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Robot-Assisted Intrafascial Simple Prostatectomy: Novel Technique

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Abstract

Purpose: We describe our initial experience with intrafascial robot-assisted simple prostatectomy (IF-RSP). Potential advantages include reduced blood loss, elimination of the need for postoperative bladder irrigation, and elimination of the risk of residual or future prostate cancer, without interrupting potency or continence.
Patients and Methods: From June 2011 to March 2012, 10 patients with symptomatic prostatomegaly on transrectal ultrasonography (TRUS) (mean 81 g) underwent IF-RSP. Three patients had acute urinary retention. Demographic perioperative and outcome data were recorded up to 1 month follow-up.
Results: Average age was 71.7 years (range 60–79 years), estimated blood loss was 375 mL (range 150–900 mL), operative time was 106 minutes (range 60–180 min), hospital stay was 1 day (range 0–3 days), and Foley catheter duration was 8.9 days (range 6–14 days). The drain was removed at a mean 2.8 days (range 0–8 days). Mean prostate volume on preoperative TRUS was 81 cc (range 47–153 cc). Mean specimen weight was 81 g (range 50–150 g). Improvement was noted in the International Prostate Symptom Score (preoperative *vs* postoperative 18.8 *vs* 1.7) and peak flow rate (12.4 *vs* 33.49 mL/min). Sexual Health Inventory for Men score ranged from 12 to 24. All patients were completely continent within 1 month postoperatively, and sexual function was preserved. One patient had urinary tract infection and one patient needed blood transfusion postoperatively.
Conclusions: IF-RSP appears to be a feasible procedure in large-volume prostatomegaly. The entire prostate tissue is removed without compromising continence and potency. Larger series and longer-term follow-up are needed to evaluate the proper place of this approach.

Introduction

Open simple prostatectomy has traditionally been the treatment of choice for patients with symptomatic giant benign prostatomegaly.[1] Initially performed by the perineal, suprapubic, and retropubic approaches, more recently transurethral endoscopic techniques have virtually replaced the open approach in many cases, albeit without quite duplicating the results of open surgery.[2–5] The endoscopic approach typically removes approximately only 50% of the gland, compared with more than 80% removal using the open approach.[5] Laparoscopic simple prostatectomy has been shown to deliver similar outcomes as those of open surgery. Sotelo and associates[6] first reported robot-assisted simple prostatectomy in 2008, demonstrating procedural feasibility and efficacy. Additional series have since reported a cumulative 47 patients in the literature to date.[7–10]

In 2012, Coelho and colleagues[11] described a modified technique of robot-assisted simple adenomectomy, which preserves the peripheral zone and intussuscepts the bladder mucosa distally to perform vesicourethral anastomosis, thus primarily reestablishing urothelial continuity circumferentially. In an attempt to address these issues, we developed a novel intrafascial technique of robot-assisted simple prostatectomy (IF-RSP) wherein a complete prostatectomy is performed while preserving the puboprostatic ligaments, periprostatic fascia, and seminal vesicles. Potential advantages of such an approach include reduced blood loss, elimination of the need for postoperative bladder irrigation, and elimination of the risk of residual or future prostate cancer, without interrupting potency or continence.

Patients and Methods

From June 2011 to March 2012, 10 patients underwent IF-RSP. All patients had symptomatic large-volume benign prostatic hyperplasia (BPH); 3 patients had an indwelling urethral catheter because of acute urinary retention. Preoperative evaluation included history, International Prostate Symptom Score (IPSS), quality of life (QoL) and Sexual Health Inventory for Men (SHIM) questionnaires, physical examination including digital rectal examination, routine laboratory

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Table 1. Demographic Data

Parameters	*Average*	*Range*	*SD*
Age (years)	71.7	60–79	6.71
Prostate volume (USTR) cc	81	47–153	34
Preoperative IPSS	18.8	5–31	7.69
Preoperative QoL	3.7	2–5	1.33
Preoperative max urine flow (mL/s)	12.43	4.6–24.4	7
Prostate-specific antigen (ng/mL)	5.81	1.9–11.33	2.93

10 patients (3 patients had acute urinary retention).
SD = standard deviation; IPSS = International Prostate Symptom Score; QoL = quality of life.

assessment with prostate-specific antigen (PSA) measurement, urinary peak flow rate (Qmax), transrectal ultrasonography (TRUS) with prostate volume measurement, and prostate biopsy documenting benign pathology. At 1 month postoperatively, all of the above tests (except for the needle biopsy) were repeated. Urinary continence was defined as use of no pads or use of one safety pad (Table 1).

Surgical technique

With the anesthetized patient in the steep Trendelenburg position, a six-port transperitoneal approach is used akin to radical prostatectomy using the four-arm daVinci® Surgical System. The bladder is dropped from the abdominal wall to enter the space of Retzius where the anterior prostate surface is defatted. The lateral prostate pedicles are controlled with 2-0 polyglactin hemostatic suture.[12] A back-bleeding suture (2-0 monofilament polydioxanone) is placed to control the anterior prostatic veins; this stitch also serves as a retraction suture to facilitate prostate dissection. Visceral endopelvic fascia is incised ventrally, medial to the puboprostatic ligaments, high along the lateral prostate surface for early release of bilateral neurovascular bundles (Fig. 1). This fascial incision is carried toward the prostate apex in a direction deep to the dorsal venous complex (Fig. 2), which is then transected and suture-ligated (3-0 polyglactin) (Fig. 3). Careful sharp and blunt dissection of the neurovascular bundle and contiguous visceral endopelvic fascia is performed with robotic scissors in a retrograde manner; this plane is mostly avascular except anteriorly. The urethra is dissected and transected as far proximally within the anterior prostate notch as possible to maximize urethral length (Fig. 4).

A horizontal cystotomy incision is created at the bladder neck and deepened over the prostate lobes until the prostate stroma is identified. One or more strategic retraction sutures are placed in the lateral lobes for traction as needed. If present, the median lobe is completely mobilized and transected at its junction with the lateral lobes. Seminal vesicles are identified and transected at the prostate base (Fig. 5). The freed specimen is placed in an Endopouch™ (Ethicon Endo-Surgery, Cincinnati, OH). Any perforating blood vessels are controlled with 4-0 polyglactin stitches or plasmakinetic device. Remnants of the seminal vesicles and vas deferens are closed with an overrunning suture of 3-0 polyglactin (Fig. 6).

Two separate sutures are used for the vesicourethral anastomosis in a running fashion over a 20F Foley catheter (Fig. 7) and checked for watertightness. The anterior aspect of the prostatic fascia is sutured to the anterior bladder wall (Fig. 8). A prevesical drain is placed if there is any anastomotic leak.

Results

Of the 10 patients, mean preoperative IPSS was 18.8 (range 5–31), QoL score was 3.7 (range 2–5), and Qmax was 12.4 mL/s (range 4.6–24.4 mL/s). SHIM score ranged from 12 to 24. A score < 20 was present in four patients; therefore, sexual function in these cases was not included in the analyses. Estimated blood loss was 375 mL (range 150–900 mL), operative time was 106 minutes (range 60–180 min), hospital stay was 1 day (range 0–3 days), and Foley catheter duration was 8.9 days (range 6–14 days). The drain was removed at a mean of 2.8 days (range 0–8 days) (Table 2).

Postoperatively, mean IPSS was 1.7 (range 1–3), QoL score was 0.5 (range 0–2), and Qmax was 33.49 mL/s (range 17–46.9 mL/s). Histopathology results confirmed benign glandular-stromal hyperplasia in all 10 patients, with no evidence of cancer. Mean prostate volume on preoperative TRUS was 81 cc (range 47–153 cc). Mean specimen weight on pathologic examination was 81 g (range 50–150 g); thus, mean TRUS weight and actual measured weight of the excised prostate were similar (Table 3). All patients were completely continent within 1 month postoperatively. In the six patients with preoperative SHIM score >20 (range 23–24), postoperative SHIM score ranged from 20 to 24. One (10%) patient had urinary tract infection because of a previous indwelling catheter, and one (10%) patient needed blood transfusion postoperatively.

Discussion

To our knowledge, this is the first report describing IF-RSP for benign disease. IF prostatectomy has been described previously during radical prostatectomy for optimizing neurovascular bundle preservation. The intrafascial plane is the plane between the prostate capsule and prostatic fascia. Thus, during an intrafascial dissection, the endopelvic fascia is incised only ventrally, medial to the puboprostatic ligaments.[13] When performed correctly, a periprostatic tissue curtain hangs on either side from the pubourethral ligament toward the bladder.[14] The neurovascular bundles lie between the anterior extension of the Denonvilliers fascia and the levator fascia. Hence, complete preservation of neurovascular bundles is achieved with intrafascial dissection.

Our technique completely excises all prostate tissue, as attested by the near-identical TRUS and pathologic prostate volumes, achieving complete adenomectomy without compromising sexual function or urinary continence. Because a complete vesicourethral anastomosis is created, the risk of hematuria is minimal, obviating the need for postoperative bladder irrigation. Also, because all prostate tissue is excised, the risk of adenoma regrowth or future development of prostate cancer is minimal. Even though patients experienced some urinary leakage after catheter removal without compromising their QoL, all of them gained complete continence within the first month postoperatively (Fig. 9).

IF prostatectomy for benign disease allows superior preservation of sexual function by following anatomic planes.[15–20] The lateral prostate fascia is preserved; the endopelvic fascia is not incised.

Incidental prostate cancer, defined as cancer diagnosed incidentally after transurethral or open surgery for

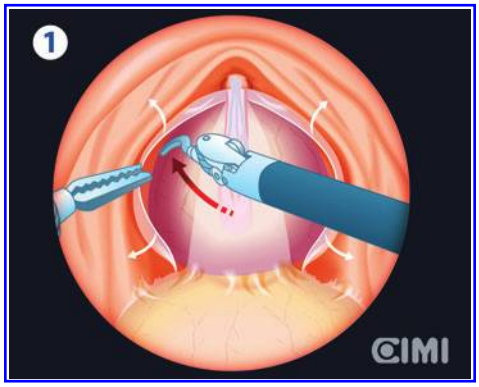

FIG. 1. Fascia dissection.

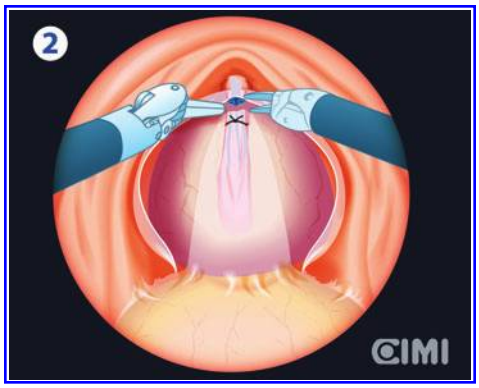

FIG. 2. Dorsal venous complex transection.

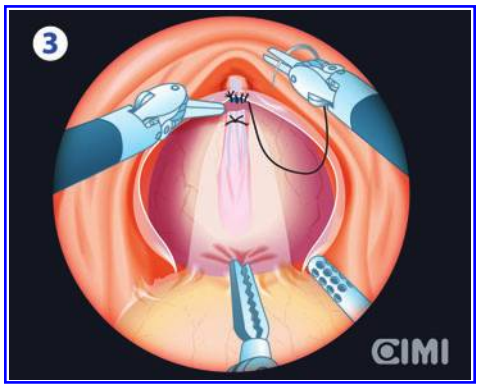

FIG. 3. Dorsal venous complex suture-ligated.

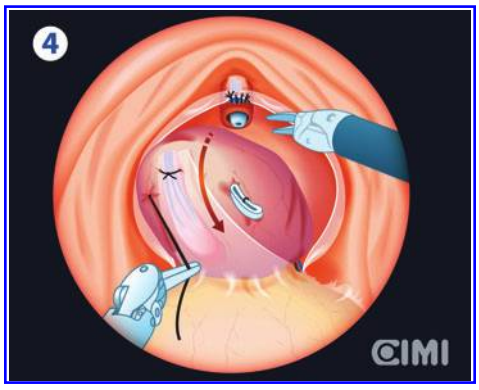

FIG. 4. The urethra is dissected and transected as far proximally within the anterior prostate notch.

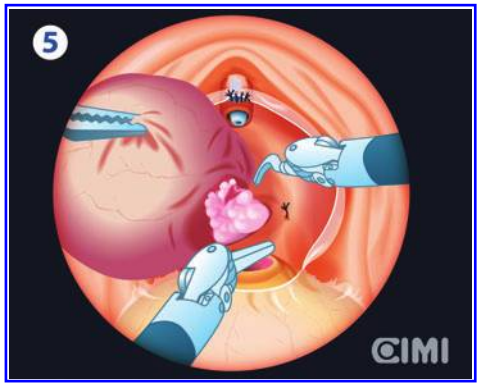

FIG. 5. Seminal vesicles are identified and transected at the prostate base.

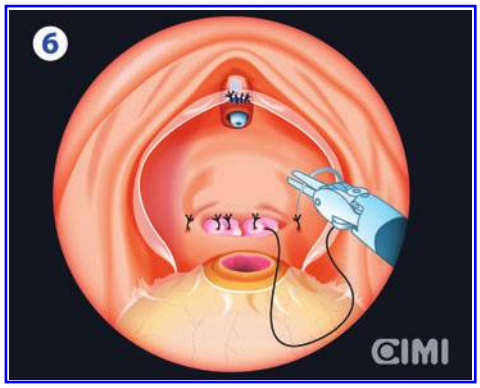

FIG. 6. Seminal vesicles and vas deferens are closed.

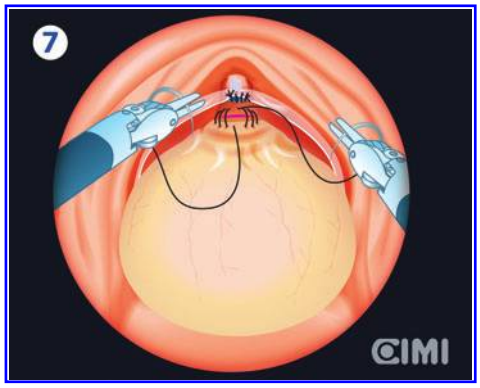

FIG. 7. Two separate sutures are used for the vesicoure-thral anastomosis in a running fashion.

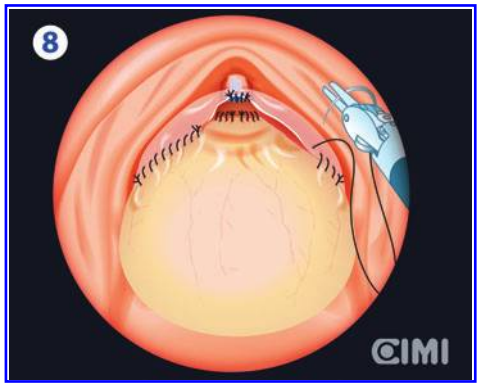

FIG. 8. Anterior aspect of the prostatic fascia is sutured to the anterior bladder wall.

Table 2. Operative Data

Parameters	*Average*	*Range*	*SD*
Operative time (min)	106	60–180	40.33
Estimated blood loss (mL)	375	150–900	284.06
Catheterization (days)	8.9	6–14	2.6
Drainage (days)	2.8	0–8	2.88
Hospitalization (days)	1	0–3	0.8
Histopathology prostate weight (g)	81	50–150	38.2

SD = standard deviation.

obstructive prostatomegaly, occurs in 4% to 16% of patients.[21] In our personal experience, incidental prostate cancer occurred in 5 of 71 (7%) patients after laparoscopic/robotic simple prostatectomy. Holman and coworkers[22] reported a prostate cancer incidence rate ratio of 1.44 (0.94–2.21, 95% confidence interval [CI]), and a mortality rate ratio of 1.37 (0.81–2.29; 95% CI) after surgery for BPH (transurethral radical prostatectomy [TURP] and open prostatectomy) in 19,598 patients over a 10-year follow-up with an incidence of 0.22% and 0.66% respectively, and a mortality rate of 0.16% and 0.44%, respectively, suggesting a possible protective effect of open prostatectomy against the future development of prostate cancer. In our series, PSA levels decreased 96%. Open prostatectomy for BPH results in a 93% decrease in PSA levels.[23]

Our 100% similarity in prostate weight between TRUS and histology—mean 81 g *vs* 81 g—is encouraging regarding the completeness of removal of all prostate tissue. In a multicenter study, Gratzke and associates[24] reported that excised prostate volume after open prostatectomy was 81% of preoperative TRUS prostate volume. Ou and colleagues[5] reported 53% and 84% of prostate tissue resected after TURP and transvesical prostatectomy, respectively, in patients with prostate volumes > 80 mL. Holmium laser enucleation of the prostate has been reported to excise between 62% to 73% of prostate volume compared with preoperative TRUS.[25]

In our 56 standard robot-assisted simple adenomectomies, we achieved 72% excision of prostate volume compared with preoperative TRUS, mean urinary Qmax increased by 150.83% (postoperative 28.42 ± 14.56 mL/s compared with baseline 11.33 ± 6.76 mL/s), postoperative IPSS 4.82, and QoL 1.18.

We have not had any complications, and the urinary tract infection rate of 10% is comparable to that in the literature (2.6%–12.9%). Our mean urinary Qmax increased by 169.42% (postoperative 33.49 ± 10.15 mL/s compared with baseline 12.43 ± 7.0 mL/s). Data from Gratzke and coworkers[24] indicated a Qmax of 1 month postoperative of 11.33 mL/s, IPSS of 4.82, QoL of 1.18, operative time of 140.45 min, blood loss of 332.59 mL, catheterization time of 8.46 days, drainage time of 3.72 days, and hospital stay of 1.6 days. Reinterventions within 2 years are reported to be 3.6% in a large series description.[26] McCullough and colleagues[27] evaluated the morbidity of laparoscopic *vs* open simple prostatectomy, defining with the minimally invasive approach fewer urinary tract infections (9.7% *vs* 1.04%), a reintervention rate of 3.1% in the laparoscopic group *vs* 1.2% in the open group.

Table 3. One-Month Follow-Up Data

Parameters	*Average*	*Range*	*SD*
Postoperative IPSS	1.67	1–3	0.81
Postoperative QoL	0.5	0–2	0.83
Postoperative max urine flow (mL/s)	33.49	17–46.9	10.15
Prostate-specific antigen (ng/mL)	0.2	0.00–0.84	0.27

SD = standard deviation; IPSS = International Prostate Symptom Score; QoL = quality of life.

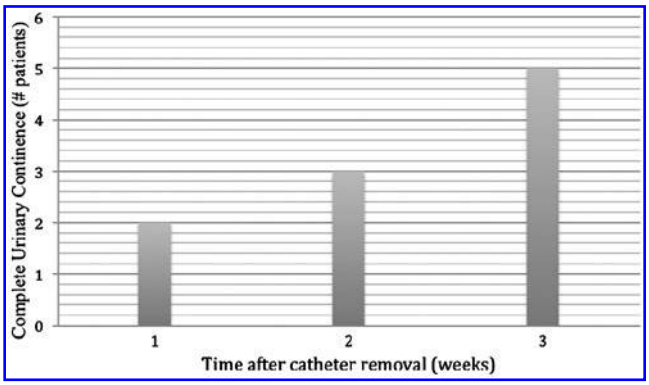

FIG. 9. Urinary continence recovery after catheter removal.

The magnification and dexterity afforded by the robot and our confidence from familiarity with prostate and periprostatic anatomy contributed significantly to our development of this approach.

We consider that this novel technique has some limitations and disadvantages because it necessitates a learning curve. It is more invasive than transurethral laser enucleation; however, that technique also has a learning curve, and not many centers have the necessary expertise with that approach. This series has a limited number of patients with no long-term follow-up, and even though the average prostate volume was 81 cc, we consider that it must be still applied in larger prostate volumes to evaluate its results. Also, Foley catheter duration appears to be longer compared with open surgery, because a vesicourethral anastomosis is applied; we could consider routine cystography practice in an earlier term to evaluate faster catheter removal. Last, robotics costs may be an inconvenience at many centers because of the increase in surgery expenses; costs implications of our approach are unknown, and further analysis is necessary.

Conclusions

IF-RSP appears to be a feasible procedure in selected patients with obstructive large-volume prostatomegaly. The entire prostate tissue is removed without compromising continence and potency, mirroring open surgery. Larger series and longer-term follow-up are needed to evaluate the proper place of this approach in the contemporary armamentarium of surgical options for obstructive BPH.

Disclosure Statement

Rene Sotelo is a consultant assistant for Intuitive Surgical Systems. For the remaining authors, no competing financial interests exist.

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Abbreviations Used

BPH = benign prostatic hyperplasia
CI = confidence interval
IF-RSP = robotic intrafascial simple prostatectomy
IPSS = International Prostate Symptom Score
PSA = prostate-specific antigen
QoL = quality of life
Qmax = peak flow rate
SHIM = Sexual Health Inventory for Men
TRUS = transrectal ultrasonography