

Research Article

Vaginal Hysterectomy Versus Two-dimensional and Three-Dimensional Total Laparoscopic Hysterectomy in Women With Benign Uterine Diseases

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Abstract

Objectives: This study aimed to compare the outcomes of vaginal hysterectomy (VH) and two- and three-dimensional total laparoscopic hysterectomy (2D TLH, 3D TLH) in women with benign uterine diseases.

Methods: A retrospective, randomized study was conducted at the Department of Obstetrics and Gynecology, Bagcilar Training and Research Hospital between 2010 and 2012. Overall, 99 women underwent VH, 68 underwent 2D TLH, and 41 underwent 3D TLH. Patients' ages, parities, uterine weights, pre- and postoperative hemoglobin (Hb) and hematocrit (Htc) values, operating times, complication rates, and hospitalization duration were compared.

Results: A statistically significant difference was found among the groups in terms of patients' ages, parities, uterine weights, operating times, and hospitalization duration ($p < 0.05$). Patients who underwent 3D TLH were younger and had lesser parities, greater uterine weights, and shorter operating times. The hospitalization duration was similar between the 2D and 3D TLH groups (average, 2 days; min, 1 day; and max, 8–10 days); however, it was shorter than the VH group (average, 3 days; min, 3 days; and max, 8 days). No statistically significant difference was observed among the groups in terms of the pre- and postoperative Hb/Htc values and complication rates ($p > 0.05$).

Conclusion: VH still remains the preferred procedure for patients with uterine prolapse and patients who require pelvic repair. 3D TLH offers quick operation with less complication rates and morbidity and reduces the hospitalization duration. Because of more favorable outcomes, we presume that 3D TLH may replace 2D TLH in the near future.

Keywords: Laparoscopy, three-dimensional imaging, vaginal hysterectomy

Cite This Article: Bayramoglu D, Bayramoglu Tepe N. Vaginal Hysterectomy Versus Two-dimensional and Three-Dimensional Total Laparoscopic Hysterectomy in Women With Benign Uterine Diseases. EJMO. 2017; 1(3): 149-154

Hysterectomy is the oldest and commonly performed gynecological procedure.^[1] It is the second most frequent gynecological operation after the cesarean section.^[2,3] Importantly, uterus removal (excluding malignancies) is performed because of fibroids, bleeding irregularities, endometrial hyperplasia or cervical dysplasia, endometriosis, and prolapse.^[1]

Hysterectomies have been traditionally performed by laparotomy or vaginally. However, with recent advances in

technology, laparoscopic equipment, and training, hysterectomies are being increasingly performed by laparoscopy.^[4] As a consequence, a reduction of 38% in abdominal hysterectomy was observed in Western countries, with an increase in laparoscopic and vaginal surgeries.^[2,5] With the worldwide increase of laparoscopic procedures, it is necessary for gynecological surgeons to publish and share their techniques, successes, complications, and recommendations to avoid possible adverse outcomes.^[4] In cases where

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Submitted Date: July 13, 2017 **Accepted Date:** September 19, 2017 **Available Online Date:** September 27, 2017

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VH is not technically possible, total laparoscopic hysterectomy (TLH) offers more benefits when compared with abdominal hysterectomy.^[6] TLH facilitates better anatomical views, allows performance of concomitant surgery, and is suitable for larger uteri and those with little or no descent (which may prove difficult to remove vaginally). There are insufficient studies in literature that compare vaginal and laparoscopic hysterectomy; hence, the method of choice in case of benign pathologies is still under debate.^[7, 8]

Nevertheless, laparoscopy is more difficult to learn and requires several psychomotor skills than open laparotomy, partly because the surgeons have to work in a three-dimensional (3D) space while being guided by two-dimensional (2D) images.^[9, 10] Therefore, surgeons lose perceptions of depth and spatial orientations and thus experience higher visual and cognitive loads.^[11-13] To overcome few of the challenges associated with laparoscopy, 3D imaging was developed as an alternative to conventional 2D imaging.^[13-17] Although 3D technology was introduced in the early 1990s, it is yet to be implemented as a standard procedure in hospitals.^[18, 19] Because of the previously experienced side effects while using 3D vision systems, i.e., a degraded viewing condition from poor image resolution, the requirement to wear uncomfortable glasses, and the system's high costs compared with 2D equipment, this technology may be less preferred.^[10-20]

The most important limitation of conventional laparoscopy is the lack of a sense of depth because of a 2D flat view of the surgical field. Surgeons are forced to rely on monocular vision to understand the 3D sense of open surgery; however, even the most experienced surgeons may face difficulties while performing complex surgical tasks such as tissue dissection and suturing under only 2D visualization.^[21] The currently available 3D visualization systems may improve the ability of the surgeons to perform complex surgical tasks in minimally invasive surgeries. With the recently developed high-definition characteristics of 3D laparoscopic vision system, clearer and sharper images can be obtained; however, the high cost and adaptation difficulties encountered by experienced surgeons in switching from 2D to 3D vision seems to prevent the widespread use of 3D laparoscopic systems.^[22] Furthermore, the lack of standard training in laparoscopy among surgeons may also be a contributing factor.

In this study, we compare the results of VH, 2D TLH, and 3D TLH. This study aimed to compare the intra- and postoperative outcomes of vaginal and 2D and 3D laparoscopic hysterectomies, all performed according to the standardized techniques.

Materials and Methods

In this study, we examined the results of patients who underwent VH, 2D TLH, and 3D TLH in the Department of Obstetrics and Gynecology, Bagcilar Training and Research Hospital between 2010 and 2012. Ethical committee approval was obtained from Bagcilar Education and Research Hospital ethical board (Approval No: 2012-93). The study was conducted according to the principles of the Helsinki Declaration. Because our study is retrospective in nature and data were collected from hospital records, we did not require informed consent.

This study was retrospectively performed and operation indications were grouped among themselves. Hysterectomies performed because of malignant tumors or patients diagnosed with malignancies during the operations were excluded from this study. Hysterectomies conducted on 208 patients with only benign reasons were included in this study. Among them, 99 (47.6%) underwent VH, 68 (32.7%) underwent 2D TLH, and 41 (19.7%) underwent 3D TLH. Surgical procedures were performed by the same surgical team.

Patient age, their parities, preoperative hysterectomy indications, pre- and postoperative hemoglobin (Hb) and hematocrit (Htc) values, uterine weights, operating times, hospitalization duration, intra- and postoperative complications, and postoperative pathology results were recorded. In all three groups, only patients who had their postoperative follow-up in the Department of Obstetrics and Gynecology were included in the study and patients with intensive care need were excluded from the study. Viking 3D laparoscopic imaging systems were used to obtain the 3D images.

For TLH, operation start time was considered as the moment of the first entry of the trocar, and for VH, it was considered as the moment of first incision. For both methods, operation end time was considered as the moment of suturing the last knot. When patients with VH were treated with cystorectocele repair, the duration of these operations was subtracted from the total operation time and only VH duration was recorded.

Hb and Htc values were measured at 1 day preoperatively and 12h postoperatively. The duration between the operation day to the hospital discharge day was considered as the hospitalization duration.

SPSS 23.0 and Microsoft Excel 2010 software were used to evaluate the data. Kruskal–Wallis test was used to evaluate the nonparametric data. One-way analysis of variance and Levene's test were used to evaluate the parametric values. In all analyses, $p < 0.05$ was considered to be statistically significant.

Table 1. The Average outcomes of VH, 2-D TLH and 3-D TLH methods

Characteristics	VH (n=99)	2D TLH (n=68)	3D TLH (n=41)	P
Age (years)	59.7±10.7	52.4±7.4	50.2±8.3	0.001*
Parity	4.2±2.2	4.4±2.3	2.8±1.1	0.015*
Uterine Weight (gr)	166.2±119.8	356.6±275.9	377.7±220.5	0.001*
Operating Time (min)	106±4.2	121.07±44.1	101.3±26.2	0.03*
Hospital Stay (day)	3 (1-8)	2 (1-8)	2 (1-10)	0.01*
Preop-Postop Hb/Htc (gr/dl, %)	12.2±1.5 / 37.2 ±4.1 10.5±1.3 / 31.7 ±3.5	12±1.7 / 36.8±4.2 10.3±1.4 / 32±3.7	11.6±1.5 / 36±4.3 9.8±1.3 / 31±4.1	0.6
Complications	8.1% (n=8)	5.8% (n=4)	2.4% (n=1)	0.4

Hb: hemoglobin; Htc: hematocrit

* p<0.05, the difference between the variables was significant.

Table 2. Indications for surgery

Indications	VH (n=99)	2D TLH (n=68)	3D TLH (n=41)
Uterine myoma	0	13	14
Total uterine prolapsus	23	1	1
Abnormal uterine bleeding	2	27	10
Endometrial hyperplasia	0	10	7
Pre-invasive cervical lesions	1	3	1
Uterine descensus	69	3	0
Others	4	12	8

Results

Operations were divided into three groups: a) 2D TLH, b) 3D TLH, and c) VH. Among the 208 analyzed patients, 68 underwent 2D TLH, 41 underwent 3D TLH, and 99 underwent VH.

Patient's ages, parities, operation times, uterine weights, hospitalization duration, pre- and postoperation Hb and Htc values, and complication rates are presented in Table 1. Pre- and postoperative Hb and Htc values and complication rates were similar among the patient groups ($p>0.05$), whereas, parities, ages, operating times, hospitalization duration, and uterine weights were significantly different among the groups ($p<0.05$; Table 1).

Complications included cuff hematoma in five patients and cuff prolapses in three in the VH group; ureter injury in two, vesicovaginal fistula in one, and cuff dehiscence in one in the 2D TLH group; and ureter injury in one in the 3D TLH group.

When the groups were compared, patients in the 3D TLH group had statistically significant lower ages ($p=0.001$),

lesser parities ($p=0.015$), shorter operating times ($p=0.03$), and greater uterine weights ($p=0.001$). When hospitalization durations were compared, patients in the VH group revealed significantly longer hospitalization duration ($p=0.01$) compared with those in the 2D and 3D TLH groups. The hospitalization durations between the 2D and 3D TLH groups were similar (Table 1). Indications of operation are presented in Table 2.

Discussion

Laparoscopic surgery is superior to open surgery because of the following reasons: a) lower operating times and blood loss, b) shorter healing periods, and c) shorter hospitalization duration. Moreover, laparoscopy requires less analgesic and the patient is saved from a large abdominal scar,^[23,24] however, in hysterectomies, laparoscopic hysterectomy is more time consuming, requires more experience, and has more complications when compared to open surgery. Thus, laparoscopic hysterectomy was less preferred over the years. Previous studies did not reveal any significant benefits of laparoscopic hysterectomy when compared with VH;^[7-25] however, most of these studies are outdated and as the TLH experience increases among gynecologists, the superiority of VH when compared with laparoscopic hysterectomy is slowly changing over time.^[26]

In a small sample size study conducted in Germany in 2007, it was observed that TLH takes longer compared with VH; however, it reduces the postoperative hospitalization duration and analgesic usage.^[1] Thereafter, a Canadian study comparing both methods has reported that TLH takes longer time and has statistically insignificant higher complication rates.^[27, 28] We assume that the time taken while switching between the instruments during TLH prolongs the operation times, along with the relatively low experience of surgeons with this method. However, in our study,

3D TLH operating times (101.3 min) were significantly lower than 2D TLH (121.07 min) and VH (106 min; $p=0.03$).

This situation can be explained by the ever increasing usage of laparoscopic hysterectomy and the related experience growth. During the 2-year study period, we observed that our operating times were reduced both in 2D and 3D TLH groups and our experience increased over the years. We presume that a shorter operating time in 3D TLH when compared to 2D TLH is because 3D TLH provides a better 3D imaging to the surgeon, thus eliminating the perception of depth problems and increasing surgical field control.

In a series comparing the surgical methods among 250 patients with uterine weights >300 g, VH was found to be faster and more cost-effective, whereas complication rates were found to be similar. Similarly, we did not observe any significant differences among the complication rates in our study. The uterine weights of the patients in the 3D TLH group (377 g) were found to be meaningfully greater than those of the patients in the VH (166 g) and 2D TLH (356 g) groups. This indicates that TLH (especially 3D TLH) can be performed in patients with large uterus.

Laparoscopic hysterectomy revealed higher urinary tract injury (bladder and ureter injuries) incidences when compared with abdominal and vaginal hysterectomies.^[7, 29-33] No urinary tract damage was observed in the VH group; however, in the 2D TLH group, two patients reported ureter injury and one patient revealed vesicovaginal fistula; in the 3D TLH group, ureter injury developed in one patient in our study. We found urinary injury ratios for 2D and 3D TLH groups (2.9% and 2.4%, respectively) to be higher than the 0.2%–0.4% values for TLH as mentioned in other studies,^[34,35] however, we did not observe any significant difference between the 2D and 3D TLH groups in terms of the urinary injury rates. Urinary bladder injury rates for 2D and 3D TLH groups (1.4% and 0%, respectively) in our study were found to be similar with the reported values (1.0% and 1.8%, respectively) in other studies. The most common complication we observed in our study was the urinary tract injuries, which is similar to other studies. Of the 68 and 41 patients in the 2D and 3D TLH groups, two and one developed ureter injuries, respectively. These complications were detected during the operations and were treated without switching to laparotomy. The complications reported in our studies were mostly observed in the earlier months of the 2-year study period. We assume that our relatively low initial surgical experience resulted in higher urinary injury rates when compared with the other studies. We expect the complication rates to drop as laparoscopic hysterectomy becomes more common and surgical experiences increase over time.

Complications observed in the VH group included cuff hematoma in five patients and cuff prolapses in three. As cuff hematoma complication developed in the postoperative period, they were treated during this period, and this led to increased hospitalization duration of the patients in the VH group. Complications observed in both 2D and 3D TLH groups had mostly developed during the operations. As they were detected and treated during the operations, these complications did not affect the hospitalization duration of the 2D and 3D TLH groups much when compared to the VH group.

When hospitalization durations were compared, a significant difference was observed in larger series studies, with the TLH group revealing shorter hospitalization duration.^[28] Similarly, we have observed the hospitalization durations of 2D and 3D TLH groups (2 days) to be similar between each other but significantly shorter than the VH group (3 days). This difference can be explained by the less-traumatizing effects of 2D and 3D TLH operations on the patients, as well as the effect of detecting and correcting the complications mostly during the operations in the TLH groups.

VH can be the preferred method in patients with smaller uterus, those having no other adnexal pathologies, those who have given birth at least once, those who have not previously undergone laparotomy, and those with prolapse. Other than these situations, TLH seems to be a more appropriate choice. Moreover, considering the new advances in technology and increasing experiences, 3D TLH might be preferred over 2D TLH, taking into account the benefits as well.

In a meta-analysis including 3643 events, TLH has been known as the procedure with the least risk of bleeding.^[29] In our study, we did not observe any significant difference among the pre- and postoperative Hb and Htc values in the different groups. The amount of bleeding, being an important surgical parameter, has been found to be similar among the 2D TLH, 3D TLH, and VH groups. This finding also supports the idea that 2D and 3D TLH methods might be preferred with the relevant patient groups.

In our study, the mean age of the patients in the 3D TLH group was found to be significantly lower than that in the other two groups. Similarly, Saceanu et al. have found the average ages of the patients who underwent laparoscopic hysterectomy to be lower than those of patients who underwent open surgery. This difference has been attributed to the fact that younger patients are more prone to embracing newer treatment methods and may be inclined to prefer laparoscopy because of the elimination of the esthetical scars.^[35] However, in our study, the patients were not given

a choice on their method of preference but rather underwent VH or laparoscopic hysterectomy solely based on the proper indications. The results indicating that the patients who underwent laparoscopic surgeries had lower mean ages also support the idea that 3D TLH should be preferred in younger patients with proper indications because of the advantages the method provides.

As a result, VH is still the first preferred method in patients who have prolapse and descensus and those who require pelvic repairs. 2D and 3D TLH might be preferred in patients (especially younger ones) who have endometriosis and abdominal adhesions, provided they exhibit the appropriate indications. With the advances in technology, 3D TLH has become an increasingly more preferred procedure. Although 3D TLH provides more benefits, like a better imaging and a better field control compared with 2D TLH, it is still considered as a more expensive method; however, as most of the complications in laparoscopic surgeries have developed because of visual errors, the superiority of 3D TLH can be proven as it provides a better perception of depth to the surgeon. Therefore, complication rates will drop with increased surgical experiences over time, and the safety of laparoscopic surgeries will be increased. The most important problems surgeons face using 3D laparoscopic systems include eye fatigue, headache, dizziness, and physical inconvenience caused by the 3D glasses. These problems are reduced in the newer and more advanced systems.^[10-13-20] In surgery, the cost of the surgical procedure is also an important parameter. Robotic surgery is widely being used; however, it is extremely expensive compared with 2D and 3D TLH. Therefore, 3D laparoscopy should be preferred over robotic surgery.

There are not many studies that involve 3D TLH compared with the other procedures. In our study, we found that the operating time and hospitalization duration of 3D TLH were shorter than those of the other methods, which are surgically important parameters. We have also found the patients in the 3D TLH group to be younger and have a greater uterine weight. They had similar blood loss and complication rates when compared with the other two groups. Although the complication rates are similar between the 2D and 3D TLH groups in our study, 3D TLH can reduce complication rates because of the benefits of image and depth perception. 3D TLH may become the preferred choice when we consider its better clinical benefits and reduced performance errors compared with 2D TLH. In the near future, 3D TLH is expected to become as common as 2D TLH and may even replace it thereafter; however, more studies with clinical results are required to prove this point.

Disclosures

Ethics Committee Approval: Ethics Committee of Bagcilar Training and Research Hospital.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship contributions: Concept – D.B.; Design – D.B., N.B.T.; Supervision – D.B.; Materials – D.B.; Data collection &/or processing – D.B.; Analysis and/or interpretation – N.B.T.; Literature search – N.B.T., D.B.; Writing – D.B., N.B.T.; Critical review – N.B.T.

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