

**Diplomarbeit**

**Implementation and Feasibility of  
Prophylactic Bilateral Salpingectomy at Benign,  
Minimally Invasive (Vaginal and Laparoscopic)  
Hysterectomy in Styria: A Retrospective Study**

eingereicht von

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**Univ.-Prof. Dr. Karl Tamussino**

Graz, am 15.12.2020

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## Preface

An der Gynäkologie habe ich schon früh in meinem humanmedizinischen Studium Gefallen gefunden. Im Zuge des Pflichtmoduls „Frauenheilkunde und frühe Lebensphase“ besuchte ich eine Vorlesung von Prof. Tamussino mit dem Thema „Ovarialkarzinom“. Das Thema machte mich im ersten Moment bestürzt, da aufgrund der späten Diagnose – meist im fortgeschrittenen Tumorstadium – das Ovarialkarzinom eine hohe Mortalität aufweist. Gleichzeitig hat das Thema mein Interesse geweckt und ich beschloss in diesem Fach meine Diplomarbeit zu schreiben. Nach einem kurzen Gespräch mit Prof. Tamussino haben wir uns auf ein Thema geeinigt „Prophylaktische bilaterale Salpingektomie bei der benignen, minimal invasiven Hysterektomie“.

Nach kurzer Recherche und Sammlung geeigneter Literatur im PubMed® wurde mit der retrospektiven Datenerhebung begonnen. Der praktische Teil der Diplomarbeit wurde in Zusammenarbeit mit Kolleginnen und Kollegen der Landeskrankenhäuser der Steiermark und dem Krankenhaus der BHB Graz ausgearbeitet. Das Schreiben der Arbeit selbst fiel mir leicht und in nur kurzer Zeit konnte ich dank der Unterstützung von Prof. Tamussino meine Diplomarbeit fertigstellen.

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# Table of contents

Preface .....	3
Acknowledgements .....	4
Table of contents .....	5
Abbreviations .....	7
List of figures .....	8
List of tables .....	9
Zusammenfassung .....	10
Abstract.....	11
1 Introduction .....	13
1.1 Ovarian cancer .....	13
1.1.1 Classification of epithelial ovarian cancer.....	13
1.1.2 Serous ovarian carcinoma.....	14
1.1.3 Screening .....	16
1.1.4 Risk factors .....	16
1.1.5 Prevention.....	16
1.2 Prophylactic bilateral salpingectomy (PBS).....	17
1.2.1 Fallopian tubes.....	17
1.2.2 Feasibility of prophylactic bilateral salpingectomy (PBS).....	18
1.2.3 Recommendation of prophylactic bilateral salpingectomy .....	19
2 Material and methods .....	20
2.1 Objectives .....	20
2.2 Database.....	20
2.3 Statistical analyses .....	21
2.4 Ethical approval .....	22
3 Results .....	23
3.1 Procedural uptake .....	23
3.1.1 Implementation of PBS .....	23
3.1.2 Consent forms.....	23
3.1.3 Surgical approach .....	24
3.1.4 Feasibility of PBS.....	24
3.1.5 Failure of PBS .....	26
3.2 Operative and perioperative measures .....	29

3.2.1	Age, BMI, parity.....	29
3.2.2	Mode of delivery .....	30
3.2.3	Surgical indications .....	31
3.2.4	Surgical experience.....	32
3.2.5	Length of hospital stay and perioperative complications .....	32
4	Discussion.....	35
4.1	Procedural uptake .....	35
4.1.1	Rate of benign hysterectomy .....	35
4.1.2	Uptake of PBS .....	35
4.1.3	Consent forms.....	36
4.1.4	Surgical approach .....	36
4.1.5	Feasibility of PBS.....	36
4.1.6	Failure of PBS .....	37
4.2	Operative and perioperative measures .....	38
4.2.1	Age .....	38
4.2.2	BMI.....	38
4.2.3	Parity.....	38
4.2.4	Mode of delivery .....	38
4.2.5	Surgical indication.....	38
4.2.6	Surgical experience.....	39
4.3	Consequences of PBS .....	39
4.3.1	Length of hospital stay .....	39
4.3.2	Perioperative complications .....	39
4.4	Limitations .....	39
4.5	Strengths .....	40
4.6	Further investigations .....	40
5	References .....	41
	Attachment – Schedule.....	46
	Attachment – Case Report Form .....	47
	Attachment - Excel-sheet.....	48

## Abbreviations

AGO	Arbeitsgemeinschaft für gynäkologische Onkologie
BMI	Body-Mass-Index
BRCA	Breast cancer gene
BSO	Bilateral salpingo-oophorectomy
EOC	Epithelial Ovarian Carcinoma
GTI	Genitourinary tract infection
HBOC	Hereditary breast-ovarian cancer syndrome
HE	Hysterectomy
HGSOC	High-grade squamous ovarian carcinoma
HNPCC	Hereditary non-polyposis colorectal cancer
ICD	International classification of diseases
LAVH	Laparoscopically assisted vaginal hysterectomy
LGSOC	Low-grade squamous ovarian carcinoma
LKF	Leistungsorientierte Krankenanstaltenfinanzierung
LKH	Landeskrankenhaus
LOS	Length of hospital stay
OEGGG	Österreichische Gesellschaft für Gynäkologie und Geburtshilfe
PBS	Prophylactic bilateral salpingectomy
POP	Pelvic organ prolapse
STIC	Serous tubal intraepithelial carcinoma
WHO	World health organization

## List of figures

Figure 1. Distribution of STIC to the ovarian epithelial surface <sup>3</sup> .....	15
Figure 2. Molecular pathway of HGSOc <sup>7</sup> .....	16
Figure 3. Overview of potential tubal pathologies in women with retained fallopian tubes <sup>6</sup> .....	19
Figure 4. Reasons for unsuccessful PBS in 2014 .....	26
Figure 5. Reasons for unsuccessful PBS in 2018 .....	26
Figure 6. Consort Diagram 2014 .....	27
Figure 7. Consort Diagram 2018 .....	27
Figure 8. Mode of delivery at benign hysterectomy with successful PBS .....	30
Figure 9. Mode of delivery at benign hysterectomy with unsuccessful PBS .....	30
Figure 10. Surgical indication for benign hysterectomy with successful PBS.....	31
Figure 11. Surgical indication for benign hysterectomy with unsuccessful PBS.....	31
Figure 12. Surgical experience at minimally invasive hysterectomy .....	32
Figure 13. Surgical complications at benign hysterectomy.....	33
Figure 14. Postoperative complications at benign hysterectomy .....	34



## List of tables

Table 1. Implementation of PBS in benign, minimally invasive hysterectomy .....	23
Table 2. Patients with and without consent to PBS in 2014 and 2018 .....	23
Table 3. Surgical approach for benign, minimally invasive hysterectomy .....	24
Table 4. Benign, minimally invasive hysterectomies with and without PBS in 2014 and 2018 .....	24
Table 5. Successfully accomplished PBS at vaginal and laparoscopic hysterectomy.....	25
Table 6. Vaginal hysterectomies with and without PBS .....	25
Table 7. Laparoscopic hysterectomies with and without PBS .....	25
Table 8. General data.....	29
Table 9. Length of hospital stay (LOS) .....	32
Table 10. Perioperative complications .....	33

# Zusammenfassung

## Fragestellung

Das seröse Ovarialkarzinom entsteht in den Fimbrien der Tube. Diese Vorläuferzellen werden als seröse tubare intraepitheliale Karzinome (STICs) bezeichnet. Zahlreiche Studien belegen, dass die prophylaktische Salpingektomie das Risiko für die Entstehung eines serösen Ovarialkarzinoms deutlich senkt. Daher empfahl die Österreichische Gesellschaft für Gynäkologie und Geburtshilfe (OEGGG) im Jahr 2015 die prophylaktische bilaterale Salpingektomie (PBS) bei Frauen im Zuge von geeigneten Operationen aus benigner Indikation durchzuführen.

## Methodik

Benigne Hysterektomien in der Steiermark aus dem Jahr 2014 und 2018 wurden retrospektiv ausgewertet. Wir vergleichen die Implementierung dieser Empfehlung 2014 vs. 2018 – vor und nach der offiziellen OEGGG-Empfehlung im Jahr 2015 – bei benignen, minimal invasiven Hysterektomien in öffentlichen Krankenhäusern der Steiermark. Weiters wird die Implementierungsrate der Salpingektomie bei der vaginalen mit jener der laparoskopischen Hysterektomie verglichen und Faktoren für eine erfolgreiche prophylaktische Salpingektomie erhoben.

## Ergebnisse

In öffentlichen Krankenhäusern der Steiermark wurden 580 minimal invasive Hysterektomien aus benigner Indikation im Jahr 2014 und 676 im Jahr 2018 durchgeführt. 68% aller Patientinnen mit benigner Hysterektomie wurden für die PBS im Jahr 2014 aufgeklärt. Im Jahr 2018 stieg die Aufklärungsrate auf 94%. Der Anteil an PBS stieg signifikant von 60% im Jahr 2014 auf 78% im Jahr 2018 (+18%). Die Rate an vaginalen vs. laparoskopischen Hysterektomien betrug 45% vs. 55% im Jahr 2014 und 56% vs. 44% im Jahr 2018. In erster Linie sind das Alter und die Parität wichtige Parameter für eine erfolgreiche Durchführung der PBS.

## Schlussfolgerung

Die PBS wurde bereits vor der offiziellen OEGGG-Empfehlung erfolgreich in den steirischen Landeskrankenhäusern durchgeführt und stieg anschließend weiter an. Bezüglich des operativen Zuganges konnte die vaginale Hysterektomie in den letzten Jahren einen deutlichen Zuwachs verbuchen.

# **Abstract**

## **Background**

It is now accepted that serous ovarian cancer originates in the fallopian tubes as so-called serous tubal intraepithelial carcinoma (STIC). Epidemiologic data indicate that salpingectomy reduces the risk of developing ovarian cancer. Accordingly, numerous societies, including the Austrian Society of Obstetrics and Gynecology (OEGGG) in 2015, have recommended prophylactic bilateral salpingectomy (PBS) in appropriate women at the time of benign gynecologic surgery. The aim of the recommendation was to lower the risk of developing serous ovarian cancer.

## **Objective**

The primary objective of the study is to evaluate the implementation of PBS at benign, minimally invasive hysterectomy in public hospitals in the Austrian province of Styria in 2014 vs. 2018 (before and after the official OEGGG recommendation in 2015). Secondary objectives include the comparison of vaginal vs. laparoscopic approach and determination of influencing factors associated with unsuccessful salpingectomy, e.g., age, BMI, parity, surgical experiences, perioperative complications, etc.

## **Methods**

This is a retrospective, multicenter study. We reviewed surgical consent forms and operative notes of benign, minimally invasive hysterectomies in Styria in 2014 and 2018. Ethics Committee approval was obtained.

## **Results**

A total of 1256 benign, minimally invasive hysterectomies were identified (580 in 2014, 676 in 2018). 68% of the patients consented to PBS in 2014 and 94% in 2018. The PBS-rate increased significantly from 60% to 78%. The proportion of vaginal hysterectomies increased from 45% in 2014 to 56% in 2018, whereas the proportion of laparoscopic hysterectomies decreased from 55% to 44%. Age and parity are the major influencing factors on the success of PBS.

## **Conclusions**

PBS at minimally invasive hysterectomy was widely performed in Styria even before the official recommendation in 2015, and increased thereafter. PBS was accomplished similarly in both laparoscopic and vaginal hysterectomy.

# 1 Introduction

Ovarian cancer is the leading cause of gynecologic cancer death and the fifth leading cause of overall cancer death in women in Austria. There are about 700 new cases and 520 deaths in Austria yearly. The five-year survival rate is about 44%. There is no reliable screening modality and nearly 50% of the patients continue to present with advanced disease. Prevention of ovarian cancer is an unmet need.<sup>1</sup>

## 1.1 Ovarian cancer

### 1.1.1 Classification of epithelial ovarian cancer

Epithelial ovarian carcinoma (EOC) is the most common ovarian cancer in developed countries, with 60% of all ovarian cancers.<sup>2</sup> The tumor has several histological subtypes, i.e., serous, mucinous, clear cell, and endometrioid ovarian carcinoma.<sup>3</sup> The origin and pathogenesis of EOC are determined by two variables, namely the cell of origin and the molecular pathway.<sup>4</sup>

#### 1.1.1.1 Origin of epithelial ovarian cancer

There are three possible mechanisms that could cause development of epithelial ovarian carcinoma via incorporation of Müllerian epithelium:

1. Tubal epithelial cells from the distal fallopian tube exfoliate and implant on the ovarian surface epithelium (endosalpingiosis).
2. The ovarian surface epithelium invaginates and incorporates into the cortex of the ovary forming cortical inclusions.
3. Endometrial cells implant on the surface epithelium of the ovary via retrograde menstruation (endometriosis).<sup>4</sup>

#### 1.1.1.2 Molecular pathogenesis of epithelial ovarian cancer

According to Kurman et al.<sup>3</sup> and Crum et al.<sup>4</sup>, there are two categories of ovarian carcinomas based on the clinicopathology and genetic features, Type I and Type II tumors.

##### 1.1.1.2.1 Type I pathway

Type I tumors (low-grade serous carcinomas, low-grade endometrioid, clear cell, and mucinous carcinomas) represent 25% of all ovarian carcinomas. The Type I pathway is a multi-step process. It is characterized by mutation in the PTEN-, BRAF-, KRAS- or beta-

catenin-genes.<sup>4</sup> These are non-aggressive carcinomas that are confined to the ovary at diagnosis. Type I tumors are mainly detected in stage Ia with a good prognosis and account for about 10% of ovarian cancer deaths.<sup>3</sup>

#### ***1.1.1.2.2 Type II pathway***

Type II tumors (high-grade serous carcinoma, undifferentiated carcinomas, and carcinosarcomas) appear as highly aggressive malignant carcinomas and constitute about 75% of all ovarian carcinomas. The Type II pathway involves a mutation in the p53 tumor suppressor gene (p53-signatures).<sup>4</sup> Type II tumors are usually detected in stage II-IV with expansion in the abdomen, causing 90% of all ovarian deaths.<sup>3</sup>

### **1.1.2 Serous ovarian carcinoma**

Serous ovarian cancer is the most lethal epithelial ovarian carcinoma.<sup>4</sup> Especially, this histological subtype shows characteristic features regarding its pathogenesis.<sup>3</sup> In the World Health Organization (WHO) classification, serous ovarian carcinoma is divided into low-grade and high-grade serous carcinoma. These tumors are two different cancer entities with separate molecular pathways.<sup>5</sup>

#### **1.1.2.1 Low-grade serous carcinoma (LGSC)**

Low-grade serous carcinoma (LGSC) is a Type I tumor that is characterized by mutation mostly in the BRAF- or KRAS-gene. It appears as a non-aggressive tumor and tightly sticks to the ovary. LGSC has its origin in the fallopian tube as papillary tubal hyperplasia. A transition from low-grade to high-grade serous carcinoma is rare.<sup>3,5</sup>

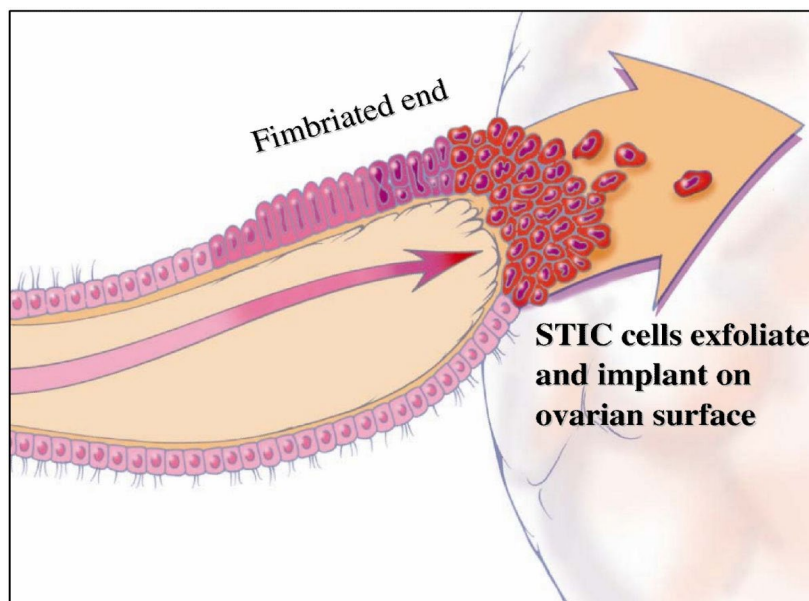
#### **1.1.2.2 High-grade serous carcinoma (HGSC)**

High-grade serous carcinoma (HGSC) is a highly aggressive tumor that shows a characteristic mutation in the p53-gene (p53-signatures). The HGSC is characterized by an abrupt transition to malignancy. It shows deep tissue invasion, early dissemination, and metastasis formation at the time of diagnosis. HGSC is responsible for sporadic (non-familial) serous carcinoma as well as for BRCA-associated ovarian serous carcinoma.<sup>3,4</sup>

#### **1.1.2.3 Serous tubal intraepithelial carcinoma (STIC)**

High-grade serous ovarian cancer differs from other histological subtypes of epithelial ovarian carcinomas through its specific carcinogenesis. The tumor emerges in the distal fallopian tube epithelium, primarily in the fimbria. Small lesions in the tubal epithelial cells

develop to serous tubal intraepithelial carcinoma (STIC), i.e., the precursor of pelvic serous carcinoma (serous cancer of the ovary, fallopian tube, or peritoneum).<sup>3</sup> Due to exfoliation, malignant cells are shed from the tubal epithelium into the tubal lumen. Via retrograde motion of the fallopian tubes, the STIC lesions spread into the abdominal cavity.<sup>6</sup> Ovulation and tubal-ovarian adhesions support the distribution process and lead to implantation on the ovarian surface epithelium (Fig. 1). With time the implanted precursor cells arise to HGSC.<sup>4</sup> At the molecular level, identical p53-signatures in STICs demonstrate a significant affiliation between HGSC and STICs.<sup>3</sup>



**Figure 1. Distribution of STIC to the ovarian epithelial surface<sup>3</sup>**

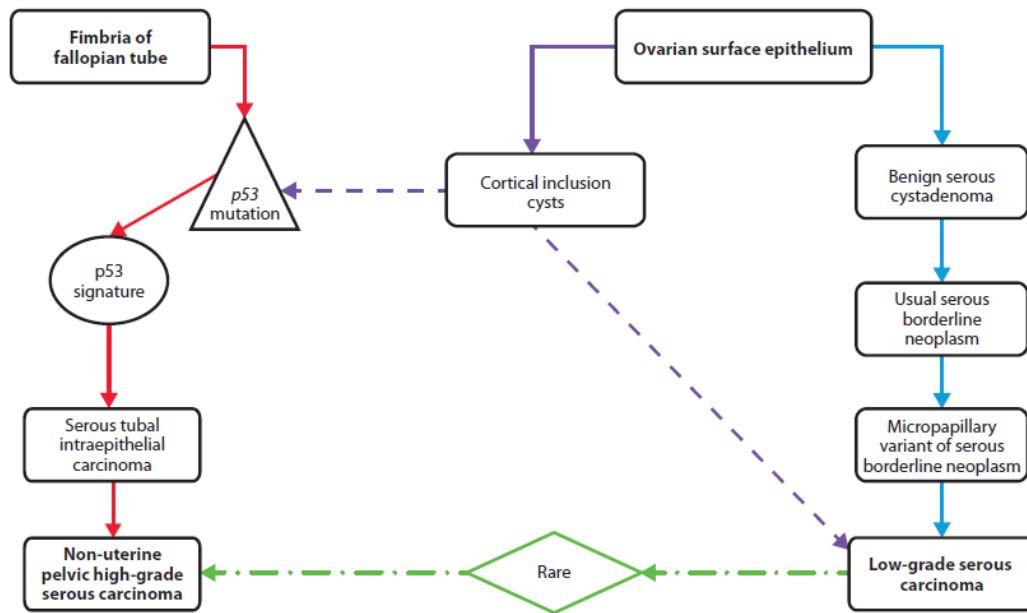


Figure 2. Molecular pathway of HGSOC<sup>7</sup>

### 1.1.3 Screening

Despite huge efforts, screening programs for ovarian cancer have not proven successful. Standard screening methods, e.g., pelvic examination and transvaginal ultrasound, are unsuccessful due to missing ultrasound algorithms, the rapid proliferation of the tumor, and early spreading throughout the peritoneum.<sup>3</sup> Further screening methods with the use of biomarkers (CA125) have not shown improved survival rates but led to a higher morbidity and mortality rate in patients who underwent operative intervention due to false-positive screening results.<sup>5</sup>

### 1.1.4 Risk factors

A family history of ovarian cancer increases the risk of developing ovarian cancer. Common genetic syndromes are “Hereditary breast-ovarian cancer syndrome” (HBOC; BRCA1/2-positive) and “Hereditary non-polyposis colorectal carcinoma syndrome” (HNPCC, Lynch-syndrome). Further risk factors are high body mass index (BMI), hormone replacement therapy in peri- and postmenopause, and infertility.<sup>5</sup>

### 1.1.5 Prevention

Several studies have shown a decrease in the risk of ovarian cancer with reduced ovulation, e.g., oral contraceptive therapy, tubal ligation, or multiple pregnancies. However, according



to the above-mentioned pathogenetic findings, avoiding the formation of serous tubal intraepithelial carcinoma (STIC) via prophylactic salpingectomy was considered a good option for preventing ovarian carcinoma.<sup>3</sup>

## **1.2 Prophylactic bilateral salpingectomy (PBS)**

Because serous ovarian carcinoma arises in the fallopian tubes as STIC (serous tubal intraepithelial carcinoma), numerous studies have provided a better understanding of the carcinogenesis of the disease (Kurman et al.<sup>3</sup>, Crum et al.<sup>4</sup>). Incidental bilateral salpingectomy is a surgical intervention that removes the fallopian tubes and thus prevents the patient from serous pelvic carcinoma (Dietl et al.<sup>6</sup>, Cibula et al.<sup>7</sup>, Falconer et al.<sup>8</sup>). In epidemiologic studies from Canada (McAlpine et al.<sup>9</sup>) and Denmark (Guldberg et al.<sup>10</sup>), incidental bilateral salpingectomy in women at baseline risk for ovarian cancer is associated with a considerable risk reduction for developing ovarian malignancies. These data have led gynecologic societies, including the Austrian Society of Gynecology and Obstetrics (OEGGG) in 2015, to recommend prophylactic bilateral salpingectomy (PBS) in appropriate women at the time of benign gynecologic surgery.<sup>11</sup> Internationally, numerous societies have issued similar recommendations: American College of Obstetricians and Gynecologists<sup>12</sup>, Royal Australian and New Zealand College of Obstetricians and Gynaecologists<sup>13</sup>, Royal College of Obstetricians and Gynaecologists<sup>14</sup> and Society of Gynecologic Oncology<sup>15</sup>.

### **1.2.1 Fallopian tubes**

The fallopian tubes are located in the abdominal cavity and are closely connected to the uterus and the ovaries. They capture the egg cell at ovulation and transport it to the uterus. The transportation is supported by the peristalsis of the fimbriae and antegrade motions of the fallopian tubes.<sup>6</sup>

Microscopic lesions in the tubal cells can be found even in benign fallopian tubes. These are precursor cells of STIC and thus mark the origin of epithelial malignancy. While STICs are frequent, primary fallopian tube carcinomas are very rare.<sup>6</sup> However, according to Kindelberger et al.<sup>16</sup>, STICs show a concomitant presence with ovarian carcinoma in over 50% of all cases. STIC is quite common in BRCA positive patients as well as in women without a family history of ovarian cancer.<sup>6</sup>

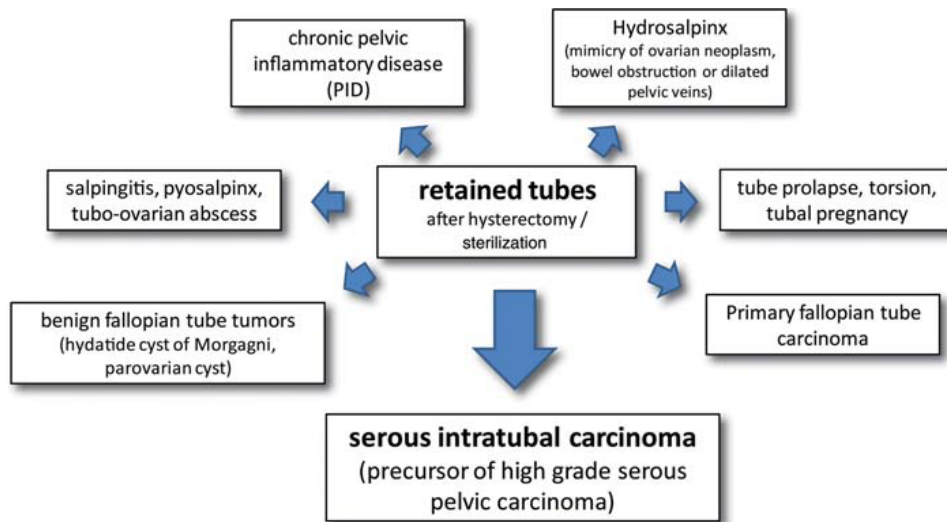
### **1.2.2 Feasibility of prophylactic bilateral salpingectomy (PBS)**

Prophylactic bilateral salpingectomy (PBS) in women at baseline risk prevents serous pelvic carcinoma by interrupting the transport of carcinogenic cells in the fallopian tubes.<sup>6</sup> Bilateral salpingectomy is a simple procedure that entails only a minimal extension of the ongoing surgical intervention. PBS is a standard procedure in a gynecologic surgical repertoire and shows a high rate of feasibility, not only at laparotomy but also by minimally invasive approaches, i.e., laparoscopic and vaginal.<sup>6,9,17</sup> It is possible to perform a bilateral salpingectomy at the time of general surgical intervention (non-gynecologic indication), gynecologic surgery, or sterilization via tubal ligation.<sup>6</sup> Compared to salpingo-oophorectomy, salpingectomy is associated with a normal postoperative hormone profile and no long-term negative effects.<sup>10</sup>

Hysterectomy is one of the most frequent gynecologic interventions and commonly combined with salpingectomy or salpingo-oophorectomy.<sup>18</sup> Incidental removal of the fallopian tubes during hysterectomy implies only a minimal additional risk for the patient, whereas the operating time, blood loss, postoperative hospital stay, and complication rate remain equal to surgery without PBS (Morelli et al.<sup>19</sup>, Ballard et al.<sup>20</sup>, Lamblin et al.<sup>21</sup>). Yet, the incidental removal of the fallopian tubes during hysterectomy with a vaginal approach can cause technical difficulties. Surgical complications are bleeding and conversion to laparotomy or laparoscopy. Postoperative complications include the formation of abscess or hematoma, ileus, blood transfusion, or any other complication that requires hospital readmission or reoperation.<sup>22</sup> Risk factors for an unsuccessful salpingectomy are high age, obesity, nulliparity, lack of vaginal access and space, ascent of the uterus in the pelvis, increased size of the uterus, tubo-ovarian disease, and pelvic adhesions (Lamblin et al.<sup>21</sup>, Sheth et al.<sup>23</sup>, Robert et al.<sup>24</sup>).

Bilateral salpingo-oophorectomy (BSO) is mostly performed in postmenopausal women with the same aim as PBS, namely reducing the risk for developing serous pelvic cancer. In high-risk groups, a premenopausal removal of the fallopian tubes and the ovary might be reasonable, because it offers a significant risk reduction for both, ovarian and breast cancer.<sup>6</sup> However, by surgically inducing menopause there is an increased risk for osteoporosis, cognitive impairment, psychosexual and cardiovascular disease, leading to a higher morbidity and mortality rate (Falkeborn et al.<sup>25</sup>, Rocca et al.<sup>26</sup>, Rivera et al.<sup>27</sup>, Parker et al.<sup>28</sup>). Therefore, in women at high risk, first, bilateral salpingectomy with ovarian conservation could be performed in premenopause, followed by oophorectomy in postmenopause.<sup>6</sup> In low-risk groups the surgeon decides in concordance with the patient whether the fallopian

tubes should be removed. Retained fallopian tubes might lead to consecutive tubal pathologies, such as hydrosalpinx, tubal torsion, tubal pregnancy, or chronic pelvic inflammatory disease (Fig. 3).<sup>6</sup>



**Figure 3. Overview of potential tubal pathologies in women with retained fallopian tubes<sup>6</sup>**

### 1.2.3 Recommendation of prophylactic bilateral salpingectomy

Considering the evidence of ovarian carcinogenesis, clinical practice was reevaluated to increase the use of incidental bilateral salpingectomy. Canada, in 2011, was the first country to recommend prophylactic bilateral salpingectomy (PBS) in appropriate women at the time of gynecologic surgery.<sup>29</sup> The Austrian Society of Gynecology and Obstetrics (OEGGG) issued a similar recommendation in 2015. Surgeons are encouraged to discuss the potential benefits of incidental salpingectomy to women at baseline risk for ovarian carcinoma prior to benign gynecologic surgery.<sup>11,30</sup>

## **2 Material and methods**

In a multicenter, retrospective study we reviewed all benign, minimally invasive hysterectomies in 2014 and 2018 (before and after the 2015 recommendation) at public hospitals in the province of Styria, Austria.

### **2.1 Objectives**

The primary objective of this study is to analyze the implementation and feasibility of PBS by determining rates of performed PBS at benign, minimally invasive hysterectomy in 2014 and 2018 in Styria. We compare the proportion of accomplished PBS according to the surgical approach of minimally invasive hysterectomy (vaginal vs. laparoscopic). Furthermore, we examine the distribution of approaches to benign hysterectomy between 2014 and 2018. From medical records, we abstract data on the route of hysterectomy, whether patients consented to PBS (or BSO), whether PBS was attempted and whether PBS was actually performed.

Secondary objectives include factors, e.g., age, BMI, parity, mode of delivery, surgical indication, surgical experience, and intraoperative complications, that might influence the rate of successfully completed salpingectomies.

### **2.2 Database**

The statistics show the uptake of PBS in population-risk women across the province of Styria before and after the official OEGGG recommendation in 2015. All regional hospitals in Styria were invited to participate in the study. The statistics include data from eight hospitals in Styria (in German LKH-Univ. Klinikum Graz, Barmherzige Brüder Graz, LKH Feldbach-Fürstenfeld, LKH Hartberg, LKH Hochsteiermark, LKH Murtal, LKH Rottenmann-Bad Aussee, LKH Weststeiermark).

Procedure-oriented Hospital Financing codes<sup>31</sup> (in German Leistungsorientierte Krankenanstaltenfinanzierung (LKF)) (JK090, JK101, JK102, JK120) who code for laparoscopic, vaginal, and combined (vaginal and laparoscopic) hysterectomy, were used to identify potential patients. Another option was to digitally work through the OR-book to recruit appropriate candidates. Data were then anonymously noted in an Excel chart or case report form (CRF) (attached).

The study population includes women aged 18 or above who underwent minimally invasive hysterectomy for benign disease. The patients underwent hysterectomy either combined with PBS or BSO or none of the additional surgical intervention (hysterectomy alone).

Exclusion criteria are lack of information on implementation and surgical approach, history of bilateral salpingectomy or salpingo-oophorectomy, known tubo-ovarian malignancy, and patients who are not coded as being of female sex.

Patients are included from January 1 to December 31, 2014, and from January 1 to December 31, 2018 (before and after the official recommendation in 2015). These intervals are chosen to compare the 2014 rate to the 2018 rate and to outline a potential change in the surgical practice of PBS in this time frame.

Data provide demographic, administrative, and clinical information based on surgical consent forms, operative notes, and discharge papers. Additionally, data for readmission to the hospital are included to assess postoperative complications. The sources are reviewed and analyzed with regard to the implementation of PBS at benign, minimally invasive hysterectomies in 2014 and 2018. Data are recorded in a Microsoft Excel<sup>®</sup>-spreadsheet.

Selected parameters involve date of birth, body-mass-index (BMI), parity, mode of delivery (cesarean section vs. vaginal delivery), length of hospital stay (LOS), written informed consent (consent to PBS or not), surgical experience (attending, resident or both), surgical indication, surgical approach (vaginal, laparoscopic or combined), implementation, intraoperative (surgical) and postoperative complications. The parameter “implementation” is divided into seven categories: (0) PBS not intended (patient did not consent to PBS, hysterectomy alone), (1) PBS, (2) BSO, (3) PBS incomplete, (4) PBS forgotten, (5) PBS not possible due to technical difficulties, and (6) others. Surgical indications include (1) abnormal uterine bleeding, (2) pelvic organ prolapse, (3) fibroids, and (4) others.

The aforementioned sources (surgical consent form, operative notes, discharge papers and data for readmission to hospital) were used to gather the required data. The results of the study should lead to a better understanding and improvement in the implementation of PBS and allow an international comparison in the uptake of preventative surgery.

### **2.3 Statistical analyses**

In descriptive analyses, continuous variables are distributed normally and presented as means with standard deviations. Categorical variables are described with frequencies and percentages. Statistical analyses are performed with Simple Interactive Statistical Analysis (SISA) (Online Version from July 2020; <https://www.quantitativeskills.com/sisa/index.htm>). Continuous variables (age, BMI, parity, LOS) are analyzed via t-tests, whereas for categorical variables and independent samples  $X^2$  tests are used.

Due to the retrospective design of the study, there might be several potential confounders. Firstly, transcription errors could cause potential bias. Secondly, wrongly coded surgical procedures or lacking health intervention codes could result in missing potential candidates. Thirdly, postoperative complications might be overseen due to imprecise assessment of data or lack of documentation. Fourthly, missing data might lead to an exclusion of patients and thus, potential bias might occur. Fifthly, the performance of PBS is associated with the personal preferences and knowledge of the surgeon and might as well lead to potential bias.

## **2.4 Ethical approval**

Ethical approval was obtained from the Ethics Committees of the Medical University of Graz and the Hospital of St. John of God in Graz (Krankenhaus der Barmherzigen Brüder Graz).

## 3 Results

### 3.1 Procedural uptake

The total study population counts 1256 women who underwent hysterectomy for benign conditions in 2014 and 2018. Of the 1256 patients, 580 cases were recorded in 2014 and 676 cases in 2018. Consequently, the number of performed benign, minimally invasive hysterectomies increased by 17%.

#### 3.1.1 Implementation of PBS

The rate of successfully accomplished PBS in 2014 was 59.6% compared to 78.0% in 2018 (+18.4%;  $P = 0$ ; Table 1).

**Table 1. Implementation of PBS in benign, minimally invasive hysterectomy**

	<b>2014</b>	<b>2018</b>
<b>PBS completed</b>	346 (59.6%)	527 (78.0%)
<b>PBS not completed</b>	234 (40.3%)	149 (22.0%)
<b>Total</b>	<b>580 (100%)</b>	<b>676 (100%)</b>

#### 3.1.2 Consent forms

For this study, we reviewed the consent forms of all patients and analyzed whether the patient consented to PBS or not. From the total study population, 187 patients (32.2%) did not consent to PBS in 2014 and 44 (6.5%) in 2018. They were therefore excluded from the study. Significantly more patients consented to PBS in 2018 compared to 2014 (+26%;  $P = 0$ ; Table 2).

**Table 2. Patients with and without consent to PBS in 2014 and 2018**

	<b>2014</b>	<b>2018</b>
<b>Consent</b>	393 (67.8%)	632 (93.5%)
<b>No consent</b>	187 (32.2%)	44 (6.5%)
<b>All</b>	<b>580 (100%)</b>	<b>676 (100%)</b>

### 3.1.3 Surgical approach

The distribution of vaginal vs. laparoscopic hysterectomies shifted significantly between 2014 and 2018 ( $P = 0.0008$ ; Table 3). While the proportion of vaginal hysterectomies increased (45.0% to 56.0%), the proportion of laparoscopic hysterectomies decreased, from 55.9% to 44.1%. However, we do not have data on benign abdominal hysterectomies.

**Table 3. Surgical approach for benign, minimally invasive hysterectomy**

	<b>2014</b>	<b>2018</b>
<b>Vaginal HE</b>	177 (45.0%)	353 (55.9%)
<b>Laparoscopic HE</b>	216 (55.0%)	279 (44.1%)
<b>Total</b>	<b>393 (100%)</b>	<b>632 (100%)</b>

### 3.1.4 Feasibility of PBS

The overall rate of successfully accomplished PBS in patients who consented to prophylactic surgery was relatively stable between 2014 and 2018. Table 4 shows a slight decrease in the number of performed PBS with 346 successful PBS in 2014 compared to 527 in 2018, i.e., 88.0% and 83.4%, respectively. Contrarily, the rate of not accomplished PBS rose from 12.0% to 16.6% ( $P = 0.0415$ ; Table 4).

**Table 4. Benign, minimally invasive hysterectomies with and without PBS in 2014 and 2018**

	<b>2014</b>	<b>2018</b>
<b>PBS completed</b>	346 (88.0%)	527 (83.4%)
<b>PBS not completed</b>	47 (12.0%)	105 (16.6%)
<b>Total</b>	<b>393 (100%)</b>	<b>676 (100%)</b>



In 2014 PBS was accomplished somewhat more frequently at laparoscopic hysterectomy compared to vaginal hysterectomy (59.5% vs. 40.5%). In 2018, however, PBS was accomplished equally in vaginal and laparoscopic hysterectomy (49.7% vs. 50.3%) ( $P = 0.0073$ ; Table 5).

**Table 5. Successfully accomplished PBS at vaginal and laparoscopic hysterectomy**

	<b>2014</b>	<b>2018</b>
<b>Vaginal HE</b>	140 (40.5%)	262 (49.7%)
<b>Laparoscopic HE</b>	206 (59.5%)	265 (50.3%)
<b>Total</b>	<b>346 (100%)</b>	<b>527 (100%)</b>

With regard to the different surgical approaches, the rate of successfully completed PBS vs. not successful PBS at the time of vaginal gynecologic surgery did not change. The share in successful prophylactic surgery of all vaginal hysterectomies reached 74.2% in 2018, compared to 79.1% in 2014 ( $P = 0.2162$ ; Table 6). Similarly, the rate of performed PBS at the time of laparoscopic surgery was completely stable over the time period with 95.4% in 2014 to 95.0% of all laparoscopic hysterectomies in 2018 ( $P = 0.8419$ ; Table 7).

**Table 6. Vaginal hysterectomies with and without PBS**

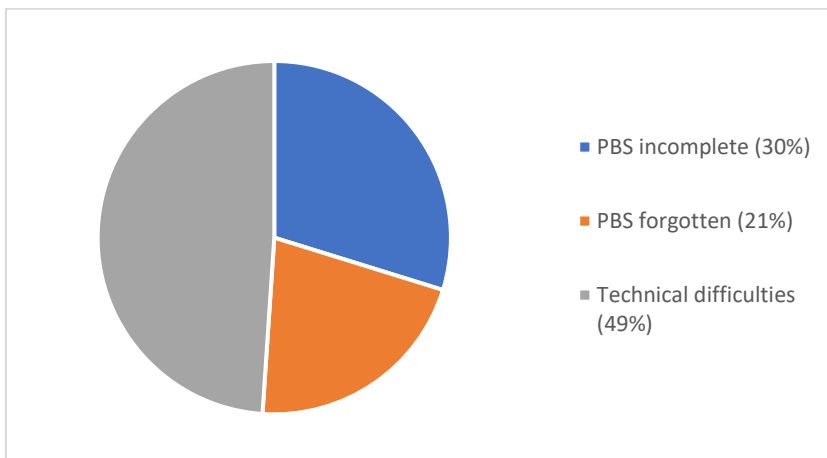
	<b>2014</b>	<b>2018</b>
<b>PBS completed</b>	140 (79.1%)	262 (74.2%)
<b>PBS not completed</b>	37 (20.9%)	91 (25.8%)
<b>Total</b>	<b>177 (100%)</b>	<b>353 (100%)</b>

**Table 7. Laparoscopic hysterectomies with and without PBS**

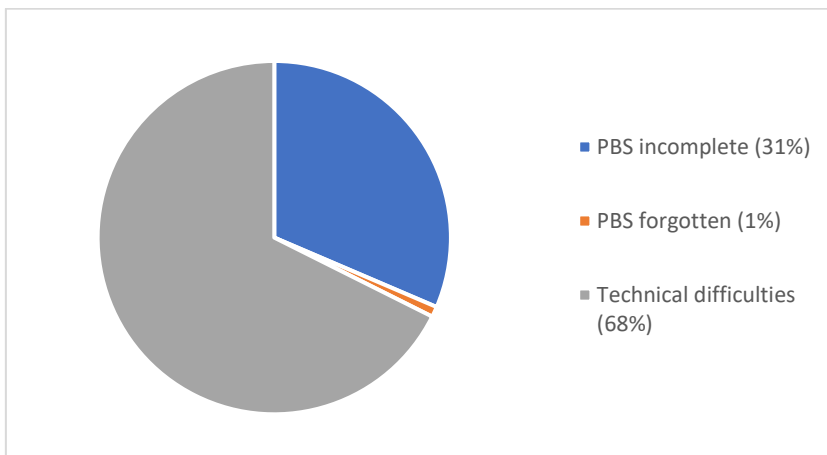
	<b>2014</b>	<b>2018</b>
<b>PBS completed</b>	206 (95.4%)	265 (95.0%)
<b>PBS not completed</b>	10 (4.6%)	14 (5.0%)
<b>Total</b>	<b>216 (100%)</b>	<b>279 (100%)</b>

### 3.1.5 Failure of PBS

Reasons for unsuccessful PBS were incomplete salpingectomy (unilateral salpingectomy), forgotten PBS, and technical difficulties due to adhesions, further tubal ligation, or fallopian tubes that are located high in the abdomen at the time of vaginal hysterectomy. In both years – 2014 and 2018 – technical difficulties were the main reason for unaccomplished PBS, namely 49% and 68%, respectively. Incomplete PBS made up a third of all unsuccessful PBS. However, the number of PBS that has been forgotten during surgery decreased remarkably from 21% to 1% of all unsuccessful prophylactic salpingectomies (Fig. 4, 5).



**Figure 4. Reasons for unsuccessful PBS in 2014**



**Figure 5. Reasons for unsuccessful PBS in 2018**

Figure 6. Consort Diagram 2014

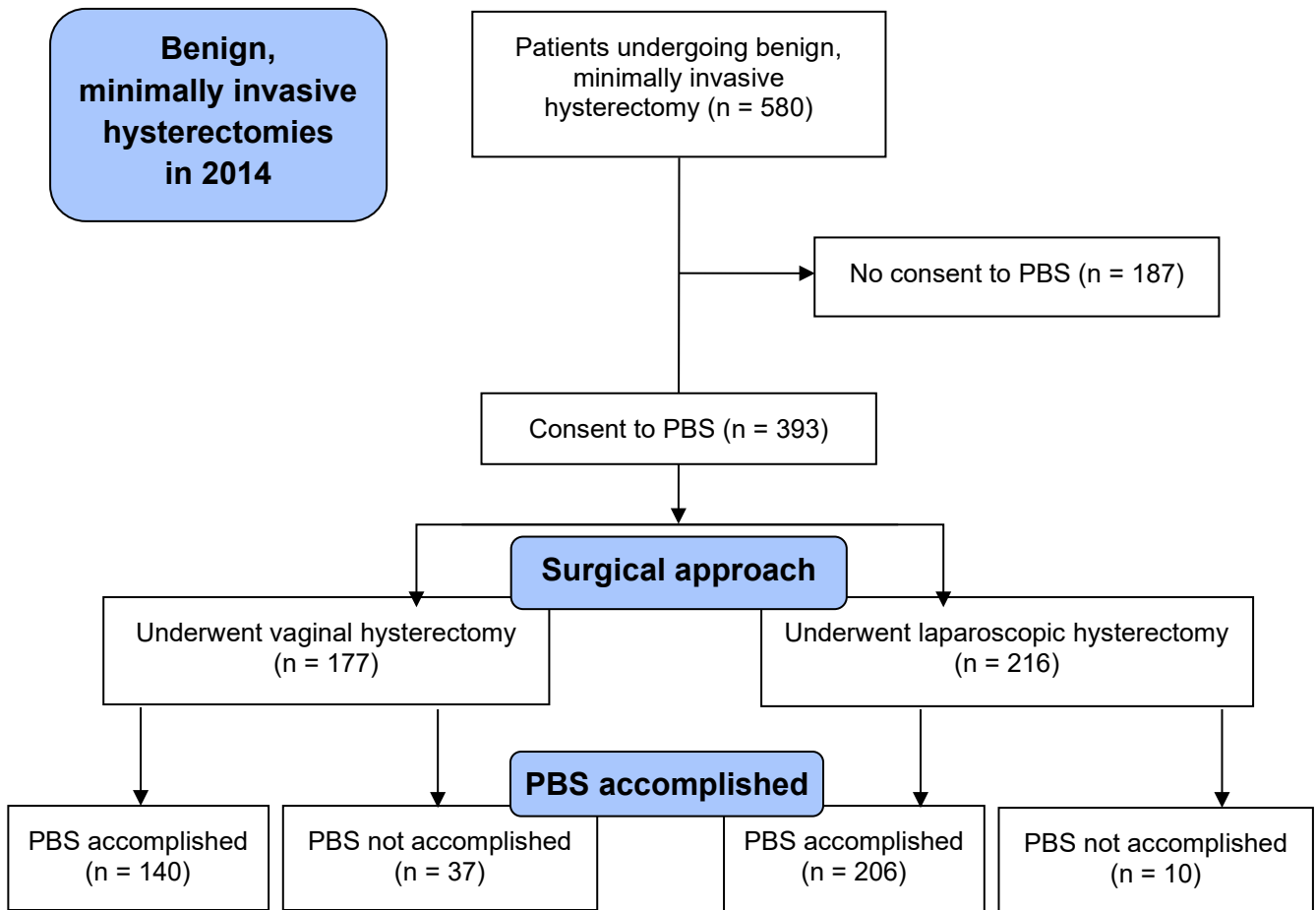
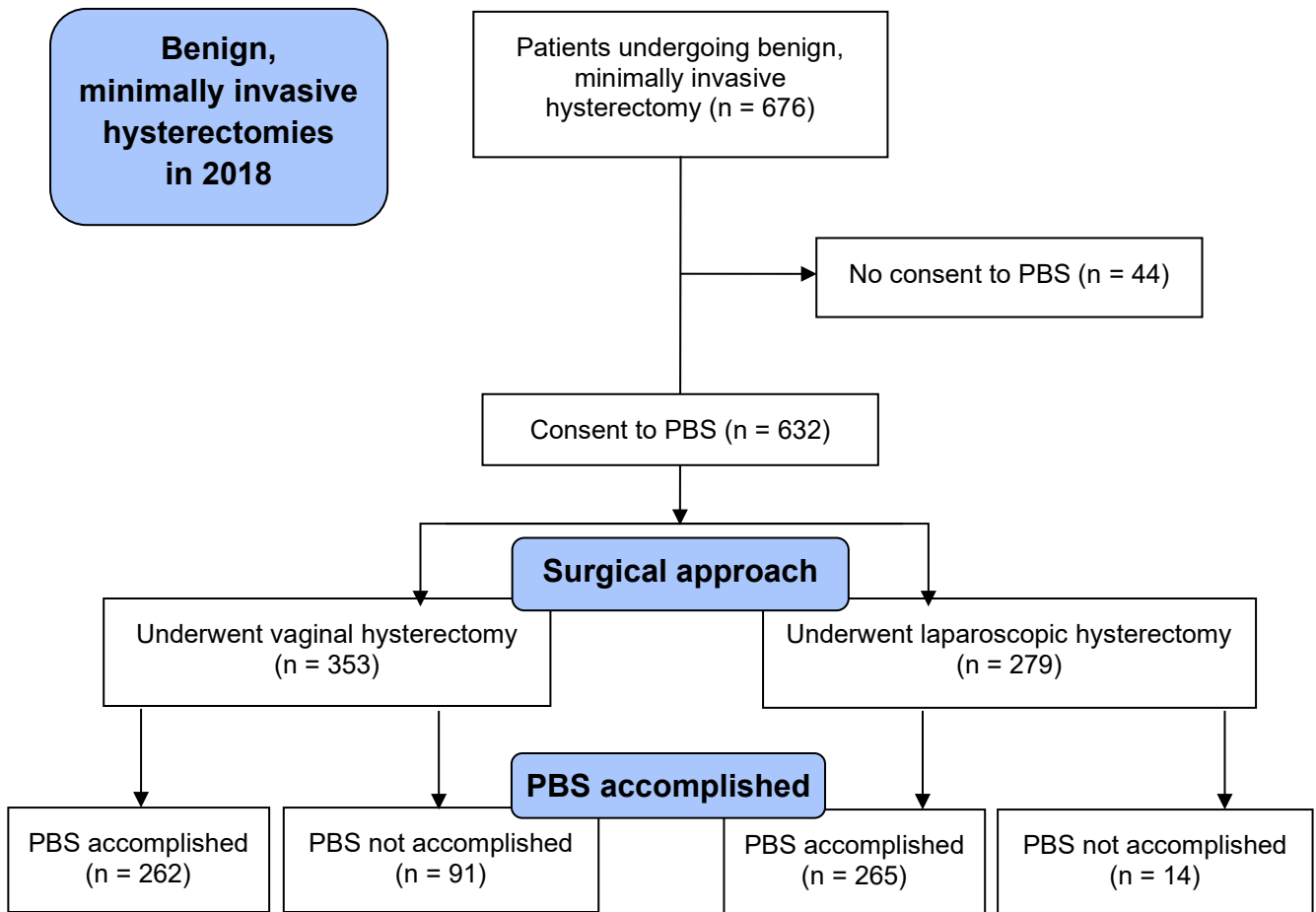


Figure 7. Consort Diagram 2018



## 3.2 Operative and perioperative measures

Secondary outcomes include operative and perioperative measures that could influence the rate of performed PBS. General data on patients were analyzed regarding their impact on the success of preventative surgery.

### 3.2.1 Age, BMI, parity

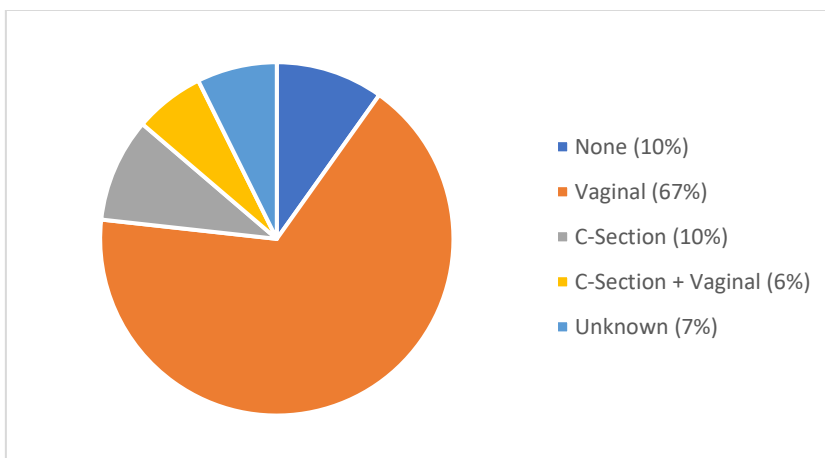
The patient's age could be a predictive parameter for successful PBS. Younger women are more likely to receive PBS than patients of advanced age. The mean age of women with completed bilateral salpingectomy is 50 years, whereas women without PBS show a mean age of 60 years ( $P < 0.0001$ ; Table 8). The Body-Mass-Index (BMI) in the two groups is similar with 26.3 and 27.0 kg/m<sup>2</sup>, respectively ( $P = 0.1039$ ; Table 8). Moreover, the number of delivered children might have an influence on the success of PBS. Women, who did not undergo PBS, show a higher parity rate with 2.5 children per woman compared to women with successfully performed PBS, namely 1.88 delivered children per woman ( $P < 0.0001$ ; Table 8).

**Table 8. General data**

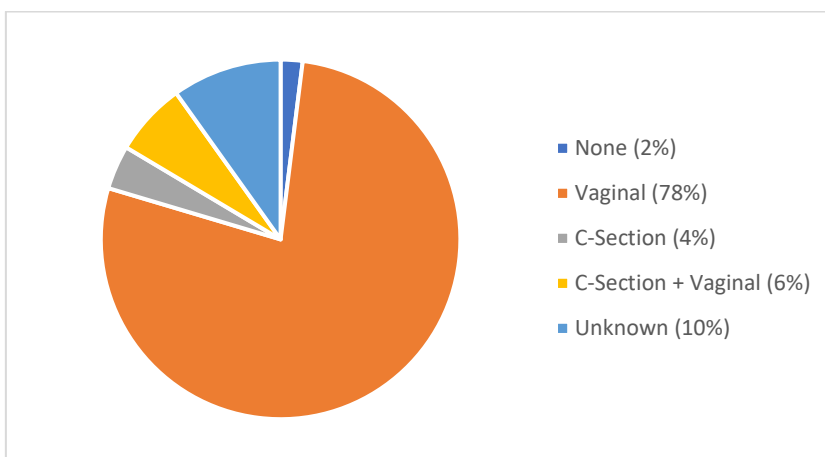
	<b>PBS successful (n = 873)</b>	<b>PBS not successful (n = 152)</b>	<b>P value</b>
<b>Age (mean, years)</b>	50.5 (SD 10.55)	59.8 (SD 12.95)	< 0.0001
<b>BMI (mean, kg/m<sup>2</sup>)</b>	26.3 (SD 5.09)	27.0 (SD 4.43)	0.1039
<b>Parity (mean, children per woman)</b>	1.9 (SD 1.15)	2.5 (SD 1.54)	< 0.0001

### 3.2.2 Mode of delivery

There are no significant differences in the mode of delivery between the two groups. A majority of the deliveries is performed vaginally, namely 67% in the group with successful PBS and 78% in the group where PBS was unsuccessful. Cesarean section is accomplished in 10% of the women with PBS, compared to 4% in the group without PBS. Vaginal delivery combined with C-Section is performed equally in both groups with 6%, respectively. 10% in the group with prophylactic surgery and 2% in the group with unsuccessful removal of the fallopian tubes do not have any children. In about 7% in the PBS-group and 10% in the Non-PBS-group the mode of delivery is not documented (Fig. 8, 9).



**Figure 8. Mode of delivery at benign hysterectomy with successful PBS**

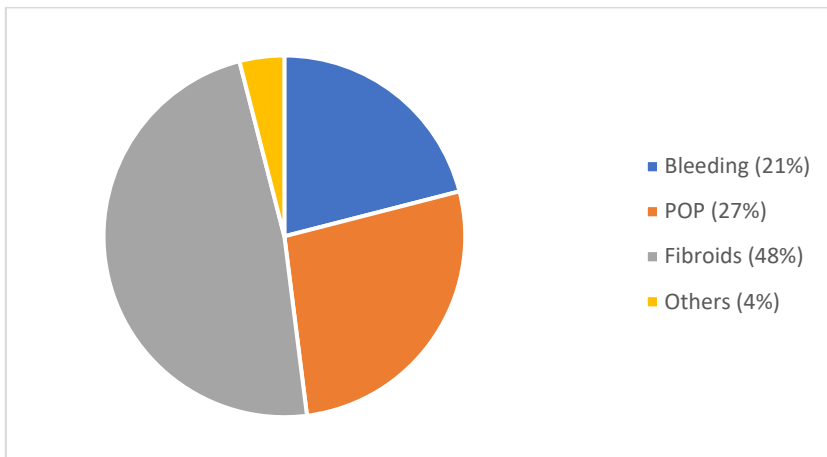


**Figure 9. Mode of delivery at benign hysterectomy with unsuccessful PBS**

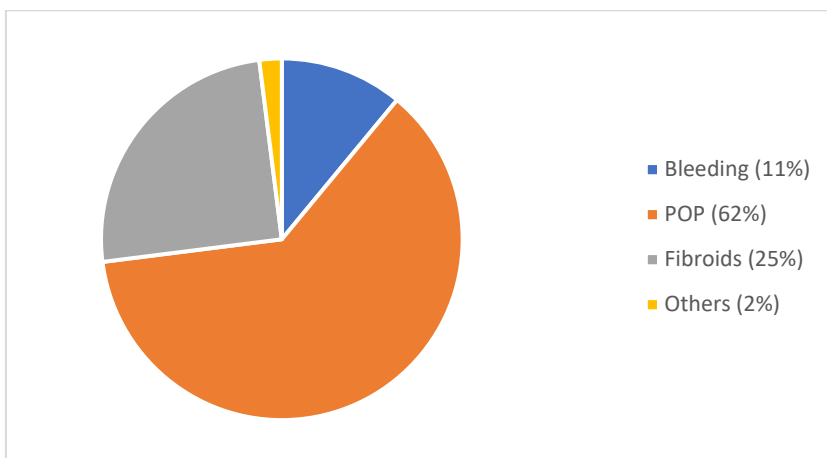
### 3.2.3 Surgical indications

Operative measures include surgical indications for benign hysterectomy and surgical experiences of the surgeon. Surgical indications for benign hysterectomy can be variable, e.g., bleeding, pelvic organ prolapse (POP), fibroids, and others. In women with successful PBS, approximately 48% receive surgery due to uterine fibroids. Bleeding and pelvic organ prolapse occur in approximately 21% and 27% of all cases, respectively. Other surgical indications are represented by only a small percentage (Fig. 10).

Compared to the PBS-group, a majority of women who did not undergo PBS, are operated on for pelvic organ prolapse (62%). In a quarter of the patients without PBS, uterine fibroids are the indication for hysterectomy. In all women with unsuccessful PBS, bleeding is less frequent with 11%. 2% are represented by other surgical indications (Fig. 11).



**Figure 10. Surgical indication for benign hysterectomy with successful PBS**



**Figure 11. Surgical indication for benign hysterectomy with unsuccessful PBS**

### 3.2.4 Surgical experience

Surgical experiences do not have an influence on the rate of successful PBS. In both groups, consultants are mainly performing minimally invasive hysterectomies. Figure 12 shows no differences in the percentage of residents performing minimally invasive hysterectomies, with 5% in the PBS-group and 7% in the group without successful PBS. In the two groups, the percentage where both – resident and consultant – operated on the patient, is similar with 2%, respectively (Fig. 12).

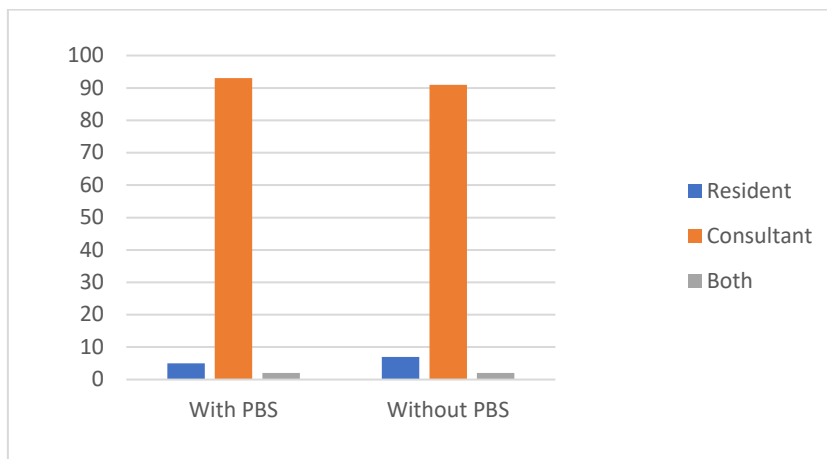


Figure 12. Surgical experience at minimally invasive hysterectomy

### 3.2.5 Length of hospital stay and perioperative complications

Consequences that could emerge from prophylactic salpingectomy, are a longer hospital stay, as well as surgical and postoperative complications. In this study, the length of hospital stay (LOS) between the two groups is equal, namely 4 days, respectively ( $P = 0.7329$ ; Table 9). The performance of PBS does not seem to have an impact on the length of hospital stay.

Table 9. Length of hospital stay (LOS)

	PBS successful (n = 873)	PBS not successful (n = 152)	P value
LOS (mean, days)	4.07 (SD 1.96)	4.13 (SD 1.72)	0.7329

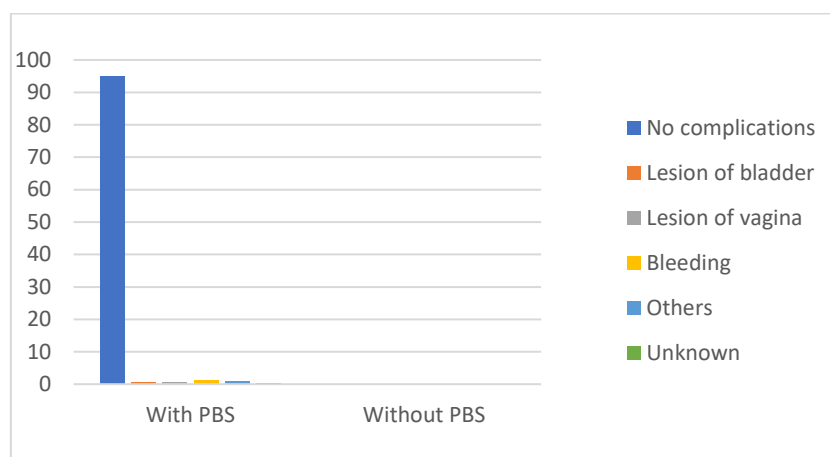


The risk of postoperative complications is similar with 8.0% in the PBS-group and 7.2% in the Non-PBS-group. However, there is a difference in the rate of surgical complications in the two groups. Women who underwent prophylactic salpingectomy, are at higher risk for complications during surgery than women who did not receive PBS. In women without PBS, no surgical complications are documented (Table 10).

**Table 10. Perioperative complications**

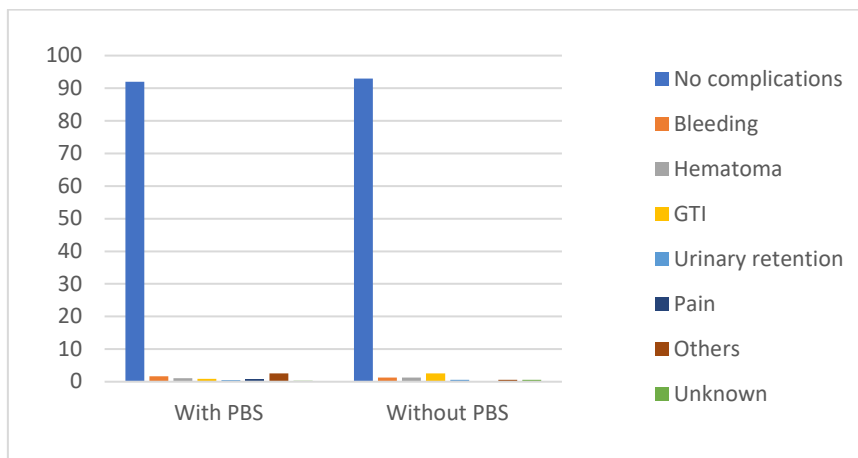
	<b>PBS successful (n = 873)</b>	<b>PBS not successful (n = 152)</b>	<b>P value</b>
<b>Surgical complications</b>	31 (3.6%)	0 (0%)	0.0014
<b>Postoperative complications</b>	70 (8.0%)	11 (7.2%)	0.7417

Surgical complications include lesions of the bladder or vagina and intraoperative bleeding. Figure 13 illustrates the distribution of surgical complications between the two groups. In about 3.6% of all patients who underwent removal of fallopian tubes, surgical complications are noted. 1% of patients experienced intraoperative bleeding. Lesions of the vagina and the bladder occurred in 0.6% of all benign hysterectomies in the PBS-group, respectively. In 1% of the cases, surgeons had to deal with other surgical complications, e.g., adhesions, wound dehiscence, or iatrogenic perforation of the ileum or the sigma. In 0.1% of all cases, the reasons for surgical complications remain unknown due to lack of documentation (Fig. 13). We could not find any surgical complications in the Non-PBS-group (Fig. 13).



**Figure 13. Surgical complications at benign hysterectomy**

Postoperative complications include bleeding, hematoma of the vagina, genitourinary tract infection, urinary retention, pain, or vaginal vault prolapse. 8% in the PBS- and 7% in the Non-PBS-group had to deal with postoperative complications. Comparing the two groups, patients who underwent prophylactic surgery, show a similar rate of postoperative bleeding than women who did not receive PBS with 1.7% vs. 1.3%. The risk for genitourinary tract infection (GTI) in the PBS-group is lower (0.9%) than in patients without PBS (2.6%). The risk for developing vaginal hematoma and urinary retention in both groups is similar, namely 1.1% and 0.5% in the PBS-group and 1.3% and 0.6% in the Non-PBS-group. In the PBS-group 0.8% of the patients experienced pain in the postoperative period, compared to 0% in the Non-PBS-group. 2.6% in the PBS- and 0.6% in the Non-PBS-group had to deal with other – mostly anesthesiologic and internistic – postoperative complications, e.g., postoperative nausea and vomiting (PONV), allergic reaction, anemia, general infection, pulmonary hypertension, or respiratory insufficiency. In some cases, postoperative complications are noted but are not otherwise specified (0.3% in the PBS-group, 0.6% in the Non-PBS-group; Fig. 14).



**Figure 14. Postoperative complications at benign hysterectomy**

## **4 Discussion**

This retrospective study shows that PBS at the time of benign, minimally invasive hysterectomy was widely performed in Styria even before the official OEGGG recommendation in 2015. The rate of PBS increased even further after 2015, corresponding to the increasing awareness of the concept of high-grade serous ovarian cancer originating in the fallopian tubes. The findings in our study might reflect the efforts of national societies to reduce the risk of ovarian cancer via prophylactic salpingectomy.

### **4.1 Procedural uptake**

Our data indicate that PBS was performed frequently in our region even before the official recommendation in 2015. The official recommendation is associated with a further increase in rates of PBS.

#### **4.1.1 Rate of benign hysterectomy**

According to Edler et al.<sup>32</sup>, the rate of benign hysterectomy in Austria declined by almost 30% between 2002 to 2014, probably due to the increasing use of medical and hormonal treatment (e.g., levonorgestrel intrauterine device) and less invasive surgery (e.g., endometrial ablation). In contrast, our data show that the number of benign, minimally invasive hysterectomy increased by 17% in Styria between 2014 and 2018. This was somewhat surprising but likely due to a decrease in open, abdominal hysterectomies (which we did not assess). In a population-based retrospective cohort study from Canada, McAlpine et al.<sup>9</sup> indicate a decrease in abdominal gynecologic surgery and an increase in laparoscopic, vaginal, and combined hysterectomies.

#### **4.1.2 Uptake of PBS**

Our data concerning the implementation of preventative surgery indicate that the rate of PBS in benign, minimally invasive hysterectomy increased from 60% in 2014 to 78% in 2018. These findings confirm that prophylactic salpingectomy is successfully implemented in the province of Styria. Similar studies on this issue confirm our results. According to McAlpine et al.<sup>9</sup>, the rates of PBS at the time of benign hysterectomy increased by 5 to 35% over the study period 2008 to 2011 in BC, Canada. Hicks-Courant et al.<sup>33</sup> analyzed the rate of prophylactic bilateral salpingectomy in the United States from 2000 to 2013 by ICD-9 codes. According to their findings, PBS trended upward by 77% during the study period. In our study, the increase in the PBS rate is flatter. This might be due to an early implementation

of PBS in 2014. In the latest study of Mandelbaum et al.<sup>34</sup>, the uptake of prophylactic salpingectomy at benign hysterectomy in the United States was ascertained. In this population-based, retrospective, observational study, women with hysterectomy alone and hysterectomy combined with PBS were assessed in the time period 2001 to 2015. While the increase between 2001 and 2010 was slight with 2.4% to 5.7%, the PBS-rate increased rapidly after the official recommendation in the US in 2010 and reached nearly 60% by 2015.

#### **4.1.3 Consent forms**

Whereas in 2014 only 68% of the patients consented to additional prophylactic surgery, 93% agreed with the implementation of PBS in 2018 (+26%). This remarkable difference is probably due to the increasing awareness of the recent concept of ovarian cancer growing in the fallopian tubes. In an Austrian survey from 2014 (Pötz et al.<sup>35</sup>), policies concerning prophylactic bilateral salpingectomy at the time of benign gynecologic surgery or cesarean section were analyzed. 70% of all responding gynecologic departments in Austria reported recommending PBS at benign gynecologic surgery.

#### **4.1.4 Surgical approach**

The surgical approach for benign, minimally invasive hysterectomy shifted between 2014 and 2018. The share of vaginal vs. laparoscopic shifted in favor of the vaginal approach. In 2018 more than a half (56%) of the minimally invasive hysterectomies were performed vaginally. The vaginal approach is an elegant surgical technique to perform hysterectomy. It is a less invasive and safe option to remove the uterus and, if applicable, the adnexa. However, performing PBS via vaginal surgery is challenging and needs to be practiced routinely. Therefore, surgeons tend to favor a laparoscopic or abdominal approach to facilitate risk-reducing surgery.

#### **4.1.5 Feasibility of PBS**

The feasibility of prophylactic surgery was relatively stable within the study period. In 88% of all informed patients, the removal of the fallopian tubes was performed successfully in 2014 and in 83% in 2018. However, the success of prophylactic surgery at the time of minimally invasive surgery depends on the surgical approach. The performance of PBS at vaginal hysterectomy is complex, whereas at laparoscopic surgery it is straightforward.

Considering the rates of successfully performed PBS at the two different surgical approaches, the number of successful salpingectomies at vaginal and laparoscopic gynecologic surgery in 2014 and 2018 differ slightly. While the PBS rate at vaginal

hysterectomy decreases slightly, the number of PBS in women with laparoscopic hysterectomy is stable. The absence of an increase in the laparoscopic and vaginal approach and the high percentages of completed PBS in 2014 are likely due to the pre-existing capability of performing PBS via laparoscopy and vaginal surgery before the PBS recommendation in 2015.

Several studies on PBS rates at the time of vaginal hysterectomy are consistent with our results (Antosh et al.<sup>18</sup>, Lamblin et al.<sup>21</sup>, Robert et al.<sup>24</sup>). The multicenter, prospective study of Antosh et al.<sup>18</sup> assessed the rate of successfully accomplished PBS at vaginal hysterectomy and found that prophylactic surgery was feasible in 81% of all vaginal hysterectomies. This result is consistent with our findings, namely, in benign, vaginal hysterectomy, PBS was accomplished successfully in 79% of all patients in 2014 and in 74% in 2018. Moreover, the data are comparable with a prospective study from France (Lamblin et al.<sup>21</sup>), in which 115 patients consented to bilateral salpingectomy at vaginal surgery between September 2013 to November 2015. In 74% of all patients, preventative surgery was technically possible. The third study is a retrospective cohort study from Canada where PBS was accomplished in 88% of vaginal hysterectomies (Robert et al.<sup>24</sup>).

#### **4.1.6 Failure of PBS**

There are various reasons for unsuccessful PBS. Intraoperatively, surgeons might face pelvic adhesions due to previous abdominal or gynecologic surgery or infection. Furthermore, fallopian tubes might be high and inaccessible at vaginal surgery. Also, women with previous tubal ligation are less likely to receive prophylactic surgery than women without tubal ligation. Studies from the United States (Antosh et al.<sup>18</sup>) and Canada (Robert et al.<sup>24</sup>) confirm our results. According to Antosh et al.<sup>18</sup>, reasons for non-completion of preventative surgery include tubes high in the abdomen, removed fallopian tubes, pelvic adhesions, and conversion to an alternative route for pathology. Similarly, Robert et al.<sup>24</sup> indicate that adhesions in the pelvis significantly influence the ability to perform prophylactic surgery. Operative and perioperative measures, i.e., age, BMI, parity, mode of delivery, surgical indication, surgical approach, and surgical experience of the surgeon might have an effect on the success of prophylactic surgery and are discussed below.

## **4.2 Operative and perioperative measures**

Operative and perioperative measures could influence the success of performing PBS.

### **4.2.1 Age**

In our study, the mean age of the PBS- and Non-PBS-group differ significantly. The mean age of women who underwent prophylactic surgery is 50 years, compared to women who did not receive PBS (60 years). These findings are confirmed by two studies, namely Lamblin et al.<sup>21</sup> and Robert et al.<sup>24</sup>. According to these studies, age is a predictive factor for the feasibility of bilateral salpingectomy with 57.5 years in the PBS-group vs. 62.9 years in the Non-PBS-group.

### **4.2.2 BMI**

Mean BMI does not differ between the two groups with a BMI of 26.3 in the PBS- vs. 27.0 in the Non-PBS-group, respectively ( $P = 0.1039$ ). In contrast, Lamblin et al.<sup>21</sup> indicate that an elevated BMI is associated with failure of prophylactic surgery. However, in our study women with a high BMI tend to not have a removal of the fallopian tubes.

### **4.2.3 Parity**

The rates of delivered children in the two groups differ significantly with parity of 1.9 in the PBS- vs. 2.5 in the Non-PBS-group, respectively. There are no similar studies on this issue that confirm our results.

### **4.2.4 Mode of delivery**

There are no significant differences in the mode of delivery between the two groups. A majority of deliveries is performed vaginally, followed by C-Section and combined vaginal delivery plus C-Section. 10% in the PBS- and 2% in the Non-PBS-group do not have any children.

### **4.2.5 Surgical indication**

The indication determines the surgical approach for hysterectomy and therefore the feasibility of PBS. Patients with pelvic organ prolapse are more likely to be operated vaginally than patients with uterine fibroids. Yet, a vaginal approach can cause technical difficulties when trying to access the fallopian tubes high in the abdomen. Fibroids, however, are mostly an indication for a laparoscopic approach which is easier to perform. According to Antosh et al.<sup>18</sup>, the three most common indications for vaginal hysterectomy are pelvic

organ prolapse (78%), therapy-resistant menstrual bleeding (20%), and uterine fibroids (11%).

#### **4.2.6 Surgical experience**

The surgical experiences of the performing surgeon show no influence on the rate of successful PBS. Consultants are mainly performing benign, minimally invasive hysterectomy with prophylactic surgery, either successful or not. Residents lead the surgery in only 6% of all cases.

### **4.3 Consequences of PBS**

#### **4.3.1 Length of hospital stay**

Concerning the length of hospital stay (LOS) no significant differences are noticed. In both groups, PBS- and Non-PBS-group, the mean length of stay is 4 days (mean LOS 4.07 in the PBS- vs. 4.13 days in the Non-PBS-group, respectively). The performance of PBS does not seem to have an impact on the length of hospital stay. Compared to the study of McAlpine et al.<sup>9</sup>, women who underwent PBS are discharged earlier and have a shorter LOS than women with hysterectomy alone (2.37 vs. 2.52 days, respectively;  $P = 0.010$ ).

#### **4.3.2 Perioperative complications**

Women undergoing prophylactic surgery have a slightly higher risk for perioperative complications compared to women without PBS, i.e., 3.5% vs. 0% in surgical complications and 8% vs. 7.2% in postoperative complications, respectively. Common perioperative complications in patients with PBS are attributed to lesions of the bladder or the vagina and intraoperative bleeding. Hysterectomy alone in 2014 and 2018 was succeeded without any surgical complications. In the study of Lamblin et al.<sup>21</sup>, no significant differences in the intra- and postoperative complications between the two groups are revealed.

### **4.4 Limitations**

One limitation of this study is its retrospective design. Wrong coding of surgical procedures and lack of documentation of patients' personal data might lead to potential bias. Secondly, multiple institutions are included in the study. The expertise of the surgeons, who perform the surgical procedures, depends on their knowledge and experience. Thus, comparing rates of successful PBS might lead to further bias. Thirdly, the number of patients in the two groups – PBS-group and Non-PBS-group – differ from each other. While there are 873 patients in the PBS-group, there are only 152 in the Non-PBS-group. This distribution of

patients makes it difficult to compare these two groups. Furthermore, this study investigates PBS at minimally invasive surgery. Abdominal hysterectomies were not included and thus, preclude conclusions about the overall number of benign hysterectomies.

#### **4.5 Strengths**

One strength of the study is its large and representative number of PBS in a large region of Austria. 82% of all eligible patients who underwent benign, minimally invasive hysterectomy in Styria were enrolled in the study. 18% did not consent to PBS and were therefore excluded from the study. On top of that, the inclusion of surgeons from multiple institutions gives a representative overview of the surgical practice of preventative surgery in our region.

#### **4.6 Further investigations**

Further investigations are needed in order to identify predictors of successful PBS to improve patient counseling and enhance the practice of preventative surgery. The performance of PBS at vaginal surgery can be challenging. Therefore, surgical training might be favorable as a means of improvement of surgical techniques (Giraudet et al.<sup>17</sup>).

Furthermore, possible sequelae of PBS should be investigated in the future. While most studies indicate that PBS does not impact ovarian reserve (Hanley et al.<sup>36</sup>, Van Lieshout et al.<sup>37</sup>), Collins et al.<sup>38</sup> reported an increased risk of menopausal symptoms at one year in patients after PBS.

Finally, while the weight of epidemiologic and molecular data is considerable, we have no prospective data showing that PBS saves lives by preventing ovarian cancer. This is being addressed prospectively in a randomized fashion by the Hysterectomy and OPPortunistic SALpingectomy (HOPPSA<sup>39</sup>) study in Sweden, the results of which, however, will take about 20 years to accrue.



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## **Attachment – Schedule**

11.10.2018: Themenwahl

21.12.2018: Protokoll verfasst

15.03.2019: Votum der Ethikkommission Medizinische Universität Graz erhalten

11.06.2019: Votum der Ethikkommission BHB Graz erhalten

15.03.2019 – 28.05.2020: Datenerhebung

29.05.2020 – 08.11.2020: Schreiben der Diplomarbeit

15.12.2020: Abgabe der Diplomarbeit

## Attachment – Case Report Form

### CRF: PBS bei minimal invasiver HE aus benigner Indikation

#### Patientin

- Geb.-Datum (TT.MM.JJ): \_\_\_\_ . \_\_\_\_ . \_\_\_\_
- Alter zum Zeitpunkt der OP (Jahre): \_\_\_\_
- Gewicht (kg): \_\_\_\_ Größe (cm): \_\_\_\_ BMI (kg/m<sup>2</sup>): \_\_\_\_
- Parität gesamt: \_\_\_\_
- Parität/Modus (0=keine, 1=nur vag., 2=nur Sectio, 3=vag. + Sectio, 4=nicht bekannt): \_\_\_\_

#### OP

- OP-Datum (TT.MM.JJ): \_\_\_\_ . \_\_\_\_ . \_\_\_\_
- Entlassungsdatum (TT.MM.JJ): \_\_\_\_ . \_\_\_\_ . \_\_\_\_
- OP-Indikation (1=abnorme Blutung, 2=Descensus, 3=Myome, 4=(Subtotal-) Prolaps, 5=andere): \_\_\_\_
- Aufklärung Salpingektomie/Adnexektomie (1 = ja, 2 = nein): \_\_\_\_
- Zugangsweg für HE (1 = vaginal, 2 = laparoskopisch, 3 = LAVH): \_\_\_\_
- OperateurIn (1=AssistenIn, 2=FA, 3=beide): \_\_\_\_
- Salpingektomie/Adnexektomie (0=nicht intendiert; 1=Salpingekt. intendiert + durchgeführt; 2=Adnexek. intendiert + durchgeführt; 3=intendiert, aber inkomplett; 4=intendiert, aber vergessen; 5=intendiert, aber aus technischen Gründen non poss.; 6=andere): \_\_\_\_
- Intraoperative Komplikationen (1=ja, 2=nein): \_\_\_\_
- Postoperative Komplikationen (1=ja, 2=nein): \_\_\_\_

#### Ggf. Kommentar:

## Attachment - Excel-sheet

### Datenerhebung: PBS bei minimal invasiver HE

im Zuge der Diplomarbeit "Implementation and feasibility of Prophylactic Bilateral Salpingectomy (PBS) at vaginal and laparoscopic hysterectomy: A retrospective study"

Durchführendes Zentrum:

Durchgeführt von:

E-Mail (für etwaige Rückfragen):

<b>Geb.-Datum</b> (TT.MM.JJJJ)	<b>Alter zum Zeitpunkt der OP</b> (in Jahre)	<b>Gewicht</b> (in kg)	<b>Größe</b> (in cm)	<b>BMI</b> (in kg/m <sup>2</sup> )	<b>Parität gesamt</b>
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<b>Parität Modus</b>	<b>OP-Datum</b> (TT.MM.JJJJ)	<b>E-Datum</b> (TT.MM.JJJJ)	<b>OP-Indikation</b>
(0=keine, 1=nur vag., 2=nur Sectio, 3=vag.+Sectio, 4=nicht bekannt)			(1=abnorme uterine Blutung, 2=Descensus, 3=Myom/Ut. myomatosus, 4=(Subtotal-)Prolaps, 5=andere)

<b>Zugangsweg</b>	<b>Operateur</b>	<b>Durchführung</b>
(1=vag., 2=lap., 3=LAVH)	(1=Ass., 2=FA, 3=beide)	(0=nicht intendiert, 1=Salpingektomie intendiert + durchgeführt, 2=Adnexektomie intendiert + durchgeführt, 3=intendiert, aber unvollständig, 4=intendiert, aber vergessen, 5=intendiert, aber aus techn. Gründen non. poss., 6=Sonstiges)

<b>Intraoperative Komplikationen</b>	<b>Postoperative Komplikationen</b>
(1=ja, 2=nein)	(1=ja, 2=nein)

<b>Aufklärung Salpingektomie</b>	<b>Kommentar</b>
(1=ja, 2=nein)	