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 Daichi 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 tissue deposit (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 pericardial patch repair and artificial chord recon-struction 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,
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,
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.

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REFERENCES

[1] Casselman F, Van Slyck F, 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.