

Morbidity of 10 110 hysterectomies by type of approach

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BACKGROUND: Since the late 1980s, the option of laparoscopic hysterectomy has raised questions about the most suitable approach to hysterectomy. **METHODS:** To evaluate the influence of the type of approach, in causing or avoiding certain complaints in hysterectomies a prospective nationwide study was conducted comprising all hysterectomies for benign disease performed in Finland during 1996. The primary outcomes of interest were the operation-related morbidity, common surgical details and post-operative complications. **RESULTS:** A total of 10 110 hysterectomies, including 5875 abdominal, 1801 vaginal and 2434 laparoscopic operations showed a low rate of overall complications, 17.2, 23.3 and 19.0% respectively. Infections were the most common complications with incidences of 10.5, 13.0 and 9.0% in the abdominal, vaginal and laparoscopic group respectively. The most severe type of haemorrhagic events occurred in 2.1, 3.1 and 2.7% in the abdominal, vaginal and laparoscopic group respectively. Ureter injuries were predominant in laparoscopic group [relative risk (RR) 7.2 compared with abdominal] whereas bowel injuries were most common in vaginal group (RR 2.5 compared with abdominal). Surgeons who had performed >30 laparoscopic hysterectomies had a significantly lower incidence of ureter and bladder injuries (0.5 and 0.8% respectively) than those who had performed ≤30 operations (2.2 and 2.0% respectively). A decreasing trend of bowel complications was also seen with increasing experience in vaginal hysterectomies. **CONCLUSIONS:** This large-scale observational study on hysterectomies provides novel information on operation-related morbidity of abdominal, vaginal or laparoscopic approach. The results support the importance of the experience of the surgeon in reducing severe complications, especially in laparoscopic and vaginal hysterectomies.

Key words: complication/epidemiology/gynaecology/hysterectomy/laparoscopy

Introduction

Hysterectomy is the most common major gynaecological operation in the world. For benign indications many countries have favoured either the abdominal (Nathorst-Boos *et al.*, 1992; Hall *et al.*, 1998; Harkki-Siren *et al.*, 1998) or the vaginal approach (Querleu *et al.*, 1993; Kovac, 1995). These traditions have prevailed unaltered throughout decades. However, since the late 1980s, the new option of laparoscopic hysterectomy (Reich *et al.*, 1989) has raised questions about the most suitable type of approach (Stovall and Summitt, 1996; Kadar *et al.*, 1997; Osborne, 1997; Porges, 1997).

The new laparoscopic technique has been assessed against the other techniques by observational patient series, case-controlled trials and also by randomized controlled trials. The advantage of the laparoscopic approach has been mainly associated with a short hospital stay and a quick convalescence (Garcia Padial

et al., 1992; Liu, 1992; Kovac, 1995; Weber and Lee, 1996). There are, however, some concerns related to the costs and the morbidity of the approach (Summitt *et al.*, 1992; Kovac, 1995; Weber and Lee, 1996). In general, the results of these studies have a limited value because they are retrospective and include only a small number of patients. Furthermore, they have been performed mainly by expert surgeons or done during the learning curve of the new procedure (Garry, 1998). In order to increase the power of the observational studies on morbidity in large numbers of patients, a prospective evaluation was conducted of all hysterectomies performed for benign indications during 1996 in the whole of Finland.

Materials and methods

From January 1 to December 31, 1996, the information on all hysterectomies performed for benign disease in Finland was registered

by the surgeon into a structured database. The data concerning pre-, peri- and post-operative surgical details and morbidity were collected during the patients' stay in the hospital. The post-operative outcome of the patients was evaluated at the end of the convalescence period. The collected data included the indication for surgery, the type of hospital (five university, 17 central, 31 local and five private hospitals), the experience of operator anonymously (≤ 30 or > 30 operations), the patient characteristics, the duration of surgery, the estimated amount of bleeding and/or episodes of accidental bleeding requiring intervention intra- or post-operatively, the uterine weight, concomitant surgery including procedures due to endometriosis, and post-operative morbidity, the length of the hospital stay and the sick leave.

The complications were divided into those which occurred during operation, during hospital stay and after discharge. The morbid events were separated by type into infection, haemorrhage, thromboembolism, injury to adjacent organs (bladder, ureter and bowel), and other complications; deaths were also recorded. Infection categories included surgical site infection (wound, intra-abdominal and vaginal infections) and non-surgical site infections (lower urinary tract and other infections) and unknown fever, i.e. febrile morbidity. The haemorrhagic events were divided into wound, intra-abdominal, vaginal and non-specific bleeding problems. Other complications included nerve entrapments, hernias, cardiovascular, gastrointestinal, urinary dysfunction.

The data were collected into a common database and it was thoroughly reviewed for consistency and missed information by one of the investigators (J.J.). A total of 160 cases was rejected from the material because the final diagnosis by histology was malignant. In 6.5% of the material the information was not totally complete; separate missing data, e.g. uterine weight, estimated blood loss, experience of surgeon.

The hysterectomies were divided by approach into three groups: abdominal hysterectomy, vaginal hysterectomy and laparoscopic hysterectomy; the standard techniques of which followed the recommendations of general operative textbooks (Rock and Thompson, 1997, Garry and Reich, 1993). Uterine fibroids and bleeding disorders were the most common indications for abdominal hysterectomy (67 and 30% respectively) and laparoscopic hysterectomy (56 and 47%) respectively, while uterine prolapse was the most common indication for vaginal hysterectomy (83%). The incidences of surgical complications were compared between these three groups of hysterectomies using relative risk (RR) and the 95% confidence intervals (CI), taking abdominal hysterectomy as the comparison term. The most common concomitant procedures, the use of prophylactic antibiotics and anti-thrombotic agents are listed in Table I.

The study protocol was approved by the joint ethical committee of the University of Turku and the Turku University Central Hospital. All the Finnish hospitals ($n = 58$) accepted the same protocol both practically and administratively.

Results

The present survey comprising 10 110 hysterectomies was performed at the time when laparoscopic hysterectomy and vaginal hysterectomy were progressively replacing the traditional abdominal hysterectomy (Figure 1). The operations were performed by > 100 operators from 58 hospitals. The majority of the procedures were total hysterectomies; but 11.6% of the abdominal hysterectomies and 2.1% of the laparoscopic hysterectomies were subtotal. The number and rate of the different types of hysterectomies by hospital level are shown in Figure 2.

The patients in the vaginal hysterectomy group (58.6 ± 13.2 years) were older ($P < 0.001$) than those in the abdominal hysterectomy and laparoscopic hysterectomy groups (48.8 ± 8.8 and 47.0 ± 7.5 years respectively). The body mass index was similar in all three groups. The uterine weight was highest in abdominal hysterectomy, the amount of intra-operative bleeding greatest in vaginal hysterectomy while the operative time was longest in laparoscopic hysterectomy (Table II). The hospital stay and convalescence period (time from operation to the day when the patient returns to daily work) was the shortest in laparoscopic hysterectomy. Vaginal hysterectomy included both anterior and posterior repair, which explains the long hospital stay. There was a statistically significant difference ($P < 0.0001$) between the incidence of concomitant procedures because of endometriosis between the groups: 10.0% in abdominal hysterectomy, 1.5% in vaginal hysterectomy and 7.6% in laparoscopic hysterectomy.

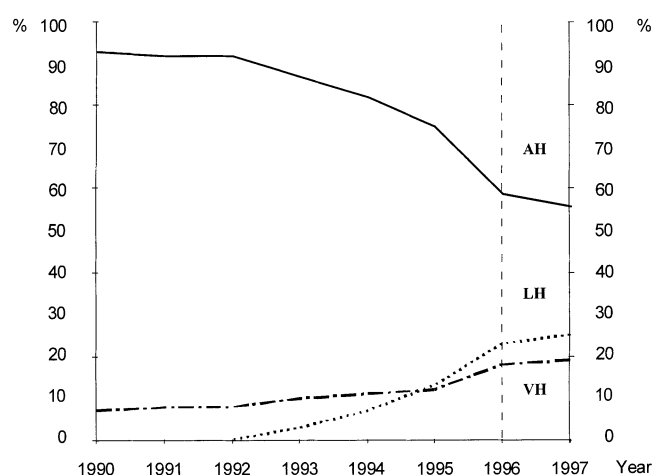
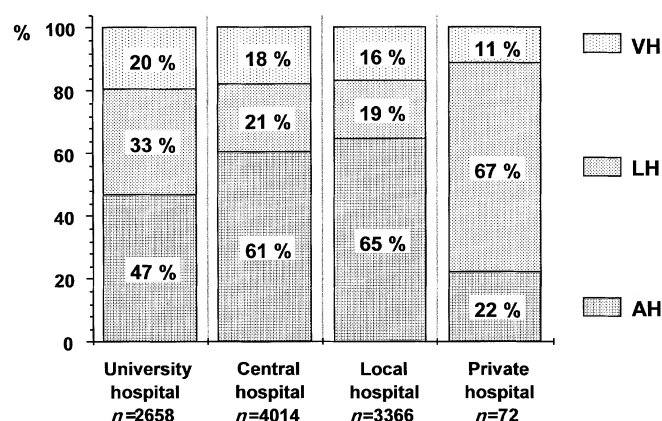
The total rate of complications in abdominal hysterectomy was 17.1%, in vaginal hysterectomy 23.3% and in laparoscopic hysterectomy 19.0%. The rates of intra-operative complications were 2.3, 3.0 and 3.2% in abdominal hysterectomy, vaginal hysterectomy and laparoscopic hysterectomy respectively. During hospital stay the rates of complications were 12.3% in abdominal hysterectomy, 16.1% in vaginal hysterectomy and 8.4% in laparoscopic hysterectomy, and those after discharge 2.5, 4.2 and 7.4% respectively.

The rate and risk ratios of major complications in the three hysterectomy groups are shown in Table III. Urinary tract and bowel injuries and peri-operative bleeding were the most severe injuries occurring during hysterectomy. Ureter and bladder complications had a significant predominance in laparoscopic hysterectomy group, while bowel complications were most common in the vaginal hysterectomy group. The peri-operative bleedings needing surgical interventions or blood transfusions during operation were most common in vaginal hysterectomy (3.1% compared with 2.1% in abdominal hysterectomy). The occurrence of thromboembolic events and death (one in each group) was similar in all groups. Wound haemorrhages occurred mainly in the abdominal hysterectomy group but vaginal haemorrhages were more common in vaginal hysterectomy and laparoscopic hysterectomy than in abdominal hysterectomy. Infections were the most common complications with incidences of 10.5, 13.0 and 9.0% in the abdominal, vaginal and laparoscopic hysterectomy groups respectively. The highest infection rate (7.3%) was observed in urinary tract infections in the vaginal hysterectomy group.

The surgeon's experience correlated with the occurrence of severe complications in laparoscopic hysterectomy. Surgeons who had performed > 30 laparoscopic hysterectomies had a significantly lower rate of bladder, ureter and bowel complications in comparison with the less experienced colleagues (Table IV). The number of bowel injuries in the vaginal hysterectomy group also decreased with increasing experience. In the abdominal hysterectomy group all severe complications took place only after the experience of 30 hysterectomies, probably because with increasing experience surgeons are involved in more difficult cases with higher risks.

Table I. Concomitant procedures, use of antibiotic and anti-thrombotic prophylaxis in abdominal, vaginal and laparoscopic hysterectomies

	Abdominal hysterectomy (n = 5875)		Vaginal hysterectomy (n = 1801)		Laparoscopic hysterectomy (n = 2434)	
	n	%	n	%	n	%
Concomitant procedures						
Adnexal surgery	3467	59.0	117	6.5	985	40.6
Vaginal repair	176	3.0	1365	75.8	152	6.3
Incontinence surgery	352	6.0	154	8.6	100	4.1
Adhesiolysis	532	9.1	10	0.6	152	6.2
Appendectomy	573	9.8	—	—	14	0.6
Bowel surgery	15	0.3	—	—	—	—
Hernia repair	35	0.6	1	0.1	6	0.2
Endometriosis surgery	55	0.9	1	0.1	15	0.6
Sacrospinal fixation	3	0.1	18	1.0	—	—
Panniculectomy	16	0.3	—	—	—	—
Lymphadenectomy	6	0.1	—	—	—	—
Antibiotics	4626	78.7	1432	79.5	2247	92.3
Anti-thrombotics	2203	37.5	848	47.1	532	21.9

**Figure 1.** The rate of abdominal (AH), vaginal (VH) and laparoscopic (LH) hysterectomies in Finland from 1990 to 1997. Figures are adapted from the annual national statistics of Finland.**Figure 2.** The rate of abdominal (AH), vaginal (VH) and laparoscopic (LH) hysterectomies by hospital level in Finland in 1996.

When comparing different hysterectomies with and without concomitant procedures we observed an increase of total rate of adjacent organ injuries in abdominal hysterectomy with concomitant procedures (0.3–1.1%), total rate of infections in laparoscopic hysterectomy (4.8–7.0%) and the rate of urinary infections in vaginal hysterectomy (4.7–8.0%). On the contrary the rate of vaginal infections decreased in abdominal hysterectomy with concomitant procedures (0.4–0.1%) as did the rate of non-specific haemorrhages in laparoscopic hysterectomy with concomitant procedures (0.9–0.2%).

Discussion

The strength of the present study lies in its prospective approach and on the large number of unselected cases. It is not biased by such problems as the use of hospital records only, the influence of special units or experienced surgeons or the analysis of a specific approach for hysterectomy or selected patient population. In this study, the operation-related details in three approaches for hysterectomy currently used for benign diseases are reported. The previous reference study (Dicker *et al.*, 1982) concentrated only on the vaginal and abdominal approaches. The present survey describes the surgical details and the complications that an average gynaecologist can face in all three hysterectomy techniques performed today. It also serves as a nationwide quality assessment. In the same year (1996) a total of 10 972 hysterectomies was performed in Finland. This value also includes malignant cases which usually comprise some 10% of all and this is why it is believed that data have been collected on all the hysterectomies performed for benign indications in that year.

The overall morbidity in the traditional abdominal hysterectomy (17.1%) in the present study was markedly lower than 42.8% reported previously (Dicker *et al.*, 1982). Because infections were and are the most common complications, the difference can be explained in part by the rather high use of

Table II. Surgery-related details (mean \pm SD) in different types of hysterectomy

	Abdominal hysterectomy (<i>n</i> = 5875)	Vaginal hysterectomy (<i>n</i> = 1801)	Laparoscopic hysterectomy (<i>n</i> = 2434)
Operation time (min)	86.1 \pm 31.5	87.7 \pm 32.4	124.0 \pm 47.7****
Intra-operative bleeding (ml)	305.1 \pm 312.6	342.3 \pm 352.9****	261.9 \pm 270.9****
Uterine weight (g)	290.4 \pm 302.1	108.7 \pm 84.2****	195.0 \pm 107.8****
Hospital time (days)	6.0 \pm 2.2	5.9 \pm 2.7	3.4 \pm 2.0****
Convalescence period (days)	34.4 \pm 5.3	34.0 \pm 8.8	21.5 \pm 8.8****

*****P* < 0.0001, when compared to abdominal hysterectomy.**Table III.** The rate and relative risks (RR) of complications associated with abdominal, vaginal and laparoscopic hysterectomies

	Abdominal hysterectomy (<i>n</i> = 5875)	Vaginal hysterectomy (<i>n</i> = 1801)	Laparoscopic hysterectomy (<i>n</i> = 2434)	
	%	%	RR (95% CI)	RR (95% CI)
Organ injury				
Ureter	0.2	—	—	1.1****
Bladder	0.5	0.2	0.3 (0.1–1.1)	2.7 (1.6–4.4)
Bowel	0.2	0.5*	2.5 (1.0–5.8)	0.4
Total	0.8	0.7	0.9 (0.5–1.6)	2.8****
Infection				
Wound	3.1	—	—	0.7****
Intra-abdominal	0.1	0.2	2.0 (0.5–8.2)	0.6****
Vaginal	0.2	1.8****	7.7 (4.1–14.3)	1.4****
Urinary tract	4.2	7.3****	1.7 (1.4–2.1)	2.6****
Other	0.2	0.3	1.3 (0.5–3.7)	0.6**
Unknown fever	2.6	3.4	1.3 (1.0–1.8)	3.2
Total	10.5	13.0**	1.2 (1.1–1.4)	9.0
Haemorrhage				
Wound	1.0	—	—	0.4**
Intra-abdominal	2.1	3.1*	1.5 (1.1–2.0)	2.7
Vaginal	0.3	1.0**	3.3 (1.7–6.3)	1.1****
Other	0.6	0.5	0.9 (0.4–1.8)	0.5
Total	4.0	4.6	1.1 (0.9–1.5)	4.7
Thromboembolism	0.2	0.2	1.3 (0.4–4.2)	0.3
Death	0.02	0.06		0.04
Other complications	1.7	4.8****	2.8 (2.1–3.7)	2.1
All complications	17.1	23.3****	1.4 (1.2–1.5)	19.0

RR and *P*-values of vaginal and laparoscopic groups are compared to the abdominal group.**P* < 0.05; ***P* < 0.01; ****P* < 0.001; *****P* < 0.0001.

antibiotic prophylaxis in the present series. However, the morbidity rate in vaginal hysterectomy (23.3%) and in laparoscopic hysterectomy (19.0%) here was unexpectedly higher than that in abdominal hysterectomy which could be related to the prospective approach of the present study, and also all possible and mild complications. The total incidence of haemorrhagic events and infections was rather similar between the three groups, but urinary tract infections were clearly more common in the vaginal hysterectomy group (7.3%) than in the others. This could be due to the older age and the long use of a urinary catheter in the vaginal hysterectomy group. Otherwise, the surgical details were similar to previous reports: the operation time was longest but hospital stay shortest in laparoscopic hysterectomy, the mean uterine weight was highest in abdominal hysterectomy group and patients in vaginal hysterectomy group were older than in other groups (Boike

et al., 1993; Kovac, 1995). The lower incidence of concomitant procedures due to endometriosis in the vaginal hysterectomy group indirectly indicates that patients assumed to have this disease were operated mostly via the abdominal or the laparoscopic approach (Table I).

Concerning the most severe events, there was one death in each group not directly related to the operation (alcoholic cirrhosis, cardiac infarct, pulmonary embolism). These mortality rates are similar to those previously reported with gynaecological surgery in a Finnish population (Virtanen and Mäkinen, 1995). Regarding other severe complications, severe bowel injuries occurred more often in vaginal hysterectomy (0.5%) than in the other groups (0.2% in abdominal hysterectomy and 0.4% in laparoscopic hysterectomy). Although these differences are small and not always clinically important, bowel injuries in vaginal hysterectomy can be related to the blindness

Table IV. The number and rate of ureter, bladder and bowel injuries in abdominal, vaginal and laparoscopic hysterectomies in relation to the surgeon's experience (≤ 30 compared with >30 operations)

	Abdominal hysterectomy (<i>n</i> = 5875)		Vaginal hysterectomy (<i>n</i> = 1801)		Laparoscopic hysterectomy (<i>n</i> = 2434)	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Ureter injury						
≤ 30 operations	–	–	–	–	20	2.2
>30 operations	9	0.2	–	–	7	0.5****
Bladder injury						
≤ 30 operations	–	–	–	–	18	2.0
>30 operations	28	0.5	4	0.4	12	0.8*
Bowel injury						
≤ 30 operations	–	–	5	1.3	4	0.4
>30 operations	12	0.2	4	0.3*	5	0.3

* $P = 0.05$; **** $P < 0.0001$.

of the vaginal approach. However, most of the urinary tract lesions occurred in the laparoscopic hysterectomy group, with an incidence similar to that reported in the literature (Meikle *et al.*, 1997). Although the rate of urinary tract injuries was highest in the laparoscopic hysterectomy group, it was noticed that the rate of bladder (1.3%) and ureter injuries (1.1%) had declined since a previous Finnish 2 year study on laparoscopic hysterectomies in 1993–1994 (1.5 and 1.4% respectively) (Harkki-Siren *et al.*, 1997). It was also noticed that the surgeon's increased experience had an effect in decreasing the rate of severe urinary tract complications in laparoscopic hysterectomy and bowel complications in vaginal hysterectomy (Table IV).

Choosing the type of hysterectomy for the patient should be individual, accepted by the patient and performed by a skilled surgeon with adequate equipment. In this regard, the current study is not definitive for selecting the approach for hysterectomy. This selection should be based on evidence evaluated by randomized controlled trials or even by meta-analyses of a number of such trials. The recent randomized controlled trials available in this regard compare laparoscopic hysterectomy and abdominal hysterectomy (Nezhat *et al.*, 1992; Phipps *et al.*, 1993; Raju and Auld, 1994; Marana *et al.*, 1999) or vaginal hysterectomy with laparoscopically assisted procedures (Summitt *et al.*, 1992; Richardson *et al.*, 1995). Furthermore, most of these studies were conducted by skilled surgeons and selected institutions in rather small series and during the learning curve of this new operative technique. Hence, these results may be biased by the lack of same surgical competence in laparoscopic hysterectomy as in abdominal hysterectomy and vaginal hysterectomy (Garry, 1998). Consequently, at the moment the present study can be more powerful than a summation of results of a large number of small selective trials together from Medline (Meikle *et al.*, 1997) or literature review (Harris and Daniell, 1996). It states morbidity figures for each operative approach of hysterectomy before new results of randomized controlled trials are available to complement, agree or disagree with the present data.

The complications of hysterectomy are not only influenced by the operator or the operative approach itself or the indication

for surgery, but also by the number and type of possible concomitant procedures. In this regard the comparison of the outcome between the three hysterectomy groups showed a significantly higher rate of infectious morbidity in vaginal hysterectomy and laparoscopic hysterectomy (compared with abdominal hysterectomy) and the highest rate of organ injuries in abdominal hysterectomy when other operations were performed concomitantly. Surprisingly, the total rate of haemorrhagic events in the laparoscopic hysterectomy group decreased with concomitant procedures, which might be because they were performed by experienced surgeons.

In summary, the present observational study on a large series of hysterectomies gives novel information of morbidity in relation to the type of operative approach. This helps doctors to give advice about the expected rate of complications to their patients before planned surgery.

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