Abdominal wall haemorrhage after robotic-assisted radical prostatectomy: Is it a complication of robotic surgery?☆

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KEYWORDS
Robotic-assisted radical prostatectomy; Prostate cancer; Complication; Postoperative bleeding

Abstract
Objective: Robotic-assisted radical prostatectomy (RARP) is the minimally invasive surgical treatment for patients with localized prostate cancer. Perioperative or postoperative complications following RARP have been reported in some studies and severe postoperative bleeding after RARP is rare, but haemodynamic instability may necessitate open surgical exploration and be associated with considerable morbidity. We reported postoperative bleeding cases, which is a kind of complication associated with robotic surgery and requiring massive transfusion after RARP.

Patients and methods: From August 2009 to May 2012, 317 consecutive patients who underwent RARP performed at our institution were analyzed. Patients with serious postoperative bleeding that caused haemodynamic instability after surgery were enrolled.

Results: A total of 5 among 317 (1.6%) patients had bleeding requiring postoperative transfusion. In these cases, mean operative time was 114 min. The mean estimated blood loss was 110 ml during operation. In these patients, hematocrit (Hct) levels gradually fell after surgery and ecchymosis was detected on the side and posterior walls of the abdomen on the second day. The mean preoperative Hct was 44.3% and mean lowest Hct was 23.1%. All patients were successfully treated without surgical exploration.

Conclusions: Robotic radical prostatectomy has proven to be a safe surgical treatment with low morbidity. However, postoperative bleeding can reach serious problems. This is the first study to explain haemorrhage, associated with possible risk of robotic surgery.

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Hemorragia de la pared abdominal después de prostatectomía radical asistida por robot; ¿es una complicación de la cirugía robótica?

Resumen
Objetivo: La prostatectomía radical asistida por robot (PRAR) es el tratamiento quirúrgico mínimamente invasivo para los pacientes con cáncer de próstata localizado. Se han notificado complicaciones perioperatorias o postoperatorias después de PRAR en algunos estudios, y el sangrado postoperatorio severo después de PRAR es poco común, pero puede ser que la inestabilidad hemodinámica requiera exploración quirúrgica abierta y se asocie con una morbididad considerable. Informamos de casos de sangrado postoperatorio, que es una especie de complicación asociada con la cirugía robótica, y la necesidad de transfusión masiva después de PRAR.

Patientes y métodos: Desde agosto de 2009 hasta mayo de 2012 317 pacientes consecutivos sometidos a PRAR en nuestra institución fueron analizados. Los pacientes con hemorragia postoperatoria grave, que causó inestabilidad hemodinámica después de la cirugía, fueron estudiados.

Resultados: Un total de 5 de entre 317 (1,6%) pacientes tuvieron hemorragia que requería transfusión postoperatoria. En estos casos la media de tiempo operatorio fue de 114 min. La media de pérdida estimada de sangre fue de 110ml durante la operación. En estos pacientes los niveles de hematocrito (Hct) gradualmente disminuyeron después de la cirugía, y se detectó equimosis en las paredes laterales y posteriores del abdomen en el segundo día. El Hct preoperatorio medio fue de 44,3% y el Hct medio más bajo fue de 23,1%. Todos los pacientes fueron tratados exitosamente sin exploración quirúrgica.

Conclusiones: La prostatectomía radical robótica ha demostrado ser un tratamiento quirúrgico seguro con baja morbilidad. Sin embargo, el sangrado postoperatorio puede llegar a problemas serios. Este es el primer estudio para explicar la hemorragia asociada con el posible riesgo de la cirugía robótica.

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continuous requirement of volume replacement and transfusion. The diagnosis of bleeding was confirmed by abdominal ultrasonography and computerized tomography (CT)-scan.

Surgical technique

All patients underwent the procedure under general anaesthesia. The patient was placed in the Trendelenburg position. A five-port transperitoneal approach using a four-arm da Vinci_Si HD system was used to perform RARP. Pneumoperitoneum was achieved by transperitoneal Veress needle technique if the patient had not previously undergone abdominal interventions; otherwise, we used the open Hasson access. The first 2 mm trocar was positioned by supraumbilical skin incision and the others were placed under direct vision by the endoscope. The patient was positioned in the 30° Trendelenburg position with the arms tucked in. Four EndoWrist (Intuitive Surgical) robotic instruments were used: monopolar curved shears, Maryland bipolar grasping, ProGrasp grasping and large needle drivers. The 0° and 30° telescopes were used. All cases were performed transperitoneally with initial dissection of the seminal vesicles. After the incision of median and medial umbilical ligaments and entrance to the space of Retzius, the symphysis pubis was identified and the extraperitoneal space was developed laterally until the vasa were identified. The endopelvic fascia (EPF) was opened using cold scissors and the levator ani muscle fibres were swept laterally. Dissection proceeded towards the apex. The puboprostatic ligaments were divided and the notch between the dorsal venous complex (DVC) and urethra was exposed. The DVC was ligated using 0 VicrylTM on a CT-1 needle.

The anterior bladder neck was divided using the monopolar scissors and monopolar cautery until the catheter was identified within the bladder. The full thickness of the posterior bladder neck was divided in the midline using monopolar cautery. The fascia overlying the vas was incised and then extended to the vas and seminal vesicles (SVs). The fourth arm was used to retract the distal end of the vas and SVs anteriorly, thereby tenting up the posterior layer of Denonvilliers’s fascia. This layer was incised close to the base of the SVs using cold scissors and perirectal fat was identified. Dissection of this posterior space allows a safe plane to develop between prostate and rectum and also exposes the lateral pedicles of the prostate. The pedicle was thinned out using blunt dissection to allow its ligation using Hem-o-Lok clips. A nerve-sparing dissection was offered to previously potent patients (sexual health inventory for men (SHIM) score > 16) without palpable disease or radiological evidence of extracapsular extension. The inter-fascial or intra-fascial plane in the posterolateral groove was developed using a cautery-free technique until the apex and urethra were visualized. The ligated DVC was then divided using monopolar scissors. The lateral pillars were sharply incised and the anterior wall of the urethra was divided using cold scissors.

The resected prostate was placed in a laparoscopic retrieval bag for later removal. A continuous suture was used for the anastomosis. Two 18 cm 3/0 Monosorb sutures on 26 mm CT-2 needles were tied together with ten throws. Both sides of the sutures were passed through the bladder neck from outside in at 5 and 7 o’clock, respectively. One continued in an anti-clockwise manner while the other suture continued clockwise until the 12 o’clock position is reached. Before tying the sutures a new 22 Ch. Foley catheter was placed. Both sides of the urethra were tied together at the 12 o’clock position. The bladder was filled with normal saline to test the anastomosis. A drain was placed through a lateral port site. The specimen was retrieved through the midline camera port following undocking of the robot.12

Results

The preoperative and postoperative clinical characteristics of the all patients are shown in Table 1. Mean patient age was 64 ± 8.6 years. Mean preoperative PSA levels were 8.4 ± 2.5 ng/ml. Mean prostate volume was 40.6 ± 12 ml. Mean robotic procedure time was 12.5 ± 34.4 min, mean estimated blood loss was 180 ± 40 ml. A nerve sparing procedure was performed bilaterally in 191 cases and unilaterally in 126 cases. Mean hospital stay was 3.2 ± 1.3 days. The mean postoperative Gleason score was 6.2 ± 1.4. A total of 5 among 317 (1.6%) patients had bleeding requiring postoperative transfusion. Table 2 shows characteristics of the five patients. Our mean operative time was 114 min and mean estimated blood loss was 110 ml for bleeding patients. The mean preoperative hematocrit (Hct) was 44.3% and mean lowest Hct was 23.1%. Postoperative fifth hours, hemogram was reduced in these five patients. However, blood pressure, pulses and general status were stable. Subsequent hemogram follow-up and Hct continued to fall constantly. Blood and blood products were transfused. Ecchymosis was detected on side and posterior walls of abdomen, scrotum, and spreading up to the legs postoperative day 2 (Figs. 1 and 2). Haemorrhage was minimally observed in abdomen drainage during the follow-up and there was no bleeding in the abdomen in tomography. However, there was severe haemorrhage on abdominal walls (Fig. 3). Bleeding of the patients stopped on the third or fourth day and hemogram became stable. All patients were successfully treated without surgical exploration.

Table 1 Basic characteristic of all patients.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>317</td>
</tr>
<tr>
<td>Mean age (years)</td>
<td>64 ± 8.6</td>
</tr>
<tr>
<td>Mean PSA</td>
<td>8.4 ± 2.5</td>
</tr>
<tr>
<td>Prostate volume (ml)</td>
<td>40.6 ± 12</td>
</tr>
<tr>
<td>Operative time (min)</td>
<td>124.5 ± 34.4</td>
</tr>
<tr>
<td>Estimated blood loss(ml)</td>
<td>180 ± 40</td>
</tr>
<tr>
<td>Blood transfusion</td>
<td>5 (1.6%)</td>
</tr>
<tr>
<td>Nerve sparing</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>Unilateral</td>
<td>126</td>
</tr>
<tr>
<td>Bilateral</td>
<td>191</td>
</tr>
<tr>
<td>Postoperative stay (days)</td>
<td>3.2 ± 1.3</td>
</tr>
</tbody>
</table>
Abdominal wall haemorrhage after robotic-assisted radical prostatectomy

Table 2  Characteristics of patients with bleeding in RARP cases.

<table>
<thead>
<tr>
<th>Patients</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>50</td>
<td>56</td>
<td>61</td>
<td>72</td>
<td>50</td>
</tr>
<tr>
<td>PSA</td>
<td>4.4</td>
<td>5.5</td>
<td>4.1</td>
<td>8.1</td>
<td>13</td>
</tr>
<tr>
<td>PV (cc)</td>
<td>50</td>
<td>30</td>
<td>35</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Type of surgery</td>
<td>Posterior RARP</td>
<td>Posterior RARP</td>
<td>Posterior RARP</td>
<td>Posterior RARP</td>
<td>Posterior RARP</td>
</tr>
<tr>
<td>Operation time (min.)</td>
<td>120</td>
<td>100</td>
<td>130</td>
<td>120</td>
<td>100</td>
</tr>
<tr>
<td>Neurovascular bundle preservation</td>
<td>Bilateral</td>
<td>Bilateral</td>
<td>Bilateral</td>
<td>Bilateral</td>
<td>Bilateral</td>
</tr>
<tr>
<td>Preoperative hematocrit</td>
<td>49</td>
<td>40</td>
<td>49.4</td>
<td>42.7</td>
<td>40.7</td>
</tr>
<tr>
<td>Lowest hematocrit</td>
<td>23.5</td>
<td>28</td>
<td>20.6</td>
<td>22</td>
<td>21.8</td>
</tr>
<tr>
<td>Total amount of postoperative transfusion (units)</td>
<td>6</td>
<td>8</td>
<td>13</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Postoperative drain removal (days)</td>
<td>10</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>Hospitalization time, days</td>
<td>14</td>
<td>6</td>
<td>10</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Hematocrit at discharge</td>
<td>30</td>
<td>34</td>
<td>37.2</td>
<td>33.2</td>
<td>37</td>
</tr>
</tbody>
</table>

Discussion

There are plenty of studies about complications following radical prostatectomy, however much of them have lacked standardizing. Martin et al. proposed several criteria that should be included in a report of complication, definition of data accrual and follow up duration, inclusion of outpatient information, definition of complication, identification of mortality and morbidity rates. In 2007, Donat modified the criteria to include procedure specific complications for urology.

In robotic surgery, intraoperative bleeding is generally a minor problem due to the elevated intra-abdominal pressure by CO₂ insufflation. Postoperative bleeding has been reported 0.5–2.0% according to various definitions after radical prostatectomy. Vascular injury may involve abdominal wall vessels or large retroperitoneal vessels. Injuries involving inferior epigastric vessels are the commonest type of vascular complication. The true incidence is unknown, but Zaki et al. reported that it is likely to exceed 3/1000 operative laparoscopies. Bleeding from the inferior epigastric vessels is often obvious during the course of laparoscopic surgery. Occasionally it may not be apparent until after the trocar has been removed at the end of the operation. In our study, postoperative bleeding complication has been observed in 317 RRP cases very low levels except 5 patients. However, 5 patients, especially bleeding in the abdominal wall, that had similar features reached severe levels. RRP was conducted through 5 port technique, after camera port veress needle and insufflation, other trocars in abdominal walls were entered through classical entry with internal and external observation, maximum effort was shown not to have any vein injury, and it was controlled if bleeding existed or not after entry and after trocars were extracted.

The operations of the 5 patients progressed without any problem, haemorrhage occurred in minimum levels,

![Figure 1](http://www.elsevier.es)  50-years-old man, postoperative day 3 extensive ecchymosis after RARP.

![Figure 2](http://www.elsevier.es)  Scrotal widespread ecchymoses in the same patient.

![Figure 3](http://www.elsevier.es)  CT scan of the abdomen showing presence of left sided abdominal wall haematoma.
and after operation, haemorrhage control was conducted both after the pressure was brought under 5 mmHg and then after the operation on the abdominal walls. Maximum muscle relaxation was ensured in all the patients and muscle relaxation traced by the anaesthetist continuously, no cramps were allowed. After making sure that no haemorrhage existed, operation was finalized. As done for all our patients, after the operation drainage, blood pressure, pulses and hemogram controls were taken. Although not all patients had haemorrhage from drainage, a decrease in haemoglobin levels was seen in the evening of the operation, and this decrease went on quickly. In spite of decrease in haemoglobin level, no haemorrhage was observed in abdomen drainage, and in tomography carried out, haemorrhage was detected on abdominal wall. The patients traced between 8 and 11 units through blood and blood products transfusion. We consider that these five complications were due to injury to the vessels not visualized even under transillumination existing on the abdominal wall and on trocar entry areas. They were on the vessels away from entries.

Bleeding control can be achieved by open or laparoscopic surgery exploration, minimally invasive surgery or observation. Open surgical exploration is the standard treatment in this situation. Kaufman and Lepor reported that reoperation for major bleeding after radical prostatectomy facilitates both healing of the vesicourethral anastomosis and removal of the urinary catheter. They compared between the men who underwent reoperation and the men whose bleeding was managed with observation. Total of blood units transfused and longer hospital stay were significantly greater in reoperation group than observation group. They found a suggestion of better continent in reoperation group.\textsuperscript{16,17} The conservative management of observation is the high rate of long-term incontinence. Conversely, all our patients who were treated with observation experienced banner continence in the average six-month follow-up. Surgery exploration was not conducted because of absence of bleeding in the operation area. HaemorrhNull of the patients ceased in the 2nd or 3rd day. Ecchymosis on side and posterior walls of abdomen, scrotum of some of the patients, spreading up to the legs were detected. Then, the patients recovered without any problems. Jeong et al. reported that all patients who had severe immediate postoperative bleeding after radical prostatectomy were successfully treated with transarterial embolization (TAE) without any additional treatment. They concluded that rapid diagnosis by CT angiography and early TAE could replace surgical exploration.\textsuperscript{21}

In robotic surgery, some of the postoperative bleeding has not been sufficiently explained by surgeons. We have three reasons probably leading the haemorrhage on abdominal wall in our cases. The first is during docking or operation, movements of robotic arms may cause extreme tension on the abdominal wall due to stable trocar and arms, and this situation may lead the vein to exceed the flexibility limit, and the vein to be damaged from its weak area. The second is, thin black lines on trocars are the zero points where the movements occurred. Trocars move to every direction without causing any trauma in these points. This is the statement supplied in introduction and usage information of the Robot. Zero points of trocars may be different due to soft error, adjustment error or placement errors, which may have led haemorrhage on abdominal wall as a result of trauma. Although arms of the robot have zero point, there is no zero point on the arm where the telescope is fixed. The fact that movement of the arm with telescope is stable as the others may have caused trauma and the last one is, during anaesthesia, myorelaxants were applied in adequate doses, even infusion was applied to some patients, and although cramps were not allowed, it can be thought that skeletal muscle contraction which were not recognized may have created trauma effect on abdominal wall that was fixed five pieces of trocars, which may have led to haemorrhage.

Abdominal wall haemorrhage during RARP is a technological complication that can be reduced by better understanding robotic arms placement and movements. Trocar placement under abdominal wall vessels transillumination, avoiding traction forces between robotic arms, assistant trocars and telescope and carefully trocar-arms movements can minimize this particular complication.

This is the first study, to our knowledge, as explained clinic of haemorrhage, associated with possible risk of robotic surgery indicating that haemorrhage of that kind is a complication of robotic surgery.

Conflict of interests

The authors declare that they have no conflict of interest.

References

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