Septal Myectomy for Hypertrophic Obstructive Cardiomyopathy using PlasmaBlade

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Glossary of Abbreviations:

- **PEAK**: Pulsed Electron Avalanche Knife
- **HOCM**: Hypertrophic Obstructive Cardiomyopathy
- **SAM**: Systolic Anterior Motion
- **TEE**: Transesophageal Echocardiography
- **LVOT**: Left Ventricle Outflow Tract
- **PVC**: Premature ventricular contraction

Central Message:

We describe the technique of surgical myectomy using PlasmaBlade in a patient with hypertrophic obstructive cardiomyopathy.

Central message figure legend: Septal myectomy using PEAK PlasmaBlade.
Introduction

Pulsed Electron Avalanche Knife (PEAK) PlasmaBlade is an electrosurgical device that generates a conductive cloud of water vapor and ions along the insulated blade's exposed rim when in contact with tissue.\(^1\) Since, PlasmaBlade operates at temperatures of 40-100°C while the blade tip stays near body temperature; it provides the atraumatic, scalpel-like cutting precision and electrocautery-like hemostasis with minimal collateral tissue damage. Thus, the risk of bleeding, tissue injury, and scar formation is minimal.\(^1\) PlasmaBlade is commonly used in ophthalmology, plastic surgery, and dermatology\(^2\)-\(^4\), but its use in cardiac surgery is limited. Here, we present our technique for septal myectomy using PlasmaBlade and its benefits.

Case presentation:

A 53-year-old male presented to our institute with history of syncope and was diagnosed with hypertrophic obstructive cardiomyopathy (HOCM) with the basal septal thickness of 2cm and systolic anterior motion of mitral valve (SAM) with mild mitral regurgitation. Patient was referred for surgical septal myectomy. Patient provided informed written consent for publication of study data (IRB number 21-011885, 4/4/2023).

Surgical Technique

Prior to surgical incision, intraoperative transesophageal echocardiography (TEE) was performed to confirm the findings. We measured left ventricle outflow tract (LVOT) gradient pre- and post-myectomy using 24Fr. spinal needle catheter to confirm surgical adequacy. Electromechanical premature ventricular contraction (PVC) was induced to measure provoked LVOT gradients.
Surgery was performed under mild hypothermic cardioplegic arrest. Cardiopulmonary bypass was established by cannulating ascending aorta and right atrium. A reverse J aortotomy was created and stay sutures were placed. Resection began 0.5-0.75cm below the nadir of the right coronary cusp and the commissure between the left and right cusps and was extended distally between these two lines down to the mid-ventricle. Using the PlasmaBlade, a horizontal plane was created by bending the tip of the PlasmaBlade at 45° angle and muscle tissue penetration was performed at the desired depth, and while penetrated muscle was retracted, we continued the horizontal cut and maintained the thickness while advancing to the LV apex. We excised a large piece of hypertrophied septum without causing any significant charring or electrocautery artifact (Figure 1). Once the desired distance reached from aortic valve annulus, we repeated this horizontal shaving approach until we were satisfied with the remaining septal thickness. We keep the septal excision depth more conservative under the membranous septum to avoid injury to His bundle. As described by Schaff et al, we used a sponge stick to push the interventricular septum to improve the visibility of mid-septum. Extent of muscular resection was guided by distribution and thickness of basal septum, septal scar and extension of septum from anterolateral to posteromedial commissures of the mitral valve. After septal resection, the aortotomy was repaired in two layers, and the patient was weaned-off cardiopulmonary bypass. Postoperative TEE evaluated LVOT resection, mitral regurgitation, and new findings. Resting and provoked LVOT gradient were measured and were 0mmHg and 8mmHg, respectively. On needle catheterization, there was no LVOT gradient at rest and post-PVC (Figure 2).

**Discussion**

Surgical blade-assisted septal myectomy is the standard approach for hypertrophied septal muscle resection, but it has limitations. While safe, sharp, precise, and reproducible, it can be challenging
to control muscle excision depth and may obscure vision and dexterity, especially in patients with small aortic roots or females. Additionally, there is a risk of unintentional valve injury. PlasmaBlade has the precision like surgical knife in excising the septal muscle. Further, as the tip of PlasmaBlade is bendable and the only active part, it is easier to control the penetration angle, the depth and thickness of the resection. To complete the resection, further plane in previously excised muscle is also easy to create. Long length of electrode prevents the obstruction of field of vision. As blade is active only after pressing the button, risk of injury to valve leaflets is minimal. We resect the hypertrophied, abnormally displaced papillary muscles, and accessory LV apical-basal muscle bundles with the help of PlasmaBlade. PlasmaBlade also prevents myocardial necrosis and conduction bundle injury due to minimal current spread. 1-3

We have performed septal myectomy in 29 patients using PlasmaBlade with 100% survival. At mean follow-up of 8.4±10.3 months, all patients are NYHA class I and mean resting and provoked LVOT gradients on echocardiography were 9.5±5.8mmHg and 14.7±8.8mmHg, respectively. No patient developed coronary-cameral fistula or residual or new flow across interventricular septum. No patient required reintervention or reoperation. We are continuing to follow our patients to assess the long-term outcome of our technique.

**Conclusion:**

PlasmaBlade is an acceptable alternative to surgical blade for myectomy with better surgical precision, varying angles of resection and a greater field of vision without significant collateral damage.

**References:**


Figures Legend:

Figure 1: Resected myectomy specimens showing absence of charring and minimal electrocautery artifact on the raw surface.

Figure 2: Intra operative needle catheter readings of the left ventricle and aorta pre myectomy (A) and post myectomy (B).
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SEPTAL MYECTOMY FOR HOCM USING PLASMA BLADE

AATS 103rd ANNUAL MEETING

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