Robotic simple prostatectomy: Initial single-center experience in Taiwan
Shu-Chi Wang, Cheng-Kuang Yang, Chih-Peng Chang, Yen-Chuan Ou*
Division of Urology, Department of Surgery, Taichung Veterans General Hospital, Taichung, Taiwan, ROC

Abstract
Objective: For patients with symptomatic large volume benign prostate hyperplasia, open simple prostatectomy has traditionally been the treatment of choice but laparoscopic simple prostatectomy (LSP) has become an effective surgical option. Since the first case of LSP was described in 2002, surgeons have continued to expand the use of minimally invasive surgery. In 2008, the first case of robotic simple prostatectomy (RSP) was reported. We herein report our initial experience with robotic simple prostatectomy.

Materials and methods: We performed retropubic robotic simple prostatectomy using a transperitoneal approach in 10 patients. All of them had significant symptomatic prostate enlargement confirmed by abdominal or transrectal ultrasound (mean 138.2 mL). Demographic data, perioperative outcomes, and functional outcomes were recorded.

Results: The median age of patients was 68 years (range 60–76 years). The median International Prostate Symptom Score at baseline was 24 (range 18–34). The median operation time was 150 minutes (range 130–180 minutes). The median estimated blood loss was 100 mL (range 50–850 mL). Intraoperative blood transfusion was required in one patient (10%). The median resected prostate weight was 77.5 g (range 60–120 g). The median hospital stay was 5 days (range 3–5 days). The median urethral catheterization was 12 days (range 9–14 days). All of these patients gained significant improvement in maximum urine flow rate (preoperative vs. postoperative 9.8 mL/min vs. 21.5 mL/min, \( p = 0.001 \)) and postvoid residual urine (preoperative vs. postoperative 125 mL vs. 10 mL, \( p = 0.001 \)).

Conclusion: Robotic simple prostatectomy is a feasible alternative for a greatly enlarged prostate gland with acceptable complications.

1. Introduction
Benign prostatic hyperplasia (BPH) is the most common cause of lower urinary symptoms in the aging male population. The most common surgical intervention for BPH is transurethral resection of the prostate. However, prolonged resection time can lead to hemorrhage or transurethral resection syndrome. For patients who have a greatly enlarged prostate, open simple prostatectomy (OSP) provides good long-term functional outcome. However, OSP was associated with a significant risk of perioperative complications and prolonged hospitalization. After the first pure laparoscopic simple prostatectomy (LSP) described by Mariano et al4 in 2002, several subsequent series demonstrated encouraging outcomes.5 However, LSP did not gain popularity among urologists because of its technical difficulties. In 2008, Sotelo et al6 reported the first case of robotic simple prostatectomy (RSP). The steep learning curve associated with conventional laparoscopy was overcome using the robotic system.7 Recently, the minimally invasive approach has been used more frequently in urologic surgery. Robot-assisted laparoscopic surgery is an alternative surgical option with potential benefits. In this report, we describe our initial experience and evaluate the feasibility of robot-assisted simple prostatectomy.

2. Materials and methods
Robotic simple prostatectomy was performed in 10 patients in our institution. All of them had symptomatic benign prostate...
hyperplasia and failed medical therapy. All patients had a prostate volume >80 mL, as estimated by either abdominal or transrectal ultrasound. Five patients (50%) experienced urinary retention and two patients (20%) were catheter dependent prior to the operation. One patient (10%) experienced gross hematuria. All patients received transrectal biopsy due to high prostate-specific antigen (PSA) levels (range 4.5–60.6 ng/mL) and all biopsy specimens were reported to be benign prostate hyperplasia cases. Preoperative evaluation included medical history review, physical examination, PSA test, International Prostate Symptom Score, uroflowmetry data, and postvoid residual urine (PVR) test. For patients with hematuria, preoperative urinary cytology examination, intravenous pyelography, and cystourethroscopy were performed for detection of urinary lesions. Postoperative assessment included pathologic data, PSA, uroflowmetry, and PVR.

2.1. Surgical technique

Each patient was given general anesthesia and was positioned in the steep Trendelenburg position. We used a four-arm da Vinci surgical system with six ports and adapted the transperitoneal approach. The bladder was mobilized using standard procedure and Retzius’ space was reached. Preprostate fat was cleared and the anterior surface of the prostate was exposed. Two rows of hemostatic sutures for control of the Santorini plexus were used. A transverse capsular incision was made with electrocautery, approximately 2 cm from the vesicoprostatic junction. Dissection of the adenoma from the prostatic capsule was performed using robotic curved scissors and blunt dissection. The bulging bilateral lobes were enucleated separately. If a median lobe was present, it was subsequently dissected while preserving a strip of the overlying mucosa. Lastly, the apical lobe was dissected and transsected from the point of the urethra carefully to avoid injury to the external sphincter. The bladder neck mucosa was approximated to the prostatic apex using a 3–0 Monocryl suture to achieve retropubicization. The anterior prostatic capsule was closed in a watertight manner. A silicon Foley balloon was inflated with 40 mL of distilled water and traction was applied.

3. Results

We successfully performed retropubic robotic simple prostatectomy with a transperitoneal approach in 10 patients. The baseline clinical characteristics of the 10 patients are presented in Table 1. The perioperative outcomes are summarized in Table 2. Robotic simple prostatectomy allows for a concomitant procedure. In one of the 10 patients, right-side inguinal hernioplasty using mesh was performed. Two patients (20%) had urethral catheter occlusion caused by blood clots, which required recatheterization and bladder irrigation. Postoperative cystogram was routinely performed, which revealed a small leak in two asymptomatic patients (20%) that required longer catheterization (13 days and 14 days, respectively). Adenocarcinoma of the prostate was identified in one patient (Gleason score 3 + 3 = 6, tumor amount 1%). This patient received observation initially but was lost to follow up after 1 year. Functional outcomes are shown in Table 3. The median postoperative PSA was 0.58 ng/mL (range 0.13–1.42), indicating a 94% reduction compared with the preoperative PSA. Both postoperative $Q_{\text{max}}$ and PVR showed significant improvement when compared with the preoperative baseline data.

4. Discussion

To select the appropriate surgical intervention for symptomatic BPH, the size of the prostate gland is an important consideration. For prostate adenoma ~80 mL, transurethral resection of the prostate is recognized as the standard of surgical treatment. For patients with prostate adenoma larger than 80 mL, both OSP and transurethral holmium laser enucleation are recommended by European Association of Urology guidelines.

In 1894, Eugene Fuller performed the first suprapubic prostatectomy and it was popularized by Peter Freyer in 1900. In 1945, Terence Millin first performed retropubic simple prostatectomy. The retropubic approach provides better prostate exposure, direct visualization of prostate adenoma during enucleation to ensure complete removal, direct visualization of prostate fossa after enucleation to control bleeding, and precise division of prostatic urethra to preserve urinary continence and minimize bladder trauma. The suprapubic approach allows better visualization of the bladder neck and ureteral orifices, which is suitable in patients with a protruding median lobe, concomitant bladder diverticulum, and large bladder calculus. Retropubic simple prostatectomy can be more challenging in patients with a large median lobe. Incision was made over the overlying mucosa at the level of bladder neck and the median prostate adenoma was dissected carefully from bladder neck muscle. By preserving the bladder neck, injury to the iatrogenic ureteral orifices can be avoided. In addition, prophylactic insertion of ureteral stents and intravenous injection of indigo carmine dye could help identify

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation time (min)</td>
<td>146</td>
<td>150</td>
<td>150</td>
<td>130–180</td>
</tr>
<tr>
<td>Blood loss (mL)</td>
<td>208</td>
<td>100</td>
<td>100</td>
<td>50–850</td>
</tr>
<tr>
<td>Resected adenoma weight (g)</td>
<td>79</td>
<td>77.5</td>
<td>60</td>
<td>60–120</td>
</tr>
<tr>
<td>Hospitalization (d)</td>
<td>4.5</td>
<td>5</td>
<td>5</td>
<td>3–5</td>
</tr>
<tr>
<td>Catheterization (d)</td>
<td>11.6</td>
<td>12</td>
<td>13</td>
<td>9–14</td>
</tr>
</tbody>
</table>

Table 2: Perioperative data.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSA preoperative (ng/mL)</td>
<td>15.9</td>
<td>10.5</td>
<td>N/A</td>
<td>4.5–60.6</td>
</tr>
<tr>
<td>PSA postoperative (ng/mL)</td>
<td>0.55</td>
<td>0.58</td>
<td>N/A</td>
<td>0.13–1.42</td>
</tr>
<tr>
<td>$Q_{\text{max}}$ preoperative (mL/s)</td>
<td>9.9</td>
<td>9.8</td>
<td>9.8</td>
<td>5.9–13.1</td>
</tr>
<tr>
<td>PVR preoperative, mL</td>
<td>180</td>
<td>125</td>
<td>N/A</td>
<td>100–430</td>
</tr>
<tr>
<td>PVR postoperative (mL)</td>
<td>14.3</td>
<td>10</td>
<td>10</td>
<td>6–29</td>
</tr>
</tbody>
</table>

Table 3: Prostate-specific antigen, maximum flow rate, and postvoid residual urine on follow up.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSA – prostate-specific antigen, mL</td>
<td>15.9</td>
<td>10.5</td>
<td>N/A</td>
<td>4.5–60.6</td>
</tr>
<tr>
<td>PSA – prostate-specific antigen, mL</td>
<td>0.55</td>
<td>0.58</td>
<td>N/A</td>
<td>0.13–1.42</td>
</tr>
<tr>
<td>$Q_{\text{max}}$ – prostate-specific antigen, mL</td>
<td>9.9</td>
<td>9.8</td>
<td>9.8</td>
<td>5.9–13.1</td>
</tr>
<tr>
<td>$Q_{\text{max}}$ – prostate-specific antigen, mL</td>
<td>24.5</td>
<td>21.5</td>
<td>N/A</td>
<td>11.6–36.5</td>
</tr>
<tr>
<td>PVR – postvoid residual urine, mL</td>
<td>180</td>
<td>125</td>
<td>N/A</td>
<td>100–430</td>
</tr>
<tr>
<td>PVR – postvoid residual urine, mL</td>
<td>14.3</td>
<td>10</td>
<td>10</td>
<td>6–29</td>
</tr>
</tbody>
</table>

BMI – body mass index; I-PSS – International Prostate Symptom Score; N/A – not available; PSA – prostate-specific antigen; PVR – postvoid residual urine; $Q_{\text{max}}$ – maximum flow rate.
Urinary leakage was observed in some patients, as noted in their postoperative course. Despite longer catheterization times, two cases showed higher blood transfusion rates compared with previous studies. We prefer longer catheterization times to ensure adequate healing. Our catheterization times were longer than in other studies, with a transfusion rate of 13%. In our initial experience, blood transfusion was required in one patient (10%). The transfusion rate was higher due to our initial cases. In another multicenter study, the overall transfusion rate was 8.2%. In a study of 902 patients who underwent open simple prostatectomy, the overall complication rate was 17% and the transfusion rate was 8%. LSP was associated with decreased blood loss, limited pain, shorter hospital stay, and no increase in postoperative complications compared with open surgery.21 Since the first robotic simple prostatectomy was described in 2008,22 numerous groups have reported their experience and results. In our review of the published data on robotic simple prostatectomy, the reported results are comparable to those of other reports (Table 4).5,12-19 In our initial experience, blood transfusion was required in one patient (10%). The transfusion rate of our group was higher due to small case numbers. In the fourth case, injury to a prostate capsule artery caused a total blood loss of 850 mL, which was the highest among all patients. There was no need for blood transfusion after this case. Our catheterization time was longer compared with the times in previous studies. We prefer longer postoperative catheterization times because we believe it might help in tissue healing. Despite longer catheterization time, two of our patients had some urine leakage, as shown on their postoperative cystograms. A multi-institutional study of 1300 patients who received robotic or LSP showed increasing numbers of robotic surgery over time.20 Robotic simple prostatectomy can be performed using either the transperitoneal or extraperitoneal approach. The extraperitoneal approach in the robotic-assisted radical prostatectomy was reported to be associated with less bowel-related complications and less postoperative pain compared with the transperitoneal approach.21 Transurethral holmium laser enucleation of the prostate was also reported to be an effective surgical option for a greatly enlarged prostate gland.22 A randomized controlled trial comparing transurethral laser enucleation and OSP for prostate glands larger than 100 g showed that both procedures were equally effective, but laser enucleation was associated with longer operation time, less blood loss, shorter catheterization time, and shorter hospital stay compared with OSP.23 Furthermore, transurethral laser enucleation can be performed under spinal anesthesia but general anesthesia is required in RSP.

In our institution, we performed robotic radical prostatectomy in more than 300 cases before the first robotic simple prostatectomy without previous experience of LSP. Our results indicate that the learning curve is short if surgeons are experienced in robotic surgery. Although our results are favorable, some limitations of our study should be considered, including small sample size, relatively short follow-up, and risk of selection bias. Therefore, we cannot confirm that the robotic approach is superior to other minimally invasive methods. Randomized trials that compare the different surgical approaches and laser prostatectomy are needed for confirmation of long-term benefits. Although there is no general consensus about the ideal minimally invasive approach for a greatly enlarged prostate gland, we believe that robotic simple prostatectomy is a feasible alternative.

Conflicts of interest

The authors declare that they have no financial or non-financial conflicts of interest related to the subject matter or materials discussed in the manuscript.

Sources of funding

No funding was received for the work described in this article.

References