ABSTRACT

Purpose: To report the initial experience on robot-assisted radical prostatectomy in Brazil. Methods: From March 2008 to March 2009, a hundred patients were treated with robot-assisted radical prostatectomy. Patient’s demographic data, as well as perioperative results of the procedures, are described in this study. Results: Patients’ mean age and mean PSA were 58 years and 7.58 ng/ml, respectively. All procedures were performed through transperitoneal approach, with a mean bleeding of 480 mL and surgical time of 298 minutes. A surgical margin affected by cancer was present in 16% of the cases. There were four complications: bleeding requiring transfusion (two cases), rectal perforation corrected on the spot and inadequate functioning of the robot. There was no conversion to another access or obit occurrences in this caseload. Conclusions: Robot-assisted prostatectomy is a reality in Brazil and the results herein presented demonstrate that this procedure can be safely performed. Long-term follow-up is still necessary to assess the oncological and functional outcomes.

Keywords: Prostatic neoplasms/surgery; Prostatectomy/methods; Robotics; Treatment outcome

INTRODUCTION

The incidence of prostate cancer (PCa) considerably increased in the last 20 years due to the association of three factors: large-scale use of detection of prostate-specific antigen (PSA) during the screening, longer male longevity and potential environmental influences (1-3). Data obtained by the Cancer of the Prostate Strategic Urologic Research Endeavor (CaPSURE), USA, showed that 52% of patients with PCa chose the surgical treatment (radical prostatectomy), 25% chose external radiotherapy, 15% chose brachytherapy and 8% opted for watchful surveillance (3).

The first radical prostatectomy reported was performed through perineal approach by Young and Halted in 1904 (4) and through retropubic approach by Millin in 1945 (5). In the beginning of 1980’s, Walsh and Lepor defined the procedure’s anatomical concept and developed the preservation of the neurovascular bundle (nerve sparing) allowing increased preservation of micition and erectile functions, thus collaborating in an important fashion with the acceptance by patients and surgeons (6). In mid-1990’s, retropubic radical
prostatectomy became the most common procedure for the treatment of PCa in the USA\(^{(7)}\).

The first laparoscopic radical prostatectomy (LRP) was performed in 1992 by Schuessler and Clayman\(^{(8)}\), and the robot-assisted laparoscopic radical prostatectomy (RARP) in 2000 within a program designed by American and French urologists\(^{(9)}\).

The advantages of the laparoscopic technique include: less bleeding, less postoperative pain, faster recovery and image magnification which increases the potential for preservation of cavernous nerves. The major disadvantage is the high level of technical difficulty for carrying out the procedure, which makes the learning curve longer. The possibility of performing the procedure with the help of a robotic system allowed the maintenance of the same advantages of the minimally invasive procedure, added by the benefits of shortening the learning curve thanks to the magnified 3-D view, articulated instruments, tremor filter and better ergonomics for the surgeon\(^{(9)}\).

Nowadays, about 64\% of all radical prostatectomy procedures are carried out with a robotic system in the USA, and the method has spread all over the world, including South America. In March 2008, a robot-assisted surgical program was initiated at the Hospital Israelita Albert Einstein, with the initial outcomes described in this study.

**OBJECTIVE**

To describe the first robot-assisted prostatectomies in patients seen at the Hospital Israelita Albert Einstein and their respective results.

**METHODS**

Data was prospectively collected in our databank after patient consent. The study enrolled patients with localized prostate adenocarcinoma who underwent robot-assisted radical prostatectomy (RARP) with the system Vinci S Surgical System (Intuitive Surgical, Sunnyvale, CA, EUA) at the Hospital Israelita Albert Einstein, from March 31\(^{st}\) 2008 to March 31\(^{st}\) 2009.

The study was approved by the Research Ethics Committee at Hospital Israelita Albert Einstein (CEP-Einstein), number 09/1204.

The procedures were performed in accordance with the surgical technique described below:

- Trocar positioning and placement: under general anesthesia, the patient is placed in extended lithotomy position, with the upper limbs along the body. The lower limbs are maintained separated and in flexion and the operating table is set to Trendelenburg position with 45\(^{\circ}\) degree inclination (Figure 1). After establishing pneumoperitoneum at 15 mmHg, the first 12 mm trocar is inserted 1 cm above the umbilicus. In patients with surgery in lower abdominal region and/or pelvis, the open approach is recommended. Under direct visualization, three 8-mm trocars, one 12-mm trocar and one 5-mm trocar are placed according to Figure 2.
- Entry into the prevesical space and control of the dorsal venous plexus: after coupling of the robotic system by using a 0\(^{\circ}\) optic (robotic arm \#1), monopolar scissors in the right arm (robotic arm \#2) and a Maryland bipolar forceps in the left arm (robotic arm \#3), the entry into the extraperitoneal space is initiated with a transversal incision in the parietal peritoneum 3-5 cm below the umbilicus, and using the ductus deferens as a lateral reference. The fourth robotic arm uses the Prograsp\(^{™}\) instrument to performe the counter-traction and to help expose the structures to be dissected in this step. After sectioning the lateral umbilical ligaments and urachus, the pubis and iliac vessels must be identified, exposed and used as anatomical parameters. One
should be careful during this step to avoid dissection too close to the abdominal wall in order to prevent the injury to epigastric vessels. After removal of the periprostatic fat, by using a combination of blunt and cutting dissection, the endopelvic fascia is bilaterally exposed. The superficial venous plexus is cautioned with the bipolar instrument and sectioned, and then the endopelvic fascia is opened laterally to the prostate from its apex to its base (Figure 3).

The puboprostatic ligaments are sectioned and the dorsal venous plexus is linked with a Vicryl-0 suture performed with a CT-1 needle. Sectioning of the venous plexus will be performed only at a later time before the urethral sectioning.

- Sectioning of the vesical neck: in obese patients or in those with enlarged prostates, the use of a 30° optical is recommended to facilitate this step. With the fourth arm performing vesical retraction with exposure of the prostate-bladder transition, the anterior vesical neck is opened by using the monopolar scissors with thermal energy to prevent bleeding. The Foley catheter is then tractioned by the fourth arm towards the abdominal wall, and the additional opening of the vesical neck is laterally carried out. In this case, the assistant performs the exposure and counter-traction of structures, such as the aspirator, and uses intermittent suctioning to prevent the loss of pneumoperitoneum. The posterior vesical neck is then incised with thermal energy, initiated in the midline and laterally extending its opening for completely sectioning the vesical mucosa in the prostate base. When the prostate median lobe is present, the ureteral meatuses must be visualized before initiating the posterior sectioning of the vesical neck.

- Dissection of ductus deferens and seminal vesicles: after completing the sectioning of detrusor fibers by using thermal energy, the ductus deferens are medially visualized. In this step, it is important to maintain the dissection plane parallel to the posterior vesical wall, thus avoiding entry into the prostate or urinary bladder perforation. Aiming at increasing the work space, the lateral muscular fibers of the vesical neck are ligated with Hem-o-lok™ clips and sectioned. Once the ductus deferens are identified, dissection is performed posteriorly and laterally for preventing exposure of the seminal vesicles. After bilateral sectioning of ductus deferens, with the fourth arm retracting the seminal vesicles medially and superiorly, the lateral adherences are sectioned without the use of thermal energy and the pedicle of each vesicle is ligated below its apex with Hem-o-lok™ clips. After release of the seminal vesicles, Denonvilliers fascia is exposed with the traction of both ductus deferens and seminal vesicles superiorly by the fourth robotic arm. This fascia is incised in the midline and dissection is performed in the midline up to the prostatic apex and then the lateral opening of this space is accomplished to facilitate the preservation of the neurovascular bundle and the control of the lateral prostatic pedicles. During this surgical step, the assistant moves the rectum away with the aspirator to avoid injuries on it.

- Preservation of the neurovascular bundle: this step must be performed without the use of thermal energy to minimize the lesion to the bundle. The neurovascular bundle is released from the posterolateral aspect of the prostate by using a combination of blunt and cutting dissection, i.e., with scissors and Maryland forceps. The lateral prostatic fascia is incised and the neurovascular bundle is pushed inferiorly in a blunt fashion; the lateral prostatic pedicle is then ligated with Hem-o-lok™ clips and sectioned (Figure 4). This dissection is extended forward up to the middle aspect of the prostate. The prostatic fascia is then opened next to is apex and carefully dissected to prevent violation of the prostatic capsule (Figure 5). Dissection is then performed backwards to complete full release of the neurovascular bundle.

- Dissection of the prostatic apex and urethra: the prostate receives upward traction from the fourth arm, the dorsal venous complex is sectioned and the urethra is exposed. The prostate is laterally moved, the urethra is dissected to maximize its length and then sectioned without the use of thermal energy. This step is fundamental to avoid oncological involvement and to assure the preservation of postoperative continence. The extraction bag is introduced (10 mm Endocatch™ bag, US Surgical
Corp., Norwalk, CT, USA) and the prostate is placed inside it.

- Lymphadenectomy: when necessary, obturating lymphadenectomy is performed before vesicourethral anastomosis. After identification of the external iliac vein, the product of lymphadenectomy is retracted by the assistant or by the fourth robotic arm, while dissection is performed with the combination of a blunt and cutting dissection. The dissection limits are: cranially, the external iliac vein; distally, the obturator nerve; and laterally the pelvic wall (Figure 6).

- Vesicourethral anastomosis: two Monocryl 2-0 sutures with CT-2 needles are used to complete the anastomosis with van Velthoven’s technique, initiating at the 4 o’clock position at the posterior vesical neck and progressing up to the 10 o’clock position on the opposite side. Anastomosis is performed clockwise in the posterior portion and counter-clockwise in the anterior portion by using two 8-mm needle holders in robotic arms #2 and #3. A Foley 20 catheter is inserted up to the urinary bladder before the two sutures are tied, with injection of 120 mL saline solution to check the presence of losses through the anastomosis. The extracting bag is removed through the supraumbilical port after insertion of the drain through the 5-mm trocar port. The 12-mm trocar ports are then closed with the Carter Thomason™ device.

RESULTS

A total of 100 RARPs were performed at Hospital Israelita Albert Einstein from march 31st 2008 to march 31st 2009. The mean age of patients was 58 years old (43-78). The neoplasm was not palpable upon diagnosis (stage T1c) in 86% of cases, with mean PSA of 7.58 ng/mL (1.98-26.6) an estimated mean prostatic volume of 47 g (20-150). Biopsy Gleason score 6 was present in 73% of the cases. Only one patient who underwent surgery presented a Gleason score 8 in the preoperative prostate biopsy (Table 1).

All the patients underwent surgery through the transperitoneal approach and none of the patients required conversion to the pure or open laparoscopic access. Mean estimated bleeding was 480 mL (100-1,800); transfusion of packed red blood cells was necessary in two patients (2%). Mean surgical time was 298 minutes (95-700). Preservation of the neurovascular bundle was performed in all the patients, being unilateral in 14% of the cases.

Mean specimen weight was 43 g (25-150) and histological analysis of the surgical specimen
evidenced Gleason scores 6, 7, 8 and 9 in 26, 66, 4 and 4% of the cases, respectively. The presence of extra-prostatic tumor extension, compromised margin and involvement of seminal vesicle by the neoplasm was found in 24%, 16% and 8% of cases, respectively. Involvement of the surgical margin was circumferential in 83% of the cases and apical in 17%. High grade prostatic intraepithelial neoplasm (PIN) was identified in 76% of cases.

The rate of intraoperative complications was 4%. Complications included: bleeding requiring blood transfusion (2), rectal perforation corrected with a primary suture (1) and poor robot positioning with consequential non-utilization of one of the mechanical arms (1). Analgesics and oral non-steroid anti-inflammatory drugs were prescribed for the control of postoperative pain. Opioid analgesics were used in 2% of patients. Mean hospital stay was 72 hours (48-120).

**DISCUSSION**

Among the options of surgical treatment for the localized PCa, robot-assisted radical prostatectomy is currently the most used procedure in the USA and Europe. In our institution, this procedure has been safely performed since March 2008, with a low complication rate.

Even after laparoscopic prostatectomy at the beginning of the last decade, retropubic surgery remained as the gold standard due to the great technical difficulty of the laparoscopic procedure, and presented prolonged surgical time and higher morbidity910. In 2000, Guillonneau and Vallencian standardized the laparoscopic technique, which reduced the surgical time and made this approach safe and reproducible11. The main advantages of laparoscopic surgery are the magnification of the visual field and the presence of pneumoperitoneum, which reduce the pressure gradient between the blood vessels and the operative field, thus reducing the bleeding in small vessels. The development of the robot-assisted surgery allowed the association of several elements with the laparoscopic technique, such as articulated instruments, tridimensional view, tremor filter and better ergonomics for the surgeon, thus allowing the procedures to be more easily and safely performed, with a significant decrease in the learning curve in addition to higher accuracy.

Oncological outcomes described in the literature have shown a potential advantage with the use of the robot-assisted technique, with decreased incidence of margin affected by the cancer when compared to the conventional retropubic technique. Smith et al. reported a reduction in this incidence from 35 to 15%12. Patel et al. showed, in a recent paper, that the incidence of positive margins decreases with increased surgeon experience, with an incidence of 2.5% in a series of 500 procedures13. The results found in this study are in accordance with data reported in the literature, as demonstrated by the total incidence of affected margin, although the most frequent location is not the apex but rather next to the gland’s lateral aspect. We believe that the great concern about maintaining an adequate margin of the prostatic apex and obtaining optimal preservation of the neurovascular bundle may justify this variation at the site of involvement of the surgical margins.

Surgical time in this current series was longer than that reported in the literature about series performed by skilled surgeons or in large patient series. Murphy et al. described their series of 400 patients who underwent RARP, in which the study of surgical time necessary in the first 50 patients was on average 250 minutes14. It depends on the surgeon and his previous experience with laparoscopic surgery. We believe that the surgical time was longer in this study compared to the literature because this is a report about the experience of multiple surgeons, with variable previous experience in laparoscopy, associated with a still small ratio of number of cases per surgeon (<20). The most accepted learning curve to consider the surgeon comfortable to perform RARP is 8 to 40 patients, with the surgeon presenting exponential improvement in his parameters as he advances in the curve. Samadi et al. consider that the learning curve to reach the level of excellence in RARP would be 70 patients, supporting the improvement of analyzed parameters as the progression in the curve, especially in the first 20 patients15.

The results about the hospitalization time in this series showed that the mean time of hospitalization reported is in conformity with the literature, which varies on average from one to three days16-17.

As the experience increases, the results also improve and the demand for RARP has increased after availability of the technique by the institution and successful treatment with good clinical results. The trend is that, similarly to other countries that have initiated the robotic technique, we will gradually observe an

**Table 1.** Summary of findings in the cases studied (n = 100)

<table>
<thead>
<tr>
<th>Data</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>58 (43-78)</td>
</tr>
<tr>
<td>Surgical time (min)</td>
<td>298 (95-700)</td>
</tr>
<tr>
<td>Estimated bleeding (ml)</td>
<td>480 (100-1800)</td>
</tr>
<tr>
<td>T2 staging (%)</td>
<td>68</td>
</tr>
<tr>
<td>T3 staging (%)</td>
<td>32</td>
</tr>
<tr>
<td>Surgical margins affected (%)</td>
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</tr>
<tr>
<td>Surgical complications (%)</td>
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</tr>
<tr>
<td>Conversions (%)</td>
<td>0</td>
</tr>
<tr>
<td>Hospital infection rates (%)</td>
<td>0</td>
</tr>
<tr>
<td>Reoperations (%)</td>
<td>0</td>
</tr>
<tr>
<td>Death (%)</td>
<td>0</td>
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ascending curve in the demand for the robotic surgery as opposed to the conventional open surgery.

CONCLUSIONS

Robot-assisted radical prostatectomy is already a reality in Brazil; it is safely performed and has presented promising initial results in our institution. The data available in this study show an agreement with international literature. Long-term follow-up of oncological and functional outcomes is still necessary for an adequate assessment of the technique and comparison to other options of surgical access.

REFERENCES