Evaluation of Long-Term Thermal Injury Using Cautery During Nerve Sparing Robotic Prostatectomy

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OBJECTIVE
In our initial 125 cases, we used cauterity during preservation of the neurovascular bundles (NVBs). We previously reported the short-term benefit of a cauterity-free versus cauterity technique. To assess long-term consequences of cauterity, we report 2-year potency outcomes for these robot-assisted laparoscopic radical prostatectomies (RLP).

METHODS
Between June 2002 and February 2004, 125 consecutive patients underwent RLP by 1 surgeon. All data were entered prospectively into an electronic database. In cases 1 to 15, the vascular pedicle and nerve were dissected with monopolar cauterity. In cases 16 to 125, the dissection used bipolar cauterity and scissors. Preoperatively, 42 met inclusion criteria: age younger than 66 years, International Index of Erectile Function (IIEF-5) of 22 to 25 and uni (12) or bilateral (35) nerve sparing. Postoperatively all patients were encouraged to use 5-PDE inhibitors. Potency was assessed by self-administered validated questionnaires.

RESULTS
Four were excluded because of treatment intervention (3) or refusal to follow-up (1). Thirty-eight have follow-up data of 24 or more months. At 3, 9, and 15 months only 3 of 36 (8.3%), 5 of 34 (14.7%), and 16 of 37 (43.2%) were potent. However at 24 months, 5 of 10 (50%) of unilateral and 19 of 28 bilateral nerve-sparing (68%) were potent with an average IIEF-5 of 18.4 and erectile firmness of 75% to 100% of baseline.

CONCLUSION
These findings suggest that in addition to other injury, thermal injury to the NVB is dense with very low recovery rates in the first 12 to 18 months. However, with nearly two-thirds ultimately reporting potency return, these injuries are generally not permanent and recovery approaches 75% to 100% of baseline. UROLOGY 72: 1371–1374, 2008. © 2008 Elsevier Inc.
METHODS

Patient Population
One hundred twenty-five RLPs were performed between June 2002 and March 2004 by a single surgeon (T.A.), which represents our initial experience. Before surgery all men were evaluated and the following data entered prospectively into an electronic database: age, height, weight, clinical T-stage and Gleason score, PSA, International Index of Erectile Function (IIEF-5), and pertinent medical history. Preoperatively, 42 met inclusion criteria: age younger than 66 years, IIEF-5 of 22 to 25, and uni or bilateral nerve sparing surgery. Four men were excluded because of either hormonal therapy intervention (3) or refusal to follow-up (1). Thirty-eight have follow-up data of 24 or more months. Postoperative sexual outcomes were attained via self-administered questionnaires, IIEF-5, and 2 questions from the EPIC-26. On the basis of these 2 questions, men are considered potent if they answered yes to both “are your erections adequate for vaginal penetration” and “are the erections satisfactory.” Erection quality was evaluated for (partial) fullness compared with preoperative fullness. Men were asked to rate the erectile fullness: 0% to 10%, 25%, 50%, 75%, or 100% compared with before surgery. All men were encouraged to take 5 PDE inhibitors beginning no later than 1 month after surgery. A nonclinical research associate (D.S.) collected follow-up information. Institutional review board approval has been in place since 2002.

All men underwent RLP with NVB preservation in an antegrade fashion when indicated (Video clips 1-4). In our initial 15 cases nerve sparing were performed using monopolar “padle” cautery, to divide the vascular pedicle and dissect NVB. At case 16 when bipolar instruments became available at our institution, we converted to round tip scissors and bipolar electrocautery. Cautery settings (Valleylab, Boulder, Colo) were set between 30 and 40 watts. Men with high-grade (Gleason Scores 7 to 10) disease in conjunction with obvious palpable disease or multiple involved cores (3 or more) with 20% or more involvement underwent wide excision of the NVB.

RESULTS

Table 1 depicts clinical data for all 125 men in our initial experience. Three of the initial 15 men who underwent RLP with monopolar cautery and 35 of the remaining 110 met the inclusion criteria for evaluation. All statistical comparisons between the groups were made by using 2-sided using Fisher exact test, the Student t test for means, and the nonparametric Wilcoxon rank sum test (SAS 8.2 statistical package, Cary, NC).

Table 1. A comparison of clinical characteristics and outcomes of the first 125 robotic prostatectomy patients using cautery for NVB preservation

<table>
<thead>
<tr>
<th>Clinical Factor (mean)</th>
<th>Nonstudy Group</th>
<th>Study Group</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>87</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>65.2 (47–78)</td>
<td>56.5 (43–65)</td>
<td>&lt;0.001</td>
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<tr>
<td>Preoperative IIEF-5</td>
<td>14.2 (22–25)</td>
<td>24.3 (22–25)</td>
<td>&lt;0.001</td>
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<tr>
<td>PSA ng/mL</td>
<td>8.1 (0.1–62)</td>
<td>6.6 (1.2–23.0)</td>
<td>0.13</td>
</tr>
<tr>
<td>Mean Gleason Score</td>
<td>6.8 (4–10)</td>
<td>6.4 (5–8)</td>
<td>0.05</td>
</tr>
<tr>
<td>AUA score</td>
<td>10.4 (0–32)</td>
<td>5.9 (0–29)</td>
<td>0.002</td>
</tr>
<tr>
<td>EBL mL</td>
<td>123.8 (25–400)</td>
<td>92 (25–250)</td>
<td>0.07</td>
</tr>
<tr>
<td>Length of stay (days)</td>
<td>1.3 (1–7)</td>
<td>1.1 (1–5)</td>
<td>0.37</td>
</tr>
<tr>
<td>Complications</td>
<td>10.5%</td>
<td>5.3%</td>
<td>0.35</td>
</tr>
</tbody>
</table>

AUA = American Urological Association; EBL = estimated blood loss; IIEF = International Index of Erectile Function; NVB = neurovascular bundle; PSA = prostate specific antigen.

Table 2. Comparison of potency outcomes at 3, 9, 15, and 24 months

<table>
<thead>
<tr>
<th>Outcome</th>
<th>3 mon</th>
<th>9 mon</th>
<th>15 mon</th>
<th>24 mon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>36</td>
<td>34</td>
<td>37</td>
<td>38</td>
</tr>
<tr>
<td>All NS</td>
<td>3/36 (8.3%)</td>
<td>5/34 (14.7%)</td>
<td>16/37 (43.2%)</td>
<td>24/38 (63.2%)</td>
</tr>
<tr>
<td>Bilateral NS</td>
<td>3/26 (11.5%)</td>
<td>4/24 (16.7%)</td>
<td>12/27 (44.4%)</td>
<td>19/28 (67.9%)</td>
</tr>
<tr>
<td>Unilateral NS</td>
<td>0/10 (0%)</td>
<td>1/10 (10%)</td>
<td>4/10 (40%)</td>
<td>5/10 (50%)</td>
</tr>
<tr>
<td>AVE SHIM (potent men)</td>
<td>20</td>
<td>14.3</td>
<td>17</td>
<td>18.4</td>
</tr>
</tbody>
</table>

AVE IIEF-S = Average IIEFS; NS = nerve sparing.

Figure 1. Potency outcomes for men who had either mono or bipolar cautery with the dissection of the neurovascular bundles during robotic prostatectomy. The graph shows the percentage of men with successful intercourse at various intervals after surgery.
the firmness was 75% to 100% of preoperative firmness. Ten had a unilateral nerve sparing procedure and 50% reported return of potency versus 69.7% with bilateral preservation ($P = 0.31$). With unilateral preservation, the average IIEF-5 was 20.6; all indicated that the firmness of erections was 75% to 100% of baseline levels. As noted, only 3 of the initial 15 cases met inclusion criteria. Remarkably, all 3 reported return of potency even though we were at the beginning of the learning curve coupled with the fact that the entire procedure was performed with monopolar cautery and without scissors. The mean IIEF-5 of this group was 19.7 and all 3 had 75% to 100% return of baseline firmness.

Fourteen were impotent with at least 24 months of follow-up. The average IIEF-5 was 3.1 (range 1 to 13) and the mean fullness compared with preoperative status was 38.5% (both $P$ values less than 0.05). Of note, 3 of 13 (23%) reported fullness of 75% and one of these men reported satisfactory intercourse (IIEF-5 score of 17) 36 months, postoperatively. Of the remaining patients, 5 reported 50% firmness, 1 25%, and 4 reported no firmness.

**COMMENT**

In this article we report our long-term potency outcomes with nerve sparing RLP in our initial experience when we used cautery to transect the PVP and dissect the NVB. During this experience, we were technically satisfied with the visual outcome (video clips 1-4) after nerve sparing surgery; but return of sexual function was “slow.” However, there are considerations worth noting to better understand our initial “slow” return of sexual function. The impact of our “learning” curve played a role in delaying the understanding our results. Second, it has taken 4 years for enough time to elapse so we could look specifically at our initial 15 cases in which we used only monopolar cautery (ie, no scissors) and we were at the beginning of the learning curve, there were 3 evaluable patients. Remarkably all 3 had return of potency (2 bilateral nerve sparing and 1 unilateral).

The numbers are admittedly small, yet the average IIEF-5 was 20 (range 17 to 23) and firmness was 90% (2 bilateral NS 95% to 100% firmness and 75% for the unilateral NS).

Next, it is interesting to see how well (or poorly) 1 nerve tolerated the thermal trauma associated with a thermal technique. Fifty percent of the men with unilateral versus 68% of bilateral nerve sparing were potent; however, because of the low numbers, we cannot determine whether this difference is a statistically significant finding. The qualitative assessment demonstrated that 5 men reported that their mean erectile firmness was 88% (range 75% to 100%) and the mean IIEF-5 score was 19.7 (17 to 25). Regardless, when one considers that just 1 nerve was spared and significant thermal energy was applied, it further supports the notion that structurally the nerve was preserved and that thermal injury primarily results in a recoverable injury. It also supports the idea that 1 nerve can compensate for 2 in many, if not most, cases.

A weakness in this study is our “learning curve” and lack of a concurrent control group. It would be of interest to compare the time with and overall strength of recovery with a concomitant group of patients who had the same surgery albeit without cautery. At the time, however, we had not yet developed our cautery free nerve-sparing technique. Although it is clearly best to avoid thermal injury to the NVB altogether if possible, this study demonstrates the natural course of surgical trauma (thermal injury) to the NVB and adds to our understanding of the healing and regenerative process and time course.

**CONCLUSION**

The benefit of avoiding thermal energy in nerve-sparing surgery strongly supports athermal techniques. This study demonstrates that the use of mono or bipolar electrocautery during transection of the prostatic vascular pedicle
and dissection of the NVB appears to create a dense but (mostly) reversible praxia to the cavernous nerve. Return of potency is severely retarded for 15 to 24 months. And our findings suggest that in those men who do recover sexual function after thermal injury, erectile firmness and satisfaction returns to approximately 85% of baseline.

References


Video Clips cited in this article can be found on the internet at: http://www.goldjournal.net