique causing a lone LA tissue tear; however, the LVSS is a promising new technology for the occlusion of the LAA during Maze procedures and with further modification can be used for endoscopic LAA isolation.

5. Disclosures and freedom of information

LVSS and accompanying devices were purchased by the Community Healthcare System, St. Catherine’s Hospital. Authors have had full control of design of device application, methods and techniques used, and production of written report. The authors have no financial or any other interest in the products used or their distributors, nor is there any ethical problem between the authors and the content of this manuscript.

References