Comparison of *de novo* urinary incontinence after abdominal and vaginal hysterectomy

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Tolga Atakul*, Ahter Tanay Tayyar**, Mert Küçük***, Özgür Deniz Turan*, Ezgi Özdemir*, Emre Zafer*, Hasan Yüksel*

**Department of Obstetrics and Gynecology, Adnan Menderes University Faculty of Medicine ,Aydın, Turkey*
***Department of Obstetrics and Gynecology, Zeynep Kamil Women's and Children's Disease Training and Research Hospital, İstanbul, Turkey*
****Department of Obstetrics and Gynecology Mugla Sıtkı Kocman University Faculty of Medicine, Muğla, Turkey*

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AIM: *This study aimed to compare the frequency and risk factors of de novo urinary incontinence (UI) following abdominal and vaginal hysterectomies for benign disease.*
METHODS: *The study included patients without incontinence history who underwent abdominal or vaginal hysterectomy for benign indications. Incontinence statuses were assessed at least one year after hysterectomies. Data for age, body mass index (BMI), parity, mode of delivery, and the types of hysterectomy and postoperative UI were recorded.*
RESULTS: *The study included a total of 196 patients with mean age of 52.8±11.4 years. Of these, 149 (76%) underwent abdominal hysterectomy (AH) and 47 (24%) had vaginal hysterectomy (VH). The mean follow-up period was 1.97±1.43 years. A total of 41 (20.9%) patients were diagnosed with UI after hysterectomy. De novo UI occurrence following AH and VH was similar($p>0.05$). Also, UI types were not significantly found different in either group ($p>0.05$).*
CONCLUSION: *This study showed that de novo UI occured frequently after hysterectomies. In addition, development and types of UI following AH and VH were comparable.*

KEY WORDS: Abdominal hysterectomy, Urinary incontinence, Vaginal hysterectomy

Introduction

Hysterectomy is a major gynaecological and frequently performed surgical procedure. Approximately 75% of the hysterectomy operations are performed in reproductive ages [1]. The most preferred surgical approaches are abdominal hysterectomy (AH) and vaginal hysterectomy (VH).
International Continence Society (ICS) and the International Urogynecology Association (IUGA) has described Urinary incontinence (UI) as involuntary leakage of urine. UI, as a symptom, is the observation of involuntary leakage of urine during the examination [2]. Stress urinary incontinence (SUI) is defined as the complaints related to involuntary leakage of urine due to coughing, exertion, on sneezing or effort. Urge urinary incontinence UUI is defined as the complaint of involuntary leakage accompanied by or immediately preceded by urgency [3].
Many etiologies have been detected which increase the frequency of UI development. Age, menopause, parity, obesity, history of vaginal birth (VB) and hysterectomy are most common independent risk factors that have been related to UI [4].
While some studies have suggested that hysterectomy operations were frequently associated with increased rate of UI [5-7], others contradicted [8,9]. In a recently published cohort study showed that the frequency of de novo UI was relatively high in patients with history of hysterec-

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Corrspondence to: Tolga Atakul, MD, Assistant Professor of Obstetrics and Gynecology. Adnan Menderes University Faculty of Medicine, Aytepe-Aydın, Turkey (e-mail: atakultolga@hotmail.com)

tomy [5]. In PubMed search for comparing UI occurrence rates following AH and VH, we were not able to find such a study Thus, we aimed to compare frequency and types of new UI development following these two common major pelvic surgeries.

Patient Selection and Method

The study included 196 patients who underwent AH or VH for benign indications between 2007 and 2015. Patients were excluded if they had history of UI evaluating with clinical examination before hysterectomy, or if they had undergone any other abdominal or gynaecological operation such as urinary tract and colorectal and endometriosis and abscess surgeries except previous caesareans. Caesarean sections (CSs) were included in the study as they were not found to increase UI in previous studies [10, 11].

Evaluation was performed including body mass index (BMI), obstetric histories, hysterectomy approaches implemented and the types of postoperative UI. While the vaginal cuff was fixed to the sacro-uterine ligament in accordance with the Richardson method in patients undergoing AH, the McCall culdoplasty method was performed for VH operations to prevent future prolapseas previously described anterior or posterior vaginal facial defects were repaired without mesh if needed [12,13]. The patients were called for examination and were included in the study within a year, following operations. Occurrence of UI was questioned during telephone interview. The diagnosis was confirmed via cough-stress test with 250 ml filled bladder in dorsal lithotomy position postoperatively.

Statistical Analysis

SPSS 22.0 (IBM Corporation, Armonk, New York, United States) software was used in for statistical analyses. The conformity of the data to normal distribution was evaluated with the Shapiro-Wilk test and variance homogeneity with Levene test. While Independent-Samples T test was used with Bootstrapresults, the Mann-Whitney U test was used with Monte Carlo results for the comparison of two independent groups in terms of quantitative data. The Pearson Chi-Square and Fisher's Exact tests were used with the Monte Carlo Simulation method in the comparison of categorical variables and the column rates were compared with each other and expressed according to the Bonferroni adjusted p value results. Quantitative variables were shown as mean ±standard deviation (SD), range (*maximum-minimum*), the median as range (*maximum-minimum*) and categorical variables were stated as numbers (n) and percentages (%) in tables. The variables were analyzed at 95% confidence level. A value of $p<0.05$ was accepted as statistically significant.

Results

The study included 196 patients with a mean age of 52.8±11.4 years (Table I). The mean follow-up period was 1.97±1.43 (1-7) years, and 41 (20.9%) patients were diagnosed with de novo UI during postoperative period. Of these patients, 30 (73.2%) had AH and 11 (26.8%) had VH. SUI was seen in 20 (10.2%) patients, and UUI was seen in 19 (9.7%) was found to be similar. The least frequent type was mixed urinary incontinence (MUI), seen only in 2 patients(1.1%). No statistically significant difference was determined between the operation methods in terms of UI incidences and the types ($p>0.05$)

The mean age of the patients who underwent VH was 59.9±12.7 years while it was 50.5±10.1 years in patients who underwent AH. The patients who underwent VH were older than the AH patients as expected and this difference was found to be statistically significant ($p=0.001$).The patients who underwent VH had a history of VB at the rate of 95.7%, while this rate was 70.5% in AH patients ($p<0.05$). While 12.6% of the AH patients had a history of CS, no VH patients had a CS history.

The mean uterine volume was 324 cm^3in AH patients and 116 cm^3 in VH patients. Uterine volumes of AH patients were larger and the difference between two groups was statistically significant ($p<0.001$) (Table II).

The median number of parity was 2 (12-0) in the AH patients and 3 (9-0) in the VH patients. The parity of the VH group patients was higher compared with AH patients and the difference between groups was found to be statistically significant ($p<0.05$).

Of patients diagnosed with UI following hysterectomy, the mean age, parity and number of VB parameters for VH group were higher compared with AH group ($p<0.001$, $p=0.001$, and $p=0.005$ respectively). The mean uterine volume was larger in AH group ($p<0.001$).

None of the analyzed parameters was found to be related to risk of de novo UI occurrence after abdominal hysterectomy except history of vaginal hysterectomy at a younger age ($p<0.05$).

Discussion

One of the interesting results from secondary analysis of the Women's Health Initiative study was the relatively higher incidence of UI in patients with history of hysterectomy than patients with an intact uterus. The most frequent time of UI onset was the 3rd postoperative year and hormone replacement therapy was ineffective in reducing the incidence of UI development [6]. Similarly, the review of 11 epidemiologic studies showed that the risk of UI occurrence in women who underwent hysterectomy was 40-80% higher than those who did not [7]. However this finding was not supported by some

TABLE I - *Comparison of the demographic characteristics of women with abdominal and vaginal hysterectomy*

	Abdominal Hysterectomy (n=149) Mean ±SD / Max.-Min.	Vaginal Hysterectomy (n=47) Mean ±SD / Max.-Min.	Total (N=196) Mean ±SD/ Max.-Min.	P Value
Age (year)	50.5±10.1 / 80-22	59.9±12.7 / 86-36	52.8±11.4 / 86-22	**0.001**
	Median (Max.-Min.)	**Median (Max.-Min.)**	**Median (Max.-Min.)**	
Uterine Volume (cm³)	324.125 (4.480.000-6.000)	116.150 (598.125-16.875)	211.000 (4.480.000-6.000)	**<0.001**
Parity	2 (12-0)	3 (9-0)	2 (12-0)	**0.005**
VD (n)	2 (12-0)	3 (9-0)	2 (12-0)	**<0.001**
C/S (n)	0.3 (3-0)	0.1 (3-0)	0.2 (3-0)	**0.002**
	n(%)	**n(%)**	**n(%)**	
VD - C/S				
None	11 (7.4)	1 (2.1)	12 (6.1)	**0.006**
VD	105 (70.5)	45 (95.7) [a]	150 (76.5)	
C/S	19 (12.8)	0 (0.0) [a]	19 (9.7)	
VD and C/S	14 (9.4)	1 (2.1)	15 (7.7)	
VD - C/S				
None	11 (7.4)	1 (2.1)	12 (6.1)	0.300
Yes	138 (92.6)	46 (97.9)	184 (93.9)	
Urinary Incontinence				
None	119 (79.9)	36 (76.6)	155 (79.1)	0.682
Yes	30 (20.1)	11 (23.4)	41 (20.9)	
Urinary Incontinence Type				
Urge	14 (46.7)	5 (45.5)	19 (46.3)	0.881
Stress	14 (46.7)	6 (54.5)	20 (48.8)	
Mixt	2 (6.7)	0 (0.0)	2 (4.9)	

Independent T test(Bootstrap) - Mann Whitney U Test (Monte Carlo) - Pearson Chi-Square Test (Monte Carlo) - Fisher Exact Test (Exact) - a: Statistically significant according to the abdominal hysterectomy group. VD: Vaginal Delivery, C/S: Cesarean Section

TABLE II - *Comparison of incontinent and continent patients after abdominal and vaginal hysterectomy*

	Urinary Incontinence (-) (n=155)			Urinary Incontinence (+) (n=41)		
	Abdominal Hysterectomy (n=119) Mean ±SD	Vaginal Hysterectomy (n=36) Mean ±SD	*P Value*	Abdominal Hysterectomy (n=30) Mean ±SD	Vaginal hysterectomy (n=11) Mean ±SD	*P value*
Age (years)	51.05±9.92	61.44±12.13	**0.001**	48.53±10.53	55.00±13.82	0.118
	Median (Max.-Min.)	**Median (Max.-Min.)**		**Median (Max.-Min.)**	**Median (Max.-Min.)**	
Uterine Volume (cm³)	336 (448-60)	117 (598-42)	**<0.001**	306 (2250-30)	120 (4875-16.9)	**0.012**
Parity	2(12-0)	3 (9-0)	**0.005**	2 (7-0)	3 (4-1)	0.446
VD (n)	2(12-0)	2.5 (9-0)	**<0.001**	2 (7-0)	3 (4-1)	0.152
C/S (n)	0.3 (3-0)	0.1 (3-0)	**0.009**	0.2 (2-0)	0 (0-0)	0.153
	n(%)	**n(%)**		**n(%)**	**n(%)**	
VD - C/S						
None	9 (7.6)	1 (2.8)	**0.030**	2 (6.7)	0 (0.0)	0.245
VD	84 (70.6)	34 (94.4) [a]		21 (70.0)	11 (100.0)	
C/S	15 (12.6)	0 (0.0) [a]		4 (13.3)	0 (0.0)	
VD and C/S	11 (9.2)	1 (2.8)		3 (10.0)	0 (0.0)	
VD - C/S						
None	9 (7.6)	1 (2.8)	0.455	2 (6.7)	0 (0.0)	1
Yes	110 (92.4)	35 (97.2)		28 (93.3)	11 (100.0)	

Independent T test (Bootstrap) - Mann Whitney U Test(Monte Carlo) - Pearson Chi-Square Test(Monte Carlo) - Fisher Exact Test(Exact) - a: Statistically significant according to the abdominal hysterectomy group. VD:Vaginal Delivery, C/S: Cesarean Section

other prospective studies [8,9]. UI may develop after hysterectomy especially in postmenopausal women [14] and might be considered as a complication of hysterectomy. Damage of the structures supporting urethra or urethral sphincter itself during hysterectomy may cause be the underlying reason for post-hysterectomy UI. Tissue

TABLE III - *Patient characteristics' comparisons regarding hysterectomy types in urinary continent and de novo incontinent patients*

	Abdominal Hysterectomy			Vaginal Hysterectomy			Total		
	Incontinence (–) (n=119) Mean±SD	Incontinence (+) (n=30) Mean±SD.	*P value*	Incontinence (–) (n=36) Mean±SD.	Incontinence (+) (n=11) Mean±SD.	*P Value*	Incontinence (–) (n=155) Mean±SD.	Incontinence (+) (n=41) Mean±SD.	*P value*
Age	51,05±9.92	48.53±10.53	0.930	61.44±12.13	55.00±13.82	**0.046**	55.27±11.69	53.46±11.32	0.302
	Median (Max.-Min.)	**Median (Max.-Min.)**		**Median (Max.-Min.)**	**Median (Max.-Min.)**		**Median (Max.-Min.)**	**Median (Max.-Min.)**	
Uterine Volume (cm³)	336 (4480-6)	306 (2250-30)	0.489	117 (598-42)	120 (487-16)	0.246	225 (2250-16)	210 (4480-6)	0.264
Parity	2 (12-0)	2 (7-0)	0.742	3 (9-0)	3 (4-1)	0.958	2 (7-0)	2 (12-0)	0.838
Number of V-Ds	2 (12-0)	2 (7-0)	0.843	2.5 (9-0)	3 (4-1)	0.958	2 (7-0)	2 (12-0)	0.825
Number of C/S s	0.3 (3-0)	0.2 (2-0)	0.306	0.1 (3-0)	0 (0-0)	1	0 (2-0)	0 (3-0)	0.355
	n(%)	**n(%)**		**n(%)**	**n(%)**		**n(%)**	**n(%)**	
VD - C/S									
None	9 (7.6)	2 (6.7)	1.000	1 (2.8)	0 (0.0)	1	2 (4.9)	10 (6.5)	0.985
VD	84 (70.6)	21 (70.0)		34 (94.4)	11 (100.0)		32 (78.0)	118 (76.1)	
C/S	15 (12.6)	4 (13.3)		0 (0.0)	0 (0.0)		4 (9.8)	15 (9.7)	
VD and C/S	11 (9.2)	3 (10.0)		1 (2.8)	0 (0.0)		3 (7.3)	12 (7.7)	
VD - C/S									
None	9 (7.6)	2 (6.7)	1.000	1 (2.8)	0 (0.0)	1	2 (4.9)	10 (6.5)	1
Yes	110 (92.4)	28 (93.3)		35 (97.2)	11 (100.0)		39 (95.1)	145 (93.5)	

Independent T test (Bootstrap) - Mann Whitney U Test (Monte Carlo) - Pearson Chi-Square Test (Monte Carlo) - Fisher Exact Test (Exact) VD: Vaginal delivery, C/S: Cesarean section

stretching and/or straining may further increase damage [15,16].

This study showed that de novo UI is not rare and it occurs approximately one in five of cases (21%) among patients undergoing AH or VH. Recently, de novo UI frequency was reported to be 8.5% based on a data from Swedish National Register for Gynecological Surgery, In this registry, 16,182 hysterectomies for benign indications have been recorded [5]. The most important problem in determining whether or not hysterectomy caused UI is recall bias. It was observed that 30% of well questioned patients had complaints about incontinence before the hysterectomy operation. This prevalence is reported around 8% in the normal female population [17]. Our study was focused on de novo UI after hysterectomies and, found higher prevalence of de novo UI occurrence than those results mentioned above. The difference may be derived from the different approach to UI diagnosis or from clinic and demographic backgrounds of studied the populations.

It is widely accepted that VH has many advantages over AH. However, some conditions may restrict the vaginal approach. Briefly, preferred surgical method for hysterectomy mostly depends on pelvic pathology, pelvic anatomy and surgeon's experience. In this study, we questioned if VH has an advantage over AH in terms of de novo UI development.

Although the patients, surgeons and indications were not uniform, this study found that the prevalence of UI after hysterectomy was not related to abdominal or vaginal approach. There are very few studies which have included a comparison between abdominal and vaginal approaches in cases of UI following hysterectomy operations for benign indications. Similar to this study, no differences had been shown between the hysterectomy methods regarding the occurrence of de novo IU after surgery [5,18-21]. However, these results are inconsistent with the other studies [7,22]. In a study by Lakeman et al.[14], it was reported that VH was an independent risk factor in terms of increased UI following hysterectomy. This was suggested to be related to cervical traction in the vaginal approach and the tissue trauma secondary to removal of a large uterus from vagina.

On the other hand, total laparoscopic, laparoscopic supracervical or laparoscopy assisted VHs have no advantage in terms of de novo UI development after surgery when compared to AH or VH [23,20].

UI is mostly categorized in subtypes of stress, urge, mixed, incontinence. In this study, de novo subtypes of both SUI and UUI were found to be around in 10% following hysterectomy. Although, de novo MUI observed rare, our results were similar with Swedish nationwide study by Engh et al. [21]. However, the SUI development increases significantly compared to other subtypes following hysterectomy [19,20] which were inconsistent with the present study. The interpretation of these study results might be confoundable as the methods are not uniform.

The results of this study showed that the methods of hysterectomy were not also related to de novo developing UI subtypes. Altman et al., in their prospective hysterectomy study groups, detected a very high number of

cases with especially SUI and UUI both preoperatively and postoperatively than the results of this study [8]. Similar to present study, they also did not find any relationship with hysterectomy methods and subtypes of UI. However, in their later research it was concluded that irrespective of hysterectomy technique, the risk for subsequent SUI surgery is increased [20]. We observed no change in the SUI frequency depending the hysterectomy method, as in Swedish Registry data [21].

There are many different causes of UI in women. Pelvic surgeries, especially hysterectomy either abdominal or vaginal are associated with de novo UI. Although the most of patients underwent hysterectomy are continent, it is crucial to detect the patients at risk for de novo UI. However, this study did not show any risk factor for de novo UI except that one is having VH at younger age.

There are some limitations to our study. First, this study is being based on an interview and pelvic examination. We have not been able to perform urodynamic study to diagnose UI postoperatively. Second, some possible risk factors cannot be under control. For example, age, parity and number of vaginal births were found to be higher in VH patients than that of AH and these conditions may be considered a reason for the connective tissue and pelvic floor failures. Despite that, pelvic floor supported by Mc Call culdoplasty during surgery and the procedure may contribute to prevention of higher incidence of de novo UI after VH.

In fact, more preventive strategies are needed. A new study suggests that vaginal native tissue repair may decrease the incidence of de novo UI [24]. The more proximal uterosacral ligament suspension with vaginal fasciae was suggested for pelvic floor support.

In summary, development of UI after hysterectomies is not rare and it might be considered as a complication. This study showed that hysterectomy is associated with the development of de novo UI irrespective of abdominal or vaginal approaches with similar incidences. The subtypes of UI are not related with surgical method. Since UI may develop as a complication of hysterectomy, it can be recommended that the risk factors must be determined and preventive measures must be implemented.

Riassunto

Lo studio ha lo scopo di confrontare i fattori di frequenza e di rischio dell'incontinenza urinaria de novo (UI) dopo isterectomia addominale e vaginale. Sono stati incluse pazienti sottoposte ad isterectomia addominale o vaginale per indicazioni di patologia benigna senza storia pregressa di incontinenza urinaria. La situazione di incontinenza è stata valutata almeno un anno dopo le isterectomie. Sono stati riportati i dati di età, indice di massacorporea (BMI), parità e tipo di parto, tecnica dell'isterectomia e tipi di UI postoperatoria.

Sono state incluse nello o studio un totale di 196 pazienti, di età media di 52,8 ± 11,4 anni. Di queste pazienti, 149 (76%) sono state sottoposte ad isterectomia addominale (AH) e 47 (24%) ad isterectomia vaginale (VH). Il periodo medio di follow-up delle pazienti è stato di 1,97 ± 1,43 anni. Un totale di 41 (20,9%) pazienti sono state diagnosticate come affette da UI insorta dopo l'isterectomia.

Le pazienti hanno presentato analoga incidenza di UI de novo sia dopo isterectomia per via addominale che per via vaginale (p>0.05), analogamente senza differenze significative di UI nei due gruppi (p>0,05).

Lo studio ha dimostrato una elevata frequenza di incontinenza urinaria dopo isterectomia in modo paragonabile dopo l'adozione della via addominale e quella vaginale. Pertanto sembra importante la valutazione preliminare dei fattori di rischio e l'adozione di procedure preventive indipendentemente dall'approccio chirurgico.

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