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## 5,926 hysterectomies: complications described by Clavien–Dindo classification

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### ABSTRACT

Hysterectomy is the most common major gynaecological surgery. Due to its high volume, the analysis of its results is relevant. The objective of this study was to describe intraoperative complications and reoperations, for both benign and malignant causes, using the Clavien–Dindo classification (approved by local ethics committee, number 100220). Between 2000 and 2019, 5926 elective hysterectomies were performed, of which 90.2% were for benign aetiology and 9.8% for malignant causes. The abdominal route was 52.7%, vaginal 40.1% and laparoscopic 7.2%. Intraoperative complications and reoperations (grade III Clavien–Dindo) were 4% and 2.1%, respectively. Oncological surgery had significantly more intraoperative complications (10% vs. 3.4%) and reoperations (3.6% vs. 1.9%) than benign procedures. Noteworthy, intraoperative complications required a new operation in only 3.4% for malignant and 2.8% for benign surgery. Our data showed the relevance of detecting and rectifying intraoperative complications during surgery, which consequently leads to a lower reoperation rate, minimising postoperative morbidity and mortality for patients.

### IMPACT STATEMENT

- **What is already known on this subject?** The surgical complications of hysterectomy, both intraoperative and postoperative, are extensively described. However, this information is not well systematised, in which elective and emergency surgery are mixed. In addition to the above, there are few documents comparing the results of hysterectomies due to benign versus malignant causes.
- **What the results of this study add?** Using the Clavien–Dindo classification, this study adds an organised description of intraoperative complications and reoperations of hysterectomy in the context of elective surgery. In addition, it provides information on the comparison between surgery for benign versus malignant causes, as well as information on intraoperative complications requiring a new operation.
- **What the implications are of these findings for clinical practice and/or further research?** These findings provide clear and orderly data about the risks of elective hysterectomy and showed the relevance of detecting and rectifying intraoperative complications during the procedure. This is useful for specialists to preoperatively identify the risks for each hysterectomy group and provide their patients with more detailed information during informed consent.

### KEYWORDS

Hysterectomy; complication; reoperation; Clavien–Dindo classification

## Introduction

Hysterectomies are the most common major gynaecological surgery carried out in developed countries after Caesarean sections (Lepine et al. 1997; Merrill 2008; Wright et al. 2013; Aarts et al. 2015). Benign aetiology accounts for 90% of all hysterectomies and only a 10% are done for malignant conditions (Aarts et al. 2015). In relation for this high surgical volume procedure, it is essential to know the perioperative complication risks. Systematic reviews have shown that minimal invasive surgery, both vaginal and laparoscopic hysterectomy, are associated with less complications and better

outcomes than abdominal route (Garry et al. 2004; Aarts et al. 2015; Sandberg et al. 2017).

Complications are difficult to classify, which impairs the comparison between centres (Dindo et al. 2004). In 2004, Clavien and Dindo validated a classification for surgical postoperative complications in five grades, based on the treatment intervention. This approach, used by different surgical specialties, permits to identify all the events that could affect the morbi-mortality of the patients and organised them for international comparisons. Grade III or more, are severe complications that corresponds to a reintervention in surgical room, use of intensive care unit or death (Dindo et al. 2004).

It is described for benign hysterectomy that perioperative complications varies from 2.8% to 8.4% (Maresh et al. 2002; Garry et al. 2004; Spilsbury et al. 2008; Mäkinen et al. 2013; Sandberg et al. 2017; Suisted and Chittenden 2017; Vandendriessche et al. 2017; Shim et al. 2019), and for oncological aetiology hysterectomies goes from 3 to 23% (Renaud et al. 2000; Covens et al. 2001; Steed et al. 2004; Chong et al. 2009; Malzoni et al. 2009; Bogani et al. 2014).

The aim of this study is to describe intraoperative complications and reinterventions using the Clavien–Dindo classification, for elective hysterectomies in benign and malignant pathology, over a period of 20 years in a public tertiary hospital.

## Materials and methods

This is a descriptive retrospective study carried out at the Obstetrics and Gynaecology Department of Hospital Padre Hurtado, Santiago, Chile. Data were compiled from the digital registry of gynaecological surgeries and hospital management from January 1 2000 to December 31 2019. All elective hysterectomies were included. Population description comprehended age, pre-operative diagnosis and surgical category (grouped as elective hysterectomy for benign or malignant aetiology). Hospitalisation days, surgical time, reoperations and intraoperative complications were analysed. The latter were defined as bladder, ureteral and/or intestinal injury and haemorrhage (more than 1000 ml of blood loss, the need for intra operative transfusion or large blood vessel injury). For the statistical analysis, each intraoperative complication event was considered separately. Therefore, each surgery could have more than one complication. Reoperations were defined as surgical procedures made in the postoperative time in the context of a complication of the primary surgery (grade III Clavien–Dindo classification) (Dindo et al. 2004), and were included in the database when they occurred during the first 30 days of the postoperative period. Reinterventions associated with other surgeries, such as cholecystectomy, appendectomy and urogynaecology procedures were excluded.

Nonparametric, central tendency measurements and average dispersion were used for population description. The frequencies obtained are presented as absolute values and percentages. Chi square test was conducted for univariate comparisons for dichotomist data. The Kruskal–Wallis ANOVA *H* test was conducted for comparisons between groups without normal distribution. Bonferroni's correction of multiple pairs comparisons for post hoc analysis was used. A *p* value < .05 was used to judge the statistical significance, using two tails for all tests. The data were analysed using SPSS v22.0 (IBM Corp, Armonk, NY) and Microsoft Excel 365 (Redmond, WA). No data were lost because the informatics system does not allow a patient being discharged if any parameter is missing. The study's protocol was presented and approved by the Ethics Committee of the Metropolitan Southeast Health Service and by the Padre Hurtado Hospital's management (February 10 2020, code 10022020). Due to the retrospective nature of the study, no informed consent was required. All data were anonymised.

## Results

A total of 41,318 gynaecological procedures were carried out during study period, of which 5926 were elective hysterectomies (14.3%). Hysterectomy for benign aetiology was 5343 (90.2%) and for malignancy 583 (9.8%). The median age of the patients was 48 (range 23–89 years), with no age differences comparing both groups.

### Surgical indications (Table 1)

In hysterectomy for benign cause, the main aetiologies were symptomatic leiomyoma (50.7%), genital prolapse (27.1%) and endometrial hyperplasia (5.5%). For malignant aetiology were ovarian (34.1%), endometrial (32.1%) and cervical cancer (28.3%).

### Surgical approach (Table 1)

In the 5926 elective hysterectomies analysed, 3122 were performed by abdominal approach (52.7%), 2377 vaginal (40.1%) and 249 laparoscopic (7.2%). There was a progressive and sustained increase in the percentage of vaginal hysterectomies during the 20-years period (from 28% in the first 3 years of observation to 42% the last 3 years) (*p* < .001).

In 2013, after the creation of a minimally invasive surgery unit, a significant increase in laparoscopic hysterectomy was observed, from 2.8% between 2000 and 2012 to 20.6% between 2013 and 2019 (*p* < .001).

### Operative time

Median surgical time of both groups was 80 minutes (range: 25–520 minutes). Hysterectomies for benign aetiology had a median of 86 minutes (range 25–520 minutes), significantly less than in those for malignant cause which had a median of 152 minutes (range 40–460 minutes) (*p* < .001). Analysing both groups (benign and malignant aetiology), abdominal surgery had a median operative time of 90 minutes (range 30–460), 65 minutes (range 25–520) for vaginal surgery and 125 minutes (range 40–380) for laparoscopic surgery. Vaginal surgery had significant less operative time than abdominal and laparoscopic hysterectomies (*p* < .001), and abdominal had less operative time than laparoscopic (*p* < .001).

### Hospital stay

Counting both groups, we found a median of three days of hospitalisation. Hysterectomy due to malignant aetiology had a significantly longer hospital stay (median four days (range 1–33 days)) than benign surgery (median of three days (range: 1–35 days)) (*p* < .001). Abdominal hysterectomy had a median of three postoperative days (range: 1–35 days), significantly more than vaginal (median two days (range: 1–33 days)) and laparoscopic (median two days (range: 1–22 days)) (*p* < .001). No differences were found between the vaginal and laparoscopic routes.

**Table 1.** Description of surgical approaches and their indications<sup>a</sup>.

Indication	Abdominal (%)	Vaginal (%)	Laparoscopic (%)	Total (%)
<b>Elective hysterectomies for benign aetiology</b>				
Myoma	1826 (34.2)	715 (13.4)	167 (3.1)	2708 (50.7)
Prolapse	157 (2.9)	1227 (23)	65 (1.2)	1449 (27.1)
Endometrial hyperplasia	98 (1.8)	141 (2.6)	54 (1)	293 (5.5)
Adnexal tumour	183 (3.4)	0	12 (0.2)	195 (3.6)
Cervical intraepithelial neoplasia	96 (1.8)	78 (1.5)	11 (0.2)	185 (3.5)
Endometriosis	136 (2.5)	2 (0.03)	18 (0.3)	156 (2.9)
Adenomyosis	54 (1)	60 (1.1)	16 (0.3)	130 (2.4)
Pelvic pain	67 (1.3)	31 (0.6)	10 (0.2)	108 (2)
Abnormal uterine bleeding	47 (0.9)	53 (1)	5 (0.1)	105 (2)
Endometrial polyp	0	8 (0.1)	4 (0.1)	12 (0.2)
Vesicouterine fistula	1 (0.02)	0	0	1 (0.02)
Arteriovenous malformation	0	0	1 (0.02)	1 (0.02)
<b>Total (%)</b>	<b>2665 (49.9)</b>	<b>2315 (43.3)</b>	<b>363 (6.8)</b>	<b>5343 (100)</b>
<b>Elective hysterectomies for malignant aetiology</b>				
Ovarian cancer	187 (32.1)	0	12 (2)	199 (34.1)
Endometrial cancer	127 (21.8)	24 (4.1)	36 (6.2)	187 (32.1)
Cervical cancer	114 (19.6)	35 (6)	16 (2.7)	165 (28.3)
Sarcoma	24 (4.1)	3 (0.5)	0	27 (4.6)
Gestational trophoblastic disease	5 (0.9)	0	0	5 (0.9)
<b>Total (%)</b>	<b>457 (78.4)</b>	<b>62 (10.6)</b>	<b>64 (11)</b>	<b>583 (100)</b>

<sup>a</sup>All the percentages are in relation to the total of the hysterectomy group (benign or malignant aetiology).

### Intraoperative complications (Table 2)

Of the 5926 hysterectomies, a total of 238 intraoperative complications were observed (4%). Vaginal route (2.2%) had significantly less complications than abdominal (5.3%) and laparoscopic approaches (4.9%) ( $p < .001$ ). No significant differences were found between the last two.

Surgery for benign aetiology had 3.4% of intraoperative complications, being haemorrhage 1.7%, bladder injury 1.1%, intestinal injury 0.4% and ureteral injury 0.1%. Surgery for malignant conditions had 10% intraoperative complication rate, being haemorrhage 6%, intestinal injury 2.4%, bladder injury 1.4% and ureteral injury 0.2%.

Hysterectomies due to malignant aetiology had significantly more complications than those for benign causes ( $p < .001$ , OR: 3.125 (95% CI: 2.27–4.3)).

### Reoperations (Table 3)

Of the 5926 hysterectomies, a total of 124 reoperations were observed (2.1%). Abdominal surgery had 2.9% reoperations, significantly more than vaginal (1.2%) and laparoscopic approach (1.4%) ( $p < .001$ ). No differences were observed between the last two.

In hysterectomy due to a benign aetiology, reoperations were 1.9%. The main causes were wound infection (0.7%), pelvic infection (0.4%) and hemoperitoneum (0.3%). The abdominal approach had a reoperation of 2.7%, vaginal 1.2% and laparoscopic 1.1%. Of the 3.4% who had an intraoperative complication in this group, five patients (2.8%) were reoperated.

In procedures for malignant aetiology, reoperations were 3.6%, with wound infection (1.7%), hemoperitoneum (0.5%) and pelvic infection (0.3%) as the main causes. Abdominal reoperated in 3.9%, vaginal 1.6% and laparoscopic 3.1%. Of the 10% hysterectomies who had an intraoperative complication in this group, two patients (3.4%) were reoperated.

**Table 2.** Description of intraoperative complications and their approaches.

Complication	Abdominal (%) <sup>a</sup>	Vaginal (%) <sup>a</sup>	Laparoscopic (%) <sup>a</sup>	Total (%) <sup>b</sup>
	N = 2665	N = 2315	N = 363	N = 5343
<b>Elective hysterectomies for benign aetiology</b>				
Bleeding	64 (2.4)	20 (0.9)	9 (2.5)	93 (1.7)
Bladder injury	27 (1)	23 (1)	8 (2.2)	58 (1.1)
Intestinal injury	14 (0.5)	6 (0.3)	2 (0.5)	22 (0.4)
Ureteral injury	5 (0.2)	2 (0.1)	0	7 (0.1)
<b>Total</b>	<b>110 (4.1)</b>	<b>51 (2.2)</b>	<b>19 (5.2)</b>	<b>180 (3.4)</b>
<b>Elective hysterectomies for malignant aetiology</b>				
Bleeding	33 (7.2)	0	2 (3.1)	35 (6)
Intestinal injury	14 (3)	0	0	14 (2.4)
Bladder injury	7 (1.5)	1 (1.6)	0	8 (1.4)
Ureteral injury	1 (0.2)	0	0	1 (0.2)
<b>Total</b>	<b>55 (12)</b>	<b>1 (1.6)</b>	<b>2 (3.1)</b>	<b>58 (10)</b>

<sup>a</sup>Percentages are in relation to the total of the surgical route of each hysterectomy group.

<sup>b</sup>Percentages are in relation to the total of each hysterectomy group (benign or malignant aetiology).

Malignant hysterectomies had significantly more reoperations than those for benign indications ( $p < .001$ , OR: 2.123 (95% CI: 1.26–3.57)). The vaginal approach had the lowest reoperation rate, compared to the abdominal and laparoscopic routes ( $p < .001$ ), and no significant differences were observed between the last two.

The main causes of reoperation were infectious complications (wound and pelvic infection). Minimal invasive surgery (vaginal and laparoscopic) had significantly fewer reoperations for infectious complications than abdominal route (0.4% vs. 1.9%) ( $p < .001$ , OR = 3.9 (95% CI: 1.71–8.92)).

### Discussion

In United States, approximately 600,000 hysterectomies are performed per year. About one-third of the female population has undergone a hysterectomy at the age of 60, with an annual cost of 5 billion dollars (Lepine et al. 1997; Merrill 2008; Wright et al. 2013; Aarts et al. 2015). Due to the high

**Table 3.** Description of reoperation indications and their surgical approach.

Indication	Abdominal (%) <sup>a</sup> N = 2665	Vaginal (%) <sup>a</sup> N = 2315	Laparoscopic (%) <sup>a</sup> N = 363	Total (%) <sup>b</sup> N = 5343
Elective hysterectomies for benign aetiology				
Wound infection	36 (1.4)	0	1 (0.3)	37 (0.7)
Pelvic infection	11 (0.4)	10 (0.4)	0	21 (0.4)
Hemoperitoneum	6 (0.2)	12 (0.5)	1 (0.3)	19 (0.3)
Evisceration	6 (0.2)	1 (0.04)	2 (0.6)	9 (0.2)
Ureteral injury	3 (0.1)	3 (0.1)	0	6 (0.1)
Intestinal injury	4 (0.2)	0	0	4 (0.07)
Bladder injury	1 (0.04)	2 (0.1)	0	3 (0.06)
Wound haematoma	2 (0.1)	0	0	2 (0.04)
Intraabdominal compress	1 (0.04)	0	0	1 (0.02)
Intestinal obstruction	1 (0.04)	0	0	1 (0.02)
Total	71 (2.7)	28 (1.2)	4 (1.1)	103 (1.9)
Indication	Abdominal (%) <sup>a</sup> N = 457	Vaginal (%) <sup>a</sup> N = 62	Laparoscopic (%) <sup>a</sup> N = 64	Total (%) <sup>b</sup> N = 583
Elective hysterectomies for malignant aetiology				
Wound infection	10 (2.2)	0	0	10 (1.7)
Hemoperitoneum	2 (0.4)	0	1 (1.6)	3 (0.5)
Pelvic infection	1 (0.2)	1 (1.6)	0	2 (0.3)
Evisceration	2 (0.4)	0	0	2 (0.3)
Intestinal injury	1 (0.2)	0	1 (1.6)	2 (0.3)
Ureteral injury	1 (0.2)	0	0	1 (0.2)
Intestinal obstruction	1 (0.2)	0	0	1 (0.2)
Total	18 (3.9)	1 (1.6)	2 (3.1)	21 (3.6)

<sup>a</sup>Percentages are in relation to the total of the surgical route of each hysterectomy group.

<sup>b</sup>Percentages are in relation to the total of each hysterectomy group (benign or malignant aetiology).

surgical volume of this intervention, it is relevant to analyse the complications in a systematic way. The use of validated classifications to define postoperative complications (Dindo et al. 2004), facilitates the data comparison between studies.

Between 2013 and 2019, the establishment in our hospital of a minimally invasive surgical unit generated a significant increase in laparoscopic hysterectomies, from 2.8% (between 2000 and 2012) to 20.6% (between 2013 and 2019). During this period, both vaginal and laparoscopic route made up to 61.2% of hysterectomies. There are multiple reports that show the importance of minimal invasive surgery due to less morbidity, faster recuperation and less risk of infection (Maresh et al. 2002; Garry et al. 2004; Spilsbury et al. 2008; Aarts et al. 2015; Sandberg et al. 2017). In our study, we reaffirm these observations, and especially found that the vaginal and laparoscopic routes compared with abdominal approach, presented significantly fewer postoperative infectious complications, which were the main causes of reoperation. This is concordant with a worldwide intention to increase minimally invasive surgery (AAGL Advancing Minimally Invasive Gynecology Worldwide 2011; Committee on Gynecologic Practice 2017).

Regarding the group of hysterectomy, our data showed that malignant hysterectomies had significantly more intraoperative complications than benign ones (10% vs. 3.4%, respectively), and more reinterventions (3.6% vs. 1.9%). These results are similar to other studies and are probably due to the greater technical complexity involved in oncological surgery, in addition to a worse baseline condition of the patients (advanced age, comorbidities, previous chemotherapy, radiation therapy or malnutrition) (Renaud et al. 2000; Covens et al. 2001; Steed et al. 2004; Chong et al. 2009; Malzoni et al. 2009; Bogani et al. 2014).

As a noteworthy point, in this study, a total of 238 intraoperative complications were observed, of which only 2.9% had to be reoperated. In benign aetiology, 2.8% of the 180 complications were reoperated and in surgery for oncological pathology, only 3.4% of the 58 intraoperative complications had a reintervention.

Our findings reaffirm the importance of minimally invasive surgery in terms of surgical complications, reoperations, operating time and hospitalisation. In addition, we found that hysterectomies performed for malignant aetiology had a significantly higher rate of intraoperative complications and reoperations than benign surgery. Limitations of this study include the retrospective design and the descriptive data. The main strengths are the systematisation of the intraoperative complications and reinterventions (by Clavien–Dindo classification), carried out in a large series of patients.

## Conclusions

Our data showed the relevance of detecting and rectifying intraoperative complications, which consequently causes a lower reoperation rate, minimising postoperative morbidity and mortality for patients. This information is useful for specialists to preoperatively identify risks for each hysterectomy group and provide their patients with more information during informed consent.

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## Disclosure statement

The authors report no conflict of interest.

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