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Open to Debate: For

Nerve-sparing Techniques During Robot-assisted Radical Prostatectomy: Clips

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Avoiding or minimizing injury to the neurovascular bundle (NVB) during robot-assisted radical prostatectomy (RARP) is critical for preservation of erectile function. Various nerve-sparing techniques followed the landmark discovery by Walsh et al. [1]. Use of energy in proximity to the NVB damages unmyelinated fibers that support erectile function. Therefore, surgical clips are widely used for energy-free control of the vascular lateral pedicles. However, the use of clips is associated with longer operative times and complications, such as clip migration, bladder neck contracture, and stone formation.

This Open Debate discusses the use of surgical clips versus bipolar cautery for lateral pedicle vascular control during nerve-sparing surgery. Prior studies evaluated clips versus low-energy techniques in terms of the recovery of erectile function after RARP. We describe current evidence to support the position that surgical clips remain the gold standard for nerve-sparing RARP.

Trauma to the NVB compromises erectile function and therefore minimizing mechanical and kinetic energy to the NVB during RARP is of paramount importance. In a

canine model of nerve-sparing radical prostatectomy, Ong et al. [2] studied the effects of different energy sources on recovery of erectile function. While erectile responses to cavernous nerve stimulation were preserved with suture ligation, the use of laparoscopic monopolar, bipolar, or ultrasonic shears in proximity to the NVB was associated with significantly reduced erectile responses in 12 dogs. Ahlering et al. [3] studied 51 men who underwent unilateral or bilateral nerve-sparing during RARP and compared vascular control with bulldog clamps versus bipolar cautery. The potency rate at 3 mo was significantly higher in the cautery-free group than in the bipolar cautery group (47% vs 8.3%; $p < 0.001$). Similar results were reported by Gill and Ukimura [4] when comparing 1-yr potency outcomes between a cautery technique with an ultrasonic scalpel and a cautery-free technique with bulldog clamping and suture ligation. They found that a cautery-free technique was associated with faster recovery of erectile function and a significantly higher intercourse rate in comparison to thermal energy (70% vs 36%; $p = 0.04$). In addition, erectile function recovery was significantly correlated with preserved blood supply within the NVB. When comparing athermal techniques, use of clips is less time-consuming in comparison to suture ligation. Thus, the use of clips as an athermal technique is promoted as the “gold standard” approach during nerve-sparing RARP [5].

Cautery is widely used during robotic surgery. Hefermehl et al. [6] studied thermal spread along bovine fascial tissues with different laparoscopic instruments and found that cautery devices have varying degrees of thermal spread, depending on both the power setting and the duration of cautery. With bipolar devices, the thermal spread

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distance for crossing the critical temperature threshold of 45 °C was 2.1 mm at 60 W and an application time of 1 s. However, a greater application time required a greater distance to maintain a margin of safety. Therefore, to minimize thermal effects, the surgeon must balance duration of cautery use and distance from the NVB.

New evidence suggests that bipolar energy may not have detrimental effects on erectile function as was previously thought. Basourakos et al. [7] compared men who underwent RARP with a bipolar cautery approach to men who had undergone RARP with clips and found no significant differences in erectile function after surgery. Longer follow-up with validated survey instruments revealed that 67% of men in the clips group recovered erections firm enough for intercourse at 2 yr after RARP, compared to 71% in the bipolar group ($p = 0.7$). While these results were encouraging, the study was limited by its retrospective, single-surgeon design. A prior study by Guimaraes et al. [8] compared the standard transperitoneal RARP approach against extraperitoneal RARP with anterior periprostatic preservation and a clipless technique. Although erectile function preservation was better and a faster return to baseline was observed in the clipless group, other factors such as surgeon experience in the extraperitoneal group and preservation of the endopelvic fascia may have contributed to differences in erectile function.

Beyond energy-free versus bipolar approaches to control the vascular pedicle, other technical considerations impact preservation of erectile function. Kowalczyk et al. [9] demonstrated the importance of limiting neuropraxia injury from countertraction on the NVB on postoperative erectile function. In addition, greater surgeon experience with sharp dissection of the prostate away from the NVB rather than blunt peeling of the NVB from the prostate also improves erectile function preservation [10]. These technical considerations beyond the approach to lateral pedicle control with versus without energy confound comparisons of current evidence. Finally, the use of machine learning and computer vision interjects objective capture of technical variation, and large prospective studies are needed to conclusively end the debate.

The use of surgical clips during nerve-sparing RARP avoids thermal injury to unmyelinated nerve fibers. While recent evidence supports that bipolar energy is noninferior

to energy-free ligation of the lateral pedicles [7], large, prospective, comparative studies that objectively and completely document and adjust for technical variation beyond lateral pedicle ligation techniques are needed to conclusively end this controversial debate.

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