Septal myectomy for hypertrophic obstructive cardiomyopathy using a pulsed radiofrequency energy soft tissue dissection instrument

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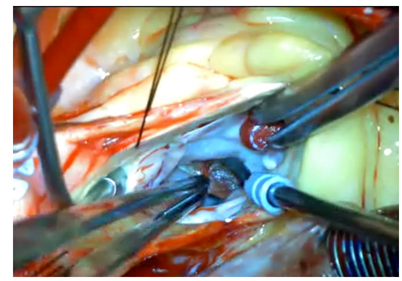

Septal myectomy using the PEAK PlasmaBlade (Medtronic).

CENTRAL MESSAGE

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

See Discussion on page 223.

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Pulsed electron avalanche knife (PEAK) PlasmaBlade (Medtronic) is an electrosurgical device that generate conductive cloud of water vapor and ions along the insulated blade's exposed rim when in contact with tissue.[1] Because PlasmaBlade operates at temperature of 40 to 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 man presented to our institute with history of syncope and was diagnosed with hypertrophic obstructive cardiomyopathy with the basal septal thickness of 2 cm and systolic anterior motion of mitral valve with mild mitral regurgitation. Patient was referred for surgical septal myectomy. The patient provided informed written consent for publication of study data (institutional review board No. 21-011885; April 4, 2023).

SURGICAL TECHNIQUE

Before surgical incision, intraoperative transesophageal echocardiography was performed to confirm the findings. We measured left ventricle outflow tract (LVOT) gradient pre- and postmyectomy using 24Fr spinal needle catheter to confirm surgical adequacy. Electromechanical premature ventricular contraction was induced to measure provoked LVOT gradients.

Surgery was performed under mild hypothermic cardioplegic arrest. Cardiopulmonary bypass was established by cannulating the ascending aorta and right atrium. A reverse *J* aortotomy was created and stay sutures were placed. Resection began 0.5 to 0.75 cm below the nadir of the right

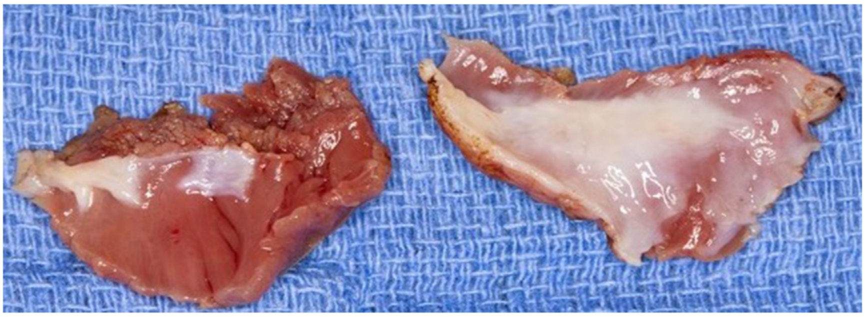


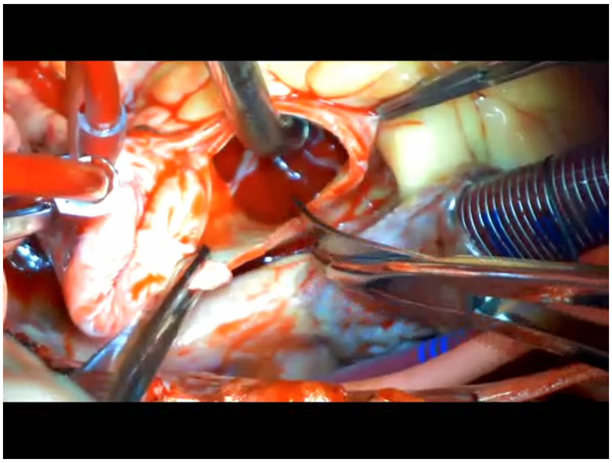
FIGURE 1. Resected myectomy specimens showing absence of charring and minimal electrocautery artifact on the raw surface.

coronary cusp and the commissure between the left and right cusps and was extended distally between these 2 lines down to the midventricle. Using the PlasmaBlade, a horizontal plane was created by bending the tip of the PlasmaBlade at a 45° angle and muscle tissue penetration was performed at the desired depth, and while the 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 the 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 and colleagues,[5] we used a sponge stick to push the interventricular septum to improve the visibility of midseptum. The extent of muscular resection was guided by distribution and thickness of the basal septum, septal scar, and extension of the septum from the anterolateral to posteromedial commissures of the mitral valve. After septal resection, the aortotomy was repaired in 2 layers, and the patient was weaned off cardiopulmonary bypass (Video 1). Postoperative transesophageal echocardiography confirmed adequate LVOT resection, trivial mitral regurgitation and absence of any additional intracardiac defect. Resting and provoked LVOT gradient were measured and were 0 mm Hg and 8 mm Hg, respectively. On needle catheterization, there was no LVOT gradient at rest and after premature ventricular contraction (Figure 2).

DISCUSSION

Surgical blade-assisted septal myectomy is the standard approach for hypertrophied septal muscle resection, but it has limitations. Although 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 women. Additionally, there is a risk of unintentional valve injury. PlasmaBlade has the precision of a surgical knife in excising the septal muscle. Further, because the tip of PlasmaBlade is bendable and the only active part, it is easier to control the penetration angle as well as the depth and thickness of the resection. To complete the resection, further plane in the previously excised muscle is also easy to create. The long length of the electrode prevents the obstruction of the field of vision. Because the blade is active only after pressing the button, risk of injury to valve leaflets is minimal. We resected the hypertrophied, abnormally displaced papillary muscles, and accessory LV apical-basal muscle bundles with the help of the 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 the PlasmaBlade with 100% survival. At mean follow-up of 8.4 ± 10.3 months, all patients are New York Heart



VIDEO 1. In the video, we provided a comprehensive overview of our approach to performing septal myectomy using the PEAK PlasmaBlade. We delved into the intricacies of the technique, explaining the steps and details. Video available at: https://www.jtcvs.org/article/S2666-2507(23)00263-8/fulltext.

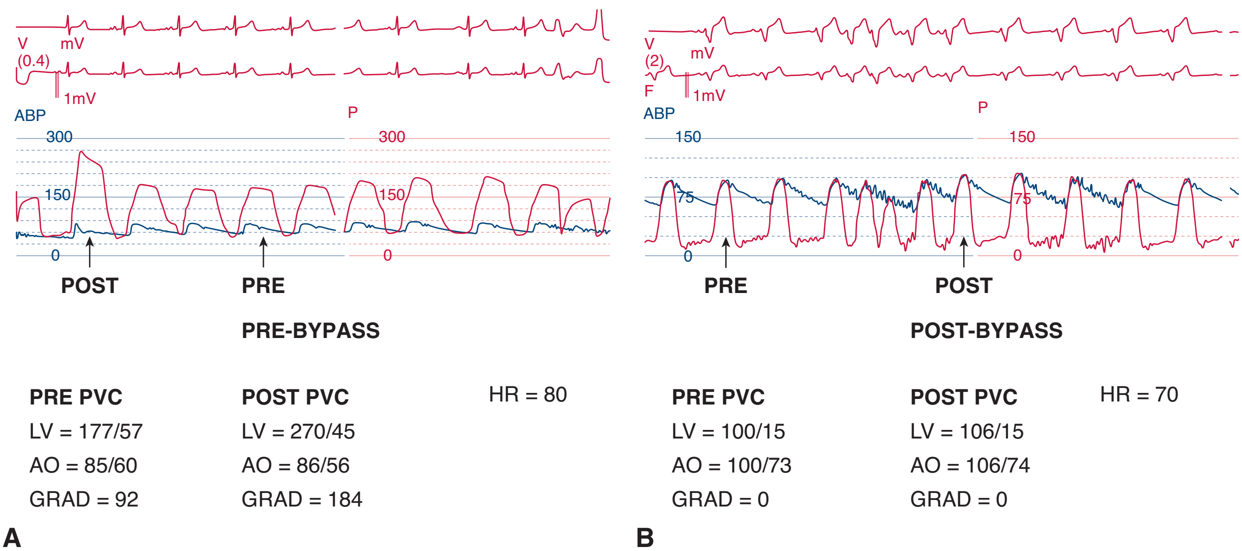


FIGURE 2. Intraoperative needle catheter readings of the left ventricle and aorta premyectomy (A) and postmyectomy (B). *PVC*, Premature ventricular contraction; *LV*, left ventricle pressure; *AO*, aortic pressure; *GRAD*, gradient.

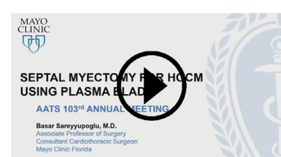
Association functional class I and mean resting and provoked LVOT gradients on echocardiography were 9.5 ± 5.8 mm Hg and 14.7 ± 8.8 mm Hg, respectively. No patient developed coronary-cameral fistula or residual or new flow across interventricular septum. No patient required reintervention or reoperation. We are continuing to follow our patients to assess the long-term outcome of our technique.

CONCLUSIONS

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

Webcast

You can watch a Webcast of this AATS meeting presentation by going to: https://www.aats.org/resources/septal-myectomy-for-hocm-using-plasma-blade.



References

1. Zientara A, Komminoth P, Seifert B, Odavic D, Dzemali O, Häussler A, et al. Skeletonized internal thoracic artery harvesting: a low thermal damage electrosurgical device provides improved endothelial layer and tendency to better integrity of the vessel wall compared to conventional electrosurgery. *J Cardiothorac Surg*. 2018;13:105.
2. Punthakee X, Keller GS, Vose JG, Stout W. New technologies in aesthetic blepharoplasty and brow-lift surgery. *Facial Plast Surg*. 2010;26:260-5.
3. Ruidiaz ME, Messmer D, Atmodjo DY, Vose JG, Huang EJ, Kummel AC, et al. Comparative healing of human cutaneous surgical incisions created by the PEAK PlasmaBlade, conventional electrosurgery, and a standard scalpel. *Plast Reconstr Surg*. 2011;128:104-11.
4. Chang EI, Carlson GA, Vose JG, Huang EJ, Yang GP. Comparative healing of rat fascia following incision with three surgical instruments. *J Surg Res*. 2011;167:e47-54.
5. Schaff HV, Said SM. Transaortic extended septal myectomy for hypertrophic cardiomyopathy. *Oper Tech Thorac Cardiovasc Surg*. 2012;17:238-50.