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Use of vaginal hysterectomy in Denmark: rates, indications and patient characteristics

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Key words
Abdominal hysterectomy, benign indication, database, laparoscopic hysterectomy, vaginal hysterectomy

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Abstract

Objective. To describe the use of vaginal, abdominal and laparoscopic hysterectomy in Denmark from 1999 to 2008, the influence of national guidelines and the patient and procedure-related characteristics associated with the choice of vaginal hysterectomy. *Design.* Nationwide register-based cohort study. *Setting.* Danish Hysterectomy Database and Danish National Patient Registry. *Population.* All women with a hysterectomy for benign indications in Denmark from 1999 to 2008. *Methods.* The incidence rate/100 000 women was used to describe the route of surgery in hysterectomies of 50 755 women. A multiple logistic regression analysis was done to examine the association between patient- and procedure-related characteristics and choice of surgical procedure including 20 486 women. *Main outcome measures.* Trends in surgical approach from 1999 to 2008. Patient- and surgery-related characteristics associated with vaginal hysterectomy from 2004 to 2008. *Results.* There was an overall increase in the use of vaginal hysterectomies from 12 to 34%, a decrease in the use of abdominal hysterectomies and a consistent number of laparoscopic hysterectomies. The number of vaginal hysterectomies varied between regions, ranging from 2 to 86%. The use of vaginal hysterectomy was not dependent on the total number of hysterectomies performed at the hospital. The characteristics associated with vaginal hysterectomy were higher age, smaller uterus size, indications for surgery (genital prolapse and severe uterine bleeding), less smoking and moderate alcohol intake. *Conclusions:* Vaginal hysterectomy has replaced abdominal hysterectomy increasingly but cannot be directly correlated to the implementation of national guidelines as there was large national variation. Several characteristics are significantly associated with vaginal hysterectomy.

Abbreviations: BMI, body mass index; ASA, American Society of Anesthesiologists; SAS, Statistical Analysis Software.

Introduction

The debate concerning optimal surgical approach for elective hysterectomy for benign gynecological disease is ongoing (1). Many randomized studies have been performed to define the optimal approach, but there are large variations in the incidence of hysterectomy on benign indications. The choice of surgical approach varies by time, between and within countries (2,3). Furthermore, we do not know which factors are influential in daily practice and what characterizes a woman having a vaginal hysterectomy for benign gynecological disease compared with women having an abdominal or laparoscopic hysterectomy.

The number of hysterectomies for benign disease has remained stable over the last two decades in Denmark, with approximately 4 500 per year. The most frequent indications are bleeding disorders and leiomyomas, despite an increasing use of minimally invasive methods for endometrial destruction

and the hormone-releasing intrauterine contraceptive device used for menorrhagia (4,5). The distribution between different routes of hysterectomy, however, changed in the 1990s (5). A Danish study of hysterectomy showed an increase in the use of vaginal hysterectomy from 1988 to 1998. In 2003, the Danish Ministry of Health published a national guideline: 'Reference Program for Benign Hysterectomy', with an updated version in 2006 (4). In accordance with the international recommendation in the Cochrane review from 2009, the Danish guideline recommends vaginal hysterectomy for smaller uteri below 300g when no contraindications are present (1,4).

The aim of this study was to describe the national trend in the use of vaginal, abdominal and laparoscopic hysterectomy from 1999 to 2008, and to examine the influence of the National Reference Program on the distribution. We also wished to describe patient- and procedure-related characteristics associated with vaginal hysterectomy and determine whether selected patient-related factors were associated with the choice of vaginal hysterectomy.

Material and methods

The study was a descriptive prospective cohort study of data collected from the Danish Hysterectomy Database and the Danish National Patient Register containing information about all operations performed in Denmark since 1977. The Danish Hysterectomy Database was established in October 2003 to monitor and improve the quality of hysterectomy in Denmark (6,7). All 32 gynecologic departments from public hospitals and recently most private hospitals report to the database. The response rate was 99% in 2005 for public hospitals and data were 92–100% complete in 2006 (6). Due to technical problems in the data collection and registration not all private hospitals are reporting to the database yet and therefore were not included. The quality of data in the Danish National Patient Register has been validated and is described as good (6,8).

The study included all patients discharged with a hysterectomy code based on the Danish classification system of surgical procedures: KLCD00, KLCD01, KLCD04, KLCD10, KLCD11, KLCD96, KLCD97, KLCC10, KLCC11, KLCC20 and KLEF13 (6). We classified hysterectomy methods into three main categories: vaginal hysterectomy, abdominal hysterectomy and laparoscopic hysterectomy; the latter including laparoscopically assisted vaginal hysterectomy.

The first part of the study describes the national trend in hysterectomies and use of surgical procedures, included 50 755 women registered with a hysterectomy code for benign indications in the Danish National Patient Register from 1 January 1999 to 31 December 2008. The second part describes patient- and surgery-related characteristics associated with vaginal hysterectomy in all women registered with a benign hysterectomy code between 1 January 2004 and 31 December 2008. A total of 20 486 women were included in the study.

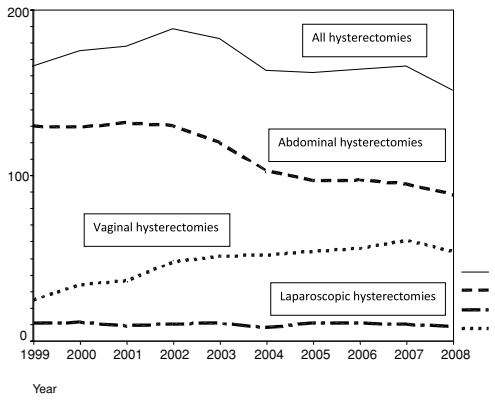

Figure 1. Incidence of hysterectomy from 1999–2008. Hysterectomies/ 100 000 women.

The following variables were studied: age, alcohol intake per week, smoking status, body mass index (BMI), ASA score (American Society of Anesthesiologists; a physical status classification system for assessing the fitness of patients before surgery), co-morbidity (hypertension and diabetes), uterine weight (weighed postoperatively) and indication for surgery divided into five groups (menorrhagia/metrorrhagia, uterine fibromas, genital prolapse, pain and other indications).

The hospitals were classified by type and number of hysterectomies performed per year. The types included university hospital centers specializing in gynecologic oncology and advanced uro-gynecology, university hospitals without gynecologic oncology, and non-university hospitals. The hospitals were divided into four groups (quartiles) regarding number of hysterectomies performed per year.

Statistical methods

The incidence rate per 100 000 women was used to describe the national trend in the use of hysterectomy and route of surgery and was calculated by dividing the number of women having a hysterectomy with the total number of women in Denmark and multiplying the result by 100 000. A Poisson regression analysis was used to test for variation in the annual incidence rate. Continuous variables are presented as 25th percentiles, median and 75th percentiles. Categorical variables are presented as frequencies and percentages. Frequencies were compared by the Chi-squared test and means by the Wilcoxon signed rank sum-test. Multiple logistic regression analysis was done to examine the association between patient- and procedure-related characteristics and choice of surgical procedure. The SAS statistical package

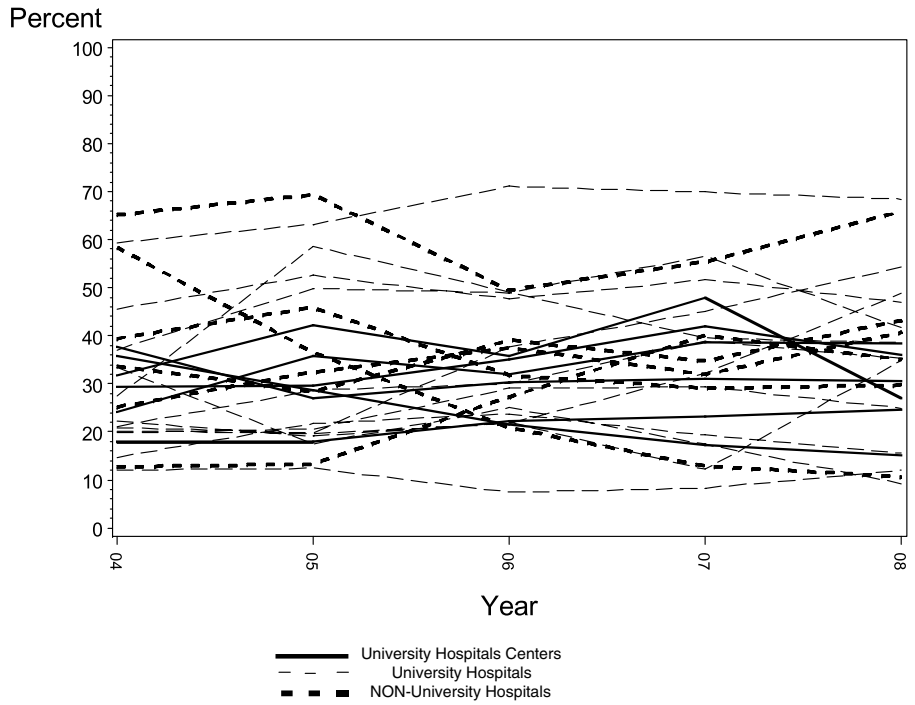

Figure 2. The distribution of hospitals in relation to vaginal hysterectomies performed over a five-year period. Danish hospitals that performed vaginal hysterectomies from 2004 through 2008 are divided into three different groups in relation to hospital size: university hospital centers, university hospitals and non-university hospitals. The figure includes all departments performing more than 10 vaginal hysterectomies a year during the period, thus seven departments were excluded from the analysis.

(version 9.2; SAS Institute, Cary, NC, USA) was used. Significance was defined as a p-value < 0.05. The multiple regression analysis included age, BMI, alcohol intake, smoking habits, uterine weight, ASA score, and indication for surgery. As the database is accredited by the Danish National Board of Health, no ethic review board approval or patient consent was required. This study was approved by the Danish Data Protection Agency.

Results

The incidence rate of benign hysterectomy in Denmark was found to be stable at a level between 189 (in 2002) and 152 (in 2008) hysterectomies/100 000 women/year (Figure 1). A Poisson regression analysis showed that the variation in incidence was not significant ($p = 0.32$).

The use of laparoscopic hysterectomy was consistent for all 10 years at a level between 6 and 7% of all hysterectomies corresponding to an incidence rate of 15/100 000 women/year. The number of abdominal hysterectomies decreased and vaginal hysterectomies increased by 123% from 671 in 1999 to 1 497 in 2008, a change from 12 to 34% of all hysterectomies. A large variation of 2–86% in vaginal hysterectomies between hospitals was observed. There was an increase from 10 to 15 departments performing more vaginal hysterectomies than the national average of 34%. The university hospital centers did not increase the use of vaginal hysterectomies, but university hospitals and non-university hospitals changed the use of vaginal hysterectomies, apparently without any obvious pattern (Figure 2).

Women who had a vaginal hysterectomy differed in age, being generally older, with a lower alcohol intake and smoking less than women who underwent abdominal or laparoscopic hysterectomy (Table 1). A large variation for most other procedure-related factors was also detected (Table 2). The most frequent indication for vaginal hysterectomy was genital prolapse (40%), while for the laparoscopic hysterectomies it was pain (26%), and for the abdominal hysterectomies it was leiomyomas (38%) (Table 2). The most frequent indication was bleeding disorders.

Vaginal hysterectomy was predominantly performed with either general or spinal anesthesia as total hysterectomies, with a median operation time of 60 minutes (Table 2). Epidural anesthesia was given as supplement to 41% of the abdominal hysterectomies. The median time of operation for abdominal and laparoscopic hysterectomy was 10 minutes longer and approximately 15% of the operations were

Table 1. Characteristics of the patients divided into surgical route for 20 486 women reported to the Danish Hysterectomy Database 2004-2008.

	Vaginal hysterectomy $N = 7028$	% 34	Abdominal hysterectomy $N = 12\,221$	% 60	Laparoscopic hysterectomy $N = 1228$	% 6	*p* value	Missing values $N = 9$
Median age (years)	49		47		44		<0.001	9
Age/years								
<34	242	3	352	3	107	9		
35-39	677	10	1135	9	219	18		
40-44	1392	20	2956	24	402	33		
45-49	1334	19	3869	32	303	24		
50-54	727	10	2104	17	120	10		
55-59	581	8	771	6	24	2		
60-64	637	9	429	4	14	1		
65-69	524	8	276	2	24	2		
>70	914	13	329	3	15	1		
Alcohol consumed (units/week)							<0.001	2100
0	3845	61	6528	60	690	61		
1-7	2020	32	3257	30	337	30		
8-14	361	5	896	8	74	7		
>14	102	2	256	2	20	2		
Tobacco							<0.001	1553
Non-smoker	4652	71	7699	68	700	61		
Smoker	1856	29	3568	32	450	39		
Body Mass Index (kg/m^2)							<0.001	359
BMI < 18.5	117	2	194	2	36	3		
18.5 ≥ BMI < 24.9	3334	48	5826	49	656	54		
25 ≥ BMI < 29.9	2352	34	3728	31	337	28		
30 ≥ BMI < 34.9	827	12	1615	13	131	11		
BMI ≥ 35	305	4	619	5	50	4		
ASA classification							<0.001	35
I-II	6875	98	12 014	98	1220	99		
III-IV	143	2	191	2	8	1		
Co-morbidity								
Hypertensio	1477	21	1693	14	104	8	<0.001	18
Diabetes (IDDM/NIDDM)	217	3	306	3	21	2	0.003	14
Uterus weight (g)							<0.001	1457
<300	6260	93	6053	54	1068	92		
300-500	312	5	2045	18	80	7		
>500	116	2	3080	28	15	1		

performed as subtotal hysterectomies. Vaginal and abdominal hysterectomies were performed in all hospitals, whereas laparoscopic hysterectomies most often were performed in hospitals with a very large or small number of hysterectomies. The experience of the surgeon did not seem to differ much for women having a vaginal or an abdominal hysterectomy, whereas women having a laparoscopic hysterectomy more often seemed to be operated on by a surgeon with very high experience. The multivariate logistic regression analysis showed that vaginal hysterectomy was independently predicted by higher age, smaller uterine size, indication for surgery (genital prolapse and severe uterine bleeding), reduced smoking and a moderate alcohol intake(1–7 units/week) (Table 3).

Discussion

During the last decade, there has been an overall increase in the use of vaginal hysterectomies and a decrease in abdominal hysterectomies. At the same time there has been an increase in the number of departments performing more vaginal hysterectomies than the national average of 34%. The number of laparoscopic hysterectomies has remained stable, indicating the change only from the abdominal to the vaginal approach. In the USA, an increase in vaginal hysterectomies has also been reported. Over a 5-year period starting in 1997 the frequency rose from 23 to 32% (2,3). No extraordinary increase in vaginal hysterectomies was observed after the

Table 2. Treatment related factors divided by surgical routes for 20 486 women reported to the Danish Hysterectomy Database from 2004-2008.

*Median (25.og 75. percentiles) **Multible categories may apply	Vaginal hysterectomy $N = 7028$	% 34	Abdominal hysterectomy $N = 12\,221$	% 60	Laparoscopic hysterectomy $N = 1228$	% 6	*p* value	Missing values $N = 9$
Indication for surgery**							<0.001	9
Menorrhagia/metrorrhagia	2326	33	4004	33	521	43		
Fibroma uteri	504	7	4618	38	114	9		
Genital prolapse	2841	40	125	1	17	1		
Pain	521	8	1226	10	312	26		
Other indications	836	12	2205	18	259	21		
Hysterectomy performed							<0.001	9
Total hysterectomy	6987	99	10 344	85	1055	86		
Subtotal hysterectomy	41	1	1877	15	173	14		
Additional surgery								
Considerable adhesiolysis	35	<1	746	6	57	5	<0.001	9
Colporrhaphy/perieoplasty	2654	38	56	0	29	2	<0.001	9
Salpingooophorectomy, unilateral	119	2	1085	9	62	5	<0.001	10
Salpingooophorectomy, bilateral	181	3	2833	23	161	13	<0.001	10
Duration of surgery (min)*	60 (48;80)		70 (55;90)		70 (50;92)		<0.001	
Anesthesia**								
Generel	5814	83	12 089	99	1225	100	<0.001	19
Spinal	1233	18	167	1	8	1	<0.001	12
Epidural	193	3	4952	41	20	2	<0.001	10
Surgeons experience (total volume of same surgical procedure)							<0.001	24
≤10	595	8	1008	8	107	9		
11-25	813	12	1324	11	84	7		
26-50	983	14	1560	13	80	6		
51-75	681	10	834	7	71	6		
76-100	662	9	686	5	49	4		
>100	3287	47	6801	56	837	68		
Hospital volume (no of hysterectomies performed pr. year)							<0.001	9
1-121	1834	26	2794	23	363	30		
122-173	1679	24	3592	29	113	9		
174-232	2061	29	3732	31	78	6		
233+	1454	21	2103	17	674	55		

national guideline for benign hysterectomy (4) was published in 2003 or when it was updated in 2006. This emphasizes the challenges in implementing evidence-based national guidelines and influencing entrenched standard procedures.

Abdominal hysterectomy remains the most frequent method used in most countries, in Denmark accounting for 60%. Focus has been on the surgeon's preference, education and learning curves in the decision-making process (9). However, the patient's various clinical characteristics may be influential as well: the indication for surgery and the need for concomitant surgery, patient co-morbidity and anesthetic risk, size and mobility of the uterus, and the local economic options for using new and better equipment to make implementation of new methods easier. We found that patient characteristics for women having a vaginal hysterectomy differed significantly from women having abdominal and laparoscopic hysterectomies by indication and additional surgical procedures, age, alcohol and smoking habits, length of surgical procedure and choice of anesthesia.

Regarding indications for surgery, the vaginal approach was originally only used for genital prolapse in Denmark. The increasing overall use of vaginal hysterectomies seems to be due to more broadened indications for the vaginal approach in accordance with international recommendations (1). In 2008, only 40% of vaginal hysterectomies were performed for genital prolapse in Denmark. The same trend is seen in USA, with genital prolapse being the indication for surgery in 44% (2,3). For larger leiomyomas detected in the perimenopause, the abdominal approach is still the best choice, whereas younger women with smaller uteri with menorrhagia and pain seem to be new candidates for vaginal hysterectomy (3,5,9,10). The need for additional adnexal surgery or adhesiolysis may influence the choice of hysterectomy approach, as these procedures are performed in only

Table 3. Multivariate analysis for predicting vaginal hysterectomy.

Vaginal hysterectomy $N = 6003$ All other hysterectomies $N = 11\,645$	Unadjusted	*p*-value	Adjusted	*p*-value
Uterus weight (g)		<0.001		<0.001
<300	Reference		Reference	
300-500	0.17 (0.15-0.20)		0.3811 (0.26-0.35)	
>500	0.04 (0.03-0.05)		0.08 (0.06-0.10)	
Indication for surgery		<0.001		<0.001
Menorrhagia/metrorragia	Reference		Reference	
Benign ovarian tumour	0.06 (0.03-0.11)		0.06 (0.03-0.12)	
Endometriosis	0.04 (0.02-0.11)		0.02 (0.01-0.08)	
Fibroma uteri	0.21 (0.19-0.24)		0.48 (0.41-0.54)	
Premalignant cases	0.67 (0.52-0.85)		0.60 (0.45-0.79)	
Pain	0.67 (0.60-0.76)		0.58 (0.51-0.66)	
Genital prolapse	39.64 (32.69-48.07)		29.93 (23.50-38.11)	
Other indications	0.84(0.74-0.94)		0.87 (0.74-1.00)	
Tobacco		<0.001		0.381
Non-smoker	Reference		Reference	
Smoker	0.84 (0.78-0.90)		1.04 (0.95-1.15)	
Alcohol consumed (units/week)		<0.001		0.001
0	Reference		Reference	
1-7	1.05 (0.98-1.14)		1.22 (1.11-1.35)	
8-14	0.69 (0.60-0.79)		0.92 (0.77-1.10)	
>14	0.68 (0.53-0.88)		1.05 (0.75-1.47)	
Age/years		<0.001		<0.001
<39	0.23 (0.20-0.26)		0.91 (0.72-1.15)	
40-54	0.16 (0.14-0.18)		0.72 (0.58-0.88)	
55-64	0.46 (0.40-0.52)		0.70 (0.55-0.89)	
≥65	Reference		Reference	
Body Mass Index (kg/m^2)		<0.001		0.009
BMI < 18.5	1.08 (0.83-1.40)		1.24 (0.89-1.73)	
18.5 ≥ BMI < 24.9	1.06 (0.97-1.16)		1.22 (1.07-1.38)	
25 ≥ BMI < 29.9	1.23 (1.11-1.35)		1.17 (1.02-1.34)	
BMI ≥ 30	Reference		Reference	
ASA classification		0.004		0.193
I-II	Reference		Reference	
III-IV	1.42 (1.12-1.81)		0.74 (0.49-1.10)	

5% of vaginal hysterectomies, in comparison with 38% of the abdominal hysterectomies. Enlarged uteri are more difficult to remove by vaginal operation, and more experienced surgeons are needed to perform the more advanced operational techniques (2,9,11,12), supporting our finding that most uteri removed vaginally were small.

Vaginal hysterectomies took slightly less time (10 minutes) than abdominal and laparoscopic operations, a finding supported by other studies (2,13–15). Mostly laparoscopic hysterectomies seem to take longer than abdominal ones (4,13,15) but in this study there was not a difference, possibly due to greater experience of the surgeons performing the laparoscopic procedures. Vaginal hysterectomy may have a lower morbidity, shorter recovery and favorable cost–benefit ratio compared to abdominal and laparoscopic hysterectomy (1,11–13). The use of fast track regimens with accelerated rehabilitation have lowered morbidity and shortened recovery times after abdominal hysterectomy (16). Comparing complications in larger studies where potential confounders are taken into account, might clarify cost–benefit issues and show whether vaginal hysterectomy will remain the recommended choice of surgical approach in the future.

Strengths of this study were the use of a large, nationwide and continuously updated database and a high completeness of data including detailed information about lifestyle and co-morbidity, surgery and hospital details. The large study population ensured sufficient power to detect even small outcome changes. However, the findings must be interpreted with limitations in mind. There is a risk for all administratively collected data to contain inaccuracies. Information on particular lifestyle issues was incomplete. Data were most often missing for alcohol (10%), tobacco (8%) and uterine weight (7%); however, a repetition of the multivariable analysis with missing information coded as unknown did not

change the estimates considerably. Therefore we do not expect the missing values to be systematically associated with vaginal hysterectomy or to have an effect on the estimates for predictive values. It may also be important to control for various patient-related characteristics, such as co-morbidities and patient's own preferences (to clarify if they influence the choice of surgical approach), which we could not do in this study, Departmental and doctor-related factors such as traditions, operations/day, personal preferences and training necessities are also likely to be of importance but were not available from the database.

Continuing to monitor national trends of different surgical approaches with systematic national audits emphasizes the implementation of evidence-based recommendations, and will be important for improving the national guidelines regarding choice of hysterectomy method.

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