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BRIEF COMMUNICATION

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Endoscopic mitral valve repair utilizing cavitron ultrasonic surgical aspirator for active endocarditis

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Abstract

Mitral valve repair for endocarditis in an acute setting is still challenging due to difficulties in debriding friable tissue and in leaving enough non-infected tissue for reconstruction. Endoscopic approaches for complex mitral valve procedures via a minimally invasive approach have been reported from high-volume programs. However, the role of endoscopic mitral valve surgery for acute infective endocarditis has not been clearly defined. We report our technique of endoscopic mitral valve repair using the cavitron ultrasonic surgical aspirator system for active endocarditis. The cavitron ultrasonic surgical aspirator with a low power setting provides enough debridement of the infective tissue and leaves healthy tissue adequate for repair under a totally endoscopic vision.

Keywords: Totally endoscopic • Minimally invasive cardiac surgery • Infective endocarditis • Mitral valve repair

INTRODUCTION

Totally endoscopic minimally invasive cardiac surgery has been performed with excellent results for decades [1, 2]. However, few reports exist for mitral valve reconstruction for acute infective endocarditis using a minimally invasive platform [3]. This may be due to the difficulty in removing infective tissue that is often friable and difficult to handle without a broader surgical field. Using the cavitron ultrasound surgical aspirator (CUSA) may mitigate the risk of mitral valve repair failure associated with paucity of remnant leaflets after the debridement. We aimed to describe our technique and early outcome of totally endoscopic mitral valve repair for acute endocarditis using CUSA.

MATERIALS AND METHODS

The study was approved by the institutional review board of Japanese Red Cross Aichi Medical Center Nagoya Daiichi Hospital (4282021). The operation was initiated under general anaesthesia with a double-lumen endotracheal tube. The patient was placed in 30° left lateral decubitus position. A 10-mm trocar for a 3D endoscope was inserted through the third or fourth intercostal space on the right mid-axillary line. The main 3-cm incision was made at the fourth or fifth intercostal space without rib-spreading. A 5-mm port for left-handed instruments was placed at the second or third intercostal space on the anterior axillary line [4]. Femoral–femoral cardiopulmonary bypass was established. The pericardium was opened, and antegrade cardioplegia line was placed. The ascending aorta was clamped with a flexible clamp through the main port, and cardiac arrest was obtained. Through a left atrial incision, we observe the mitral valve and the vegetation (Fig. 1A). A specimen was gathered. The CUSA system (Integra LifeSciences, NJ, USA) was inserted through the main port to aspirate the vegetation and debride the infective issue and fibrin deposits (Fig. 1B and C). The intensity of the CUSA was set at a minimum, and irrigation was also set at the level sufficient to clean the tip of the CUSA (Videos 1 and 2). The remnant leaflet was examined after the debridement, and mitral valve repair was performed according to the valve anatomy. For a large defect in the leaflet, the autologous pericardial patch repair technique was utilized. After testing the repair, the atriotomy was closed.

RESULTS AND DISCUSSION

Ten patients (median age: 55 ± 15 years, 50% male) underwent totally endoscopic mitral valve repair using this technique from March 2014 to February 2022 (Table 1). The time from diagnosis to surgery was 12 ± 8 days. Resection and suture, autologous pericardium patch repair and artificial chord reconstruction were used in 1, 4 and 4 patients, respectively, in terms of mitral valve repair technique. Eight patients (80%) had a standard annuloplasty. There was no conversion to mitral valve replacement. The operation time, cardiopulmonary bypass time and aortic cross-clamp time were 175 ± 60,

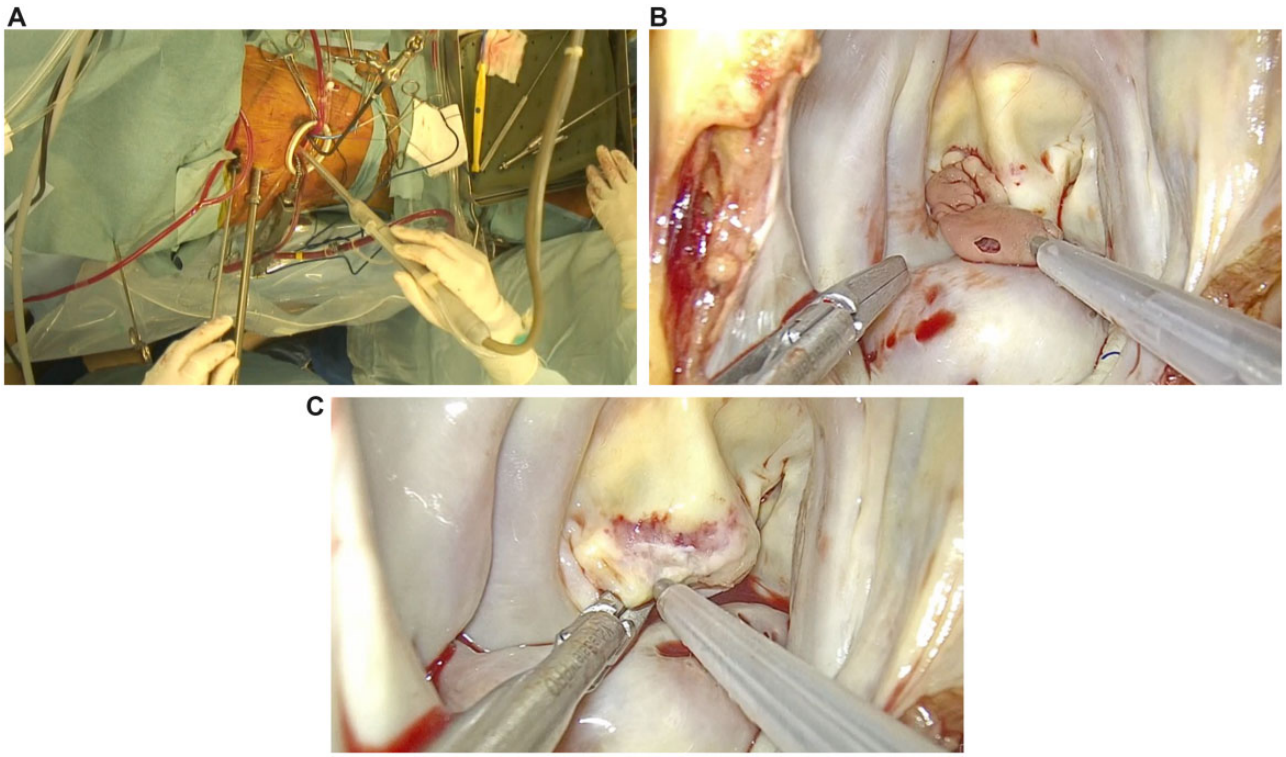
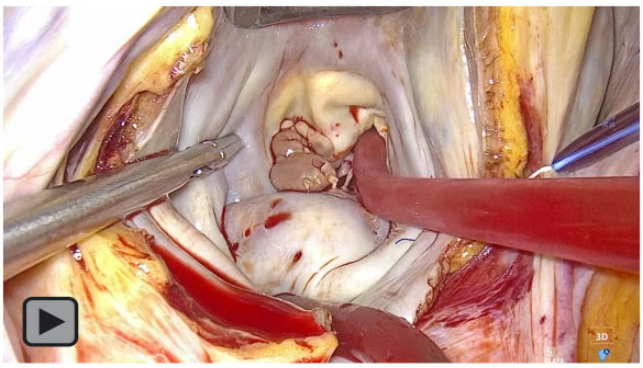
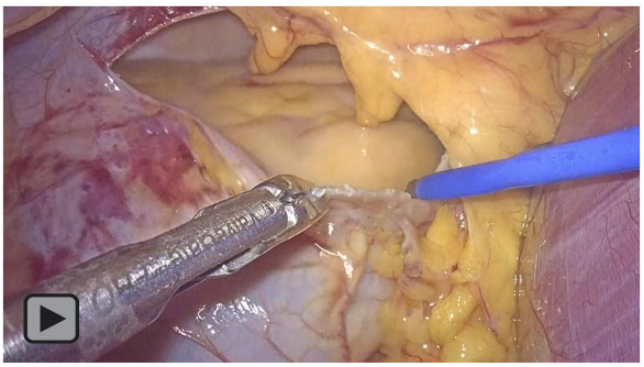


Figure 1: The main, second port and the camera port incisions were made (**A**). The cavitron ultrasonic surgical aspirator was introduced through the main port. 3D-endoscopic view of debridement with cavitron ultrasonic surgical aspirator (**B** and **C**).



Video 1: Videos demonstrating totally 3D-endoscopic mitral valve repair for endocarditis.



Video 2: Videos demonstrating totally 3D-endoscopic mitral valve repair for endocarditis.

124 ± 46 and 90 ± 38 min, respectively. No operative mortality or neurological complication occurred. None of these patients developed recurrence of infection or more-than-mild mitral valve regurgitation during the follow-up (mean follow-up: 36 ± 37 months).

An endoscopic approach in cardiac surgery has been utilized for years. However, reports of the use of MICS for acute endocarditis are limited [1–4]. CUSA system effectively fragments solid tissue such as calcification or solid tumour using ultrasonic waves. Surgeons can adjust the intensity by changing the amplification of vibration. Built-in saline irrigation prevents the damage to the underlying tissue. High-frequency vibration breaks solid tissue, such as mitral annular calcification in cardiac surgery [5]. We applied this CUSA system in the endoscopic platform to debride infective tissue during valve surgery. We set the intensity at the lowest to prevent damage to the local tissue and leave as much tissue as possible. We suggest that surgeons have to leave attention on the debris from this manoeuvre and irrigate carefully after the debridement.

We also suggest that this technique may be limited for mitral leaflet pathology and may not include annular abscess or aortic valve lesion in acute endocarditis setting. Careful patient selection should be made with preoperative examinations. We recommend continuing postoperative antibiotics adequately. This technique is useful in our usual endoscopic setup for valve surgeries [2, 4], where the regular scalpels or scissors are difficult to manipulate through a small slit. We have applied this technique in 10 cases of acute endocarditis without any mortalities or recurrences in the mid-term follow-up,

Table 1: Details of the mitral interventions

Age, gender/reason for urgent surgery	Findings in surgery	Causative microorganism	Procedures	Annuloplasty	Follow-up status
52F/MR, HF	P1 prolapse, vegetation at P1 and A1	*Streptococcus agalactiae*	Resection/suture	Semi-rigid ring	Trace MR at 61 months
32F/MR, septic shock, pregnant	PC prolapse, vegetation at PC and A3	MSSA	Edge-to-edge suture	Short pericardial band at PC	Trace MR at 99 months
66F/MR, HF	AC prolapse, vegetation at P2 and AC	*Streptococcus mitis*	Edge-to-edge suture	Semi-rigid band	Trace MR at 95 months
56F/uncontrolled infection	AC–P1 annular involvement, vegetation at P1, P2 and AC	*Streptococcus agalactiae*	Leaflet resection. Autologous pericardial patch at AC	Short pericardial band at AC-P2	Mild MR at 45 months
71M/uncontrolled infection	Perforation at A2, P2 prolapse, vegetation at P2 and A2	*Corynebacterium striatum*	Autologous pericardial patch at A2	Semirigid band	Trace MR at 18 months
32M/MR, HF	PC–P3 prolapse, vegetation at P3, PC and A3	No growth (antibiotics given before culture)	Autologous pericardial patch at PC, artificial chord	Semi-rigid ring	Trace MR at 10 months
44F/uncontrolled infection	A2–3 prolapse, vegetation at P3–PC and A2–3	MRSA	Autologous pericardial patch at PC, artificial chord	Flexible band	Trace MR at 10 moths
78M/uncontrolled infection	Bulky vegetation at A2	MRSA	–	Flexible band	Mild MR at 8 months
47F/uncontrolled infection	P1 and PC prolapse, vegetation at P1–3	MSSA	Artificial chords, edge-to-edge repair	Semirigid ring	Trace MR at 5 months
68M/uncontrolled infection	P2 prolapse, vegetation at P2–3 and A1	MSSA	Artificial chords	Flexible band	Trace MR at 5 months

AC: anterior commissure; F: female; HF, heart failure; M: male; MR, mitral regurgitation; MRSA, methicillin-resistant *Staphylococcus aureus*; MSSA, methicillin-sensitive *Staphylococcus aureus*; PC, posterior commissure.

CONCLUSION

CUSA-assisted debridement of the infected mitral leaflets may mitigate the risk of recurrence and may increase the chance of mitral repair in acute endocarditis.

Conflict of interest: Toshiaki Ito received proctor fee from Edwards Lifescience, Inc. and lecture fee from Medtronic, Inc. and Abbott, Inc. (no direct conflict with this article). All other authors declared no conflict of interest.

Reviewer information

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REFERENCES

[1] Casselman F, Van Slycke S, Wellens F, De Geest R, Degrieck I, Van Praet F *et al.* Mitral valve surgery can now routinely be performed endoscopically. Circulation 2003;108:48–54.

[2] Ito T, Maekawa A, Hoshino S, Hayashi Y, Sawaki S, Yanagisawa J *et al.* Three-port (one incision plus two-port) endoscopic mitral valve surgery without robotic assistance. Eur J Cardiothorac Surg 2017;51:913–8.

[3] van der Merwe J, Casselman F, Stockman B, Roubelakis A, Vermeulen Y, Degrieck I *et al.* Endoscopic port access surgery for isolated atrioventricular valve endocarditis. Interact CardioVasc Thorac Surg 2018;27:487–93.

[4] Ito T, Hosoba S, Orii M, Kato R. Minimally invasive valve surgery using high resolution (3D) scope. Oper Tech Thorac Cardiovasc Surg 2021;26:574–87.

[5] Brown AH, Davies PG. Ultrasonic decalcification of calcified cardiac valves and annuli. Br Med J 1972;3:274–7.