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Original article

Comparison of clinical findings and inflammation indicator levels between laparoscopic hysterectomy and abdominal hysterectomy in an instructional setting

Maliheh Arab [1,*], Mahsa Asghari [2], Behnaz Ghavami [2], Shahla Noori Ardabili [2]
Robabeh Ghodssi-Ghassemabadi [3], Kourosh Sheibani [4]

[1] Department of Obstetrics & Gynecology, Shahid Beheshti University of Medical Sciences, Iran
[2] Department of Obstetrics & Gynecology, Tehran University of Medical Sciences, Tehran, Iran
[3] Department of Biostatistics, Department of biostatistics, Tehran, Iran
[4] Basir Eye Health Research Center, Tehran, Iran

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Abstract

Background: The objective of this study was to compare clinical findings and inflammation indicator levels between total laparoscopic hysterectomy (TLH) and total abdominal hysterectomy (TAH) in an instructional setting.

Methods: In this prospective study, 80 total hysterectomy procedures were performed at the gynecology clinic of Imam Hossein Medical Center, Tehran, Iran over the period between January 2017 and October 2019. Patients were divided into two groups according to the type of operation. Forty patients underwent TLH (TLH group) and 40 patients underwent TAH (TAH group). Surgery-related outcomes and inflammatory mediators were both assessed before and 24 hours after the surgery.

Results: We observed significantly lower operation bleeding (P <0.001), postoperative lower c-reactive protein (CRP) (P <0.001), higher length of surgery (P <0.001), and higher anesthesia duration (P <0.001) in TLH group compared to TAH group. There was no statistically significant difference between groups regarding post-operation transfusion, adverse events, polymorphonuclear leukocytes (PMN) count, white blood cell (WBCs) count and platelet (PLT) count, as well as the hemoglobin (Hb) levels.

Conclusion: Our study results show that the TLH can be safely performed in our instructional setting and it decreases intraoperative bleeding and postoperative day one CRP levels compared to the TAH method.

Keywords: C-reactive protein, hysterectomy, laparoscopy, laparotomy

Introduction

Hysterectomy is presumably one of the most common gynecological procedures performed due to various causes from uterine and ovarian malignancies to abnormal uterine bleeding (AUB) and fibroids, with a prevalence of about 33% among gynecological procedures (1,2). Hysterectomy can be performed using different methods including laparotomy and laparoscopic procedures. Laparoscopy is an alternative method to open surgery that has an important role in gynecology and is widely employed in cystectomy, oophorectomy, and hysterectomy (3). Palmer performed the first surgical laparoscopy in the field of gynecology in the 1950s and the first laparoscopic vaginal hysterectomy was conducted in 1989 (4,5). Since then laparoscopy has been used more and more in place of open surgical procedures; mainly due to fewer short- and long-term complications, less bleeding, shorter recovery time and hospitalization, as well as being less painful than traditional surgery (4, 6, 7). The benefits of this method are believed to be related to less manipulation in laparoscopic method and reduced release of inflammatory mediators 8. On the other hand, laparoscopic procedures are generally slower, especially when the setting-up time is included,

*Correspondence author: Prof. Dr. Maliheh Arab, Gynecology ward, Imam Hossein Medical Center, Shahid Maddani Street, Tehran, Iran
Tel: +98-9121593277 Email: drmarab@sbmu.ac.ir

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need special equipment, and surgeons with limited experience might take much longer to complete the , which might result in a higher complication rate (4, 9). In the present study, we compared clinical findings and inflammation indicator levels between TLH and total TAH methods in a teaching setting.

Materials & Methods

This prospective study included women with abnormal uterine bleeding (AUB) who were referred to the gynecology clinic of Imam Hossein Medical Center, Tehran, Iran over the period between January 2017 and October 2019 and were candidates for total hysterectomy due to various causes such as uterine myoma, and hyperplasia. The present study was approved by the ethics committee of Shahid Beheshti University of Medical Sciences (IR. SBMU. MSP.REC.1398.447) and informed consent was obtained from all participants before entering the study. The surgical approach was chosen according to patient's preference.

All TLH procedures were performed by laparoscopic surgeons with high experience. TLH was performed abdominally using an open approach and entrance through the umbilicus. The TAH procedure was carried out using a Pfannenstiel incision by same experienced surgeons in the same hospital.

We included 40 eligible patients undergoing TLH (TLH group) and 40 eligible patients who underwent TAH (TAH group). The exclusion criteria were having a large uterine size, presence of underlying inflammatory diseases, and laparoscopic conversion to laparotomy. We recorded all related characteristics and findings of patients in both the TLH and TAH groups. These findings included age, body mass index (BMI), reason for surgery (myoma, simple cyst, endometrial hyperplasia, other), comorbidities (hypertension, diabetes mellitus, other), the mean uterine size, non-steroidal anti-inflammatory drugs (NSAIDs), immunosuppressive drugs, uterine size, history of previous surgery, cesarean section, laparotomy, dilation and curettage (D&C), smoking, and postsurgical adhesions.

The length of surgery, anesthesia duration, the amount of post-operation blood transfusion and the volume of intra-operative bleeding were all compared between the two groups. We assessed the volume of blood loss during surgery by counting the number of

procedures and are more likely to make mistakes

blood gases and measuring the volume of blood suctioned during the surgery. Inflammatory mediators such as the level This prospective study included women with abnormal uterine bleeding (AUB) who were referred to the gynecology clinic of Imam Hossein Medical Center, Tehran, Iran over the period between January 2017 and October 2019 and were candidates for total hysterectomy due to various causes such as uterine myoma, and hyperplasia. The present study was approved by the ethics committee of Shahid Beheshti University of Medical Sciences (IR. SBMU. MSP.REC.1398.447) and informed consent was obtained from all participants before entering the study. The surgical approach was chosen according to patient's preference.

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The length of surgery, anesthesia duration, the amount of post-operation blood transfusion and the volume of intra-operative bleeding were all compared between the two groups. We assessed the volume of blood loss during surgery by counting the number of blood gases and measuring the volume of blood suctioned during the surgery. Inflammatory mediators such as the level of c-reactive protein (CRP), polymorphonuclear leukocytes (PMN), white blood cell count (WBCs) and platelet count test (PLT), as

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well as the hemoglobin (Hb) levels were compared within each group before and 24 hours after the operation and also between the two groups.

Finally, complications such as fever, pneumonia, atelectasis, urinary tract infection (UTI), incision opening and incisional hernia, as well as thrombosis and embolism were assessed. C-reactive protein (CRP), polymorphonuclear leukocytes (PMN), white blood cell count (WBCs) and platelet count test (PLT), as well as the hemoglobin (Hb) levels were compared within each group before and 24 hours after the operation and also between the two groups.

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Sample size was calculated based on findings of the study by Facy et al., (10) to find the difference between the mean CRP changes between the two groups of laparoscopy and laparotomy by 8 units and standard deviation of 12 for each group. Taking into account the test power of 80% and the first type of error of 0.05, we needed at least 37 people in each group. We entered 40 patients in each group to deal with the probable loss in the follow-up phase.

Statistical Methods

The data were presented as the mean and standard deviation (SD) for continuous variables and frequency and percent for categorical variables. Baseline characteristics and outcomes were compared between the two groups by an independent samples t-test or chi-squared test. We used logistic regression and ANCOVA to adjust for categorical baseline differences when comparing groups' outcomes. To compare the change of variables within each group, a paired sample t-test was performed. The significance level was set at 0.05. The R 3.6.1 statistical package was used for data analysis.

Results

The mean age of patients entering the study was 47.6 ± 7.8 years. The youngest patient was 32 years old, and the oldest patient was 68 years old. There was no statistically significant difference in the mean age of patients in the two surgical groups. Also, no statistically significant difference was observed between the two groups regarding BMI, reason for surgery, comorbidities, NSAID/ immunosuppressive drug, uterine size, history of previous surgery, history of cesarean section, history of previous laparotomy, history of D & C, smoking, and presence and location of adhesions. The only statistically significant difference in demographic findings between the two groups was the number of patients undergoing hysterectomy due to the presence of myoma, which was significantly higher in TAH group compared to TLH group (p = <0.006) (Table 1).

The mean length of surgery was significantly higher in the TLH group (208.3 ± 75.3minutes) compared to laparotomy group (150.6 ± 48.47 minutes) (P<0.001). In addition, the anesthesia duration was longer in TLH group the mean length of surgery was significantly higher in the TLH group (208.3 ± 75.3minutes) compared to laparotomy group (150.6 ± 48.47 minutes) (P<0.001). In addition, the anesthesia duration was longer in TLH group (259.4 ± 79.8) compared to patients undergoing TAH group (184.6 ± 50.16 minutes) (P<0.001). On the other hand, the mean volume of bleeding was significantly higher in the TAH group (879.8 ± 350.6 cc) compared to the TLH group (253.8 ± 202.6 cc) (P<0.001). The differences in above mentioned variables remained significant after adjusting the results for the presence of myoma. In the TAH group 10% of patients and in the TLH 7.5% of patients received post-operative transfusion (in all cases one packed cell) indicating no significant difference between the two groups. Also 12.5% of patients in each group showed adverse events with no statistically significant difference between the two groups. These adverse events in the TLH group included trocar implant in 5% of patients and developing post-surgical fever in 7.5% patients. In the TAH group, 10% of patients had infection or opening of the incision after surgery, while 2.5% of patients developed a herniated area and fever (Table 2).

As it can be deduced from Table 3, the mean postoperative hemoglobin level (Hb) was significantly lower in both groups of patients compared to pre-operation levels (P<0.001 for both groups). Also, the PMN count (P<0.001 for both groups) and WBC count (P<0.001 for both groups) significantly increased in both groups of patients in comparison to pre-operation readings. While the PTL in the TLH group was significantly lower post-operatively compared to pre-operative readings (P=0.026), this reduction was not statistically significant in the TAH group. Finally, the CRP levels significantly increased in both groups compared to pre-operative readings (p<0.001 for both groups). The only statistically significant difference in the two groups of patients regarding these inflammatory mediators was observed in CRP levels on day one post-operatively, which was significantly higher in the TAH group (P<0.001) and the difference remained significant after adjusting for myoma (P<0.001). Figure 1 shows the mean level of CRP in the laparoscopy and laparotomy groups before and after the surgery.

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Table 1. Characteristics of participants in the two groups of patients undergoing laparoscopic hysterectomy and abdominal hysterectomy

Variable	Total n (%) (n=80)	Laparoscopy n (%) (n=40)	Laparotomy n (%) (n=40)	P value*
Age (years) (mean±SD)	47.55 ± 7.84	47.35 ± 8.03	47.75 ± 7.75	0.821
BMI**(kg/m^2) (mean±SD)	26.63 ± 3.67	27.01 ± 3.32	26.25 ± 3.99	0.354
Reason for Surgery				
Myoma	32 (40)	10 (25)	22 (55)	0.006
Abnormal Uterine Bleeding	56 (70)	28 (70)	28 (70)	0.999
Simple cyst	10 (12.5)	6 (15)	4 (10)	0.499
Uterine Hyperplasia	7 (8.8)	3 (7.5)	4 (10)	0.999
Other	3 (3.8)	3 (7.5)	0 (0)	0.241
Comorbidities				
Hypertension	20 (25)	11 (27.5)	9 (22.5)	0.606
Diabetes Mellitus	9 (11.3)	6 (15)	3 (7.5)	0.481
Other Disease	15 (18.8)	8 (20)	7 (17.5)	0.775
NSAID| ISDs***	5 (6.3)	3 (7.5)	2 (5)	0.999
Uterine size (mm) (mean±SD)	10.81 ± 9.39	11.47 ± 12.91	10.16 ± 3.28	0.538
History of Surgery	55 (68.8)	27 (67.5)	28 (70)	0.809
History of Cesarean Section	19 (23.8)	12 (30)	7 (17.5)	0.189
History of laparotomy	11 (13.8)	4 (10)	7 (17.5)	0.330
History of D&C****	35 (43.8)	17 (42.5)	18 (45)	0.822
Smoking	4 (5)	2 (5)	2 (5)	0.999
Presence of Adhesions	18 (22.5)	11 (27.5)	7 (17.5)	0.284
Adhesions type				
To bladder or intestine	11 (13.8)	5 (12.5)	6 (15)	0.163
Other region	7 (8.8)	6 (15)	1 (2.5)	

*P values are calculated according to independent samples t-test or Chi-squared test
**Body mass index, ***Nonsteroidal anti-inflammatory drugs/ Immunosuppressive drugs, ****Dilation and Curettage

Table2. Comparison of surgery related outcomes between the two groups of patients undergoing laparoscopic hysterectomy and abdominal hysterectomy

Variable	Laparoscopy Mean ± SD	Laparotomy Mean ± SD	P value	P value*
The Length of Surgery (minutes)	208.3 ± 75.3	150.6 ± 48.47	<0.001	<0.001[1]
Anesthesia duration	259.4 ± 79.79	184.6 ± 50.16	<0.001	<0.001[1]
Intraoperative bleeding	253.8 ± 202.6	879.8 ± 350.6	<0.001	<0.001[1]
Post-operation transfusion, n (%)	3 (7.5%)	4 (10%)	0.999	0.872 [2]
Adverse Event, n (%)	5 (12.5)	5 (12.5)	0.999	0.825 [2]

P values adjusted for myoma ([1]: ANCOVA; [2]: Logistic regression)

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Table 3. Comparison of the inflammatory mediators between the two groups of patients undergoing laparoscopic hysterectomy and abdominal hysterectomy

Variable	Surgery group Time	Laparoscopy Mean ± SD	Laparotomy Mean ± SD	P value**	P value***
Hemoglobin (Hb) (mg/dl)	Pre-operation	11.7 ± 1.4	11.3 ± 1.3	0.238 [1]	
	Post-operation	10.4 ± 1.1	10.3 ± 1.0	0.527 [2]	
	P value*	<0.001	<0.001		
	Difference	-1.3 ± 1.0	-1.0 ± 0.9	0.192 [1]	0.357
Polymorphonuclear leukocytes (PMN) (%)	Pre-operation	61.5 ± 12.1	66.1 ± 10.4	0.074 [1]	
	Post-operation	74.5 ± 13.1	74.2 ± 9.2	0.700 [2]	
	P value*	<0.001	<0.001		
	Difference	12.9 ± 14.8	8.14 ± 10.3	0.094 [1]	0.231
White blood cell count (WBCs)	Pre-operation	7.6 ± 2.4	7.79 ± 2.4	0.740 [1]	
	Post-operation	9.3 ±2.9	9.14 ± 2.7	0.951 [2]	
	P value*	<0.001	<0.001		
	Difference	1.7 ± 3.2	1.35 ± 2.37	0.565 [1]	0.930
Platelet count test (PLT)	Pre-operation	248.1 ± 63.2	254.8 ± 96.7	0.716 [1]	
	Post-operation	230.5 ± 56.3	249.9 ± 84.7	0.146 [2]	
	P value*	0.026	0.676		
	Difference	-17.60 ± 48.0	-4.80 ± 72.1	0.353 [1]	0.248
C-reactive protein (CRP)	Pre-operation	4.49 ± 3.5	4.87 ± 4.2	0.662 [1]	
	Post-operation	58.9 ± 30.3	103.2 ± 42.5	<0.001[2]	
	P value*	<0.001	<0.001		
	Difference	54.4 ± 31.3	99.3 ± 42.2	<0.001[1]	<0.001

*P value for within group comparison (Paired sample t-test)
** P value for comparison between groups (1: Independent sample t-test; 2: ANCOVA)
*** P value for comparison between groups adjusted for myoma effect (ANOVA).

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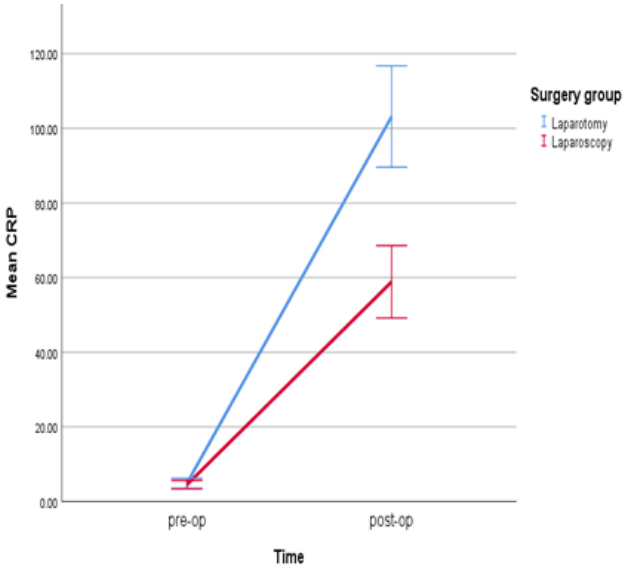

Figure 1. The mean level of c-reactive protein (CRP) between the two groups of patients undergoing laparoscopic hysterectomy and abdominal hysterectomy

Discussion

In the present study, we compared clinical findings and side effects between laparoscopic and laparotomy hysterectomy in an instructional setting. When comparing the surgical related outcomes between the two groups of patients, we observed a statistically significant longer mean time for surgical procedures among patients undergoing laparoscopy compared to patients undergoing laparotomy. Similar to our results, Balcı et al., (4) in their study on patients undergoing either TLH or TAH, observed a significantly higher mean surgical duration among patients undergoing laparoscopy. Also, Härkki-Sirén et al, (11) and Vaisbuch et al., (12) have reported longer mean operating time for TLH compared to TAH group. It seems that this is a constant finding in most studies comparing these two methods of hysterectomy, but the difference in the surgical operation time might be higher when the laparoscopic procedure is performed by less experienced surgeons. Therefore, laparotomy has the advantage of shorter operating times than laparoscopic surgery. In our study, the mean duration of anesthesia was significantly longer in the laparoscopy group compared to the laparotomy group. This can be explained by the longer mean operation time among patients undergoing laparoscopy.

We also observed a significantly higher amount of intraoperative bleeding in the TAH group compared to the TLH group. Similar to our results, Satoet al., (13) reported a significantly higher mean bleeding volume among 325 patients undergoing TAH group compared to 125 patients undergoing TLH. Furthermore, in several other studies, less intraoperative blood loss has been reported in TLH group compared to TAH group (14-16).

We also compared hemoglobin levels and inflammatory mediators between the two groups of patients. The only statistically significant difference in two groups of patients regarding these variables was observed in CRP levels post-operatively. This difference was significantly higher in the TAH group on day one postoperatively, and the difference remained significant after adjusting for myoma. Similar to our findings, Hou et al., (17) reported a significantly higher mean CRP level among 30 patients undergoing TAH compared to 33 patients undergoing TLH on day one after the surgery. Also, Härkki-Sirén et al., (11) and Labib et al., (18) reported significantly higher levels of CRP among patients undergoing TAH group compared to patients undergoing TLH group on day one postoperatively.

Regarding postoperative complications, 12.5% of patients in each group showed adverse events with no statistically significant difference between the two groups.

The present study had some shortcomings including the relatively low sample size for comparison of complications between the two groups. In addition, there was no comparison of pain levels or hospitalization time between the two groups of patients. We suggest further studies with a larger sample size to reliably compare the short- and long-term complications between these two methods of hysterectomy.

Conclusion

The laparoscopic hysterectomy method in our instructional setting resulted in significantly lower intraoperative bleeding and postoperative day one CRP levels, but significantly higher operation time.

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Conflicts of Interest

We declare that we have no competing interests.

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