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Prostate Cancer

Erectile Function and Oncologic Outcomes Following Open Retropubic and Robot-assisted Radical Prostatectomy: Results from the LAParoscopic Prostatectomy Robot Open Trial

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Abstract

Background: Whether surgeons perform better utilising a robot-assisted laparoscopic technique compared with an open approach during prostate cancer surgery is debatable.
Objective: To report erectile function and early oncologic outcomes for both surgical modalities, stratified by prostate cancer risk grouping.
Design, setting, and participants: In a prospective nonrandomised trial, we recruited 2545 men with prostate cancer from seven open (n = 753) and seven robot-assisted (n = 1792) Swedish centres (2008–2011).
Outcome measurements and statistical analysis: Clinometrically-validated questionnaire-based patient-reported erectile function was collected before, 3 mo, 12 mo, and 24 mo after surgery. Surgeon-reported degree of neurovascular-bundle preservation, pathologist-reported positive surgical margin (PSM) rates, and 2-yr prostate-specific antigen-relapse rates were measured.
Results and limitations: Among 1702 preoperatively potent men, we found enhanced erectile function recovery for low/intermediate-risk patients in the robot-assisted group at 3 mo. For patients with high-risk tumours, point estimates for erectile function recovery at 24 mo favoured the open surgery group. The degree of neurovascular bundle preservation and erectile function recovery were greater correlated for robot-assisted surgery. In pT2 tumours, 10% versus 17% PSM rates were observed for open and robot-assisted surgery, respectively; corresponding rates for pT3 tumours were 48% and 33%. These differences were associated with biochemical recurrence in pT3 but not pT2 disease. The study is limited by its nonrandomised design and relatively short follow-up.
Conclusions: Earlier recovery of erectile function in the robot-assisted surgery group in lower-risk patients is counterbalanced by lower PSM rates for open surgeons in organ-confined disease; thus, both open and robotic surgeons need to consider this trade-off when determining the plane of surgical dissection. Robot-assisted surgery also facilitates easier identification of nerve preservation planes during radical prostatectomy as well as wider dissection for pT3 cases.
Patient summary: For prostate cancer surgery, an open operation reduces erection problems in high-risk cancers but has higher relapse rates than robotic surgery. Relapse rates appear similar in low/intermediate-risk cancers and the robot appears better at preserving erections in these cases.

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1. Introduction

Radical prostatectomy outcome assessment has competing endpoints of cancer control and functional recovery. While in the USA over 80% of the radical prostatectomies today are performed using robot assistance, many argue that the only difference with the new technique is that it costs far more and does not improve the aforementioned outcomes. While a recent randomised controlled trial demonstrated similar short-term outcomes between open retropubic and robot-assisted radical prostatectomy, this only examined two surgeons and thus the results may not be generalisable to the surgical community at large [1]. A large prospective study has shown that robot-assisted radical prostatectomy is a safe procedure with some improvements in perioperative outcomes compared with open surgery [2], and our group has also demonstrated similar continence recovery between surgical modalities [3].

In Sweden, a radical prostatectomy comes at a low cost or no cost for the patient and virtually all patients within a specific geographical region are operated on at one hospital which performs either open or robot-assisted surgery. Hence, for most men, place of residence decided whether the radical prostatectomy was done with an open or robot-assisted approach. This facilitated starting a prospective data collection with the necessary features to reach the high validity of a clinical trial in which randomisation was replaced by place of residence. Focusing on erectile function recovery, degree of neurovascular-bundle preservation, and oncologic outcome in relation to tumour characteristics, we herein present data at 3 mo, 12 mo, and 24 mo of follow-up. Such data are not available in other studies, including randomised controlled trials.

2. Materials and methods

The LAParoscopic Prostatectomy Robot Open (LAPPRO) study recruited patients who underwent radical prostatectomy from September 2008 to November 2011, by 50 different surgeons from 14 centres (7 robot assisted and 7 open retropubic), accounting for around half the annual case-load in Sweden [1]. A third-party trial secretariat collected preoperative baseline, postoperative 3-mo, 12-mo, and 24-mo patient-reported outcomes with telephone reminders for initially nonresponsive patients. Clinical record forms were completed by health care professionals concerning clinical characteristics and intraoperative surgical steps; the secretariat regularly monitored the trial centres and 1% of the forms and patient-report questionnaires were entered twice and compared for agreement.

End-points in this study were erectile function recovery and positive surgical margin (PSM) and prostate-specific antigen (PSA)-relapse rates at 3 mo, 12 mo, and 24 mo after surgery. The LAPPRO study questionnaires have the same clinometric approach as a previous randomised controlled trial, SPCG-4, and more than 20 large data collections of cancer survivors [4–6]; to further confirm the question-and-answer categories were understood correctly by men with a recent diagnosis of prostate cancer, face-to-face validation was performed. The methods utilised have been extensively detailed elsewhere [7–10]. The Gothenburg Regional Ethical Review Board (Number 277-07) approved the study (ISRCTN06393679); the protocol is available at www.ssorg.net. All primary and secondary end-points, study planning, data, and statistical analysis were prespecified and approved by the LAPPRO committee led by nonurologists, before all investigations.

Inclusion criteria for the current analysis were: (1) men aged <75 yr, (2) being able to read and write Swedish, (3) having a tumour staged clinically as T1–T3, (4) PSA<20 ng/ml, (5) no previous malignancy, and (6) no signs of distant metastases. Men who were preoperatively potent (using the same definition as for postoperative potency given below) were included in the erectile function analyses. To minimise learning-curve bias, only surgeons that had performed >100 procedures were included. Throughout the study period, each surgeon performed either open retropubic or robot-assisted surgery only.

Among the surgical steps qualified by the surgeon in the clinical record form we asked, "Which approach was used during the neurovascular-bundle dissection?" The surgeon answered separately for the left and right side by marking one of the following four categories: (1) "Intrafascial," (2) "Interfascial," (3) "Partial nerve-sparing," (4) "No nerve-sparing procedure was carried out, the neurovascular-bundle was completely resected." These responses were combined for both sides into seven categories (from least to most neurovascular-bundle preservation): (1) No, (2) Partial unilateral/bilateral, (3) Inter/intra-fascial unilateral, (4) Inter/intra-fascial plus partial, (5) Interfascial bilateral, (6) Interfascial plus intrafascial, (7) Intrafascial bilateral.

Erectile function level was assessed across two specific domains [5,8,11–13]:

(1) *Penile stiffness* "How stiff was your penis at sexual activity during the last month?" a) "not applicable, I have not had sexual activity," b) "never stiff enough at any time," c) "stiff enough less than half of the time," d) "stiff enough more than half of the time," e) "stiff enough every time,"
(2) *Morning erection* "If you have had morning erection(s) during the last month, how stiff was your penis?" a) "Not applicable, I have not had a morning erection," b) "not stiff enough for intercourse at any time," c) "stiff enough less than half of the time," d) "stiff enough more than half of the time," e) "stiff enough every time."

Postoperative erectile function recovery was defined as when a patient answered "stiff enough less than half of the time," "stiff enough more than half of the time," or "stiff enough every time" on ≥1 domain. Postoperative use of erectile aids was also recorded but these men were classed as impotent for the analyses.

Oncologic outcome for both surgical cohorts was assessed by PSM and PSA-relapse rates (PSA > 0.2 ng/ml; including information on treatments given before relapse) stratified by pathologic stage.

2.1. Statistical analysis

For adjustments, we used weighting by stabilised inverse probability of treatment weights in order to emulate comparison groups with similar characteristics. We did this by first estimating the propensities of receiving each treatment (robot assisted or open) using logistic regression with adjustment variables as predictors, and then weighting the responses of each patient, that is, the product of the overall probability of their received treatment and the inverse estimated propensity of them receiving their treatment.

For erectile function, we considered the subgroup of men who preoperatively reported erectile function sufficient for intercourse on more than half of occasions. Men with no information at baseline were excluded. We assumed that all men lost their erectile function at the time of operation and considered the cumulative proportion of recovered erectile function above each threshold (ie, reporting no use of prostaglandin E1 medication, and erectile function more than never, more than half of occasions, and at every occasion, respectively) at the three measurement time points (3 mo, 12 mo, and 24 mo after surgery). We defined the time to recovery of each level of erectile function as the

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