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Cerrahi Yaklaşımın İdrar Yolu Fonksiyonuna Etkisi: Laparoskopik ve Vajinal Histerektomi Sonrası Ürodinamik Değişikliklerin Karşılaştırılması

The Impact of Surgical Approach on Urinary tract function: Comparing Urodynamic Changes after Laparoscopic and Vaginal Hysterectomy

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ÖZ

Amaç: Dünya çapında jinekolojik hastalıkların görülme sıklığının hızla artması, minimal invaziv cerrahi prosedürleri ön plana çıkarmaktadır. Bu çalışma minimal invaziv cerrahi yöntemlerden laparoskopik ve vajinal histerektomi tiplerinde üriner sistem değişikliklerini değerlendirmek amacıyla yapıldı.

Gereç ve Yöntem: 2017-2021 yılları arasında üçüncü basamak bir hastanede benign nedenlerle histerektomi yapılan toplam 86 katılımcı seçilerek iki gruba ayrıldı. Grup I'de vajinal histerektomi ile tedavi edilen 43 katılımcı yer alırken, grup II'de laparoskopik histerektomi ile tedavi edilen 43 katılımcı yer aldı. Kadınlarda Alt İdrar Yolu Semptomları anketi kullanıldı ve her iki grupta da akış hızı, işeme süresi ve diğer faktörleri belirlemek için istatistiksel analiz yapıldı.

Bulgular: Bu çalışmanın sonuçları her iki grupta da başlangıçtaki duyuşal bağlamda herhangi bir değişiklik olmadığını gösterdi ($p = 3,63$). Mesane kapasitesi de her iki grupta da farklılık göstermedi. Ancak ameliyat sonrasında grup I'de 8 katılımcıda (%18,6) detrüsr kasında aşırı aktivite gözlenirken, grup II'de 2 katılımcıda (%4,6) gözlendi ($p=0,021$). İdrar akış hızı ve rezidüel idrar hacmi her iki grupta da benzer aralıklardaydı.

Sonuç: Bu çalışma, jinekolojik hastalığı olan hastalarda uygulanan minimal invaziv cerrahi yöntemlerin üriner sistemde benzer sonuçlara yol açabileceğini vurgulamaktadır. Bu anlamda çalışma, ameliyat sonrası dönemdeki üriner sistem değişikliklerinin öngörülmesi ve yönetilmesi açısından faydalı olacaktır.

Anahtar Kelimeler: Histerektomi; Laparoskopik; Vajinal; Jinekolojik; Ürodinami

ABSTRACT

Aim: The rapidly increasing prevalence of gynecological diseases worldwide brings minimally invasive surgical procedures to the fore. This study was conducted to evaluate the urinary system changes of laparoscopic and vaginal hysterectomy types, which are minimally invasive surgical methods.

Materials and Method: A total of 86 participants who underwent hysterectomy for benign reasons between 2017 and 2021 in a tertiary hospital were selected and divided into two groups. Group I included 43 participants treated with vaginal hysterectomy, while group II included 43 participants treated with laparoscopic hysterectomy. The Lower Urinary Tract Symptoms in Women questionnaire was used, and statistical analysis was performed to determine flow rate, voiding time, and other factors in both groups.

Results: The results from this study showed that there was no change in the initial sensory context in both groups ($p = 3,63$). Bladder capacity also did not differ in both groups. However, postoperatively, excessive activity in the detrusor muscle was observed in 8 participants (18.6%) in group I, while it was observed in 2 participants (4.6%) in group II ($p=0.021$). Urine flow rate and residual urine volume were in similar ranges in both groups.

Conclusion: This study emphasizes that minimally invasive surgical methods for patients with gynecological diseases may have similar results in the urinary system. In this sense, the study will be useful in terms of predicting and managing post-operative period urinary system changes.

Keywords: Hysterectomy; Laparoscopic; Vaginal; Gynecological; Urodynamics

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INTRODUCTION

There are different surgical procedures defined in hysterectomies performed for benign gynecological pathologies. Approximately 20% to 40% of women in every developed and developing country have undergone hysterectomy at the age of 60 (1). The main methods for hysterectomy operation include vaginal, laparoscopic and abdominal hysterectomy, but recently the laparoscopic trend has been increasing by up to 30% in many countries. It is the most suitable, economical, and sustainable (2).

Like all medical sciences throughout Turkey, the gynecology department has developed and uses surgical service techniques, standards, equipment and technologies at the level of current literature knowledge (3). These advancements and updated methods have facilitated patients with more effective procedures but despite these surgical advancements, the internal body changes that are part of a hysterectomy are either undergone by laparoscopic or vaginal hysterectomy (4). Literature studies have shown that both vaginal and laparoscopic hysterectomy procedures have significant effects on women, drawing attention to the different psychological and physical changes they cause in the female body (5). A recent systematic review highlighted that there is a contrast between the empirical knowledge and patients' reviews on the aftermaths of hysterectomy surgeries and contended that researchers depict the significant changes in the sexual desire, self-esteem, perceived body image and general feeling of pleasures (6).

In contrast, the patients narrate a wide range of significant negative consequences including changes in body image sense, difficulties with dynamic adjustments, urine incontinence, ovarian cysts, and fluctuating body sugar and blood levels (6). Further, the systematic review has portrayed a generic challenging situation faced by the women after hysterectomy and has not highlighted any specific type of hysterectomy-related consequences (6). Additionally, the researcher only appreciates the quality and the satisfactory procedure of laparoscopic hysterectomy, but no exact prelude information is available that reflects the body dynamics and particularly the urodynamic changes (7). There are only studies that depict that connection between the urodynamic study and radical hysterectomy and has not provided any comparison of the effectiveness of urodynamic study on body changes after vaginal and laparoscopic hysterectomy and in addition, there is no exact information available in the literature that depict the Turkish women experience after

hysterectomy and urodynamic study (8). Based on these limitations on the empirical side, the study grounded its aim in elucidating the impact of laparoscopic and vaginal hysterectomy on the urodynamic changes faced by women, therefore.

Vaginal hysterectomy is defined as the procedure of removing the uterus through the vaginal route to treat uterine prolapse in women and is characterized as a fast, cost-effective treatment with a low complication rate and short recovery time. Vaginal hysterectomy (VH) was first performed by the Italian autonomist Berengario da Carpi, Bologna, in 1507 (9). Vaginal hysterectomy has the advantages of less objective pain, less need for analgesia, faster recovery and transition to daily life compared to other types of hysterectomy, as well as fewer complications in the intraoperative and postoperative period. The vaginal route has been discussed as the safe method for hysterectomy and it has been emphasized that it is applied more frequently than other methods (10).

The vaginal hysterectomy has been discussed in the literature with different psychological and physical parameters and the consequences and the mechanism of performance of vaginal hysterectomy have been highlighted (11,12). Like, a study that investigated the difference between the vaginal and laparoscopic hysterectomy procedures concerning body weight, operation time, blood loss, hospital stay, postoperative analgesia and intra and immediate operation complications of obese vs non-obese patients (13). After conducting the results and compiling the results, the study concluded all the under-observation parameters were the same for both vaginal and laparoscopic hysterectomy, only operation time was recorded as short for the vaginal hysterectomy and suggested that vaginal hysterectomy should be widely adopted for vaginal removal as it has additional characteristics than the laparoscopic hysterectomy (13).

The laparoscopic hysterectomy is the other type or dimension of hysterectomy. The laparoscopic hysterectomy has two types: conventional and a modern era updated method called robotic or robot-assisted laparoscopic hysterectomy; it is a minimally invasive treatment approach for gynecological diseases characterized by having robotic assistance and a three-dimensional view, a more accurate instrument controls and a quick learnable process (14). The term hysterectomy in simple words is the most common surgical intervention in gynecology for various benign and malignant indicators and has different procedures of treatment, one of which is the laparoscopy. Conventional laparoscopic hysterectomy surgery uses small incisions for the manipulation of tissues by using endoscopic cameras and

long surgical instruments (15). Laparoscopic surgery has been discussed in the literature as the second beneficial method for treating gynecological diseases and malignancies and in this domain, both types of laparoscopies have been highlighted as effective surgical methods that help the patient come back to their normal life in a short time and patients have mentioned significant advantages of laparoscopic treatments for their gynecological issues (16).

The urodynamics is the study of the lower urinary tract functioning and an effort or attempt to reproduce the patient symptoms to provide a pathophysiological explanation; in simple words, it is the analysis of the functional anatomy of the bladder and urethra and their response to filling, storing and voiding regardless of the method (17). This technique of urodynamics is widely applied and effective in the assessment and evaluation of the functioning of the urinary tract system. The physicians have been sustaining that the evaluation of urodynamics is a defensive or initial approach before the risks e.g., time invasiveness, discomfort, urinary tract infection and alleviated costs for the treatments. Further, it has been also highlighted that the urodynamic study has the power to diagnose concomitant detrusor overactivity, voiding dysfunction and intrinsic sphincter deficiency (18). The incumbency of the urodynamic study for the patients having any lower urinary tract dysfunction, however, there is a controversial debate on the ideal point for the urodynamic exam in the patients but still this tool has its weightage in effectively tracking any malfunctioning in the urinary tract (19). This tool also has central value in detecting the changes in the urinary tract functioning after a hysterectomy performed by any type and it has been empirically evaluated and proven in a study finding that hysterectomy cause urinary infections, inefficient bladder emptying and voiding symptoms (20). Thus, it revealed that urodynamics and the vaginal or laparoscopic hysterectomy do have an interconnection and doing a urodynamic study after a hysterectomy can facilitate the surgeons with prelude updating on any dysfunction in the lower urinary tract functioning of women.

The primary significance of conducting this study was to highlight the challenges, issues and dynamics faced by the women after hysterectomy. Moreover, this study was designed so that it will illustrate the true picture of the changes within the urinary tract faced by the women and to individually portray the urodynamics after laparoscopic and vaginal hysterectomy. From the practical perspective, this study will enable the women, the medical staff, and the doctors to get the urinal dynamical changes

and to understand and make some countable effective measures against the dynamic challenges.

MATERIALS AND METHOD

From August 2017 to April 2021, a total of 86 patients were included in this study, namely those who sought treatment in the in-patient departments of the Authors' institute. The study was approved by Konya Karatay University Clinical Research Ethics Committee (approval number 2023/040). Each patient signed informed consent forms. Informed consent forms provide detailed information about the procedure and potential hazards. The patients were divided into two groups of similar size: Group I (n=43) underwent vaginal hysterectomy. Laparoscopic hysterectomy was performed in Group II (n=43). The scope of our research includes all individuals who underwent hysterectomy and urodynamic examination due to non-malignant gynecological disorders. We eliminated individuals with diabetes mellitus, neurological diseases, previous urological pelvic surgery, previous cesarean section, and history of urinary tract infection. In all operations, patients were administered general anesthesia.

The surgeon selected the typical minimally invasive surgical approach, prioritizing vaginal hysterectomy as the primary option, and subsequently laparoscopic hysterectomy. Laparoscopic hysterectomy was performed using a reusable umbilical or 12-mm port (Xcel; Ethicon Endo-Surgery, Inc., Somerville, NJ) for the optics, along with three helper ports. The assistant ports consisted of either three 5-mm ports or two 5-mm ports and one 10-mm port, all located in the lower quadrants. A standard vaginal hysterectomy was performed. Each research participant had a thorough process of obtaining extensive medical background, including physical examination, and standard pre-operative testing. The ICIQ-FLUTS (International Consultation on Incontinence Modular Questionnaire on Female Lower Urinary Tract Symptoms), together with urodynamic examination (cystometry and uroflowmetry), were conducted before to and six months following the surgical procedure.

Statistical Analysis

The data were analyzed using the Statistical Program for Social Science (SPSS) version 18.0. The quantitative data were presented as the mean value plus or minus the standard deviation (19). The qualitative data were presented in terms of frequency and percentage. Subsequent experiments were conducted: Two independent samples T-test is used to determine the statistical significance when comparing the means of two continu-

ous variables. Paired t-test: t represents the difference in means between the pre and post measurements. The chi-square (x²) test of significance was utilized to compare proportions between two qualitative components. The Pearson correlation coefficient (r) test was used to assess the correlation between the data. The p-value, which represents the likelihood, was considered statistically significant if it was below 0.05, and highly significant if it was below 0.01.

RESULTS

For this study, a total of 86 participants with gynecological disorders were selected from three in-patient healthcare facilities in Turkey for a period of 2017 to 2021. The voluntary participation of these participants was ensured. These participants were divided into two groups. Group I included 43 participants who underwent vaginal hysterectomy while group II included 43 participants who underwent laparoscopic hysterectomy.

Table 4.1 Demographics of the participants

PMs	Grp I		Grp II		Mn diff	t-test	
	Mn	± SD	Mn	± SD		t	P value
Age (years)	59.15	3.67	54.73	4.16	2.44	2.403	0.058
Wt. (Kg)	70.03	7.87	69.16	6.93	1.67	0.874	0.387
Parity	2.74	0.78	3.11	0.76	-0.071	-0.337	0.735

Mn= mean; diff= difference; wt= weight; grp= group;

PM= parameters

Table 4.1 shows the demographic characteristics of the participants in this study. It was observed that the average age of group I was 59.15 years, and the average age of group II was 54.73 years, which was significantly different (p = 0.058). However, the average weight of group I was 70.03 kg, the average weight of group II was 69.19 kg, and there was no significant difference between the groups (p = 0.387). Additionally, the parity value was found to be 2.74 for group I and 3.11 for group II, and there was no significant difference between the groups (p = 0.735).

Table 4.2 shows that first sensation volumes increased after surgery in both groups. In Group I, the average initial sensation volume was 167.77 ml before the operation and increased to 178.01 ml after the operation. In Group II, the mean initial sensation volume before the operation was 169.44 ml, and it increased to 179.91 ml after the operation. However, these findings were not significant in terms of preoperative and postoperative volume (p=0.363, p=0.373, respectively).

Table 4.2 Comparative analysis of first sensation between group I and group II

FS	Grp I		Grp II		Mn diff	t-test	
	Mn (Daya & Jere)	± SD	Mn (Daya & Jere)	± SD		t	p-value
Pre	167.77	24.82	169.44	22.25	-2.01	-4.378	0.363 NS
Post	178.01	14.97	179.91	15.18	-3.51	-0.905	0.373 NS
P value	0.6		0.67				

FS= first sensation; Mn= mean; diff= difference; grp= group

Table 4.3 shows that CBC volume decreased after surgery for both groups. In Group I, it was observed that the CBC volume decreased from 518.12 ml before surgery to 477.01 ml after surgery. Similarly, in group II, the CBC volume was recorded as 514.01 ml before surgery but decreased to 486.3 ml after surgery. These findings were not statistically significant in both groups (p = 0.617, p = 0.298, respectively).

Table 4.3 Comparative analysis of CBC volume in group I and group II

CBC	Grp I		Grp II		Mn diff	t-test	
	Mn (Daya & Jere)	± SD	Mn (Daya & Jere)	± SD		t	p-value
Pre	518.12	25.33	514.01	25.73	3.32	0.506	0.617
Post	477.01	100.18	486.32	65.94	-33.34	-1.516	0.298
P value	0.11		0.15				

CBC= "Cystometric bladder capacity;" Mn= mean; diff= difference; grp= group

It has been observed that there was no over activity in detrusor muscle of both groups before the surgery. However, over activity was observed in 8 participants (18.6%) of group I after operation, while it was observed in 2 participants (4.6%) of group II. In total 10 participants faced over activity (11.6%) in their detrusor muscle.

Table 4.5 shows that maximum "flow rate" (p= 0.067) was reduced in group I, while the voiding time was increased (p= 0.058). However, not much change was observed in max flow rate (p= 0.068) and voiding time (p= 0.062) in group II. Moreover, the average flow rate was found to be greater in group II as compared to group I.

Table 4.4 Over activity in detrusor muscle in both groups

Post-op. Presence of DM OA	Grps				Total	
	Grp I		Grp II		No.	%age
	No.	%age	No.	%age		
-ve	35	81.39	41	95.3	76	88.3
+ve	8	18.6	2	4.65	10	11.6
Total	43	100.00	43	100.00	86	100.00
x ²					5.456	
P value					0.021	

OA= over activity; DM= detrusor muscle; op= operative; Mn= mean; diff= difference; grp= group

Table 4.6 shows that the residual volume of urine increased in group I was modest as compared to group II ($p = 0.128$).

Table 4.5 Uroflowmetry characteristics

	Grp I		Group II	
	Pre-op	Post-op	Pre-op	Post-op
Voided vol (Daya & Jere)	264.5 ± 48.8	274.6 ± 60.7	274.7 ± 58.3	284.4 ± 56.8
P value	0.157		0.156	
Max FR (ml/sec)	26.2 ± 5.2	24.2 ± 5.3	25.71 ± 4.7	27.2 ± 4.5
P value	0.067		0.068	
Voiding tm. (sec)	50.3 ± 11.6	61.2 ± 9.8	48.7 ± 8.7	46.4 ± 9.4
P value	0.058		0.062	
Average FR (ml/sec)	7.5 ± 2.3	6.8 ± 1.4	6.6 ± 1.8	8.8 ± 2.71
P value	0.064		0.066	

FR= flow rate; Max= maximum; tm= time; vol= volume

Table 4.6 Volume of residual urine in both groups

Grps	Testing time	RV Mn (Daya & Jere)	± SD	Paired dif		Paired samplet-test	
				Mn (Daya & Jere)	SD	t	p-value
Grp I	Pre post	54.11	7.59	3.29	1.28	4.82	0.128 NS
		57.33	5.59				
Grp II	Pre Post	50.74	3.98	1.42	1.02	3.777	0.217 NS
		52.14	3.02				
RV	Grp I Mn (Daya & Jere)	± SD	Grp II Mn (Daya & Jere)	± SD	Mn dif	t-test	
						t	P value
Pre	54.11	7.58	50.75	3.98	-1.34	-0.855	0.395 NS
Post	57.33	5.57	52.12	3.02	2.55	3.506	0.083 NS

RV= residual volume

DISCUSSION

To enhance the life expectancy of women, it is crucial to understand the enduring negative consequences of surgical procedures (22). The purpose of this study was to examine the impact of laparoscopic versus vaginal hysterectomy on lower urinary tract symptoms and functions by utilizing urodynamic studies. Our objective was to determine whether the type of operation (vaginal or laparoscopic hysterectomy) has any influence on postoperative lower urinary tract functions. An assessment was conducted to determine the correlation between the urinary symptoms and the urodynamic parameters before and after the operation. Several research have conducted comparisons between abdominal and vaginal hysterectomy. Polat et al. conducted a physiological evaluation of the bladder, urethra, and anorectum in 26 women prior to hysterectomy, as well as six weeks and six months following the procedure. According to their finding, certain women may see a significant rise in

rectal and bladder sensitivity following a hysterectomy performed for non-cancerous conditions (23). The modifications persisted for a duration of six months; however, they did not exhibit any correlation with variations in rectal or vesical motor activity. Furthermore, it is important to note that these modifications were not always associated with the initiation of urinary or gastrointestinal issues. Following a complete hysterectomy, local injury, infection, and edema were eliminated as reasons of the heightened sensitivity in the pelvic organs. However, we have reached the conclusion that the reason for the heightened sensitivity in the rectum and bladder observed in certain women following vaginal and abdominal hysterectomy remains unidentified. It may be possible that removal of a major pelvic organ and its associated nerve supply alters the regulation of sensation from adjacent organs. In another study, total abdominal, vaginal, laparoscopic, and subtotal hysterectomy types for benign gynecological pathologies were compared in terms of urinary and sexual functions. It was observed that 6 months after the surgeries, urinary symptoms occurred less frequently, and urodynamic parameters did not change (24).

The current study found no evidence of a causal relationship between hysterectomy and involuntary detrusor contractions or urinary incontinence. Additionally, there was no change in urethral adequacy and no increase in stress incontinence after hysterectomy. A separate study showed that 58.3% of 36 women who underwent complete hysterectomy had complaints before surgery, but only 38.9% had proven impairment based on urodynamic testing. Additionally, 75% of women experienced posthysterectomy symptoms and an additional 30.6% developed urodynamic abnormalities. Their findings show that complete hysterectomy is associated with an increase in the occurrence of vesicourethral dysfunction, both subjectively and objectively (25). Another study compared different types of hysterectomies, such as full abdominal, vaginal, laparoscopic, and subtotal. A total of 187 women, aged between 29 and 73, who underwent hysterectomy for different reasons were examined. Six months after the operation, a significant decrease was observed in the frequency of urinary complaints ($p = 0.01$), but no change was observed in urodynamic studies (17).

Based on our research, the pre- and postoperative urodynamic examinations in both groups showed that all observed alterations were within the range that is considered clinically acceptable. Therefore, it may be concluded that urodynamic investigations demonstrated that neither vaginal nor laparoscopic hysterectomy had a noteworthy impact on bladder function

and capacity.

This study incorporates various limitations which can be overcome in future research. For instance, a small sample size was selected for this study due to limited resources. Additionally, this study only focused on patients from Turkey due to easy accessibility of the required data. This limited the scope of this study. Therefore, in future research, a large number of sample size can be selected to attain significant outcomes. Within this context, the data can also be collected within the context of different countries. This approach can be effective in determining different types of operations and other medical measures which are taken by healthcare professionals worldwide for treating gynecological disorders. This can also add value to the current research, leading to significant outcomes.

CONCLUSION

Both vaginal and laparoscopic hysterectomy for non-cancerous uterine conditions did not have a negative impact on urinary bladder function. Based on the results of uroflowmetry and cystometry, it was shown that hysterectomy, whether performed vaginally or laparoscopically, did not have a negative impact on urinary bladder function in cases with benign uterine diseases. Therefore, we advise against relying on the impact of hysterectomy on bladder functioning based on personal preference for either vaginal or laparoscopic surgery.

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