

ORIGINAL ARTICLE

Hysterectomy—A Comparison of Approaches

Andreas Müller, Falk C. Thiel, Stefan P. Renner, Mathias Winkler, Lothar Häberle, Matthias W. Beckmann

SUMMARY

Background: The advantages and disadvantages of the various surgical techniques for hysterectomy are currently a topic of debate, with particular controversy over leaving the cervix in situ in the laparoscopic supracervical hysterectomy (LASH) procedure.

Methods: In a retrospective single-center study, medical history and clinical characteristics were compared in patients who had undergone hysterectomy for benign disease in the period 2002–2008 at the Department of Obstetrics and Gynecology, Erlangen University Hospital. Postoperative satisfaction and the frequency of secondary operations for prolapse or incontinence in women with surgery between 2002 and 2007 were surveyed by means of a questionnaire.

Results: The longest hospital stay was observed after abdominal hysterectomy (AH; 10 days), followed by vaginal hysterectomy (VH; 7.8 days) and laparoscopy-assisted vaginal hysterectomy (LAVH; 7.2 days). The shortest stays in hospital were seen after LASH (5.9 days) and total laparoscopic hysterectomy (TLH; 5.7 days). The shortest operating time was noted with VH (87 min) and the longest with LAVH (122 min). The lowest rates of blood loss were with LASH (1.38 g/dL) and TLH (1.51 g/dL). The highest rate of postoperative complications occurred after AH (8.9%). No differences were found in relation to postoperative satisfaction or surgery for prolapse or incontinence.

Conclusion: No postoperative benefits were found for leaving the cervix in situ when performing LASH. However, this was not a controlled randomized study.

Data derived from the system of reimbursement according to diagnosis-related groups show that a total of 138 164 extirpations of the uterus were carried out in German hospitals in 2007 (1). Hysterectomy was therefore the fifth most frequently performed operation in that year (1).

Whether every hysterectomy is necessary is a topic of debate, and the frequency of surgery in Germany is controversial. However, that was not the subject of the present study and will not be discussed here. Removal of the womb has shown good results with low rates of complications in symptomatic myoma, endometriosis, dysmenorrhea, and refractory bleeding disorders such as hypermenorrhea (2, 3, 4). Nevertheless, preference should be given to less invasive methods when developing an individualized treatment plan.

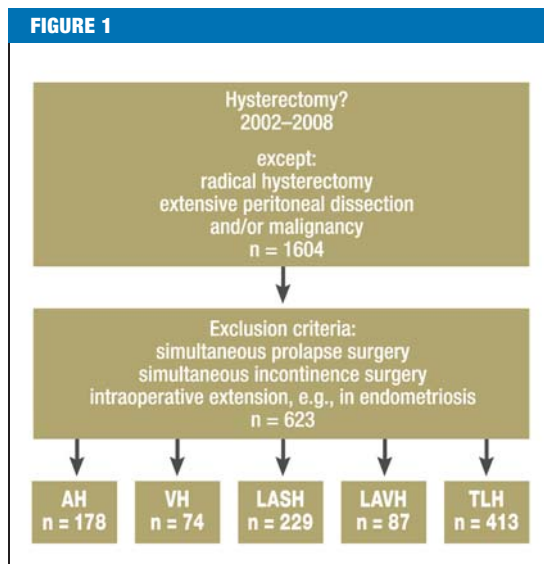
A recently published national cohort study demonstrated that women who had undergone hysterectomy, compared with non-hysterectomized women, had more than twice the rate of operations for stress incontinence and approximately twice the rate of surgery for prolapse. The technique or type of surgery used in hysterectomy was not critical (5, 6).

Once the benefits and risks have been weighed up and hysterectomy identified as the best treatment, the surgeon essentially has to decide among five procedures: abdominal hysterectomy (AH), vaginal hysterectomy (VH), laparoscopic supracervical hysterectomy (LASH), laparoscopically assisted vaginal hysterectomy (LAVH), and total laparoscopic hysterectomy (TLH) (2, 4). To date VH has been the method of choice (7–9). The laparoscopic surgical procedures can be viewed as alternatives (2, 9, 10) and are particularly advantageous in obese patients and in those with adnexal pathology (11–13). In recent years the LASH technique has gained favor among patients and surgeons (4). It is unclear whether leaving the cervix in situ is beneficial. The argument of a higher postoperative risk of cervical carcinoma following LASH has been largely refuted by careful selection of patients for operation (14). LASH seems to be the hysterectomy procedure least afflicted by complications (13, 15). With regard to rates of secondary incontinence and prolapse, no long-term benefit of leaving the cervix in place has yet been demonstrated. Equally, patients whose cervix was left in situ after hysterectomy have

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Flow diagram showing selection of patients treated during the period 2002 to 2008 according to pre-defined criteria



AH, abdominal hysterectomy;
 VH, vaginal hysterectomy;
 LASH, laparoscopic supracervical hysterectomy;
 LAVH, laparoscopically assisted vaginal hysterectomy;
 TLH, total laparoscopic hysterectomy

shown no postoperative change in subjective perceptions (4–6, 16, e2, e3).

The aim of the present study was to compare various clinical parameters of the different types of hysterectomy and report the current trends with regard to the employment of the different procedures at a German university hospital. In the context of a survey of patients, women who had undergone hysterectomy were interviewed about postoperative events and their degree of satisfaction.

Patients and methods

Patients

In January and February 2009, we retrospectively registered the data of all women who had undergone hysterectomy at Erlangen University Hospital in the years 2002 to 2008. To enable exclusive comparison of the factor “hysterectomy” among the various operation techniques, patients in whom hysterectomy was accompanied by any of the following procedures were excluded:

- Simultaneous prolapse operations (e.g., anterior or posterior colporrhaphy, fixation of the vaginal apex)
- Simultaneous incontinence operations (e.g., tension-free vaginal tape, TVT)
- Other extensions of the intervention that were not necessitated by complications (e.g., rectal resection in endometriosis).

Of the total of 1604 patients who had undergone hysterectomy during the study period, 623 were excluded from analysis (303 VH, 188 AH, 78 LAVH, 40 LASH, and 14 TLH) (Figure 1). Thus, the data on 981 patients

were analyzed. Figure 1 shows the distribution of the various surgical procedures, and Figure 2 shows the trends of the different techniques during the period investigated.

The following parameters were registered:

- Age
- Body mass index (BMI)
- Parity
- Previous operations
- Length of stay
- Operating time
- Uterus weight
- Blood loss
- Blood transfusions
- Complications.

To improve comparability, each patient’s previous operations were expressed as a total score (PO score). Previous operations were scored as follows:

Each laparoscopy: 1 point

Each laparotomy, including cesarean section: 2 points

Blood loss was defined as a lower hemoglobin (Hb) level on the first day after operation than before operation. Complications were classified as follows:

- Intraoperative complications: transfusion-relevant hemorrhage, damage to the bladder, bowel, ureter, or blood vessels, anesthesia problems, and conversion to AH
- Postoperative complications: infections or increase in body temperature to above 38°C, hematoma, revision/secondary operation, deep vein thrombosis, fistula formation, wound healing disorder.

Surgical techniques

The surgical techniques have been described in detail elsewhere (4, 17). A brief account of the methods and information on ethics committee approval can be found in the eBox. Selection of the best method depends primarily on the size of the uterus, the dimensions of the vagina, and any previous surgery. At the beginning of the study period the method of choice was VH, with AH viewed as an alternative. This changed fundamentally with the introduction in 2002 of the laparoscopic techniques, which largely displaced AH.

Patient survey

In January and February 2008, all patients who had undergone surgery in the years 2002 to 2007 and whose operations had taken place at least 6 months previously were contacted in writing. With the aid of a questionnaire, it was established whether postoperative treatment for prolapse symptoms or surgery for incontinence had been necessary, and whether this had affected the patient’s sex life. The only possible responses to these three questions were “yes” and “no.” The questionnaire also inquired whether the patient’s image of herself as a woman had changed as a result of removal of her womb. The possible answers to this question were “no,” “hardly at all,” “a bit,” “a lot,” and “completely.” In addition, the patients were asked to

state how satisfied they were with the outcome of surgery. The possible answers were “very,” “fairly,” “moderately,” “not really,” and “not at all.”

Statistical methods

The five types of operation in this retrospective survey were statistically tested to determine whether they differed with respect to the parameters registered. Depending on the parameter to be investigated, the following tests were used:

- Unifactorial analysis of variance, optionally with post-hoc Tukey–Kramer tests
- Kruskal–Wallis test
- Chi-square test
- Fisher’s exact test.

All of these tests were two-sided, and a p value ≤0.05 was considered to indicate a significant difference. Only when significant differences were found between operation techniques were they compared pairwise by means of post-hoc tests. The p values were adjusted according to the Bonferroni–Holm method.

Results

The results are summarized in *Table 1*, and the findings of statistical analyses are presented in *eTable 1* and *eTable 2*.

Age, BMI, parity, and PO score

The patients in the LASH group were younger than those in the other groups. The VH and LAVH groups had lower proportions of patients who had never given birth (Para0). Otherwise there were no significant differences among the groups with regard to parity, BMI, and previous operations.

Length of stay

The patients in the LASH and TLH groups displayed significantly shorter hospital stays than those in the other groups, but LASH and TLH did not differ from one another (*eFigure 1*).

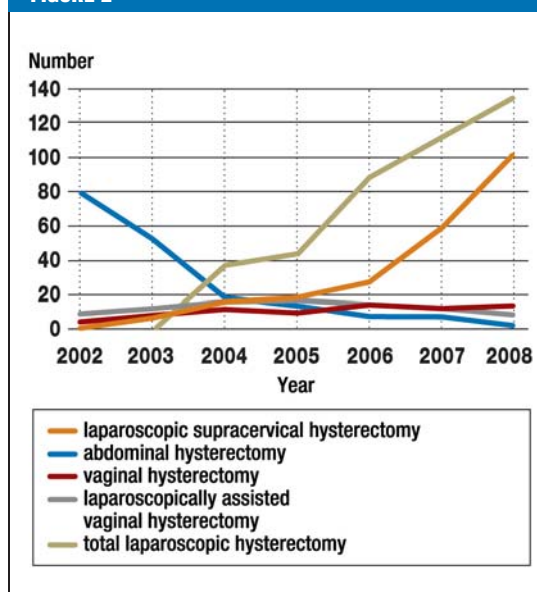
Operating time, uterus weight, blood loss, and adnexectomy rate

The operating time for VH was significantly shorter than for all other methods. TLH showed a shorter operating time than LAVH (*eFigure 2*). The heaviest uteri were those removed by AH and LASH. Uterus weight was significantly greater for TLH than for VH (*Table 1*). The decrease in Hb was significantly smaller with LASH and TLH than with AH and VH (*eFigure 3*). The groups did not differ significantly with regard to unilateral adnexectomy. Bilateral adnexectomy was significantly more frequent in AH than in all other methods of hysterectomy, and least frequent in LASH (*Table 1*).

Complications and blood transfusions

There were no deaths during the study period. The various procedures for hysterectomy showed no significant differences with regard to intraoperative complication rates or the frequency of blood transfusions. The

FIGURE 2



Numbers of patients subjected to the five different techniques of hysterectomy over the seven years of the study period

postoperative complication rate was significantly higher in the AH group (8.9%) than in all other groups (*Figure 3*).

Patient survey

Questionnaires were sent to 590 patients and returned by 309 patients (52%). Of the 309 completed questionnaires, 303 (98%) were suitable for analysis. The data are displayed in detail in *eTable 3* and *eTable 4*. The average time since surgery was 2 to 3 years for LASH and TLH and 4 to 6 years for AH, VH, and LAVH. The groups did not differ with regard to the rate of surgery for prolapse symptoms or incontinence or the patients’ responses concerning changes in sexuality following hysterectomy. Most patients answered “no” to the question whether their image of themselves as a woman had changed as a result of losing the womb, and most stated that they were “very” satisfied with the outcome of hysterectomy. These parameters did not differ among the various surgical techniques.

Interim analysis

Because the groups varied in size over the study period as a whole, the patients treated during the 2004 to 2005 segment were selected to permit an interim analysis of similar-sized groups (*eTable 5*). This interim analysis confirmed the results described above, although the lower numbers of cases meant that not all differences attained the same level of significance as in the overall analysis (*eTables 6 and 7*).

The patient survey was subjected to a similar interim analysis. To ensure a comparable duration of follow-up, the results for operations in the sub-period 2002 to 2004 were examined (*eTables 8 and 9*). Here too, as in the overall analysis, there were no significant differences among the surgical techniques.

TABLE 1

Values of the measured parameters for the different surgical techniques*¹

	AH n = 178	VH n = 74	LASH n = 229	LAVH n = 87	TLH n = 413
Age (years)	49.5 (48.1–50.9)	50.3 (47.8–52.7)	45.5 (44.8–46.2)	48.7 (46.9–50.5)	47.5 (46.7–48.4)
BMI (kg/m ²)	26.5 (25.8–27.3)	27.2 (25.6–28.7)	25.3 (24.7–25.9)	26.4 (25.2–27.7)	26.0 (25.5–26.5)
Para0	49 (27.5%)	3 (4.1%)	63 (27.5%)	11 (12.6%)	122 (29.5%)
Para1	37 (21.3%)	15 (20.3%)	38 (16.6%)	14 (16.1%)	88 (21.7%)
Para2	67 (37.6%)	37 (50.0%)	103 (44.9%)	38 (43.7%)	143 (34.6%)
Para3	20 (11.2%)	14 (18.9%)	23 (10.0%)	17 (19.5%)	42 (10.1%)
PO score	1 (0–2)	1 (0–1)	1 (0–2)	1 (0–2)	1 (0–2)
Length of stay	10.0 (9.4–10.5)	7.8 (7.3–8.3)	5.9 (5.7–6.0)	7.2 (6.8–7.7)	5.7 (5.5–5.8)
Operating time (min)	108 (103–114)	87 (80–94)	110 (105–115)	122 (114–129)	108 (103–112)
Uterus weight (g)	452 [30–7300]	136 [51–136]	321 [27–1200]	213 [22–980]	246 [20–1150]
Hb decrease (g/dL)	1.88 (1.72–2.05)	1.97 (1.60–2.34)	1.38 (1.23–1.52)	1.74 (1.53–1.94)	1.51 (1.40–1.61)
Unilateral adnexectomy	19 (10.6%)	0 (0%)	13 (5.6%)	10 (11.5%)	27 (6.5%)
Bilateral adnexectomy	68 (38.0%)	9 (10.8%)	6 (2.6%)	23 (26.4%)	70 (17.1%)
Intraoperative complications	2 (1.1%)	0 (0%)	1 (0.4%)	0 (0%)	5 (1.21%)
Postoperative complications	18 (8.9%)	3 (4.1%)	1 (0.4%)	4 (4.6%)	15 (3.6%)
Blood transfusions	7 (3.9%)	1 (1.4%)	1 (0.4%)	0 (0%)	3 (0.7%)

*¹ Mean and 95% confidence intervals (in parentheses) for age, BMI, length of stay, operating time, and Hb decrease; mean with minimum and maximum values (in square brackets) for uterus weight; number and percentage (in parentheses) for parity, adnexectomy, complications, and blood transfusions; median and interquartile range (in parentheses) for PO score; AH, abdominal hysterectomy; VH, vaginal hysterectomy; LASH, laparoscopic supracervical hysterectomy; LAVH, laparoscopically assisted vaginal hysterectomy; TLH, total laparoscopic hysterectomy; PO score, total number of previous operations for each patient

Discussion

Very few prospective randomized studies comparing the various methods for hysterectomy have been performed. The data that have been published mostly involve retrospective analysis of two or at most three surgical techniques. The present retrospective, exploratory cohort study compares five different methods of hysterectomy. Given the retrospective nature of the study, the absence of randomization, and the variability in length of the postoperative observation period, the interpretation and informative value of some of the parameters is limited. There was a general change in indications with the introduction of the laparoscopic techniques of hysterectomy, which largely replaced abdominal hysterectomy in the course of the study period. The indications may also have been affected by the size of the uterus and the intention to perform adnexectomy at the same time.

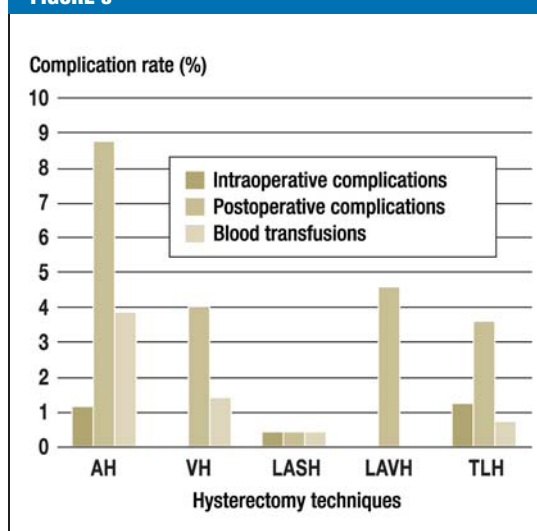
Other parameters are more amenable to interpretation. For example, the laparoscopic techniques displayed the least blood loss. Operating time, on the other hand, was shortest for VH and longest for LAVH. The operating time for AH may be detrimentally affected by the highest rate of simultaneous bilateral adnexectomy, the increased difficulty of surgery with a very large uterus, and the greater time required to close the layers of the abdominal wall. Similarly, the long operating time for LAVH was partly due to the repositioning necessitated by the change in access route. The findings regarding operating time broadly correspond to the results of large meta-analyses (12) and the conclusions of individual reviews (4, 13).

It also appears feasible to compare and interpret complication rates. No significant differences among the various hysterectomy techniques were found for intraoperative complications. The overall low complication rate of around 1% corresponds to earlier analyses of complication rates for TLH and LASH at our institution (18, 19) and elsewhere (2). Intraoperative complication rates of 5% to 10% are unacceptably high and can be reduced to an acceptable level of 1% to 2% by appropriate training of the surgeons involved (18, 19, 21, 22). The most common complications of laparoscopic hysterectomy are injuries to the bladder (12, e1). These were most frequent in the TLH and AH groups. Previous surgery seems to be a major risk factor for bladder injury.

As already described by other authors (13, 15, 16), we found the lowest complication rate for the LASH technique. Postoperative complications were most frequent with AH, where problems associated with the laparotomy predominated (12).

Dehiscence of the vaginal apex occurred on the first postoperative coitus in four patients of the TLH group. According to the findings of Hur et al., the underlying cause is thermic necrosis on separation of the uterus from the vagina, together with other risk factors such as smoking (23). The suture technique may also play an important part.

FIGURE 3



AH, abdominal hysterectomy;
 VH, vaginal hysterectomy;
 LASH, laparoscopic supracervical hysterectomy;
 LAVH, laparoscopically assisted vaginal hysterectomy;
 TLH, total laparoscopic hysterectomy

Complications and blood transfusions in the various hysterectomy techniques

Much more difficult to interpret, in light of the above-mentioned limitations, are length of hospital stay, patient satisfaction, and the reoperation rate. With a questionnaire completion rate of 52%, selection bias cannot be ruled out. LASH and TLH displayed the shortest lengths of stay, on average 4 days shorter than with AH. This difference is presumably only partly due to the laparoscopic technique, because the patients treated by the LASH technique were younger.

On the other hand, TLH and LASH have been performed particularly frequently since the introduction of the system of reimbursement according to diagnosis-related groups motivated hospitals to shorten their patients' length of stay.

In the review cited above, the hospital stay for VH was 1 day shorter than for AH and that for laparoscopic hysterectomy was 2 days shorter than for AH (12). These findings confirm the tendency apparent from our analysis.

The various surgical techniques for hysterectomy did not differ with regard to high patient satisfaction, altered sexuality, and the change in self-image as a woman. The frequency of surgery for incontinence or prolapse was also not associated with surgical technique. There was a trend towards a lower reoperation rate for LASH, but of all the techniques investigated in the present study this was the one with the shortest duration of follow-up and the youngest patients.

To date, there are no long-term data demonstrating that the LASH technique is beneficial with regard to postoperative quality of life, sexuality, bladder and bowel function, or prolapse (5, 6). This corresponds to recently published comparisons of LASH with other

TABLE 2

Advantages and disadvantages of the different hysterectomy techniques*¹

Hysterectomy procedure	Advantages	Disadvantages
Abdominal hysterectomy	Hardly limited by uterus size	Longest length of stay, highest rate of postoperative complications, longest recovery phase
Vaginal hysterectomy	Shortest operating time, shortest recovery phase	Limited by uterus size and previous operations, highest blood loss, restricted assessability of the adnexa
Laparoscopic supracervical hysterectomy	Lowest complication rate, low blood loss, short length of stay	Minimal vaginal bleeding persists in 10% to 17% of patients
Laparoscopically assisted vaginal hysterectomy	Feasible even in the case of large uteri and previous operations, combination with other operative procedures (prolapse and incontinence surgery)	Long operation time and complex instrumentation because of change of access route
Total laparoscopic hysterectomy	Low blood loss, short length of stay	None to date

*¹ Based on the authors' own findings and published results

surgical techniques (22, 24, e2, e3) and to the findings presented here. However, analysis seemed to confirm a tendency towards the lowest complication rate for LASH; therefore, it should be questioned whether removal of the cervix is indicated.

In the period immediately after surgery, the laparoscopic methods of hysterectomy resulted in a better quality of life and a swifter resumption of daily activities (4, 8, 12, 25). These days, the rapid return to normal life is a particularly strong argument in favor of the laparoscopic techniques. Patients should be informed, however, that they have a 10% to 17% risk of minimal postoperative menstruation following LASH.

The advantages and disadvantages of the different techniques for hysterectomy are shown in *Table 2*. When it has been decided that hysterectomy is indicated, VH is still justified in the case of a small uterus or in combination with other vaginal procedures, e.g., for correction of prolapse (4, 19). In the above-mentioned cohort study, however, VH was associated with the highest rate of subsequent prolapse surgery (5). It is unclear whether this is related to the surgical technique, which necessarily involves distension in the area of the pelvic floor, or to other factors, because particularly women with pre-existing prolapse are suitable for VH (5, e4, e5).

Conclusions

The studies published to date seem to show that the rates of long-term prolapse or incontinence and the quality of life after LASH do not differ from those after other techniques of hysterectomy. Therefore, we present VH and the two laparoscopic methods to our

patients as equally valid alternatives and discuss the advantages and disadvantages of each procedure. Even in obese patients and those with a large uterus, the two laparoscopic techniques—LASH and LAVH—can often be used instead of AH (e6). We have thus been able to reduce the rate of AH for benign diseases of the uterus to less than 5% in our institution.

Conflict of interest statement

The authors declare that no conflict of interest exists according to the guidelines of the International Committee of Medical Journal Editors.

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KEY MESSAGES

- Hysterectomized women seem to have a higher risk of subsequent prolapse or incontinence than non-hysterectomized women.
- The role of surgical technique in relation to other risk factors has not been clearly established. To date, no long-term benefit of leaving the uterine cervix in situ has been demonstrated.
- Laparoscopic supracervical hysterectomy is the technique with the lowest complication rate.
- In general, vaginal hysterectomy and the laparoscopic procedures display the most advantages for the patient.
- The overwhelming majority of hysterectomies can be performed via vaginal or laparoscopic access, so abdominal hysterectomy should be carried out only in exceptional circumstances.

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For e-references please refer to:
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eBOX

The principal characteristics of the various techniques for hysterectomy

- **Abdominal hysterectomy**

Abdominal hysterectomy is performed as “open” surgery via a laparotomy.

- **Vaginal hysterectomy**

In vaginal hysterectomy access is exclusively via the vagina.

- **Laparoscopic supracervical hysterectomy (LASH)**

LASH is conducted purely laparoscopically; the corpus uteri is divided from the cervix and removed using an electrical morcellator. The cervix is left “in situ.”

- **Laparoscopically assisted vaginal hysterectomy (LAVH)**

LAVH begins as a laparoscopic procedure and ends as a vaginal hysterectomy.

- **Total laparoscopic hysterectomy (TLH)**

In TLH the hysterectomy is completely laparoscopic; suturing of the vagina is achieved either via vaginal access or also laparoscopically. A uterus too large to be retrieved via the vagina is removed using a morcellator.

Ethics approval

No ethics committee approval was necessary for the retrospective data analysis, because anonymity was guaranteed. The patient survey was approved by the ethics committee of the Medical Faculty of the University of Erlangen-Nürnberg (serial number 3868).

ORIGINAL ARTICLE

Hysterectomy—A Comparison of Approaches

Andreas Müller, Falk C. Thiel, Stefan P. Renner, Mathias Winkler, Lothar Häberle, Matthias W. Beckmann

eTABLE 1

“Raw” p values and p values after “adjustment” according to the Bonferroni-Holm method

	Test	Raw p value	Adjusted p value
Age (years)	ANOVA	<0.00001	<0.0001
BMI (kg/m ²)	ANOVA	0.03	0.17
Para0	Chi square	<0.00001	<0.0001
Para1	Chi square	0.47	1.00
Para2	Chi square	0.02	0.14
Para3	Chi square	0.03	0.17
PO score	Kruskal–Wallis	0.56	1.00
Length of stay	ANOVA	<0.00001	<0.00001
Operating time (min)	ANOVA	<0.00001	<0.0001
Uterus weight (g)	ANOVA	<0.00001	<0.00001
Hb decrease (g/dL)	ANOVA	<0.00001	<0.0001
Unilateral adnexectomy	Chi square	0.01	0.10
Bilateral adnexectomy	Chi square	<0.00001	<0.00001
Intraoperative complications	Fisher	0.80	1.00
Postoperative complications	Fisher	<0.001	<0.01
Blood transfusions	Fisher	0.01	0.10

PO score, total number of previous operations for each patient

eTABLE 2

Post-hoc tests for ANOVAs with significant results (significant p values only)

	Significant differences	p value (post-hoc test)
Age (years)	LASH-AH	<0.001
	VH-LASH	<0.001
	LAVH-LASH	0.02
	TLH-LASH	0.03
Length of stay	LASH-AH	<0.0001
	LAVH-AH	<0.0001
	TLH-AH	<0.0001
	VH-AH	<0.0001
	LAVH-LASH	<0.001
	VH-LASH	<0.0001
	TLH-LAVH	<0.0001
	VH-TLH	<0.0001
Operating time (min)	VH-AH	<0.01
	VH-LASH	<0.001
	TLH-LAVH	0.03
	VH-LAVH	<0.001
	VH-TLH	<0.001
Uterus weight (g)	LASH-AH	<0.001
	LAVH-AH	<0.001
	TLH-AH	<0.001
	VH-AH	<0.001
	VH-LASH	<0.001
	TLH-LASH	<0.01
	LASH-LAVH	<0.01
Hb decrease (g/dL)	LASH-AH	<0.001
	TLH-AH	<0.01
	VH-LASH	<0.001
	VH-TLH	0.01
Para0	AH-VH	<0.001
	VH-LASH	<0.001
	VH-TLH	<0.0001
	LASH-LAVH	0.05
	LAVH-TLH	0.01
Bilateral adnexectomy	AH-VH	<0.001
	AH-LASH	<0.00001
	AH-TLH	<0.00001
	VH-LASH	0.04
	LASH-LAVH	<0.00001
Postoperative complications	LASH-TLH	<0.00001
	AH-LASH	<0.001

AH, abdominal hysterectomy; VH, vaginal hysterectomy; LASH, laparoscopic supracervical hysterectomy; LAVH, laparoscopically assisted vaginal hysterectomy; TLH, total laparoscopic hysterectomy

eTABLE 3

Distribution of patients among the different hysterectomy techniques in the period 2002 to 2007*¹

	Abdominal hysterectomy	Vaginal hysterectomy	Laparoscopic supracervical hysterectomy	Laparoscopically assisted vaginal hysterectomy	Total laparoscopic hysterectomy
Operations 2002 to 2007 (total N = 721)	175	61	128	78	279
Questionnaires sent (n = 590)	160	60	118	74	178
Questionnaires analyzed (n = 303)	82	44	60	42	75
Surgery for prolapse symptoms	4 (4.8%)	7 (15.9%)	2 (3.3%)	4 (9.5%)	7 (9.3%)
Surgery for incontinence	3 (3.8%)	2 (4.6%)	1 (1.7%)	1 (2.6%)	3 (4.1%)
Altered sexuality	20 (24.4%)	15 (34.1%)	22 (36.7%)	15 (35.9%)	24 (32.0%)

*¹The questionnaire was sent only to the 590 patients whose operations had taken place at least 6 months previously. Data on surgery for secondary prolapse and incontinence and on altered sexuality are expressed as absolute numbers and percentages

eTABLE 4

Self-image as a woman and satisfaction with surgical outcome following the different techniques of hysterectomy (absolute numbers and percentages)

Has your image of yourself as a woman changed?	"No"	"Hardly at all"	"A bit"	"A lot"	"Completely"
Abdominal hysterectomy (n = 82)	58 (71%)	12 (15%)	6 (7%)	6 (7%)	0 (0%)
Vaginal hysterectomy (n = 44)	32 (73%)	3 (7%)	7 (16%)	2 (5%)	0 (0%)
Laparoscopic supracervical hysterectomy (n = 60)	47 (78%)	6 (10%)	6 (10%)	1 (2%)	0 (0%)
Laparoscopically assisted vaginal hysterectomy (n = 42)	32 (76%)	4 (10%)	4 (10%)	1 (2%)	1 (2%)
Total laparoscopic hysterectomy (n = 75)	54 (72%)	11 (14%)	6 (8%)	2 (3%)	2 (3%)
How satisfied are you with the outcome?	"Very"	"Fairly"	"Moderately"	"Not really"	"Not at all"
Abdominal hysterectomy (n = 80)	50 (63%)	24 (29%)	4 (5%)	2 (3%)	0 (0%)
Vaginal hysterectomy (n = 43)	32 (74%)	10 (23%)	0 (0%)	1 (3%)	0 (0%)
Laparoscopic supracervical hysterectomy (n = 59)	41 (69%)	14 (24%)	1 (2%)	2 (3%)	1 (2%)
Laparoscopically assisted vaginal hysterectomy (n = 40)	32 (80%)	5 (13%)	2 (4%)	0 (0%)	1 (3%)
Total laparoscopic hysterectomy (n = 72)	55 (76%)	13 (18%)	4 (6%)	0 (0%)	0 (0%)

eTABLE 5

Interim analysis of the period 2004 to 2005*¹

	Abdominal hysterectomy n = 31	Vaginal hysterectomy n = 21	Laparoscopic supracervical hysterectomy n = 35	Laparoscopically assisted vaginal hysterectomy n = 32	Total laparoscopic hysterectomy n = 79
Age (years)	46.9 (43.4–50.4)	49.8 (45.6–53.0)	45.7 (43.2–48.1)	49.5 (46.5–52.5)	46.4 (44.5–48.2)
BMI (kg/m ²)	24.8 (23.4–26.2)	26.5 (24.2–28.8)	24.1 (22.5–25.8)	24.7 (23.0–26.5)	25.5 (24.5–26.6)
Para0	10 (32.3%)	2 (9.5%)	6 (17.1%)	4 (12.5%)	19 (24.1%)
Para1	8 (25.8%)	4 (19%)	4 (11.4%)	10 (31.3%)	25 (31.6%)
Para2	8 (25.8%)	10 (47.6%)	14 (40.0%)	15 (46.9%)	18 (22.8%)
Para3	2 (6.45%)	5 (23.8%)	4 (11.4%)	2 (6.25%)	8 (10.1%)
PO score	1 (0–1)	0 (0–1)	0 (0–1)	1 (0–2)	1 (0–1)
Length of stay	9.4 (8.4–9.9)	7.7 (6.7–8.7)	6.3 (5.6–7.0)	7.5 (6.4–8.1)	5.6 (5.2–6.0)
Operating time (min)	107 (92–120)	86 (73–99)	112 (100–123)	120 (107–131)	105 (97–111)
Uterus weight (g)	453 [43–1800]	143 [130–160]	358 [80–779]	201 [48–980]	250 [57–1100]
Hb decrease (g/dL)	1.83 (1.46–2.20)	2.30 (1.70–2.89)	1.30 (0.98–1.61)	1.83 (1.46–2.19)	1.51 (1.26–1.76)
Unilateral adnexectomy	3 (9.7%)	0 (0%)	3 (8.6%)	2 (6.3%)	5 (6.3%)
Bilateral adnexectomy	13 (41.9%)	3 (13.6%)	2 (5.7%)	8 (25.0%)	12 (15.2%)
Intraoperative complications	1 (3.2%)	0 (0%)	0 (0%)	0 (0%)	1 (1.26%)
Postoperative complications	2 (6.5%)	1 (4.5%)	0 (0%)	1 (3.1%)	2 (2.5%)
Blood transfusions	1 (3.2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

*¹Mean and 95% confidence intervals (in parentheses) for age, BMI, length of stay, operating time, and Hb decrease; mean with minimum and maximum values (in square brackets) for uterus weight; number and percentage (in parentheses) for parity, adnexectomy, complications, and blood transfusions; median and interquartile range (in parentheses) for PO score; PO score, total number of previous operations for each patient

eTABLE 6

“Raw” p values and p values after “adjustment” according to the Bonferroni-Holm method: comparison of the different groups in the years 2004 and 2005

	Test	Raw p value	Adjusted p value
Age (years)	ANOVA	0.18	1.00
BMI (kg/m ²)	ANOVA	0.37	1.00
Para0	Fisher	0.21	1.00
Para1	Chi square	0.19	1.00
Para2	Chi square	0.04	0.43
Para3	Fisher	0.33	1.00
PO score	Kruskal-Wallis	0.41	1.00
Length of stay	ANOVA	<0.00001	<0.00001
Operating time (min)	ANOVA	0.01	0.12
Uterus weight (g)	ANOVA	<0.0001	<0.001
Hb decrease (g/dL)	ANOVA	0.01	0.10
Unilateral adnexectomy	Fisher	0.74	1.00
Bilateral adnexectomy	Fisher	<0.01	0.08
Intraoperative complications	Fisher	0.56	1.00
Postoperative complications	Fisher	0.48	1.00
Blood transfusions	Fisher	0.26	1.00

PO score, total number of previous operations for each patient

eTABLE 7

Post-hoc tests for ANOVAs with significant results in the years 2004 and 2005 (significant p values only)

	Significant differences	p value (post-hoc test)
Length of stay	LASH-AH	<0.001
	LAVH-AH	<0.01
	TLH-AH	<0.001
	VH-AH	0.04
	TLH-LAVH	<0.001
	VH-TLH	<0.001
Uterus weight (g)	LAVH-AH	<0.001
	TLH-AH	<0.001
	VH-AH	<0.001
	VH-LASH	0.02

AH, abdominal hysterectomy; VH, vaginal hysterectomy; LASH, laparoscopic supracervical hysterectomy; LAVH, laparoscopically assisted vaginal hysterectomy; TLH, total laparoscopic hysterectomy

eTABLE 8

Data on surgery for secondary prolapse and incontinence and on altered sexuality (absolute numbers and percentages) for patients operated upon in the years 2002 to 2004

	AH	VH	LASH	LAVH	TLH
Questionnaires analyzed (n = 140)	62	23	18	25	12
Surgery for prolapse symptoms	3 (4.8%)	4 (17.4%)	0 (0%)	1 (4%)	0 (0%)
Surgery for incontinence	3 (4.8%)	0 (0%)	0 (0%)	0 (0%)	1 (8.3%)
Altered sexuality	14 (22.6%)	7 (30.4%)	10 (55.6%)	7 (28%)	5 (41.6%)

AH, abdominal hysterectomy; VH, vaginal hysterectomy; LASH, laparoscopic supracervical hysterectomy; LAVH, laparoscopically assisted vaginal hysterectomy; TLH, total laparoscopic hysterectomy

eTABLE 9

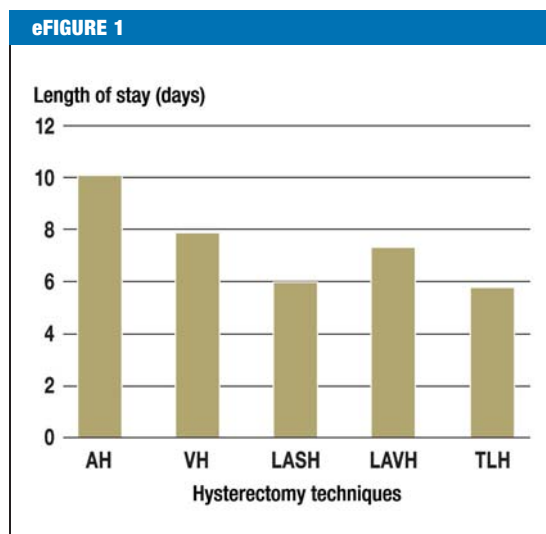
Self-image as a woman and satisfaction with surgical outcome following the different techniques of hysterectomy (absolute numbers and percentages): operations in the years 2002 to 2004

Has your image of yourself as a woman changed?	"No"	"Hardly at all"	"A bit"	"A lot"	"Completely"
Abdominal hysterectomy (n = 62)	45 (73%)	9 (15%)	3 (5%)	4 (7%)	0 (0%)
Vaginal hysterectomy (n = 23)	17 (74%)	1 (4%)	3 (14%)	2 (8%)	0 (0%)
Laparoscopic supracervical hysterectomy (n = 18)	15 (83%)	2 (11%)	1 (6%)	0 (0%)	0 (0%)
Laparoscopically assisted vaginal hysterectomy (n = 25)	19 (76%)	1 (4%)	3 (12%)	1 (4%)	1 (4%)
Total laparoscopic hysterectomy (n = 12)	8 (66%)	2 (17%)	2 (17%)	0 (0%)	0 (0%)
How satisfied are you with the outcome?	"Very"	"Fairly"	"Moderately"	"Not really"	"Not at all"
Abdominal hysterectomy (n = 62)	40 (65%)	17 (27%)	2 (3%)	3 (5%)	0 (0%)
Vaginal hysterectomy (n = 23)	15 (65%)	6 (26%)	0 (0%)	1 (4%)	0 (0%)
Laparoscopic supracervical hysterectomy (n = 18)	12 (66%)	4 (22%)	0 (0%)	1 (6%)	1 (6%)
Laparoscopically assisted vaginal hysterectomy (n = 25)	17 (68%)	4 (16%)	2 (8%)	0 (0%)	1 (4%)
Total laparoscopic hysterectomy (n = 12)	5 (42%)	6 (50%)	1 (8%)	0 (0%)	0 (0%)

ORIGINAL ARTICLE

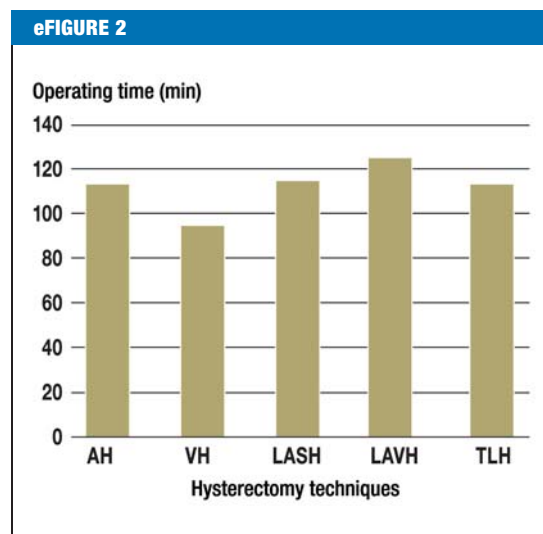
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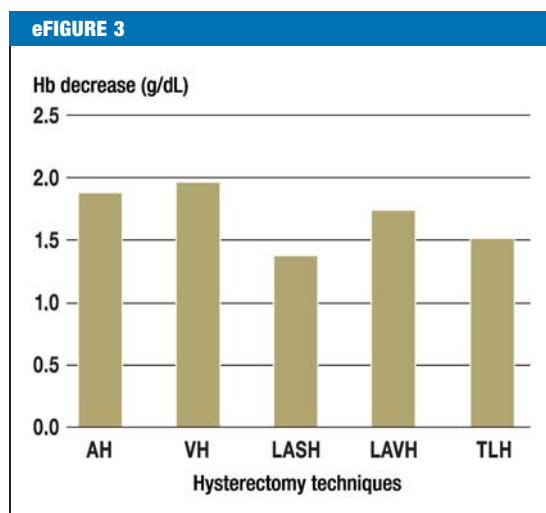
Mean length of stay in hospital after the different hysterectomy procedures

AH, abdominal hysterectomy;
 VH, vaginal hysterectomy;
 LASH, laparoscopic supracervical hysterectomy;
 LAVH, laparoscopically assisted vaginal hysterectomy;
 TLH, total laparoscopic hysterectomy



Mean operating time for the different hysterectomy procedures

AH, abdominal hysterectomy;
 VH, vaginal hysterectomy;
 LASH, laparoscopic supracervical hysterectomy;
 LAVH, laparoscopically assisted vaginal hysterectomy;
 TLH, total laparoscopic hysterectomy



Mean surgery-related decrease in Hb for the different hysterectomy procedures

AH, abdominal hysterectomy;
 VH, vaginal hysterectomy;
 LASH, laparoscopic supracervical hysterectomy;
 LAVH, laparoscopically assisted vaginal hysterectomy;
 TLH, total laparoscopic hysterectomy

ORIGINAL ARTICLE

Hysterectomy—A Comparison of Approaches

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The complications encountered with the various techniques for hysterectomy

There was one case of injury to the ureter in laparoscopic supracervical hysterectomy (LASH) and two of injury to the urinary bladder in abdominal hysterectomy (AH). The ureteral lesion in LASH could be attributed to electrothermal damage from the use of monopolar current. The bladder lesions in AH occurred during dissection of the vesicocervical space in patients with a history of cesarean section.

- Five intraoperative complications occurred during total laparoscopic hysterectomy (TLH):
 - Bladder injuries in four patients (0.96%). Three of these patients had undergone two or more cesarean sections, while one displayed massive adhesions in the true pelvis following multiple previous operations.
 - One TLH procedure had to be converted to AH because of the large size of the uterus (898 g).
- Abdominal hysterectomy group:
 - Three postoperative hemorrhages requiring treatment
 - Four urinary tract infections requiring treatment
 - Two non-specific rises in temperature
 - Four wound healing disorders and three abdominal wall hematomas
- Vaginal hysterectomy group:
 - Three urinary tract infections requiring treatment
- Laparoscopic supracervical hysterectomy group:
 - One urinary tract infection requiring treatment
- Laparoscopically assisted vaginal hysterectomy group:
 - Two urinary tract infections requiring treatment
 - Two hematomas at the vaginal apex
- Total laparoscopic hysterectomy group:
 - One postoperative hemorrhage requiring treatment
 - Four urinary tract infections requiring treatment
 - Two non-specific rises in temperature
 - Four hematomas at the vaginal apex
 - Four suture dehiscences of the vaginal apex on first postoperative sexual intercourse