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Original Article

Laparoscopic hysterectomy trends in challenging cases (1995–2018)

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ABSTRACT

Objective: : To investigate the effect of challenging factors on laparoscopic hysterectomy trends within twenty-four years.
Population and Method: : This was a trend analysis study of 7558 women who underwent hysterectomy for benign indications between 1995–2018 in Bursa Uludag University Hospital, Turkey. A trend analysis of obesity, previous laparotomy (≥3) and uterine specimen weight (≥500 g) was applied for abdominal hysterectomy (TAH), vaginal hysterectomy (VH), and laparoscopic hysterectomy (TLH) rates in this period. The primary outcome was laparoscopic hysterectomy trends throughout the years. We measured the effect of obesity, previous laparotomies and large uterus on TLH trends as secondary outcomes.
Results: : The ratio of TLHs to all hysterectomies was 2.4% in 1995 and 44.7% in 2018 which increased 33 times higher over 24 years. The percentage of obese patients in TLH cases increased from 1% to 37%, the rate of patients who had three or more previous laparotomy in TLH cases increased from 0% to 32.2%, and the percentage of patients who had more than 500 g uterus specimen in laparoscopic hysterectomy cases increased from 0% to 32.8%.
Conclusion: : Laparoscopic hysterectomy trends are increasing in challenging cases. Obesity, previous surgeries, and large uteruses are no longer a limiting factor for laparoscopic hysterectomy.
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Introduction

Hysterectomy is one of the most common operations in benign gynecological surgery. After Richardson's first abdominal hysterectomy in modern gynecological surgery in 1929, thousands of women undergo hysterectomy operations every year all over the world. [1] Over 500,000 women in the United States have a hysterectomy procedure every year.

Abdominal and vaginal hysterectomy has been the two main types of hysterectomy for many years. [2] Until Reich performed the first laparoscopic hysterectomy in 1989, minimally invasive procedures began to change the practice of modern gynecology. In the 1990s, laparoscopic hysterectomy became an essential hysterectomy route with the spread of cutting edge technology in gynecological endoscopy. Because of its numerous advantages such as complete exploration of the abdominal cavity, fast return to everyday life, short recovery period, and better cosmetic results, it became a gold standard procedure in a short time comparing to total abdominal hysterectomy. [3] Today in many countries, thousands of women undergo laparoscopic hysterectomy instead of abdominal hysterectomy with benign gynecological indications.

Laparoscopic hysterectomy is an excellent procedure in many cases where vaginal hysterectomy cannot be performed technically or when having other surgeries such as endometriosis or gynecological cancers associated at the same time. Compared to robotic hysterectomy, laparoscopic hysterectomy can be implemented in every hospital settings which has main operating theatres as it is more economical, accessible and sustainable. Although laparoscopic skills require a long and demanding learning curve, it is now an essential part of all gynecology resident training programs. [4] After the residency programme, every gynaecologist wants to be at a sufficient level to perform a laparoscopic hysterectomy safely.

Laparoscopic hysterectomy rates and trends have increased drastically in the last two decades compared to other hysterectomy types. The rates of laparoscopic hysterectomy, which accounts for only 1% of all hysterectomies in the 1990s, has reached 30% in many countries in recent years. [5] The laparoscopic route has become the most common approach to hysterectomy according to the United States national surveillance data after 2010 [6].

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In the years when the surgical practice of laparoscopic hysterectomy was gradually established in gynecological surgery, the indications were limited to certain conditions. For the surgeons who newly started laparoscopic surgery, patients with dysfunctional uterine bleeding with small uteruses were the primary indication for laparoscopic hysterectomy. Large uterus with multiple myomas, previous abdominal surgeries, and obesity were the relative contraindications for laparoscopic surgery at the beginning times of minimally invasive procedures. However, in the following years, rapidly evolving medical technology and increased laparoscopic knowledge enabled surgeons to perform laparoscopic hysterectomies for more difficult cases. Today, many gynecological endoscopy centers consider morbid obesity and previous abdominal surgery as specific laparoscopic hysterectomy indications to minimize the surgical site infections. Moreover, morbid obesity is also an indication as ergonomics and exposition are even more difficult by laparotomy. Similarly, as laparoscopic skill increases, uterine size is no longer a limiting factor for surgeons.

This study aims to present the laparoscopic hysterectomy trends in a university hospital within twenty-four years from start to date and to investigate the effect of previous laparotomy, obesity and uterine specimen weight on laparoscopic hysterectomy trends throughout the years.

Methods

Study design

The present study is a retrospective analysis of hysterectomies performed for benign gynecological diseases at the Department of Obstetrics and Gynecology in Bursa Uludag University Hospital, Turkey. Data were retrospectively collected from patient records in the hospital patient database programme and analyzed. Before surgical treatment at our department, all patients sign an informed consent form which was allowing the use of their surgical video, pathological specimen, and clinical data for research purposes. Although it was a retrospective study, medical research ethics committee approval was obtained (UU-SUAM-MREC-2018-2/13).

Data collection

Patient data including age, parity, body mass index (BMI), menopausal status, previous laparotomy, hysterectomy indication, and uterine specimen weight were extracted from the operational records. When calculating the previous laparotomy, any abdominal surgery performed by Pfannenstiel incision or midline incision with the peritoneal insertion was included. The cut-off value for large uteruses was determined as 500 g as the uterus extending out of the true pelvis weighs 500 g on average. The exclusion criteria were hysterectomies performed for malignant reasons. Women who did not sign an informed consent form allowing the use of their clinical data for research and who had improper or incomplete surgical data had to been excluded from the study.

Hysterectomy indications of the patients were extracted from the hospital patient database. We perform 200–400 hysterectomies per year for benign indications in our department, and the first laparoscopic hysterectomy was performed in 1995 in our department. Since 1995, three main hysterectomy types have been performed in our department. These are Total Abdominal Hysterectomy (TAH), Vaginal Hysterectomy (VH) and Total Laparoscopic Hysterectomy (TLH).

After each hysterectomy, the pathological specimen is weighed in grams and recorded. Hysterectomy types were determined according to years, and the trend toward analyses was performed. For the parameters that may affect the type of hysterectomies such as obesity (BMI $\geq$ 30 kg/m2), previous abdominal surgery, and uterine weight, trend analyses were calculated year by year.

Surgeons of the minimally invasive unit of the department

Consultants or professors in the department performed operations. The department is one of the most competent endoscopic surgery centers in Turkey and regularly organizes gynecological endoscopic surgery training workshops, symposiums, and congresses each year. [7] All surgeons in the department had advanced pelvic surgeon certification and accredited from the Society of Minimally Invasive Gynecology, Turkey [8].

Data mining and statistical analysis

The x^2 test was used to analyze the difference between 2 proportions; the *t*-test was used to determine the significance of the difference between 2 proportions or percentages; the Mann–Whitney U test was used to compare a quantitative value between 2 groups of patients. Demographic data were analyzed via analysis of variance, Kruskal–Wallis test, x^2 test, or Fisher exact test. A mean $\pm$ standard deviation value was calculated for age, BMI, parity, menopausal status at the time of hysterectomy. A p-value below 0.05 was considered to be statistically significant. SPSS version 20 (IBM, Armonk, NY, USA) was used to analyze the data source. Whether there is a change in hysterectomy rates in terms of obesity, previous laparotomy and uterine weight was analyzed with chi-square trend analysis and related OR (odds ratio) values were given. Trend analyses were performed with the Epi Info 3.5.4 programme which is open to the use of researchers on the site of the World Health Organization. Epi Info™ is a public domain suite of interoperable software tools designed for the global community of public health practitioners and researchers. It provides for secure data entry form and database construction, a customized data entry experience, and data analyses with epidemiologic statistics, maps, and graphs for public health professionals who may lack an information technology background. [9] For the registration of the data and the production of charts, spreadsheet Excel has been used.

Results

A total of 7558 hysterectomy cases within twenty-four years were included in the study. Table 1 shows the basic demographic characteristics of the patients and Table 2 demonstrates hysterectomy indications. The most common indications for TLH and TAH were abnormal uterine bleeding and myoma uteri. Pelvic organ prolapse was the most common indication for vaginal hysterectomies. The most frequently performed hysterectomy type in total was abdominal hysterectomy (5137 patients, 67.9%), followed by vaginal hysterectomy (1229 patients, 16.3%), and laparoscopic hysterectomy (1192 patients, 15.8%) respectively.

Hysterectomy trends formed by years are shown in Fig. 1. There was a statistically significant increasing trend in laparoscopic and vaginal hysterectomy rates over the years, while a considerable decrease was seen in abdominal hysterectomy rates. Initially, the rate of laparoscopic hysterectomy was 2.4% in 1995. However, this rate increased exponentially to 44.7% in 2018. According to the odds ratios, the 2018 TLH rates were 33.22 times higher than the 1995 TLH rates (Table 3).

The rate of obesity in TAH and VH patients did not change according to the years, whereas in TLH patients, a statistically significant increasing trend was observed throughout the years (Fig. 2). While there were no obese patients in TLH patients in 1995,

Table 1
Demographic characteristics of the patients.

	TAH	VH	TLH	Total
Number of operations	5137	1229	1192	7558
Age (years)	50.0 ± 10.3 (40:81)	53.5 ± 13.5 (40:89)	50.0 ± 10.3 (40:81)	50.6 ± 11.0 (40:89)
BMI (kg/m^2)	27.5 ± 4.3 (20:36)	28.2 ± 4.5 (22:38)	28.4 ± 4.7 (19:35)	27.7 ± 4.4 (19:38)
Menopausal status at the time of hysterectomy	2553 (49.7%)	664 (54.0%)	597 (50.1%)	3814 (50.5%)
Parity				
Parity 0	508 (9.9%)	98 (8.0%)	132 (11.1%)	738 (9.8%)
Parity 1-2	2826 (55.0%)	664 (54.0%)	679 (57.0%)	4169 (55.2%)
Parity ≥3	1803 (35.1%)	467 (38.0%)	381 (32.0%)	2651 (35.1%)
Previous Laparotomy				
Prev.surgery 0	1527 (29.7%)	347 (28.2%)	338 (28.3%)	2212 (29.3)
Prev.surgery 1-2	2585 (50.3%)	629 (51.2%)	603 (50.6%)	3817 (50.5%)
Prev.surgery ≥3	1025 (20.0%)	253 (20.6)	251 (21.1%)	1529 (20.2%)

Data are given as Mean (±Standard deviation) with (Minimum:Maximum) or n (%).

Table 2
Hysterectomy indications of the patients.

Hysterectomy Indication	TAH	VH	TLH	Total
Uterine Myomatosis	1801 (351%)	34 (2.8%)	407 (34.1%)	2242
Adenomyosis	851 (16.5%)	21 (1.7%)	122 (10.2%)	994
Abnormal (Dysfunctional) Uterine Bleeding	1792 (34.9%)	6 (0.4%)	401 (33.6%)	2199
Endometrial Hyperplasia	251 (4.9%)	0 (0%)	64 (5.3%)	315
Endometriosis	362 (7.0%)	0 (0%)	128 (10.7%)	490
Pelvic Organ Prolapse	11 (0.3%)	1158 (94.2%)	12 (10.0%)	1181
Other	69 (1.3)	10 (0.9%)	58 (4.8%)	137
Total	5137	1229	1192	7558

Values are given as number (percentage).
TAH: Total Abdominal Hysterectomy; **VH:** Vaginal Hysterectomy; **TLH:** Total Laparoscopic Hysterectomy.

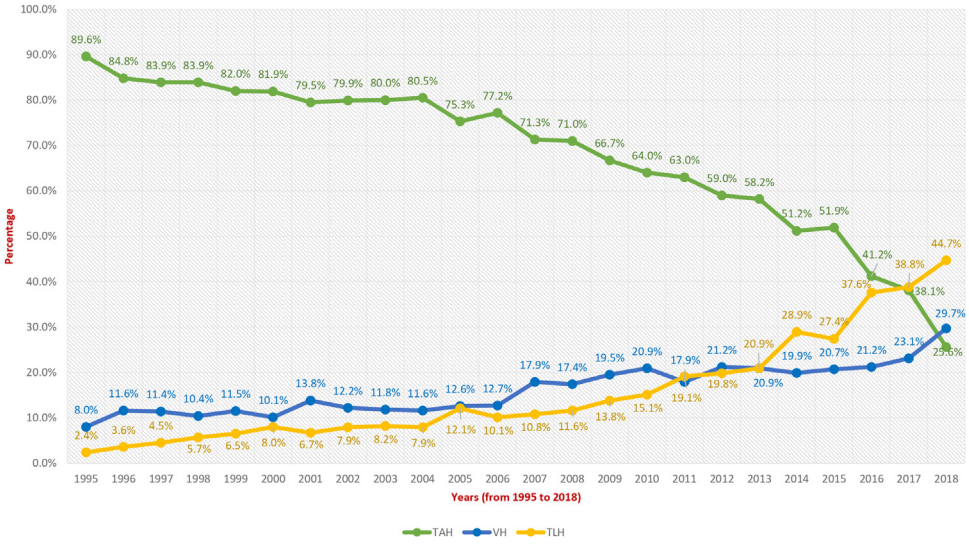

Fig. 1. Hysterectomy trends in twenty four year.

37% of TLH patients were obese in 2018. Odds ratio increased from 1.00 to 4.12 in 24 years (Table 4).

The patients who had three or more previous laparotomies in TLH patients followed an increasing trend from 1995 to 2018 over the years (Fig. 3). The increasing trend in odd's ratios was more than three times. The rate of patients who had more than three or more previous laparotomies over the years has increased significantly within TLH patients and reached from 0% (OR:1.00) in 1995 to 32.2% (OR: 3.34) in 2018 (Table 5).

When the rate of hysterectomies for large uteruses from pathological specimens were evaluated, there was no change in TAH and VH patients from 1995 to 2018, whereas a statistically significant increasing trend was demonstrated in TLH patients who had large uteruses more than 500 g (Fig. 4). While the pathological specimen of any patient in TLHs was not more than 500 g in 1995 (OR:1), this rate increased to 32.8% (OR:3.42) in 2018 (Table 6).

Discussion

In this study, we have demonstrated how laparoscopic hysterectomy affects the hysterectomy trends in a university hospital over the last 24 years. While many factors such as obesity, previous abdominal surgery, and large uterus were considered as definitive contraindications for TLH in the 1990s, we are now able

Table 3
Percent distribution of hysterectomies by years and odd's ratios.

Years	TAH (n = 5137)	OR	VH (n = 1229)	OR	TLH (n = 1192)	OR
1995	302 (89.6%)	1.00	27 (8.0%)	1,00	8 (2.4%)	1.00
1996	285 (84.8%)	0.65	39 (11.6%)	1,51	12 (3.6%)	1.52
1997	278 (83.9%)	0.61	38 (11.4%)	1,49	15 (4.5%)	1.95
1998	282 (83.9%)	0.61	35 (10.4%)	1,34	19 (5.7%)	2.47
1999	264 (82.0%)	0.53	37 (11.5%)	1,49	21 (6.5%)	2.87
2000	266 (81.9%)	0.52	33 (10.1%)	1,30	26 (8.0%)	3.58
2001	249 (79.5%)	0.45	43 (13.8%)	1,83	21 (6.7%)	2.96
2002	254 (79.9%)	0.46	39 (12.2%)	1,61	25 (7.9%)	3.51
2003	236 (80.0%)	0.46	35 (11.8%)	1,55	24 (8.2%)	3.64
2004	256 (80.5%)	0.48	37 (11.6%)	1,51	25 (7.9%)	3.51
2005	211 (75.3%)	0.36	35 (12.6%)	1,64	34 (12.1%)	5.68
2006	236 (77.2%)	0.39	39 (12.7%)	1,68	31 (10.1%)	4.64
2007	206 (71.3%)	0.29	52 (17.9%)	2,52	31 (10.8%)	4.94
2008	209 (71.0%)	0.29	51 (17.4%)	2,41	34 (11.6%)	5.38
2009	194 (66.7%)	0.23	57 (19.5%)	2,80	40 (13.8%)	6.55
2010	191 (64.0%)	0.21	62 (20.9%)	3,02	45 (15.1%)	7.32
2011	184 (63.0%)	0.20	52 (17.9%)	2,49	56 (19.1%)	9.76
2012	175 (59.0%)	0.17	63 (21.2%)	3,09	59 (19.8%)	10.2
2013	190 (58.2%)	0.16	68 (20.9%)	3,03	68 (20.9%)	10.84
2014	163 (51.2%)	0.12	63 (19.9%)	2,84	92 (28.9%)	16.74
2015	153 (51.9%)	0.13	61 (20.7%)	2,99	81 (27.4%)	15.57
2016	126 (41.2%)	0.08	65 (21.2%)	3,10	115 (37.6%)	24.76
2017	119 (38.1%)	0.07	72 (23.1%)	3,44	121 (38.8%)	26.05
2018	108 (25.6%)	0.04	126 (29.7%)	4,87	189 (44.7%)	33.22
p-value	**<0.001**		**<0.001**		**<0.001**	

Data are given as n (%).
OR: Odd's ratio.

to perform a laparoscopic hysterectomy for these women safely and routinely. More than 30% of patients who underwent TLH in our minimally invasive surgery unit are now obese, have previous abdominal surgeries, or have large uteruses.

With the development of technology in endoscopic procedures, a revolution has been experienced not only in gynecology but also in almost every branch of surgery in the last thirty years. [10] In the 2000s, there was a considerable increase in laparoscopic operations in gynecology as in many areas of surgery. Laparoscopic surgery gradually replaces abdominal hysterectomy due to its many advantages such as faster recovery period, better cosmetic results, less wound infection. In parallel with the United States and the world, we observed an increasing trend in TLH rates in our clinic with this study.

Strengths and limitations

The most powerful aspect of this study is to analyze more than 7500 hysterectomies within twenty-four years in a tertiary referral center and to calculate their trend analysis over the years. In contrast to the classical trend toward analysis, the inclusion of confounding factors that may affect the route of hysterectomies such as obesity, previous laparotomy, and large uterus can make the study stronger.

The most significant limitation of this study was its retrospective design. However, it is inevitable that the data must be retrospective in trend analyses. Another limitation of the study was the lack of complication rates and lack of trend analysis of these complications. While the TLH rates increased over the years from 1995 to 2019, calculating the relationship between laparoscopy complications and TLHs could have improved the strength of the study. As in the study of Donnez et al., we think that the complication rates of laparoscopic hysterectomies performed by a single surgical team are similar to those of abdominal hysterectomies. [11] Our total laparoscopic hysterectomy complications in the last fifteen years were 0.9% for conversion to laparotomy, 2.1% for urinary tract injury, 0.68% for vaginal cuff dehiscence, and 0.6% for bowel injury which were similar to those in the data from large studies and systematic reviews [3,12–15].

The fact that conversion to laparotomy rates are not shown in the study can be considered as a limitation. Since 2003 conversion to laparotomy rates have been less than or equal to one per year, we did not need to make these analyses.

Laparoscopic and robotic procedures in minimally invasive gynecology

Although endoscopic operations can be performed laparoscopically and robotically nowadays, laparoscopic surgery has many advantages such as simple system infrastructure and less cost than robotic surgery. Although the learning curve is more comfortable and faster, the setup costs of the robotic surgical system are prohibitive. Furthermore, many social insurance policies do not allow to pay for robotic hysterectomy costs or make an extra charge for the patients. The number of active robotic surgical systems in Turkey's hospitals is higher than the European average. [16] However, system efficiency and sustainability are low except for a few hospitals due to the reasons mentioned above. Laparoscopic

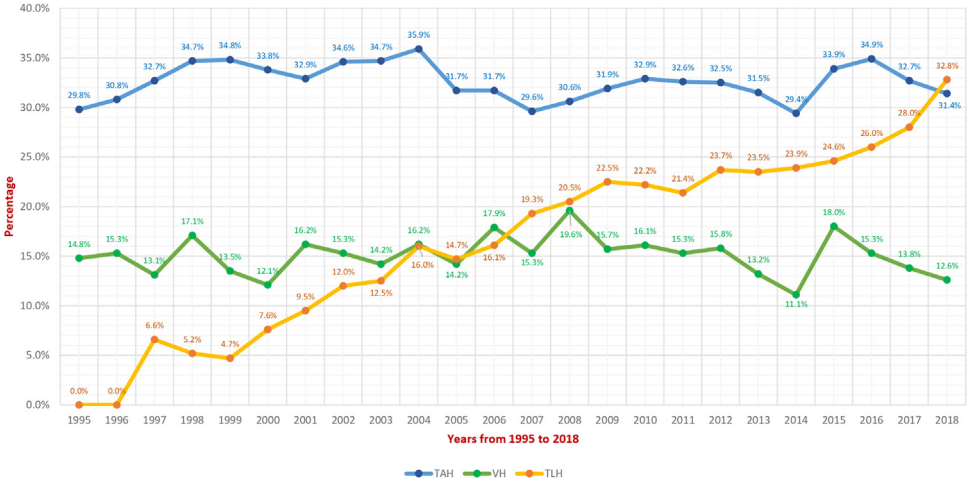

Fig. 2. Trend analysis of uterine weight (≥500 g) in hysterectomy patients within 24 years.

Table 4
Percent distribution of obesity rates by years and odd's ratios.

Years	Obese women in TAH patients (1545/5137)	OR	Obese women in VH patients (352/1229)	OR	Obese women in TLH patients (n = 1192)	OR
1995	91 (30.1%)	1.00	9 (33.3%)	1.00	0 (0%)	1.00
1996	85 (29.8%)	0.92	11 (28.2%)	0.79	1 (8.3%)	0.64
1997	86 (30.9%)	0.95	10 (26.3%)	0.71	2 (13.3%)	1.08
1998	87 (30.8%)	0.95	11 (31.4%)	0.92	2 (10.5%)	0.82
1999	75 (28.4%)	0.82	13 (35.1%)	1.08	3 (14.2%)	1.17
2000	81 (30.4%)	0.90	9 (27.2%)	0.75	4 (15.3%)	1.27
2001	77 (30.9%)	0.88	13 (30.2%)	0.87	4 (19.0%)	1.65
2002	79 (31.1%)	0.89	13 (33.3%)	1.00	5 (20.0%)	1.75
2003	66 (27.9%)	0.78	9 (25.7%)	0.69	5 (20.8%)	1.84
2004	76 (29.6%)	0.85	12 (32.4%)	0.96	6 (24%)	2.21
2005	61 (28.9%)	0.75	10 (28.5%)	0.80	8 (23.5%)	2.15
2006	77 (32.6%)	0.91	10 (25.6%)	0.69	8 (25.8%)	2.44
2007	60 (29.1%)	0.71	16 (30.7%)	0.89	8 (25.8%)	2.44
2008	64 (30.6%)	0.75	14 (27.4%)	0.76	9 (26.4%)	2.52
2009	57 (29.3%)	0.66	18 (31.5%)	0.92	11 (27.5%)	2.66
2010	58 (30.3%)	0.65	17 (27.4%)	0.76	13 (28.8%)	2.84
2011	51 (27.7%)	0.57	16 (30.7%)	0.89	16 (28.5%)	2.80
2012	58 (33.1%)	0.66	17 (26.9%)	0.74	17 (28.8%)	2.83
2013	59 (31.0%)	0.60	21 (30.8%)	0.89	20 (29.4%)	2.92
2014	47 (28.8%)	0.47	17 (26.9%)	0.74	28 (30.4%)	3.06
2015	46 (30.0%)	0.50	19 (31.1%)	0.91	26 (32.0%)	3.31
2016	35 (27.7%)	0.35	18 (27.6%)	0.77	38 (33.0%)	3.46
2017	37 (31.0%)	0.36	22 (30.5%)	0.88	43 (35.5%)	3.86
2018	32 (29.6%)	0.22	27 (21.4%)	0.55	70 (37.0%)	4.12
p-value	0.800		0.279		<**0.001**	

Data are given as n (%).
OR: Odd's ratio.

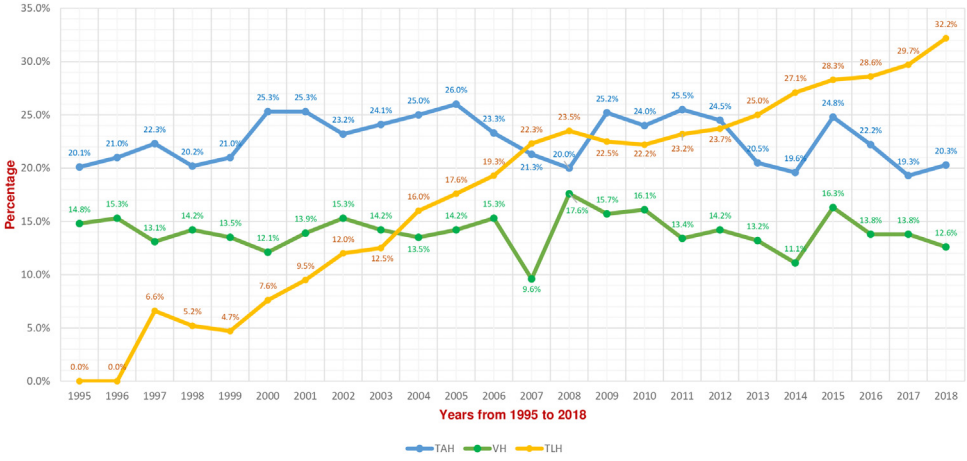

Fig. 3. Trend analysis of previous laparotomy (3 or more) in hysterectomy patients within 2 years.

surgery has now taken its place in the construction of standard operation theatres in many hospitals all over the world and has many advantages compared to robotic surgery such as low cost, fewer ports, and similar complication rates.

Limit for laparoscopic hysterectomy

The issue of the limitations of laparoscopic hysterectomy is exceptionally complex. In the medical literature, it has been shown that laparoscopic hysterectomy can be performed even for more than 6000-gram uterus. [17] Most of the studies are showing that laparoscopic hysterectomy is safe, especially in myomatous uterus over 500–1000 grams [18,19]. Since a myomatous uterus would reach approximately 500 g while growing from true pelvis to the abdomen, we determined it as a cut-off value in our study.

Numerous studies have shown that laparoscopic hysterectomy can be performed safely in obese patients. [20] In a systematic review for outcomes of laparoscopic hysterectomy, body mass index $\geq$30 kg/m^2 was associated with longer operative time and increased complication rates. [21] Due to changes in the abdominal wall anatomy, initial access to the abdomen in obese patients may be more difficult [22]. In our study, we found that TLH was increasingly performed to obese patients in a trend toward analysis in twenty-four years. However, we could not calculate the possible increase in complication rates since we

Table 5
Percent distribution of previous laparotomy (≥3) rates by years and odd's ratios.

Years	Women underwent ≥3 abdominal/pelvic surgery in the TAH group (1555/5137)	OR	Women underwent ≥3 abdominal/pelvic surgery in the VH group (171/1229)	OR	Women underwent ≥3 abdominal/pelvic surgery in the TLH group (285/1192)	OR
1995	61 (%20.1)	1.00	4(%14.8)	1.00	0(0%)	1.00
1996	60 (%21.0)	1.05	6(%15.3)	1.05	0(0%)	0.00
1997	62 (%22.3)	1.13	5(%13.1)	0.87	1(%6.6)	0.50
1998	57 (%20.2)	1.01	5(%14.2)	0.96	1(%5.2)	0.39
1999	53 (%20.0)	0.99	5(%13.5)	0.90	1(%4.7)	0.35
2000	56 (%21.0)	1.05	4(%12.1)	0.79	2(%7.6)	0.58
2001	63 (%25.3)	1.34	6(%13.9)	0.93	2(%9.5)	0.74
2002	59 (%23.2)	1.20	6(%15.3)	1.05	3(%12.0)	0.96
2003	57 (%24.1)	1.26	5(%14.2)	0.96	3(%12.5)	1.00
2004	64 (%25.0)	1.32	5(%13.5)	0.90	4(%16.0)	1.33
2005	55 (%26.0)	1.39	5(%14.2)	0.96	6(%17.6)	1.50
2006	55 (%23.3)	1.20	6(%15.3)	1.05	6(%19.3)	1.68
2007	44 (%21.3)	1.07	5(%9.6)	0.61	7(%22.5)	2.04
2008	42 (%20.0)	0.99	9(%17.6)	1.23	8(%23.5)	2.15
2009	49 (%25.2)	1.34	9(%15.7)	1.08	9(%22.5)	2.03
2010	46 (%24.0)	1.25	10(%16.1)	1.11	10(%22.2)	2.00
2011	47 (%25.5)	1.36	7(%13.4)	0.89	13(%23.2)	2.12
2012	43 (%24.5)	1.29	9(%14.2)	0.96	14(%23.7)	2.18
2013	39 (%20.5)	1.02	9(%13.2)	0.88	17(%25.0)	2.33
2014	32 (%19.6)	0.97	7(%11.1)	0.72	25(%27.1)	2.61
2015	38 (%24.8)	1.31	10(%16.3)	1.13	23(%28.3)	2.78
2016	28 (%22.2)	1.13	9(%13.8)	0.92	33(%28.6)	2.82
2017	23 (%19.3)	0.95	10(%13.8)	0.93	36(%29.7)	2.97
2018	22 (%20.3)	1.01	16(%12.6)	0.84	61(%32.2)	3.34
p-value	0.518		0.815		<**0.001**	

Data are given as n (%).
OR: Odd's ratio.

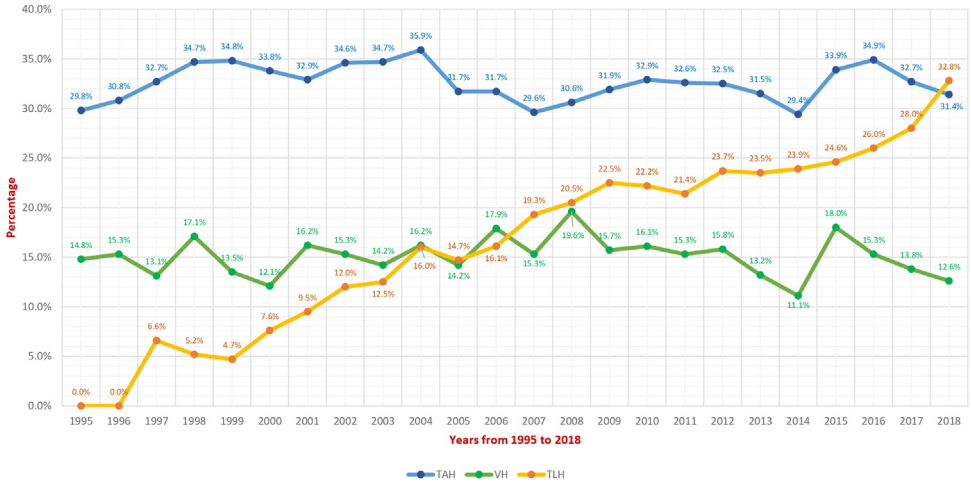

Fig. 4. Trend analysis of uterine weight (≥500 g) in hysterectomy patients within 24 years.

could not reach the operational data before 2000 in the patient database of our hospital which may be a limitation for this study. Obese patients may not tolerate the Trendelenburg position with pneumoperitoneum, and this may limit the operational success [23]. These patients should be referred to sleep apnea clinics to evaluate how they maintain safety levels of airway pressures in the Trendelenburg position in operation [24]. Additional suggestions for successful laparoscopy in the obese patient include extra care with positioning, liberal padding, Allen stirrups, and bariatric length instruments [25].

Previous abdominal surgery has always been a limiting factor for surgeons who have recently started laparoscopic hysterectomy. In particular, previous cesarean sections and intestinal surgery may negatively affect the endoscopist's TLH decision. We know that women with previous cesarean section face an increased risk of complications when undergoing a hysterectomy later in their lifetime. [26] However, the possible adverse effect of all the previous abdominal surgeries on the type of hysterectomy is unpredictable [27]. In other words, complications of the laparoscopic hysterectomy with previous abdominal surgeries can be similar or a little bit higher compared to vaginal or abdominal hysterectomies [12–15]. In our study, we have shown that previous abdominal surgery is not a limiting factor for laparoscopic hysterectomy. Palmer's point and Lee-Huang point can be used as safer points for initial access to the abdomen. [28]

Table 6
Percent distribution of uterine specimen weight (≥500 g) in hysterectomy patients by years and odd's ratios.

Years	Women with uterine specimens greater than 500 grams in the TAH group (1690/5137)	OR	Women with uterine specimens greater than 500 grams in the VH group (184/1229)	OR	Women with uterine specimens greater than 500 grams in the TLH group (285/1192)	OR
1995	90 (29.8%)	1.00	4 (14.8%)	1.00	0 (0%)	1.00
1996	88 (30.8%)	1.05	6 (15.3%)	1.05	0 (0%)	0.00
1997	91 (32.7%)	1.15	5 (13.1%)	0.87	1 (6.6%)	0.50
1998	98 (34.7%)	1.25	6 (17.1%)	1.19	1 (5.2%)	0.39
1999	92 (34.8%)	1.26	5 (13.5%)	0.90	1 (4.7%)	0.35
2000	90 (33.8%)	1.21	4 (12.1%)	0.79	2 (7.6%)	0.58
2001	82 (32.9%)	1.16	7 (16.2%)	1.12	2 (9.5%)	0.74
2002	88 (34.6%)	1.24	6 (15.3%)	1.05	3 (12.0%)	0.96
2003	82 (34.7%)	1.25	5 (14.2%)	0.96	3 (12.5%)	1.00
2004	92 (35.9%)	1.32	6 (16.2%)	1.11	4 (16.0%)	1.33
2005	78 (36.9%)	1.38	5 (14.2%)	0.96	5 (14.7%)	1.21
2006	75 (31.7%)	1.10	7 (17.9%)	1.26	5 (16.1%)	1.35
2007	61 (29.6%)	0.99	8 (15.3%)	1.05	6 (19.3%)	1.68
2008	64 (30.6%)	1.04	10 (19.6%)	1.40	7 (20.5%)	1.82
2009	62 (31.9%)	1.11	9 (15.7%)	1.08	8 (22.5%)	1.75
2010	63 (32.9%)	1.16	10 (16.1%)	1.11	10 (22.2%)	2.00
2011	60 (32.6%)	1.14	8 (15.3%)	1.05	12 (21.4%)	1.91
2012	57 (32.5%)	1.13	10 (15.8%)	1.09	14 (23.7%)	2.18
2013	60 (31.5%)	1.09	9 (13.2%)	0.88	16 (23.5%)	2.15
2014	48 (29.4%)	0.98	7 (11.1%)	0.72	22 (23.9%)	2.20
2015	52 (33.9%)	1.21	11 (18.0%)	1.27	20 (24.6%)	2.30
2016	44 (34.9%)	1.26	10 (15.3%)	1.05	30 (26.0%)	2.47
2017	39 (32.7%)	1.15	10 (13.8%)	0.93	34 (28.0%)	2.74
2018	34 (31.4%)	1.08	16 (12.6%)	0.84	62 (32.8%)	3.42
p-value	0.813		0.709		<**0.001**	

Data are given as n (%).
OR: Odd's ratio.

Conclusion

In conclusion, we have found that the increasing incidence of laparoscopic hysterectomy trends throughout twenty-four years, positively affects the women who have risk factors such as obesity, previous abdominal surgery, and large uterus. While these factors were previously perceived as a relative contraindication for laparoscopic hysterectomy, they are no longer considered to be a restrictive condition for laparoscopy at the moment. We hope that there will be no benign gynecological indication for abdominal hysterectomy in the near future.

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Author contributions

AO was the gynaecologist managing all scientific process of this process and was involved in the writing of the drafts of the study protocol/manuscript; IK provided information for the patients from the hospital patient data system and reviewed the study protocol and the manuscript; TG was the outcome assessor, and was involved in the writing of the drafts of the study protocol/manuscript and the data collection; GO reviewed the draft of the statistical analysis plan written by BCD and did the final data analysis; GU and KO reviewed, corrected and proofread the manuscript.

Details of ethics approval

Approval from the Medical research ethics board of Bursa Uludag University Hospital, Turkey: 14 August 2018, UU-SUAM-MREC-2018-2/13. All participants provided written informed consent.

Declaration of Competing Interest

The authors declare that they have no conflicts of personal, political, intellectual or religious interests and nothing to disclose.

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