

Prostate Cancer

Degree of Preservation of the Neurovascular Bundles During Radical Prostatectomy and Urinary Continence 1 Year after Surgery

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Abstract

Background: Many elderly or impotent men with prostate cancer may not receive a bundle-preserving radical prostatectomy as a result of uncertainty regarding the effect on urinary incontinence.

Objective: We searched for predictors of urinary incontinence 1 yr after surgery among surgical steps during radical prostatectomy.

Design, setting, and participants: More than 100 surgeons in 14 centers prospectively collected data on surgical steps during an open or robot-assisted laparoscopic radical prostatectomy. At 1 yr after surgery, a neutral third-party secretariat collected patient-reported information on urinary incontinence. After excluding men with preoperative urinary incontinence or postoperative irradiation, data were available for 3379 men.

Intervention: Surgical steps during radical prostatectomy, including dissection plane as a measure of the degree of preservation of the two neurovascular bundles.

Outcome measurements and statistical analysis: Urinary incontinence 1 yr after surgery was measured as patient-reported use of pads. In different categories of surgical steps, we calculated the percentage of men changing pads “about once per 24 h” or more often. Relative risks were calculated as percentage ratios between categories.

Results and limitations: A strong association was found between the degree of bundle preservation and urinary incontinence 1 yr after surgery. We set the highest degree of bundle preservation (bilateral intrafascial dissection) as the reference category (relative risk = 1.0). For the men in the remaining six groups, ordered according to the degree of preservation, we obtained the following relative risks (95% confidence interval [CI]): 1.07 (0.63–1.83), 1.19 (0.77–1.85), 1.56 (0.99–2.45), 1.78 (1.13–2.81), 2.27 (1.45–3.53),

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and 2.37 (1.52–3.69). In the latter group, no preservation of any of the bundles was performed. The pattern was similar for preoperatively impotent men and for elderly men. Limitations of this analysis include the fact that noise influences the relative risks, due to variations between surgeons in the use of undocumented surgical steps of the procedure, variations in surgical experience and in how the surgical steps are reported, as well as variations in the metrics of patient-reported use of pads.

Conclusions: We found that the degree of preservation of the two neurovascular bundles during radical prostatectomy predicts the rate of urinary incontinence 1 yr after the operation. According to our findings, preservation of both neurovascular bundles to avoid urinary incontinence is also meaningful for elderly and impotent men.

Patient summary: We studied the degree of preservation of the two neurovascular bundles during radical prostatectomy and found that the risk of incontinence decreases if the surgeon preserves two bundles instead of one, and if the surgeon preserves some part of a bundle rather than not doing so.

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1. Introduction

In radical prostatectomy, the surgeon has the goal of removing all malignant cells to improve survival [1] while at the same time operating, if possible, in a manner that will enable the patient to recover his sexual health and urinary continence after the surgery [2]. Two neurovascular bundles run very close to the prostate. We know that preservation of these two bundles is of central importance if the patient is to recover his sexual health [3]. We do not know, however, if the degree of preservation of these neurovascular bundles predicts urinary continence [4–15].

Seminal work by Patrick Walsh in the early 1980s [16] showed that the nerves mediating penile erection pass outside of the prostate, mainly in the two neurovascular bundles. However, the role of the bundles in acting on the external urethral sphincter, crucial to the maintenance of urinary continence after a radical prostatectomy, remains unclear. The bundles may provide blood supply or structural support to the external sphincter, although this has not been proven anatomically [2,17]. Autonomic nerve fibers in the bundles may innervate the striated urethral sphincter or pass through the sphincter to innervate the smooth muscle sphincter component of the membranous urethra. Many dispute, however, the idea that autonomic nerves, in the bundles or outside of them, innervate the specialized striated and slow-twitch muscle sphincter, which may function primarily to maintain passive continence when a person is not urinating [17–20].

Because the two neurovascular bundles run near the prostate, a large tumor can require a wide incision if all the malignant cells are to be removed, and this can prevent the surgeon from being able to preserve the neurovascular bundles [21]. However, several factors result in making it more often possible for the surgeons to completely or partially preserve one or both bundles. With intensified screening, smaller tumors than before are discovered [22]. With improved visual aids, the neurovascular bundles and the adjacent tissue can be identified more clearly than in the past. For sexually active men today, it is a given to consider whether the tumor biology allows preservation of the neurovascular bundles. For sexually inactive men, however, the practice varies drastically, which reflects

our limited knowledge of the role, if any, that the neurovascular bundles play in controlling the functioning of the external urethral sphincter. Even if the tumor is small and lies well within the prostate capsule, sometimes none of the neurovascular bundles are preserved [23,24], completely in concordance with the guidelines of the European Urological Association and the American Urological Association [25,26].

Surgical steps that differ between procedures, but that can be documented in a standardized way, can be studied as predictors of long-term outcomes. To gain knowledge for refining the technique, more than 100 surgeons, working within a framework of prospective data collection at 14 centers, documented the procedure during radical prostatectomy using the same protocol. To increase validity, a neutral third party, administratively separated from all clinical centers and working scientifically only, prospectively collected patient-reported outcomes [27]. The referenced article [27] refers to the metrics around outcome after radical cystectomy; however, the methodological aspects are probably also relevant for the validity when measuring outcome after radical prostatectomy. Based on the collected data, we asked whether preservation of the neurovascular bundles, or other surgical steps, predicts the rate of urinary incontinence 1 yr after surgery.

2. Patients and methods

2.1. Overview

A previous article describes the LAPPRO (LAParoscopic Prostatectomy Robot Open) study [28]. The patients for this study were recruited from 14 centers, seven centers performing robot-assisted laparoscopic radical prostatectomy and seven centers performing open retropubic radical prostatectomy. We investigated the pros and cons associated with each of the two techniques. A neutral study secretariat collected patient-reported data before surgery as well as 3, 12, and 24 mo after surgery. In addition, we gathered clinical record forms concerning the situation before surgery, then on the surgical steps taken during surgery, and finally on clinical characteristics during follow-ups at 1.5–3 mo after surgery and again at 12 and 24 mo after surgery. The LAPPRO protocol can be found at the website of the Scandinavian Surgical Outcomes Research Group [29], and some further details can be found in the Current Controlled Trials database [30]. The Regional Ethical Review Board in Gothenburg (No 277-07) approved the study.

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