Original Investigations

Robotic versus laparoscopic hysterectomy; comparison for early surgical outcomes
Takmaz and Güngör. Robotic hysterectomy vs laparoscopic hysterectomy

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Abstract

Objectives: Aim of the study is to compare early surgical outcomes of robotic assisted laparoscopic hysterectomy with laparoscopic hysterectomy for benign diseases, in terms of operation time, estimated blood loss(EBL), perioperative complications, hospital stay and first gas discharge.

Material and Methods: Medical records of 146 patients, who underwent laparoscopic (n:84) and robotic assisted laparoscopic hysterectomy (n:62) for benign diseases were extracted from medical database. Medical records of operation time, estimated blood loss, length of hospital stay and first gas discharge were evaluated between the groups.

Results: Mean age and mean BMI of both groups were comparable. The difference in the mean estimated blood loss was not statistically significant between laparoscopic (91±65ml) and robotic group (80±37ml, p=0.43). The difference in the mean first gas discharge time was not statistically different between laparoscopic (15±5hours) and robotic group (17±6hours, p=0.33). The length of hospital stay was comparable between groups (1.4±0.5 vs 1.5±0.7 days, p=0.64). The mean operation time was longer for robotic group (150±180min.) when compared with laparoscopic group (105±18min, p=0.00). The mean uterine weight of robotic group was significantly higher compared with laparoscopic group (234±157 gr vs 153±119 gr, respectively, p=0.00).

Conclusion: Early surgical outcomes of robotic assisted laparoscopic and laparoscopic hysterectomy were comparable in terms of EBL, first gas discharge and hospital stay. Operation time is longer in robotic hysterectomy.

Keywords: Robotic hysterectomy, laparoscopic hysterectomy

Introduction

Various novel types of medical and surgical treatments have been increasingly implemented in gynecology practice, hysterectomy is still the second most common gynecologic procedure for benign uterine diseases second to c-section (1). The most common indications for hysterectomy are fibroids and abnormal uterine bleeding (2). Hysterectomy can be performed with abdominal (AH), vaginal (VH), laparoscopic (LH) and robotic assisted laparoscopic (RH) approaches. An increasing trend for minimally invasive hysterectomy approaches such
as vaginal, laparoscopic and robotic assisted laparoscopic have been performed in the last two decades (3). Compared to AH, minimally invasive hysterectomy procedures provide shorter hospital stay, less bleeding, faster recovery and lower infection rates with better cosmetic results (4, 5). As a result, minimally invasive hysterectomy procedures are recommended as the first option when compared with the abdominal route (6). After the FDA (Food and Drug Administration) approval of the robotic assisted laparoscopic surgery in gynecologic procedures in 2005, another alternative option had its place in minimally invasive hysterectomy procedures. Although robotic assisted laparoscopy has disadvantages such as increased cost and longer operation times, improved dexterity, faster learning curve, instrument facilitation of 7 degrees of freedom, decreased tremor and 3D visualization make RH procedure preferable especially in more difficult cases such as in morbidly obese patients, having prior abdominal surgery or enlarged uterus (7-9).

In our study, we retrospectively compared the perioperative outcomes of LH with RH patients who had undergone hysterectomy for benign gynecologic indications.

**Materials and Methods**

Medical records of the patients who underwent robotic and laparoscopic hysterectomy between January 2015 and June 2018 for benign indications (fibroids, chronic pelvic pain abnormal bleeding or uterine prolapse) were extracted from hospital database system. The study was approved by institutional review board (ATADEK 2019-12). Patients who had a non-gynecologic or gynecologic additional procedure in the same session or who had a history of prior surgery or with chronic non-gynecologic conditions (liver, kidney, pulmonary disease, diabetes) were excluded from the study groups. All procedures performed in the study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Written informed consent was obtained from all participants. Medical records of operation time, estimated blood loss (EBL), length of hospital stay and first gas discharge time were evaluated and compared between the groups. Operation time was defined as the time from intubation to the end of extubation of the patient. Estimated blood loss was calculated with the difference of fluid volume between irrigation and suction. Hospital stay was defined as the post-operative days passed after surgery until discharge. First gas discharge time was defined as in which hour the first gas discharge was recorded after the surgery. Uterine weight was recorded by weighting the materials in the pathologic examination room immediately after removing of uterus.

Rumi II (Cooper Surgical, Trumbull, CT) uterine manipulator was applied after intubation for all cases. All operations were performed in lithotomy position with steep Trendelenburg (up to 30 degrees) in 13mmHg carbon dioxide pressure.

LH operations were performed by four abdominal ports (10mm umbilical, 5mm right, left and suprapubic porta), and integrated advanced bipolar and ultrasonic instrument (Thunderbeat-Olympus Corp. of America) was used for dissecting and vessel sealing.

RH operations were performed with da Vinci Si® or da Vinci Xi® (Intuitive Surgical, Inc., Sunnyvale, CA platforms by using 4 abdominal ports (in Si platform; 10mm umbilical, 8 mm right and left ancillary ports and 12mm assistant port, and in Xi platform; 8mm umbilical, right and left ancillary ports and 12mm assistant port). Side docking was performed for applying the patient card to abdominal ports in order to manage the uterine manipulator. Monopolar scissor was used for dissection and bipolar fenestrated forceps was used for vessel sealing.

After prophylactic antibiotic administration, all cases were undergone the same surgical steps. Following the port placement, round ligaments were dissected firstly. Than infundibulopelvic ligaments were dissected (if the patient was under 50 years old, utero-ovarian ligaments were dissected for preserving ovaries). Bilateral uterine arteries were sealed and dissected after
skeletonization. After incising the vaginal cuff, hysterectomy materials were removed through the vagina. Vaginal cuff closures were performed with 2.0 barbed suture in both groups. No major complication had recorded during operations or in early post-operative periods. After post anesthesia care unit, all patients were followed up in gynecology inpatient service with administration of a routine post-operative follow up medication of non-steroid analgesics and anti-emetics.

**Statistical Analysis**
The R-3.4.3 programme (R Core Team. 2017) was used for statistical analysis. Normality assessment of the variables was made by Shapiro Wilks Test. Descriptive statistical methods (mean, standard deviation, median) were used for evaluating the study data. Student-t Test was used to compare normally distributed quantitative variables of the groups, while Mann Whitney U Test was used for non-normally distributed variables. The statistical significance level was set at 0.05.

**Results**
Medical data of 146 patients were extracted for the study groups. Of the total 146 patients, 82 were undergone LH, 62 were undergone RH. Mean age and BMI were not significantly different between groups. Operation time was significantly longer in RH group than LH group (150min±180 vs 105min±18, respectively, p<0.00) (Table 1). Uterine weight was significantly higher in RH group than LH group (234gr±157 vs 153gr±119, respectively, p<0.00). The means of EBL were 80ml and 91ml for the RH and LH groups, respectively, the difference did not reach statistically significance (p=0.43). The mean of the first gas discharge time after the operation in RH group was 17 hours, while in LH group was 15 hours. However, the difference was not statistically significant (p=0.33). The means of hospital stay length were not statistically different between RH group and LH group (1.5days±0.7 and 1.4days±0.5, respectively, p=0.64) (Table 1).

**Discussion**
In our study, we found that perioperative outcomes for RH were comparable with LH, in terms of bleeding, first gas discharge time and hospital stay in patients who underwent simple hysterectomy for benign conditions. However, operation time was significantly longer in RH group than LH group.

After the first description of the total laparoscopic hysterectomy by Reich et al. in 1989, the application of minimally invasive procedures has been increased in hysterectomy operations (10). Various studies revealed the advantages of the minimally invasive hysterectomy such as less bleeding, less peri-operative and post-operative complication rates, shorter hospital stay and better post-operative recovery period (11-13). Not only in perioperative improvement but also in long term benefits of minimally invasive hysterectomy procedures were revealed (5). Beside the advantages of the minimally invasive hysterectomy procedures, some difficulties such as long learning curve, increased need of various equipment and educated hospital staff make these procedures slowly applicable into the practice.

One of the most important improvements in minimally invasive gynecologic surgery was the introducing of the robotic surgery into the surgical practice. First reported cases series of RH was published in 2002 (14). Thanks to the endo-wrist movements and 3D visualization, the robotic surgery is superior to laparoscopic procedures in terms of precise dissection and suturing capacity. Shorter learning curve is one of the other advantage of robotic surgery. It was revealed that performing fifty RH can complete the learning curve of the procedure (15,
Related to these advantages, robotic hysterectomy rates were grown fast subsequently the FDA (Food and Drug Administration) approval (17). However, robotic surgery has some disadvantages. These are longer operation times and higher costs (18-20). Longer operation times are due to the docking procedure which is the fixation of the robotic arms to the ports. On the other hand, it was revealed that the docking times got shorter with the experience (21).

Increased cost is the other major disadvantage of the robotic surgery. Average cost of RH is 1.5-3 times higher than the average cost of the LH (22). Investment of the console, maintenance cost and instrument cost per case are the main three reasons of the increased cost of robotic procedures. However, increase in the frequency of usage and decrease in the production costs could reduce the average cost of RH in the long term.

Another disadvantage is the size of the robotic system components. Robotic surgery has 3 components; surgeon console, patient card and the endoscopic tower. For the organization and application of these devices, both large operating room and trained hospital staff are needed.

In addition, robotic surgery has cosmetic disadvantages. In robotic gynecologic surgery, upper abdominal or umbilical area has to be used for port placements. Also, the port incisions are larger when compared with the laparoscopic incisions. Goebel et al. reported that robotic surgery can be less preferable as a result of negative cosmesis (23).

Although discomfort of the surgeon is not a component of perioperative outcome, it is another disadvantage of the robotic surgery. Neck stiffness, finger and eye fatigue were reported as the common complaints of robotic surgeons (24). However, there is no trial which compares the surgeon discomfort between RH and LH operations.

Hospital stay is another component of the perioperative outcome. In our study, as previous published papers, hospital stay for LH and RH was comparable (25).

Although, no perioperative complication was reported in our study groups, a metaanalysis reported that vaginal cuff dehiscence can be higher in RH (26). However, Scandola et al. claimed that RH was associated with lower perioperative complications in terms of vaginal cuff dehiscence (27). And also, in the context of complications, vaginal approach has to be considered for another alternative minimally invasive technique. A Cochrane analysis of hysterectomy techniques highlighted the fewest intraoperative complications, quickest return to baseline activities, and the fewest number of urinary/bowel dysfunction and dyspareunia issues with the vaginal approach(28).

Despite all the disadvantages, there are studies showing that robotic hysterectomy is preferable in some patient groups. Several papers reported that the use of robotic surgery is more advantageous than laparoscopy especially in obese patients or having large uterus (7, 29-31).

There are some limitations of our study. As our study did not include abdominal hysterectomy group, the perioperative improvements of endoscopic methods which were shown in the previous studies could not be studied. Other limitation is the difference of the uterine weight between the groups. Larger uterine weight can be a reason for the longer operation times in the RH group in our study.

**Conclusion**

Our study is revealed that RH did not improve perioperative outcomes in patients who underwent simple hysterectomy for benign conditions. Considering longer operation times and significantly increased costs, it does not seem reasonable to choose robotic approach for simple hysterectomy. Our results confirm the ACOG (American College of Obstetricians and Gynecologists) recommendation which points out that vaginal or laparoscopic hysterectomy are the preferable procedures for simple hysterectomy (32). However, robotic hysterectomy is
an important minimally invasive surgical alternative for laparoscopic hysterectomy, depending on the patient's condition, the difficulty of surgery and the preferences of the surgeon.

**Conflict of Interest:** Authors declare that there is no conflict of interest.

**References**

Table 1. Early Surgical parameters and characteristics of groups

<table>
<thead>
<tr>
<th></th>
<th>Laparoscopic Hysterectomy (n=84)</th>
<th>Robotic Hysterectomy (n=62)</th>
<th>p</th>
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<tbody>
<tr>
<td>Age</td>
<td>51±8.2</td>
<td>50±4.5</td>
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<tr>
<td>BMI</td>
<td>25±4.7</td>
<td>27±7.5</td>
<td>0.51</td>
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<tr>
<td>Uterine Weight (gr)</td>
<td>153±119</td>
<td>234±157</td>
<td>0.00</td>
</tr>
<tr>
<td>Op. Time (min)</td>
<td>105±18</td>
<td>150±180</td>
<td>0.00</td>
</tr>
<tr>
<td>EBL (ml)</td>
<td>91±65</td>
<td>80±37</td>
<td>0.43</td>
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<tr>
<td>First Gas Discharge (hour)</td>
<td>15±5</td>
<td>17±6</td>
<td>0.33</td>
</tr>
<tr>
<td>Hospital stay (day)</td>
<td>1.4±0.5</td>
<td>1.5±0.7</td>
<td>0.64</td>
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Op. Time: Operation time  
EBL: Estimated Blood Loss  
Data was presented as mean ± standard deviation