

## Full length article

## A Swedish population-based evaluation of benign hysterectomy, comparing minimally invasive and abdominal surgery



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## ABSTRACT

**Objective:** The aim was to evaluate surgical routes for benign hysterectomy in a Swedish population, including abdominal and minimally invasive surgery.

**Study design:** Prospectively collected data from the Swedish National GynOp Registry 2009–2015: 13 806 hysterectomy cases were included: abdominal (AH, n = 7485), vaginal (VH, n = 3767), conventional laparoscopic (LH, n = 1539) and robotically-assisted (RAH, n = 1015).

**Results:** The VH group had the shortest operation time at 75 min, AH 97 min and RAH 104 min. LH was longest at 127 min ( $p < 0.005$ ). The mean estimated blood loss was higher in the AH group (250 ml) compared to all minimally invasive surgery (MIS, 65–172 ml);  $p < 0.005$ .

Conversion rates were 10% for LH, 4.8% for VH and 1.6% for RAH ( $p < 0.005$ ). Hospitalization and patient-reported time to normal activities of daily living (ADL) were longer for AH compared to MIS ( $p < 0.005$ ). Time to return to work was eight days longer in the AH group (35 days) compared with the MIS groups ( $p < 0.005$ ).

Complications were fewest in the VH group at 5.4% compared with AH 7.6% and RAH 8.7% (both  $p < 0.001$ ), but did not significantly differ from the LH group at 6.6%. Overall patient satisfaction was reported to be 86–94% one year after surgery.

**Conclusion:** Women operated on for benign hysterectomy with minimally invasive methods in Sweden 2009–2015 had reduced length of hospitalization, as well as time to resuming normal ADL and return to work, compared to AH. Postoperative outcome measures were improved by minimally invasive methods and MIS should preferably be used.

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## Introduction

Hysterectomy remains the most common major gynecological operation performed worldwide. The Swedish National Quality Registry for Gynecological Surgery “GynOp” records the majority of hysterectomies performed in Sweden, which number approximately 4000 annually [1]. Since 2008, it has also included robotically-assisted laparoscopies (RAL). The rate of 167 hysterectomies per 100 000 women in Sweden 2015 [2] is traditionally low, compared to other European countries (i.e. Estonia 205/100 000

[3], Germany 295/100 000 [4], Italy 370/100 000 [5] and the US 510/100 000 [6]).

Minimally invasive surgery (MIS) benefits patients as it results in reduced blood loss, fewer scar-related complications, and a shorter duration of sick leave, admission stays, and the period until resumption of days to normal activities of daily living (ADL) [7–10]. A Cochrane systematic review from 2006 and 2015 [11] recommends MIS as the first option before abdominal hysterectomy (AH), when the weight of the uterus is less than 300 g [12].

In gyn-oncological surgery, mostly for localized endometrial cancer, there is evidence showing smaller amounts of blood loss and less serious complications compared to AH [13,14], suggesting robotically-assisted hysterectomy (RAH) to be a superior method for these patients. Recently published GynOp-based studies on cervical and endometrial cancer show not only a difference in blood loss but also a faster return to normal ADL [15,16].

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There are a number of publications on RAH in benign gynecological surgery, mostly comparing AH to laparoscopic hysterectomy (LH) [17,18]. In practice, RAH seems not only to be replacing conventional laparoscopic techniques but is used for more difficult cases that previously had to be targeted with the open technique, laparotomy [8,19]. Some studies report a decline in vaginal hysterectomies (VH) since the introduction of RAH [20,21].

The aim of this population-based study was to evaluate and compare benign hysterectomies performed by laparotomy, vaginal, conventional or robotically-assisted approach in terms of per- and postoperative outcomes, complications and patients' satisfaction one year after surgery.

## Material and methods

Data were extracted from the GynOp registry, which covers 75% of all gynecological operations in Sweden [1]. The registry contains information from both the patient and the gynecological surgeon. A validated questionnaire inquiring about the actual health status, symptoms related to the planned operation and previous health care experience, was sent to the patient prior to surgery. At registration for surgery, the preoperative status was noted, including the *estimated size of the uterus*, evaluated clinically by palpation and sonography. The size was assessed as small or normal, or for enlarged uteri, was described compared to pregnancy weeks.

Analyzed results reported by the surgeon included operation time, estimated blood loss, peroperative complications, conversion rate, the length of hospitalization and planned return to work. Per- and postoperative complications, return to normal ADL, actual return to work, occurrence of readmission and/or return visit and overall satisfaction were registered through validated patient-reported questionnaires both after eight weeks and one year after surgery.

After registration, these data were acknowledged and verified by the surgeon, including the severity/grade of the patient-reported complications. In the GynOp registry, major complications were defined as injury to the bowel, urinary tract, nerves, or vessels that caused reoperation or hospitalization for more than seven days or persistent physical handicap or death, bleeding of more than 3000 ml or leading to reoperation, infection that led to readmission, deep vein thrombosis or pulmonary embolism, and any other major complication (i.e. aspiration, allergic shock, myocardial infarct, or cerebral complication). Minor complications were defined as variations not meeting the criteria above. Since 2015, complications have been graded according to the Clavien-Dindo- system, but this grading system was not available for our data.

Variables were defined to have a range, and all cases outside the pre-defined range were considered as outliers. Ranges were defined as follows: operation time 30 to 300 min, Body Mass Index (BMI) 15 to 75 kg/m<sup>2</sup>, length of hospitalization 0 to 10 days, time to normal ADL 0 to 30 days and return to work 0 to 365 days. Actual return to work was only analyzed for patients aged 65 years or younger. Women with uterus size compared to or larger than the 16th pregnancy week were excluded, as they were represented mostly in the AH group and would have biased the outcome.

20881 cases of hysterectomies performed for benign disorders between January 2009 and December 2015 were initially identified. The main indication for surgery included abnormal uterine bleeding, myoma, ovarian cyst, pain (including dysmenorrhea, adenomyosis, endometriosis, etc.), and others. Exclusion criteria consisted of malignancy or suspected malignant disease, vaginal prolapse, urinary incontinence surgery, myomectomy or subtotal hysterectomy, and resulted in the exclusion of 7075 cases.

The hysterectomy route was defined by primary incision. Consecutively, conventional laparoscopy includes both laparoscopically-assisted vaginal hysterectomy (LAVH) and total laparoscopic hysterectomy (TLH). Out of 46 reporting hospitals included in our material, 13 reported RAH (three hospitals in 2009, five in 2010 and 2011, six in 2012, 11 in 2013 and 13 hospitals in 2014 and 2015). They included both public as well as privately owned hospitals, on a wide range from university hospitals to smaller regional ones.

We conducted a multiple linear regression analysis to identify independent variables affecting the outcome. Included variables were dichotomized – as uterus size smaller or corresponding to the eighth week of pregnancy, and another group with uterus size enlarged to a size corresponding to more than eight weeks of pregnancy.

In a subgroup analysis of material from the most current years 2013–2015, we defined two groups of surgeons, one group registering 10 or more hysterectomies per year, compared to those with less than 10 procedures/year as a their surgical volume.

## Statistical analysis

Categorical data were analyzed by Pearson's chi-square or Fisher's exact test. Continuous variables were analyzed using a Student's *t*-test or ANOVA. A *p*-value < 0.05 was considered to be statistically significant. Bonferroni post-hoc analysis was applied. Multiple linear and logistic regression analyses were used for evaluating variables affecting per- and postoperative outcome. A stepwise approach was employed in order to exclude, one-by-one, the variables demonstrated to be non-significant in multiple testing with removal at *p* > 0.1. The extracted data was analyzed by SPSS 22.0.0 and SPSS 23.0.0 (IBM Corp., Armonk, NY, USA).

The study was approved by the Ethical board of the University of Umeå, Sweden, no. 2013-236-32 M (additive to 08-120 M).

## Results

Of 13 806 women included, 7485 (54.2%) had an AH, 3767 (27.3%) a VH, 1539 (11.1%) a conventional laparoscopic approach and 1015 women (7.4%) a RAH. There was a clear increasing trend in the number of hysterectomies performed by MIS from 2009 to 2015 (Fig. 1). The indication for surgery was distributed to the groups according to Table 1.

Patients' characteristics are presented in Table 2. Women in the AH group were older and their preoperatively estimated uterus

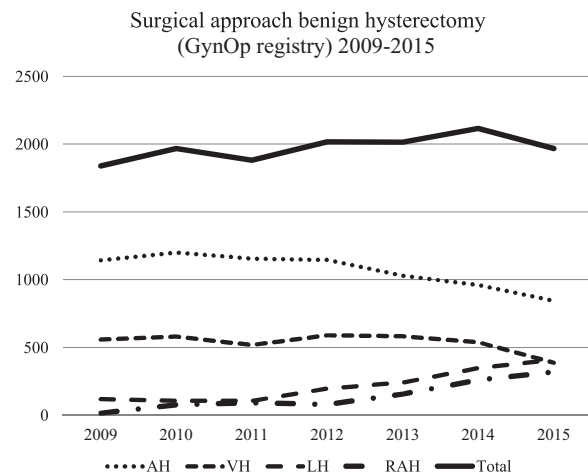


Fig. 1. There was a trend towards an increase in the number of minimally invasive hysterectomies from 2009 to 2015.

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