Minimally Invasive Surgical Release of Entrapped
Mapping Catheter in the Mitral Valve

Hyung Gon Je, MD, PhD; Jeong Won Kim, MD*; Sung Ho Jung, MD; Jae Won Lee, MD, PhD

Two cases of catheter entrapment in the mitral valve, which is a rare complication of pulmonary vein isolation, were successfully treated via robot-assisted minimally invasive surgery. (Circ J 2008; 72: 1378–1380)

Key Words: Ablation; Complication; Mitral valve; Surgery

Surgical ablation is currently the most effective means of curing atrial fibrillation (AF), but application of the Maze III operation for non-valvular paroxysmal AF has been limited by the perceived increased risk of morbidity after sternotomy/thoracotomy and cardiopulmonary bypass. Since the description of catheter ablation for AF by Haïssaguerre et al in 1994, the popularity of pulmonary vein (PV) and posterior left atrial isolation has grown, with increasing number of reports attesting to its efficacy and safety, notwithstanding that issues regarding the potential for various complications and relatively lower efficacy remain. Circular mapping catheter entrapment in the mitral valve (MV) is one such rare complication, which, to the knowledge of the authors, has not been shown to be treatable by robot-assisted minimally invasive surgery. The present report describes 2 cases of this complication successfully resolved with the aid of the AESOP 3000 robotic visualization system.

Case Reports

Case 1

A 45-year-old man presented with recurrent symptomatic episodes of paroxysmal AF over the past year. Therapeutic trials with several anti-arrhythmia agents had to be aborted because of intolerable side-effects. The patient underwent PV isolation and left atrial circumferential ablation with a circular mapping catheter and an ablation catheter. A 7Fr 10-pole circular mapping catheter of 20 mm circular configuration diameter (Lasso®, Biosense Webster, Diamond Bar, CA, USA) was used to locate and confirm the results of ablation. Successful ablation was confirmed by the mapping catheter, but catheter movement was met by resistance that prohibited further attempts at removal.

Transesophageal echocardiography (TEE) revealed entrapment of the catheter tip in the MV apparatus (Fig 1). Traction and clockwise and counterclockwise rotation maneuvers to release the tip resulted in its fracture at the very proximal portion (Fig 2). Emergency operation was indicated to remove the catheter and repair any MV injuries that may have occurred. As we had experience of more than 300 cases of minimally-invasive MV surgery, the operation was performed via right anterolateral mini-thoracotomy (4 cm in size) using an AESOP 3000. The patient was supine with 30-degree right-side up. The right internal jugular vein was cannulated percutaneously and the right femoral artery and vein were cannulated via a 2-cm skin incision. Following transthoracic aortic cross-clamping with a Chitwood clamp and antegrade cardiopulmonary arrest, MV exposure was conducted via left atrial incision along the interatrial groove. The posterior leaflet between the middle (P2) and lateral (P1) scallops was torn and a chorda rupture at the lateral scallop of the posterior MV leaflet was found. The mapping catheter tip was severely entangled within the MV chordae and the anterolateral papillary muscle. After careful removal of the catheter under direct vision, a new chorda to the P1 scallop was formed and multiple interrupted sutures with 5-0 polypropylene were used to re-approximate the position of the torn posterior leaflet. Because successful ablation was confirmed perioperatively, no further surgical ablation was conducted. Intraoperative TEE showed a mild (grade 2/4) degree of residual mitral regurgitation, necessitating re-institution of cardiopulmonary bypass for subsequent implantation of a 27-mm Tailor annuloplasty ring (St Jude Medical Inc, St. Paul, MN, USA). Residual mitral regurgitation was no longer observed in the post-repair intraoperative TEE. Total cardiopulmonary bypass and aortic cross-clamping times were 243 and 182 min, respectively. The patient fully recovered from surgery and remained in normal sinus rhythm during follow-up.

Case 2

Two months after the first case, a 48-year-old man was referred with an 8-year history of recurrent symptomatic episodes of paroxysmal AF. Despite previous medical treatment, the patient had developed palpitations, effort-related chest pain and subsequent half an hour of resting chest pain. The patient underwent the same catheter ablation technique as described in Case 1. During the ablation confirmation procedure, catheter movement was met by severe resistance.
Surgical Release of Catheter Entrapped in MV

Circulation Journal   Vol.72, August 2008

and TEE confirmed catheter entrapment in the MV apparatus, which was not amenable to release by gentle traction and rotation. Based on the previous experience, surgery was undertaken immediately. The proximal portion of the mapping catheter was cut just inside the entrance to the left atrium to facilitate iatrogenic atrial septal defect closure and reduce tension in the distal portion of the catheter. Left atrial exploration revealed the catheter was severely entangled within the lateral commissure of the MV (Fig 3). To avoid the possibility of trauma to the MV during catheter removal, the mapping catheter was cut into multiple segments to facilitate atraumatic release. Despite these measures, a chorda rupture at the middle portion of the anterior MV leaflet (A2) and tearing of the P1 scallop resulted in significant MV regurgitation (Fig 4). Multiple monofilament sutures for the P1 scallop repair and new chorda formation for the A2 portion were followed by implantation of a 28-mm Carpentier-Edward ring. The Maze procedure was omitted because of preoperative confirmation of successful ablation. Intraoperative TEE showed trace mitral regurgitation. Total cardiopulmonary bypass and aortic cross-clamping times were 193 and 102 min, respectively. Serial echocardiograms showed the minimal mitral regurgitation to be durable and the patient remained in normal sinus rhythm during follow-up.
Discussion

Catheter entrapment in the heart valves is a rare complication of arrhythmia ablation procedures. The reported incidence of MV damage during ablation of a left-sided accessory pathway is 0.04%. The incidence of catheter entrapment during ablation therapy for AF is not well known, but at least 15 cases have occurred sporadically since 2001 (personal communication to local distributor of Lasso® mapping catheter). Since 1997, more than 150 cases of ablation have been performed annually at Asan Medical Center and 350 cases of catheter ablation were conducted in 2006. However, the present 2 cases are the only incidents of Lasso catheter entrapment in the MV in our experience.

Only 4 cases of this complication in association with PV ablation for paroxysmal AF have been described4–6 and in 2 cases, successful release was achieved using another catheter and guiding sheaths, as well as pushing forward rather than pulling back on the entrapped catheter.4 In another case, gentle traction led to catheter fracture with subsequent distal migration of the segment to the abdominal aorta from where removal was fortuitously possible.5 In the final case, gentle traction and rotation resulted in acute regurgitation because of MV apparatus injury. The patient underwent MV replacement with a mechanical valve via a median sternotomy.6 In the current report, the complicated entanglement of the catheter with the mitral subvalvular structures precluded surgical release of the intact catheter, despite direct visualization. As a measure to facilitate catheter release in these situations, segmentation seems to have several advantages. First, it reduced tension and minimized mitral subvalvular apparatus injury. Second, cutting and withdrawing the proximal catheter region made iatrogenic atrial septal defect repair easier by clearing up the clutter in the surgical field. Third, it facilitated the catheter release from within its severe entanglement in the mitral apparatus.

Robot-assisted minimally invasive MV surgery may allow early recovery, less pain and the creation of a smaller surgical wound. We found that it can be easily applied to the uncommon but emergency situations described herein, thereby maximally allaying patient disgruntlement with a failed intervention. To our knowledge, this is the first successful demonstration of surgical resolution of this difficult complication where not only the catheter was successfully released but the MV was also repaired through the same robot-assisted minimally invasive approach. In consideration of the sudden unexpected nature of the surgery from the patient’s perspective and the minimally invasiveness of the described approach, robotic-assisted minimally invasive surgery may be a good option to treat complications of this type.

References