Abstract

Objective: Localized prostate cancer is a common disease for which minimally invasive treatment methods are being explored. Perineal prostatectomy, as a historical open procedure, is modified to incorporate contemporary surgical ideas. There is relatively little in the literature regarding modern adaptations of perineal prostatectomy. This method of anatomic radical perineal prostatectomy has been developed to accomplish a minimally invasive method of achieving goals of disease control and preservation of genito-urinary functions.

Methods: Prospective outcome data is accumulated on 508 consecutive radical perineal prostatectomies by a single surgeon. Pathologic stage and PSA detectability are measures of cancer control. Pad use and ability to complete intercourse measure urinary and sexual function. General complications and other outcome measures are evaluated.

Results: Freedom from PSA detectability by pathologic stage is 96.3%, 79.4%, and 69.4% for organ confined, specimen confined and margin positive in the absence of seminal vesical invasion with an average 4 years follow up (3–114 months). Margins are positive in 18% of cases. The average cancer size is 9.4 g and 36% of cases have extracapsular invasion. By the first, third, sixth months and one year, 38%, 65%, 88% and 96% are free of pad use and report being dry. While over 80% of nerve-spared patients enjoy the return of spontaneous erectile function, the men with bilateral nerve preservation note earlier and more complete return of function. There are no cardio-pulmonary complications or deaths. Transfusions occurred in 1%, none in the past 400 cases. Average total hospital charges are USD$4889.00 in 1999 and 2000. Anterior urethral strictures, anastomotic strictures and fecal urgency/stress flatus occur 2%, 2% and 2–4%, respectively.

Conclusions: This method of prostatectomy is able to achieve complete cancer resection while preserving urinary and sexual function as well as laparoscopic or retropubic prostatectomy. The simplicity and minimally invasive nature of this procedure contribute to a short recovery and low overall cost of therapy. The anatomic radical perineal prostatectomy is a cost-efficient, outcome effective minimally invasive method of treating men with localized prostate cancer.

Keywords: Radical prostatectomy; Perineal prostatectomy; Prostate cancer; Outcomes; Minimally invasive

1. Introduction

With the widespread use of early detection practices, prostate cancer is usually detected while clinically localized and potentially curable. Radical prostatectomy is considered the most reliable method of eradication of localized prostate cancer. Laparoscopic radical prostatectomy, as a minimally invasive approach to radical prostatectomy, have been developed as an alternative to radical retropubic prostatectomy [1,2]. The perineal approach to radical prostatectomy has long been considered a less invasive method of prostatectomy [3]. Hugh Hampton Young utilized a perineal approach in 1904 [4]. Belt described a subsphincteric entry into the pelvis and early dissection of the vas and seminal vesicals in 1942 [5]. Walsh defined the anatomy of the paraprostatic cavernosal nerve bundles and described a method of nerve preservation during retropubic prostatectomy in 1982 [6].
In 1985, Weiss applied this information to develop a nerve sparing technique during total perineal prostatectomy [7]. In 1988, Weldon described the nerve sparing radical perineal prostatectomy and a 56% success rate in 9 patients [8]. We modified the technique of perineal prostatectomy to incorporate early dissection of the vasa and seminal vesicles, bladder neck preservation and nerve sparing techniques in the early 1990s [9]. Over the past 9 years, the anatomic radical perineal prostatectomy, herein described, has undergone modifications to reduce the burden of treatment on the patient while optimizing functional and oncologic outcomes.

2. Methods

2.1. The technique

Following appropriate evaluation and counseling for radical prostatectomy, the decisions regarding erectile nerve preservation and use of neo-adjuvant hormone therapy are discussed. Bilateral nerve sparing techniques are considered for patients with good erectile function and non-palpable tumors with a Gleason score of 6 or less involving less than 20% of 2 or fewer sextants. Unilateral nerve preservation is considered in men with one side and both apex sextants meeting the above criteria when the contra-lateral base and/or mid sextant does not meet the criteria. Neoadjuvant hormone therapy is considered in men with large prostate glands, delayed surgical dates, large tumors, locally advanced tumors or those that are referred after neoadjuvant hormone therapy has already been initiated. Bladder neck and proximal urethral preservation is intended in men without large adenomas, prior transurethral prostatectomy, transition zone tumors or large tumors in the base of the peripheral zone. A more complete description of this technique has been published previously [10]. Specific technical issues will be reviewed as they relate to specific surgical goals.

Pelvic lymphadenectomy is performed immediately prior to prostatectomy in the 1% of patients with high risk for metastasis in this series. Prostates larger than 100 cc on ultrasound are downsized with hormone therapy for 4–12 months, as needed. While the procedure is more difficult with prostate gland sizes greater than 90 cc, the gland is always removed intact. Prostates that measure larger than 160 cc have not presented to this author in 10 years. Measurement of the distance between the ischial tuberosities and assessment of the angle between the inferior rami of the pubic bone should be considered before attempting the perineal approach to the prostate larger than 200 cc.

The perineal incision is placed with the apex in the mid-perineum and the ends medial to the ischial tuberosities and anterior to the anus to avoid compromise of anal canal function. By elevating the fibrous confluence found immediately posterior to the raphé of the bulbospongiosus muscle with a forceps, the recto-urethralis muscle is easily visualized and divided revealing Denonvillier’s fascia. A fixed retraction system, such as the Thompson Retractor (Thompson Surgical, Inc., Traverse City, MI, USA) greatly facilitates exposure and frees up the surgical assistant’s hands. A Lowsley tractor is placed in the urethra to assist in identification of landmarks and to facilitate manipulation of the prostate.

Traditional techniques are based upon early division of the urethra at the apex, resulting downward rotation of the prostate into the operating field, obscuring visualization of the seminal vesicles. Utilizing this anatomic approach, the vas and seminal vesicles are dissected and divided with the prostate elevated behind the pubic bone. In cases of wide excision, all fibrofatty tissue inside Denonvillier’s fascia and lateral to the levator ani muscles are taken ‘en bloc’ with the prostate and endopelvic fascia intact to achieve the widest possible margin of resection. If desired, the bladder base can be resected up to the ureteral orifices and some pelvic floor muscle fibers can be resected with the prostatic apex to achieve a wider margin of resection at the base and apex, respectively.

In nerve sparing cases, Denonvillier’s fascia is incised from the midpoint of the seminal vesicle to the mid-apex. With careful sharp dissection the cavernosal nerve bundles and associated fascia is separated from the prostate from apex to adjacent to the seminal vesicles. This dissection is performed bilaterally if both nerve bundles are to be spared. In unilateral nerve sparing cases, a wide excision is carried out on the contralateral side.

The urethra at the apex is dissected out of the prostatic apex up to the veru montanum where it is divided. At the bladder neck, the proximal urethra is dissected out of the base of the prostate for a length of one centimeter, preserving the bladder neck and proximal urethral stump. An interrupted or running anastomosis is then performed under excellent exposure.

In men with prior transurethral prostatectomy, very large glands or cancer near the bladder neck, bladder neck preservation is not intended. In this situation, a gaping vesical neck results after amputation of the bladder neck. The bladder neck is then tailored to a snug 20F opening without evertting the urothelium. The anastomosis is then accomplished in a similar manner being sure to include urothelium in each anastomotic suture. The ‘tennis racquet’ closure of the bladder neck is reinforced with another layer of absorbable running suture.

The levator ani muscles are re-approximated in the midline with a penrose drain overlying the rectum. Ambulation and diet are advanced on the day of surgery. The penrose drain is removed prior to discharge on the morning post-operative day one. The catheter is removed 4 days later (in recent cases). A cystogram is performed in selected cases. Activities, except bicycle riding, are unrestricted when the catheter is removed. The patient returns in 2 months for his first PSA. PSA testing is done every 3 months for the first year, every 6 months for the next two years and then annually for life, if undetectable. PSA detectability (>0.2 ng/ml) is considered biochemical evidence for failure.

2.2. Data management

All data are accumulated prospectively on a database by the surgeon during follow up visits. Patients are called periodically for long-term follow up if they are no longer seen in the surgeon’s practice.

The operative technique and clinical practice has evolved over the 8.5-year study period. Later modifications of technique are based upon earlier data assessment, such that recent outcomes are better than initial outcomes. The above technique is the current manifestation of this evolution. Outcome data presented are segregated by significant technical differences. Cancer control is based upon 508 consecutive patients undergoing radical perineal prostatectomy with or without pelvic lymphadenectomy for clinically localized prostate cancer, exclusive of clinically advanced or salvage cases in a solo practicing, community urologist’s practice. Continence data are based upon 439 patients from February 1995 to January 2002. In February 1995, bladder neck preservation with a
stump of proximal urethra and apical dissection of urethra to the veru montanum was initiated. When an adequate proximal stump of urethra results, end-to-end urethrourethral anastomosis is performed. If the bladder neck is preserved, but the proximal urethra is deemed suboptimal, urethro-intact-vesical neck anastomosis is performed. The default technique if bladder neck preservation is not possible is a ‘tennis-racquet’ reconstruction of the bladder neck, as outlined above. In the past 2 years the duration of post-operative catheter drainage has gradually been reduced from 17 days to 4 days. Cystograms performed at 8 days were universally normal, which prompted reduction of catheter time to 4 days in the most recent 50 patients. Complications are compiled from all 508 patients. Complexity of data and limitations of this manuscript preclude a more detailed assessment of each technical nuance and associated outcomes.

3. Results

3.1. Patient characteristics

508 consecutive cases performed by a single surgeon are prospectively accumulated over the past 8.5 years. Average patient age is 65.8 years. The average pre-biopsy PSA is 6.8 (range 0.3–29.9) and biopsy Gleason score is 6.3. The average prostate weight and cancer weight are 49.3 g and 9.6 g, respectively, and are based upon specimen weight and percent involvement with cancer. Seven patients underwent pelvic lymphadectomy and all were negative for metastatic disease on frozen section analysis.

3.2. Cancer control

Ninety-six percent and seventy-nine percent of men with organ confined and clean margins with extracapsular disease are free of biochemical evidence of recurrent disease, respectively. As the pathologic stage increases, biochemical evidence for recurrent disease becomes more common. Four men underwent prostatectomy despite occult metastatic disease that was apparent on permanent section of lymph nodes after initially negative frozen section analysis. Follow up ranges from 3 to 102 months with an average follow up of 48 months. See Table 1.

Table 1

<table>
<thead>
<tr>
<th>Pathologic stage</th>
<th>Number (%)</th>
<th>% PSA &lt; 0.2</th>
</tr>
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<tbody>
<tr>
<td>B (Organ confined)</td>
<td>326 (64.2)</td>
<td>96.3%</td>
</tr>
<tr>
<td>C1 (Specimen confined)</td>
<td>68 (13.4)</td>
<td>79.4%</td>
</tr>
<tr>
<td>C2 (Positive margins)</td>
<td>85 (16.7)</td>
<td>69.4%</td>
</tr>
<tr>
<td>C3 (Seminal vesical inv.)</td>
<td>25 (4.9)</td>
<td>24%</td>
</tr>
<tr>
<td>D (Occult metastatic)</td>
<td>4 (0.8)</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>508 (100)</td>
<td>85.8%</td>
</tr>
</tbody>
</table>

PSA < 0.2 is considered undetectable. Average follow up is 48 months (3–102 months).

While 36% of cases have extracapsular disease, positive margins are seen in 16.3% of cases without seminal vesicle invasion and in 18% overall. Margins are focally (less than 1 mm²) positive in 8.9%, isolated and non-focal in 4.3% and multifocal in 3.1% of cases. Biochemical freedom from recurrence is noted in 91% of men with focal margin positivity and 45% if the margins positive are nonfocal or multiple. Positive margins are noted at the apex, anterior, bladder neck and bladder base along the seminal vesicals in 5.1%, 2.6%, 3.1% and 2.8%, respectively. See Fig. 1.

Biochemical evidence for recurrent is noted in 14.2% of patients. To date, 5 (1%), 23 (4.5%) and 7 (1.4%) of the men have been treated with radiation therapy, hormone therapy or both, respectively. There have been no deaths due to prostate cancer, however, 7, 2, 1, and 2 have died of heart disease, bladder cancer, stroke, and unknown, respectively. One man was murdered while free of disease.

3.3. Urinary continence

By the first month, second month, fourth month, sixth month and one year, 38%, 53%, 74%, 85% and 96% of patients are free of pad usage. Two and one half percent of patients use one pad daily for minimal stress incontinence and 1.5% use more than one pad daily after the first year. ‘Socially dry’ continence preceeded ‘totally dry’ continence by 6–8 weeks during the first six months after surgery. Eight men were treated with 1–5 collagen implants while 6 (1.2%) received artifical sphincters. See Fig. 2.

3.4. Return of erectile function

Criteria for consideration of cavernosal nerve preservation are based upon the staging by sextant biopsies (medial and lateral cores in each sextant). Initially, only fully potent men with unilateral, non-apical tumors are offered nerve preservation of the contralateral nerve bundle. Since July 2001, bilateral nerve
preservation has been performed in selected patients as noted above. While follow up is short in bilateral nerve spared men, initial recovery of spontaneous erections occurs within six months post-operative in 82% of bilaterally nerve-spared men. Eighteen percent did not recover significant erectile function and are considered failures. See Table 2 for nerve sparing results.

3.5. Complications

Distal urethral strictures and anastomotic strictures have occurred in 2% each. Office cystoscopic evaluation and dilation resolved most strictures with 3 patients undergoing internal urethrotomy under anesthesia. One patient developed a recurrent urethro-cutaneous fistula, which required excision and Gracilis muscle interposition flap. He is continent and cancer-free 8 years post-operation. One man has experienced anal incompetence, while 2–4% note mild fecal urgency or valsalva related flatus. One man experienced a transient ischemic event and another a mild stroke on the day of discharge, requiring an extra day of neurologic tests and initiation of rehabilitation. No cardiac or pulmonary complications occurred. There were no perioperative deaths. No patients developed lower extremity neuropraxia. Two percent of patients had rectal injuries that were all identified, repaired with a two-layer closure and recovered without adverse sequelae. No specific alteration in post-operative management is undertaken in men with repaired proctotomies as all men are prepped for this possible complication.

3.6. Cost issues

Operative time is not abstracted from operative notes; however, most cases are completed between 75 and 120 minutes with less than 10% taking longer or shorter time. The length of hospital stay declined throughout the study period as a nursing care pathway was instituted and improvements in preoperative teaching resulted in a steady decline in the length of stay. While initial patients were hospitalized for 3–4 days, the average length of hospital stay of the most recent 300 patients is 1.1 days. In the past 300 patients, 95% are discharged on the morning after surgery and 5% on the second postoperative day. Average hospital charges were $4889.00 in 1999 and 2000. Blood banking of autologous blood, type and screening for potential transfusion are not performed. Post-operative lab testing of any type is rare.

4. Discussion

The anatomical radical perineal prostatectomy is cost-effective, safe and versatile. The exceptionally low risk of lymph node metastasis obviates the need for lymphadenectomy in the majority of prostatectomy patients, thus avoiding abdominal surgery [11]. This method of perineal prostatectomy results in excellent cancer control by incorporating all periprostatic tissues to the levator ani muscles in wide excision cases. Despite relatively large average cancer volumes (9.4 gm) and 36% with extracapsular invasion the margin positive rate is 18%. Gibbons and Iselin have demonstrated excellent cancer control in men followed for 20 years following radical perineal prostatectomy [12,13]. While failure in the presence of occult distant metastasis is predetermined, locally confined cancers can be cleanly excised with good long-term freedom from disease with radical perineal prostatectomy. Whether the retropubic, perineal or laparoscopic approach is used for radical prostatectomy, clean margin excision in the absence of metastatic disease is the basis for long-term disease-specific survival.

Weldon reported a 25%, 7% and 16% incidence of anterior, apical and posterolateral positive margins during radical perineal prostatectomy, respectively [14]. Overall he noted 44% positive margins. He felt that at least 45% of the anterior positive margins were the result of avulsing the puboprostatic ligaments off of the anterior surface of the prostate. In the present

![Fig. 2. Socially dry (0–1 pad daily, solid squares) and totally dry (no pad use, open circles) by weeks after catheter removal.](image-url)

Table 2

<table>
<thead>
<tr>
<th>Nerves spared</th>
<th>Number</th>
<th>Spontaneous erections</th>
<th>Adequate for intercourse</th>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unilateral</td>
<td>46</td>
<td>34 (74%)</td>
<td>16 (35%)</td>
<td>2 mo–2+ years</td>
</tr>
<tr>
<td>Bilateral</td>
<td>12</td>
<td>10 (83%)</td>
<td>3 (25%)</td>
<td>2–6 months</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>49 (82%)</td>
<td>22 (37%)</td>
<td></td>
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Note that follow up is short in bilaterally nerve spared men, which accounts for the relative similarity in results. Bilaterally nerve spared men achieve potency faster and more completely than unilaterally spared men. Several men in each group are followed less than 2 months.
series, the puboprostatic ligaments and associated anterior tissue is divided with electrocautery at least 2 mm anterior to the prostate. Apical margins positive are the most common site in this series (5.1%) primarily because of the relative absence of positive margins at other locations. The author feels that careful entry into the pelvis and judicious use of nerve sparing limits the risk of positive margins.

Perineal exposure facilitates easy dissection and anastomosis of the urethra. The use of end-to-end urethreourethrostomy was first used in this series in 1995 [15]. Gaker applied dissection of proximal urethreourethrostomy in 1996 [16]. Coakley described a urethra and a urethrourethrostomy during retropubic prostatectomy in 1996 [16]. Coakley described a relationship between the length of urethra preserved and return of continence following radical retropubic prostatectomy [17]. The perineal approach provided unmatched exposure to urethral dissection and anastomosis, therefore, the reduced incontinence seen in this series compared to the retropubic series is consistent with their findings. Olsson reported a 78.4% one-year rate of ‘pad free’ continence following laparoscopic radical prostatectomy [18]. The laparoscopic approach does not incorporate dissection of urethral length at the base and apex of the prostate, but rather divides the urethra flush at these locations. The additional urethral length preserved during the present series may account for the superior post-operative continence.

Limited and selective use of nerve sparing resulted in no patient having a margin positive at a site of nerve preservation. Only 10% of men in the present series underwent a nerve sparing procedure. The majority of nerve-spared patients have spontaneous erectile activity, however, bilateral nerve preservation results in erectile rigidity adequate for intercourse as early as 2–3 weeks after surgery. Follow up in the patients undergoing bilateral nerve preservation is short as this technique was not performed prior to July 2001 out of concern for the ability to achieve cancer-free surgical margins. The bilaterally nerve spared men that are followed longer than 6 months are nearly all able to penetrate vaginally to complete intercourse with or without sildenafl. Because many patients use sildenafl before surgery (including some that can penetrate without sildenafl), many also require its use after nerve sparing surgery. Longer follow up in the use of nerve sparing is necessary to better evaluate this function, however, the presence of spontaneous erections in at least 82% of these men suggests at least good efficacy.

Bishoff reported a higher rate of fecal soilage following perineal versus retropubic prostatectomy, however, their perineal incisions extend 1–2 cm posterior to the anal orifice [19]. In this series, one man has severe anal incompetence and 2–4% report either mild fecal urgency or flatus during valsalva maneuvers. While no comparative data is available, the low incidence of anorectal problems is likely due to the anterior location of the perineal incision.

While body habitus and prior abdomino-pelvic surgery impact negatively upon a given patient’s candidacy for laparoscopic prostatectomy and to some extent retropubic prostatectomy, essentially all men that are candidates for prostatectomy can undergo perineal prostatectomy. Price reported a 21% incidence of lower extremity neuropraxia following perineal prostatectomy when utilizing candy cane stirrups with a mean operating time of 175 minutes [20]. This author experienced a similar finding of lower extremity neuropraxia in 8 of the first 14 patients when self-teaching this procedure in 1992. By supporting the weight of the leg with Allen stirrups (Allen Medical Systems, Bedford Heights, OH, USA) instead of candy cane stirrups, this complication no longer occurs. It is important to avoid excessive cephalad flexion of the hips as well as prolonged surgical time to avoid compromise of the lower extremity neurovascular status.

Patient acceptance is very high as the treatment and recovery are short and very well tolerated. Radical perineal prostatectomy is a minimally invasive, outcome-effective and cost-efficient method of managing localized prostate cancer.

References


Editorial Comment

C.E. Iselin, Geneva, Switzerland

The author reviews a series of 508 consecutive patients treated over 10 years by radical perineal prostatectomy (RPP) for localized prostate cancer. The purpose is to provide data which may support the known oncologic and functional efficiency of the procedure, such as its minimally invasive and cost-efficient aspects, as already shown by several investigators [1–3]. Although this paper contains interesting features suggesting the above, the significant range of several methodologic and outcome parameters reflects the evolution of the authors technique, such as the introduction of a clinical care pathway during the series. In the era of laparoscopic prostatectomy, the unfortunately so-called lost art of RPP deserves vigorous argumentation. This may have been achieved by dividing the series in 2 or 3 groups, in an effort to evaluate the impact of the cardinal changes that have milestone this cohort, and led the author to defend so enthusiastically RPP, for which he is to be congratulated.

References