**Thesis**

# Can the Fallopian Tubes be Visualized/Accessed at Bariatric Surgery?

## A Feasibility Study


submitted by

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under the supervision of


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Graz, 26.08.2024

Declaration of Academic Integrity

I hereby confirm that this thesis is the result of my own independent scholarly work. I also confirm all material from the work of others (in books, articles, essays, dissertations, and on the internet) is acknowledged and quotations and paraphrases are clearly indicated. No material other than that cited in the reference list has been used. I have read and understood the Medical University's regulations and procedures concerning plagiarism.

Graz, 26.08.2024 Daniela Pucher m.p.

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# Zusammenfassung


**Hintergrund**

Sogenannte serous tubal intraepthelial carcinomas (STICs) gelten als die Vorläuferläsionen von serösen Ovarialkarzinomen. Sie entstehen in den Fimbrien der Tuben. Dementsprechend ist eine prophylaktische bilaterale Salpingektomie mit einem deutlich niedrigeren Risiko an einem serösen Ovarialkarzinom zu erkranken assoziiert.

Im Rahmen von gynäkologischen Operationen ist die prophylaktische Salpingektomie evidenzbasiert etabliert und wird seit 2015 auch von der Österreichischen Gesellschaft für Gynäkologie und Geburtshilfe (OEGGG) empfohlen. Eine Durchführung der prophylaktischen Salpingektomie auch im Rahmen nicht-gynäkologischer Eingriffe wie beispielsweise einer bariatrischen Operation wäre ein interessanter Ansatz, die Inzidenz und Mortalität des Ovarialkarzinoms zu reduzieren.

**Methodik**

In einer prospektiven, multizentrischen Studie mit 31 teilnehmenden Frauen wurde evaluiert, ob die Eileiter im Rahmen eines laparoskopischen bariatrischen Eingriffes durch bestehende Trokare dargestellt werden können. Es wurde auch überprüft, ob die Eileiter über bestehende Trokare mit Instrumenten erreicht und somit potenziell entfernten werden könnten (wobei tatsächlich kein Eingriff an den Eileitern erfolgte). Intraoperativ wurden die Patientinnen in Trendelenburg-Lagerung gebracht und die Anästhesie-Parameter dokumentiert. Ein positives Ethikvotum liegt vor.

**Ergebnisse**

Die Eileiter konnten bei 26 von 31 Frauen erfolgreich dargestellt werden. Die Tuben konnten bei 23 Frauen mit zwei Instrumenten erreicht werden, bei drei Frauen mit einem Instrument. Die dafür notwendige zusätzliche Operationszeit betrug im Durchschnitt 3,5 Minuten. Die Anästhesie-Parameter blieben dabei im akzeptablen Bereich und es kam zu keinem Shiften der teilnehmenden Frauen am OP-Tisch.

**Schlussfolgerung:**

Eine prophylaktische Salpingektomie im Rahmen einer bariatrischen Operation scheint potenziell machbar zu sein.

# Abstract

## Background

It is now known that most serous ovarian cancers arise in the fallopian tubes, mostly in the fimbriae. These precancerous lesions are called serous tubal intraepithelial carcinomas (STICs). Salpingectomy is associated with a significantly reduced risk for developing serous ovarian carcinoma. Prophylactic removal of the fallopian tubes as part of appropriate gynecological surgery is established and has been recommended by the Austrian Society of Gynecology and Obstetrics (OEGGG) since 2015. There is a considerable reason to explore prophylactic salpingectomy at the time of non-gynecological surgery.

## Methods

In a prospective, multicenter study involving 31 participating women, we investigated whether the fallopian tubes can be visualized and accessed through existing trocars after laparoscopic bariatric surgery. Our aim was to determine the feasibility of removing the fallopian tubes during this type of surgery. Intraoperative anesthetic parameters were documented. Institutional ethics committee approval was obtained.

## Results

The fallopian tubes were successfully visualized in 26 of 31 women (84%). The tubes could be reached with two instruments in 23 women and with one instrument in 3 women. The additional operating time required for this was 3.5 minutes on average. Anesthesia parameters remained within the acceptable range.

## Conclusion

Prophylactic removal of the fallopian tubes (PBS) at the time of bariatric surgery appears to be feasible.

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# List of Abbreviations

| | |
|---|---|
| Aa. | Arteries |
| AE | Appendectomy |
| AGO | Working Group for Gynecologic Oncology |
| AGOC | American College of Obstetricians and Gynecologists |
| ASMBS | American Society of Metabolic and Bariatric Surgery |
| BMI | Body Mass Index |
| BRCA1 | Breast Cancer Gene 1 |
| BRCA2 | Breast Cancer Gene 2 |
| CA 125 | Cancer Antigen 125 |
| cm | Centimeters |
| CRP | C-reactive Protein |
| DNA | Deoxyribonucleic Acid |
| e.g. | Exempli Gratia |
| EOC | Epithelial Ovarian Cancer |
| Et al. | Et Alia |
| Fig. | Figure |
| FIGO | International Federation of Gynecology and Obstetrics |
| GLP-1 | Glucagon-like Peptide 1 |
| HGSC | High-Grade Serous Carcinoma |
| LAVH | Laparoscopically assisted vaginal hysterectomy |
| LGSC | Low-Grade Serous Carcinoma |
| LKH | State Hospital |
| min. | Minutes |
| mm | Millimeters |
| OEGGG | Austrian Society of Gynecology and Obstetrics |
| ÖGP | Austrian Society of Pathology |
| OSE | Ovarian Surface Epithelium |
| PBS | Prophylactic Bilateral Salpingectomy |
| SEE-FIM | Sectioning and Extensively Examining the Fimbriated End of Fallopian Tube |
| SGO | Society of Gynecologic Oncology |
| STIC | Serous Tubal Intraepithelial Carcinoma |

| | |
|---|---|
| TNF-α | Tumor Necrosis Factor alpha |
| TP53 | Tumor Protein P53 |
| UICC | Union for international Cancer Control |
| vs. | Versus |
| Vv. | Veins |
| WHO | World Health Organization |

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# 1 Introduction

With approximately 720 new cases and 500 deaths annually in Austria, ovarian cancer is the leading cause of gynecological cancer deaths and the fifth most common cause of cancer-related death in women in Austria.[1] Typically, ovarian cancers are detected at advanced stages, resulting in a poor five-year survival rate of about 44%. In approximately half of all patients, the cancer has already spread beyond organ boundaries at the time of diagnosis.[2] Ovarian cancer presents with nonspecific symptoms, particularly in its early stages, making early detection challenging. There are no specific or sensitive modalities available for an effective screening test for the general population.[3]

## *1.1 Ovarian cancer*

According to the World Health Organization (WHO), ovarian tumors are classified into the following groups depending on histogenesis: epithelial tumors, sex cord stromal tumors, germ cell tumors, tumors of non-specialized ovarian tissue, unclassified primary tumors of the ovary, and metastatic tumors.[4,5]

### 1.1.1 Risk Factors

Women in the general population have a lifetime risk of between 1.3% and 1.9% for ovarian cancer. Women with a genetic predisposition have a high risk of developing ovarian cancer. The most common mutations, BRCA1 and BRCA2, confer a lifetime risk of invasive epithelial ovarian cancer by age 80 of 44% (BRCA1) and 17% (BRCA2). In women with Lynch syndrome (hereditary non-polyposis colorectal cancer syndrome), the lifetime risk of ovarian cancer varies from 2% to 15%.[6] Further factors such as infertility, nulliparity, a high body mass index (BMI), endometriosis, and estrogen replacement therapy (over five years) increase the risk of ovarian cancer.[7]

### 1.1.2 Classification of Epithelial Ovarian Cancer

With a share of 60% of all cases of ovarian cancer, epithelial ovarian carcinoma (EOC) is by far the most common. EOC can be categorized into four primary histologic subtypes: serous, mucinous, clear cell, and endometrioid.[4]

### 1.1.2.1 Pathogenesis of Epithelial Ovarian Cancer

According to Kurman et al.[8], the subtypes of epithelial ovarian carcinoma are divided into two categories. Depending on the genetics and molecular characteristics, type I and type II tumors are distinguished.

#### *1.1.2.1.1 Type I Tumors*

This group includes malignant Brenner tumors, mucinous, endometrioid, clear cell, and low-grade serous carcinomas (LGSC). Clinically, these tumors grow as large, cystic, unilateral neoplasms. They grow indolently and have a particularly good prognosis when confined to the ovary. Only 10% of ovarian cancer deaths are due to type I tumors. They follow a multistep carcinogenesis and are associated with wild-type p53 (TP53), but often further mutations are found in genes such as PTEN, KRAS, BRAF, and β-catenin.[5,8]

#### *1.1.2.1.2 Type II Tumors*

This group includes high-grade serous carcinomas (HGSC), undifferentiated carcinomas, and carcinosarcomas. These tumors are detected in advanced stages in more than 75% of cases. They are highly aggressive, high-grade, and develop rapidly. Genetically, type II tumors are characterized by P53 mutations, defects in DNA repair pathways, and genomic instability. HGSC is the most common type, accounting for 81% of all advanced-stage EOC. Almost three-quarters of all EOC deaths are due to HGSC.[5,8]

### 1.1.3 Serous Ovarian Carcinoma

There are two types of ovarian serous carcinomas: high-grade serous carcinomas (HGSC) and low-grade serous carcinomas (LGSC). 70% to 80% of all subtypes of epithelial ovarian cancer are HGSCs, and less than 5% are LGSCs. There are differences between these two types: different clinical presentations, different genetic and molecular profiles, and even different prognoses.[4]

#### 1.1.3.1 Low-Grade Serous Carcinoma (LGSC)

These tumors develop in a stepwise manner: From serous borderline tumors to noninvasive low-grade serous carcinomas to invasive low-grade serous carcinomas. Low-grade serous carcinomas have a BRAF or KRAS mutation. They are less aggressive and have a better clinical course. A transition from low-grade to high-grade serous carcinoma is possible but rare.[9]

#### 1.1.3.2 High-Grade Serous Carcinoma (HGSC)

High-grade serous ovarian cancer is not only the deadliest but also the most common type of ovarian cancer. When first diagnosed, high-grade serous carcinomas are in most cases already advanced. They are characterized by mutations in the tumor suppressor gene p53, showing high chromosomal instability and have a high proliferation rate.[9] High-grade carcinomas develop rapidly and have an aggressive clinical course. There is also a genetic predisposition to HGSC in women with BRCA1 and BRCA2 mutations.[4]

According to Shih et al.[10], mathematical models have shown that it can take many years or even decades from the development of a TP53 mutation, the earliest known molecular modification, to a serous tubal intraepithelial carcinoma (Fig. 1). Progression to HGSC follows in a shorter period.

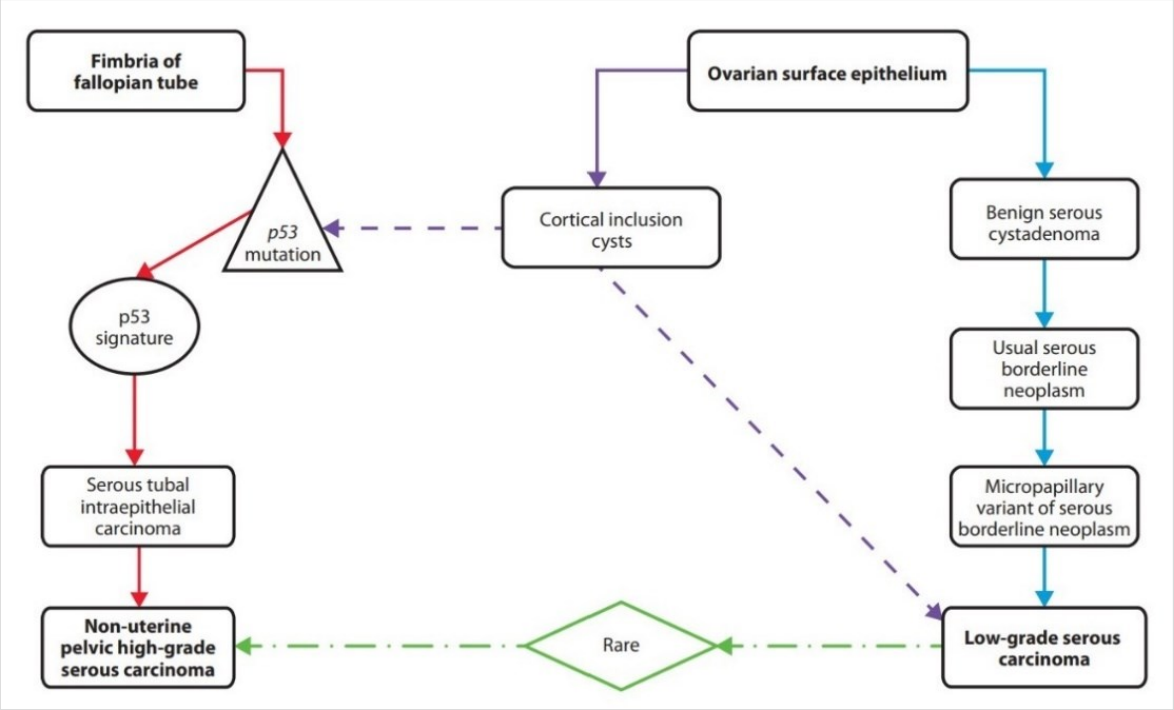


**Figure 1. Molecular pathway of HGSC [11]**

## 1.1.3.3. Serous Tubal Intraepithelial Carcinoma (STIC)

Based on current evidence, serous tubal intraepithelial carcinoma (STIC) is considered the earliest form of uterine serous adnexal malignancy.[5,12] In most cases, STICs are localized in the distal end of the tube, either in the infundibulum or the fimbriae. Like HGSCs, STICs also exhibit certain features such as a TP53 mutation associated with overexpression of p53, genomic instability, and a high mitotic index. These factors favor the evolution of HGSC.[9] STICs can become invasive and invade the underlying fallopian tube mucosa. More commonly, STIC cells can detach from the tube surface and spread directly onto the peritoneal surface, which surrounds the ovary, omentum, peritoneal wall, and intestine (Fig. 2). Tubal-ovarian adhesions or ovulation support this process.

The translocated STIC cells can survive in certain niches of the tissue environment. There they proliferate to form tumor nodules, which can lead to tumor ascites. As a rule, the ovaries are the first stop for STIC cells to develop into an ovarian HGSC. The reason for this is the proximity to the fimbriae and the favorable environment there (e.g., rich blood supply). Direct transition to the omentum or peritoneum is also possible, resulting in peritoneal primary HGSC.[10] STIC occurs in women with BRCA mutations as well as in women without a genetic predisposition to ovarian cancer.[13]

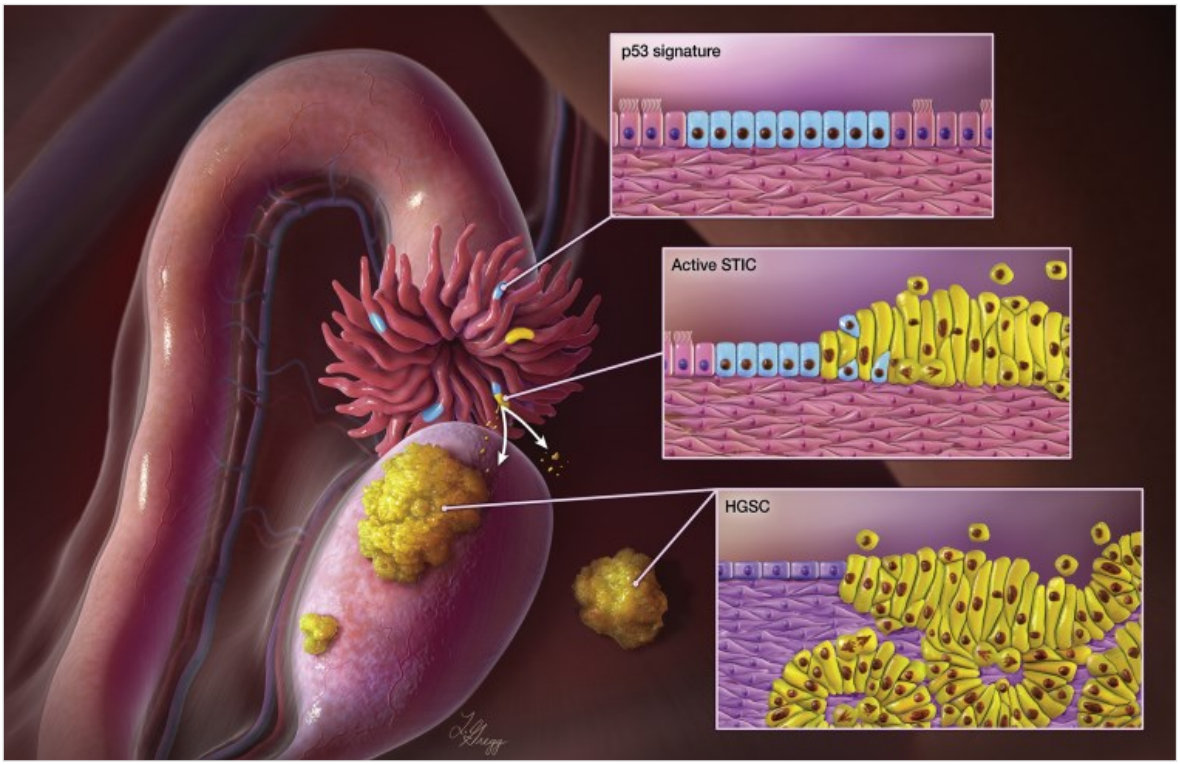


**Figure 2. Paradigm of fallopian tube as the origin of HGSCs [10]**

### 1.1.4 Prevention

Many protective factors are well-established, like the use of oral contraceptive pills, tubal ligation, pregnancy, and breastfeeding. This effect is probably the result of reducing the number of ovulation cycles.[6] Based on the growing evidence of tubal origins of epithelial ovarian cancer and epidemiologic data, prophylactic bilateral salpingectomy is now considered as a preventive measure for ovarian cancer.

### 1.1.5 Screening

A successful strategy for early detection of ovarian cancer has not been developed. Pelvic examination, vaginal ultrasound, or even the use of biomarkers (carbohydrate antigen 125 or CA125), did not provide a survival benefit.[6]

#### 1.1.5.1 Cancer Antigen 125 in Diagnosis

Generally, patients with epithelial ovarian cancer have a high serum concentration of CA125 (over 35 U/ml). However, it is not safe to rely solely on the CA125 value. Previous studies have shown that elevated CA125 levels were also found in about 1% of the healthy population and 5% of patients with other diseases, such as coronary artery disease or endometriosis. Due to the high false positive rate, women

without ovarian cancer may experience unnecessary psychological and physiological distress. CA125 is not a reliable early indicator of ovarian cancer. Patients with elevated CA125 levels are detected only at an advanced stage. The mortality rate did not significantly decrease when CA125 was used as a diagnostic indicator.[14–16]

### 1.1.6 Prognosis

Ovarian cancer has the highest mortality rate among gynecological cancers. When ovarian cancer is first diagnosed, it is already advanced (stage III or IV) in most women. Accordingly, these women have a poor five-year survival rate of only 5-25%. However, the five-year survival rate for HGSC first diagnosed at earlier stages is also only 60-85%. The postoperative tumor remnant is the strongest independent prognostic factor after the tumor stage. In advanced tumor stages, it is difficult or impossible to completely remove the tumor, which has spread to the entire abdominal cavity and organs. If it is possible to operate macroscopically tumor-free, the chances of cure are 60%. If the diameter of the residual tumor exceeds 1 cm, the 5-year survival rate drops rapidly to about 10%.[4,17]

#### 1.1.6.1 Cancer Antigen 125 in Prognosis

While CA125 is not a reliable diagnostic marker, there is agreement that CA125 plays a significant role in the prognosis of ovarian cancer. The presence of a high CA125 level after chemotherapy or surgery is associated with a poor prognosis.[18]

Other factors that can influence the prognosis of patients with serous ovarian cancer are age, previous illnesses, comorbidities, social status, onset, and course of the disease.

### 1.1.7 Ovarian Cancer Staging

Ovarian cancer is categorized into different stages based on internationally accepted criteria. The spread of the tumor is described based on these criteria and assigned to a stage accordingly. This is necessary to be able to plan optimal treatment and therapy. A preliminary classification of the tumor is possible even before an operation. However, an exact statement and precise classification regarding the spread and malignancy of the tumor is only possible after the operation and histological examination of the tumor tissue.[19,20]

Two systems are primarily used to classify ovarian cancer into different stages: the Figo staging system and the TNM classification.

#### 1.1.7.1 FIGO Staging System

The FIGO staging system is a system for classifying malignant gynecological tumors and was developed by the International Federation of Gynecology and Obstetrics (FIGO) and last revised in 2014.[21,22]

- FIGO stage 0: carcinoma in situ
- FIGO stage I: tumor is limited to the organ of origin
- FIGO stage II: tumor affects adjacent tissue or organs
- FIGO stage III: tumor affects more distant tissue or organs
- FIGO stage IV: tumor with distant metastases [22]

Depending on the gynecological tumor, the FIGO stages are subdivided.

#### 1.1.7.2 TNM Classification

The TNM classification was developed in 1964 by P. Denoix to classify malignant tumors, has been used internationally ever since, and is regularly updated by the Union for International Cancer Control (UICC).

The three letters "T-N-M" correspond to the respective criteria for the classification of a malignant tumor:

- T (Tumor): information about the spread and size of the primary tumor
- N (Nodes): describes the number (or absence) of regional lymph node metastases
- M (Metastases): describes the number (or absence) of distant metastases[23]

#### *1.1.7.2.1 T Category*

The T category can be assigned a number or another letter:

- Tx: no statement or no measurement of the primary tumor possible
- T0: primary tumor cannot be found
- T1-4: increasing size or spread of the tumor (further classification possible using additional lowercase letters (e.g., T1a to T1c))[19,20]

#### *1.1.7.2.2 N Category*

Category N contains information on regional lymph node metastases. Many tumors metastasize to surrounding lymph nodes before they form distant metastases.

- Nx: no statement about affected lymph nodes possible
- N0: no regional lymph node metastases
- N1-3: increasing number of regional lymph node metastases[19,20]

The N category is often followed by the number of lymph nodes examined (e.g., N0 (0/11)).[23]

#### *1.1.7.2.3 M Category*

If a malignant tumor has spread to other parts of the body in addition to the original site, this is referred to as distant metastasis. The M category indicates whether a malignant tumor has already formed distant metastases.

- M0: no distant metastases
- M1: one or more distant metastases present[19,20]

### 1.1.7.3 TNM and FIGO Ovarian Cancer Staging System

The TNM classification is only partially transferable to the FIGO classification.
In the interests of standardization, it is recommended that the TNM classification should always be specified by the pathologist (and additionally also the FIGO stage, Table 1).[24]

**Table 1. FIGO ovarian cancer staging system and corresponding TNM [21,24,25]**

| FIGO | description | TNM |
|---|---|---|
| **Stage I:** | **The tumor is limited to one or both fallopian tubes or ovaries. No metastasis to lymph nodes, other organs, or tissue** | **T1 N0 M0** |
| IA: | The tumor is limited to only one ovary (with an intact capsule) or only one fallopian tube. No tumor invasion on the surface of the ovary or fallopian tube. No malignant cells in the peritoneal washings or ascites. | T1a N0 M0 |
| IB: | The tumor is limited to both ovaries (with an intact capsule) or both fallopian tubes. No tumor invasion on the surface of the ovaries or fallopian tubes. No malignant cells in the peritoneal washings or ascites. | T1b N0 M0 |
| IC: | The tumor is limited to one or both ovaries or fallopian tubes and: | T1c N0 M0 |
| IC1: | Intraoperative tumor cell spread | T1c1 N0 M0 |
| IC2: | Rupture of the capsule before surgery or tumor invasion on the ovarian or tubal surface | T1c2 N0 M0 |
| IC3: | malignant cells in the peritoneal washings or ascites | T1c3 N0 M0 |

| | | |
|---|---|---|
| **Stage II:** | **The tumor affects one or both ovaries or fallopian tubes with tumor extension in the pelvis (below pelvic prim). No metastasis of the tumor in lymph nodes, other organs, or tissue outside the pelvis.** | **T2 N0 M0** |
| IIA: | Extension of the tumor to the uterus and/or ovaries and/or fallopian tubes | T2a N0 M0 |
| IIB: | Extension of the tumor to other (intraperitoneal) tissue or organs of the pelvis | T2b N0 M0 |
| **Stage III:** | **The tumor affects one or both ovaries or fallopian tubes with histological (or cytological) evidence of tumor spread to the peritoneum outside the pelvis and/or metastasis of the tumor to regional (retroperitoneal) lymph nodes.** | **T1-3 N0-1 M0** |
| IIIA1: | Only retroperitoneal lymph node metastases with: | T1-2 N1 M0 |
| IIIA1(i): | largest diameter smaller than 10mm | T1-2 N1a M0 |
| IIIA1(ii): | largest diameter greater than 10mm | T1-2 N1b M0 |
| IIIA2: | Microscopic spread of the tumor outside the pelvis with or without retroperitoneal lymph node metastases. | T3a2 N0-1 M0 |
| IIIB: | Macroscopic peritoneal metastases (largest diameter less than or equal to 20 mm) outside the pelvis with or without retroperitoneal lymph node metastases | T3b N0-1 M0 |
| IIIC: | Macroscopic peritoneal metastases (largest diameter more than 20 mm) outside the pelvis with or without retroperitoneal lymph node metastases or tumor extension into the liver or spleen capsule (without parenchymal involvement of these organs) | T3c N0-1 M0 |

| **Stage IV:** | **Presence of distant metastases (excluding peritoneal metastases)** | **T1-4 N1-3 M1** |
|---|---|---|
| IVA: | Presence of pleural effusion (with positive cytology) | T1-4 N1-3 M1a |
| IVB: | Distant metastasis of the tumor to organs outside the abdominal cavity (e.g., to the lungs or brain), inguinal lymph nodes, or even lymph nodes outside the abdominal cavity | T1-4 N1-3 M1b |

The stages (Fig. 3) can provide information about prognosis and appropriate treatment. The initial diagnosis of ovarian cancer occurs in most patients at advanced stages (FIGO stage III or IV).[22]

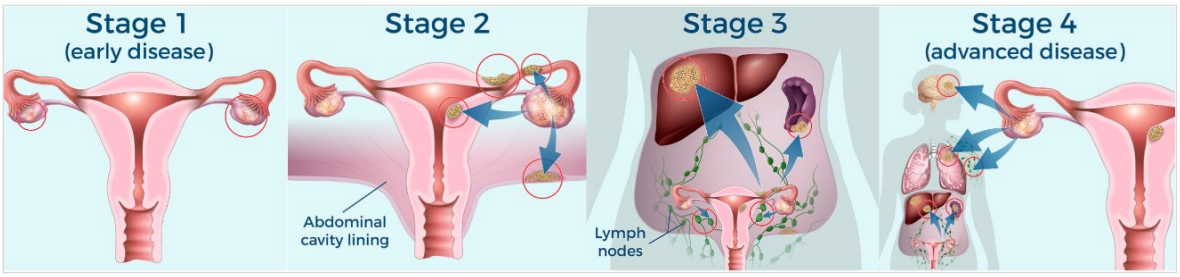


**Figure 3. Staging ovarian cancer [26]**

## *1.2 Prophylactic Bilateral Salpingectomy (PBS)*

As a preventive strategy for ovarian cancer prophylactic bilateral salpingectomy is recommended.[27] High-grade serous carcinomas of the ovaries, tubes, and peritoneum have their origin in the distal tube (called serous tubal intraepithelial carcinoma (STIC)). Prophylactic salpingectomy is also called opportunistic or elective salpingectomy. In PBS, the fallopian tubes are removed along with the fimbriae. This is nowadays done as part of gynecologic surgery in women who have completed their family planning.[28] Several studies have shown that salpingectomy, performed for benign indications, has the potential to prevent a significant number of pelvic serous carcinomas.[29–31] Retrospective, population-based data from Denmark and Sweden on bilateral salpingectomy with ovarian preservation have demonstrated that salpingectomy in the general (low-risk) population is associated with a 42%[32] and 65%[33] risk reduction for ovarian cancer.[6]

### 1.2.1 Prophylactic Bilateral Salpingectomy in the General Population

With knowledge of the development of precancerous lesions in the fallopian tubes, recommendations for bilateral prophylactic (opportunistic) salpingectomy in gynecologic and obstetric surgeries came from numerous gynecologic societies.[27] In 2015, the Working Group for Gynecologic Oncology (AGO) of the Austrian Society of Gynecology and Obstetrics (OEGGG) and the Austrian Society of Pathology (ÖGP) brought out a recommendation: Eligible women (with completed childbearing) should be offered prophylactic salpingectomy during an appropriate gynecologic procedure, tubal sterilization, or cesarean section.[27,28] In the United States the Society of Gynecologic Oncology (SGO) also mentions salpingectomy as a strategy to reduce the risk of ovarian cancer in eligible women, aiming to prevent the most common, aggressive subtype of ovarian cancer and thus many deaths.[27,34] Other international professional societies have published similar statements: the Royal Australian and New Zealand College of Obstetricians and Gynaecologists[35] and the American College of Obstetricians and Gynecologists.[36] All societies with supportive statements on prophylactic salpingectomy represent well-developed countries.[27] According to the Society of Gynecologic Oncology (SGO), pathological

preparation in low-risk women should include a complete section of the fimbriae, representative sections of the fallopian tube, and any suspicious lesions.[34]

#### 1.2.1.1 Prophylactic Bilateral Salpingectomy (and Oophorectomy) in the High-Risk Population

In women with an identified BRCA1 or BRCA2 germline mutation, bilateral salpingo-oophorectomy represents the greatest risk reduction for ovarian cancer development. It also significantly reduces the risk of breast cancer in these patients.[11] After the surgical removal of fallopian tubes and ovaries in high-risk patients, a pathological examination should be performed. The so-called SEE-FIM protocol is used. [24,34]

#### 1.2.1.2 SEE-FIM Protocol

With the discovery of STICs, the SEE-FIM protocol was also developed. This protocol includes micro-sections of the fallopian tubes with a detailed examination of the fimbriae after a salpingectomy (Fig. 4).[24,34]

This detailed examination of the fallopian tubes is intended to detect premalignant and malignant lesions in the fallopian tubes. This means that if STICs or carcinomas are present, targeted therapy can be initiated and, above all, the development of serous pelvic carcinoma can be prevented.[37,38]

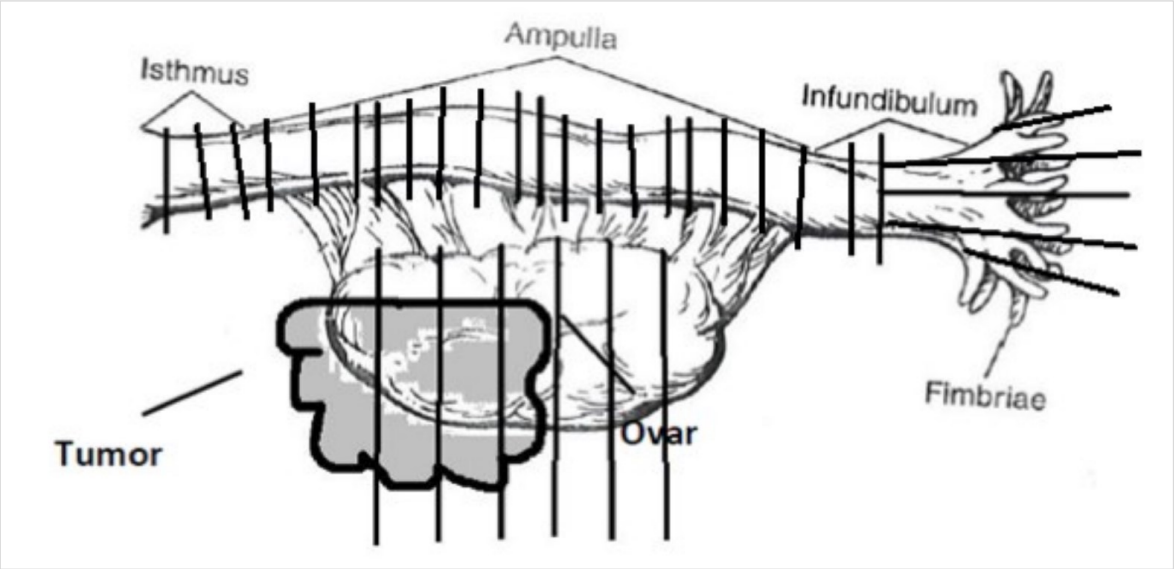


**Figure 4. Pathological examination of fallopian tubes and ovaries (SEE-FIM)[37]**

### 1.2.2 Feasibility, Benefits, and Risks of Prophylactic Bilateral Salpingectomy

According to the American College of Obstetricians and Gynecologists (ACOG)[36], the fallopian tubes should be completely removed as part of a salpingectomy. Special attention should be paid to the fimbriated end: all fimbrial attachments to the ovary should be removed or cauterized. Precancerous lesions of the ovary may be located throughout the fallopian tube, so complete salpingectomy is preferred over fimbriectomy.[39] The ovaries themselves and their blood supply (Aa. and Vv. ovaricae and Rami ovarici arteriae uterinae) are not damaged by the procedure: the incision for salpingectomy is made along the posterior margin of the fallopian tubes, and the mesosalpinx is preserved (Fig. 5).[40]

Removing the fallopian tubes in women, in addition to the primary surgical procedure (e.g. cesarean section), is considered a safe procedure. This applies not only to laparotomies but also to minimally invasive approaches such as laparoscopies or vaginal procedures. PBS demonstrates a high rate of feasibility and there is no evidence of increased morbidity. Salpingectomy can eliminate tubal-associated complications such as tubo-ovarian abscess, hydrosalpinx, tubal gravidity, and tubal prolapse.[9,28,36,41]

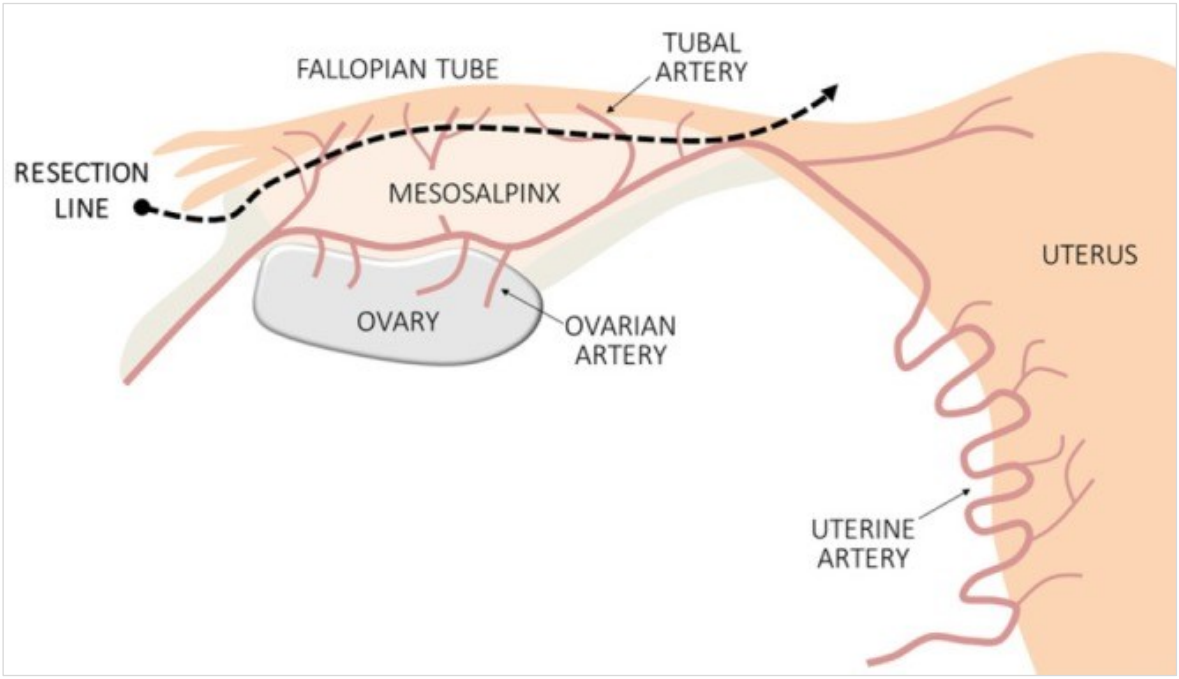


**Figure 5. Schematic representation of salpingectomy [39]**

Based on current knowledge about the development of ovarian cancer in the fallopian tubes and the benefits of salpingectomy, the American College of Obstetricians and Gynecologists (ACOG)[36] supports the following conclusions:

- Salpingectomy does not cause functional damage to the ovary .[42,43]
- There is only one significant difference when it comes to cases with and without salpingectomy; an increase in operative time. The additional operation time for sterilization with salpingectomy is about 10 minutes and the additional operation time for hysterectomy with salpingectomy is about 16 minutes. No differences were found between the two groups (with/without salpingectomy) regarding the following: postoperative complications, blood transfusions, readmissions, length of hospital stay, fever, or infections.[44]
- The surgeon should inform women (at population-based risk for ovarian cancer) about the potential benefits of BPS during hysterectomy.
- Salpingectomy at the time of cesarean section and postpartum salpingectomy are feasible and safe.
- Patients seeking permanent sterilization should be informed of the benefits and risks of salpingectomy.
- Contraception by PBS is more effective than tubal ligation.[42,45]

### 1.2.2.1 PBS at the Time of Non-Gynecological Surgery

Many societies recommend prophylactic salpingectomy at the time of gynecological surgeries (e.g., hysterectomy) or instead of tubal ligation, and this is commonly performed. Prophylactic bilateral salpingectomy during abdominal or non-gynecologic surgeries could be an option to prevent numerous cases of cancer and related deaths.[6]

A study published in March 2020[46] examined the feasibility of prophylactic salpingectomy during laparoscopic cholecystectomy. Women undergoing laparoscopic cholecystectomy were offered additional prophylactic salpingectomy during the operation to prevent ovarian cancer. Approximately 60% of the women surveyed expressed a desire for prophylactic salpingectomy. PBS could be performed in 98 of 105 laparoscopic cholecystectomies. It could not be performed in seven women due to poor visibility or adhesions. The additional operating time averaged 13 minutes, and there were no complications (intraoperative or postoperative) attributable to salpingectomy.

This study is an excellent example of how it is feasible to perform a bilateral salpingectomy at the time of a general surgical.

## *1.3 Overweight, Obesity and Ovarian Cancer*

According to the WHO, around 43% of adults (aged 18 and over) were overweight in 2022 and 16% were even obese. The prevalence of obesity among adults worldwide has more than doubled in the last 35 years.[47] The body mass index (BMI) describes the ratio of a person's weight in kilograms to height in meters ($kg/m^2$). For adults, WHO defines overweight as a BMI of 25 or more and obesity as a BMI of 30 or more. Obesity and overweight have an enormous disease value. They lead to a reduced quality of life and numerous accompanying diseases and complications, including type 2 diabetes mellitus, an increased cardiovascular risk, orthopedic consequences, and an increased risk of tumor diseases.[48–50]

Obesity therapy is based on three main pillars:

1. Lifestyle changes (physical activity, healthier diet)
2. Medication
3. Bariatric surgery[50]

### 1.3.1 Ovarian Cancer and Body Size

A meta-analysis by Olsen et al.[51], which included 28 studies, showed that overweight and obesity are associated with an increased risk of ovarian cancer. Numerous other studies support this assumption and describe a positive association between BMI and the risk of ovarian cancer.[52–55] Childhood obesity or obesity five years before ovarian cancer diagnosis is associated with poorer long-term patient survival.[56]

Highly increased adipose tissue is associated with molecular pathological changes that promote carcinogenesis and negatively influence the disease courses of gynecological cancers. Many causes are discussed, such as systemic inflammatory processes, pathologically increased hormone production of adipocytes, or obesity-induced insulin resistance (Fig. 6).[57]

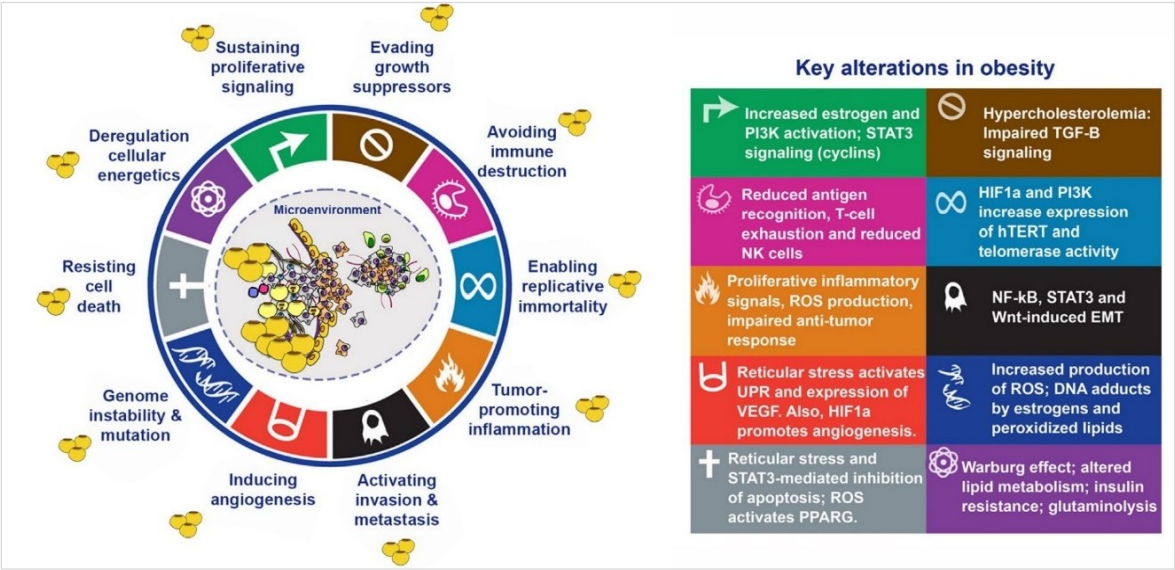


**Figure 6. Effects of obesity and adiposity in the hallmarks of cancer [49]**

### 1.3.1.1 Tumor-promoting Inflammation

In the increased adipose tissue, there is an increased immigration of immunocompetent cells and the proportion of pro-inflammatory M1 macrophages increases. It is being discussed whether this can be interpreted as an immune response to cell damage in adipocytes, as the increased uptake of saturated fatty acids leads to an altered cell membrane permeability of the adipocytes. The proinflammatory M1 macrophages release cytokines (such as tumor necrosis factor (TNF-α) or interleukins), which can have a direct oncogenic effect via various signaling pathways and can promote inflammation and thus oxidative DNA damage and the cellular mutational load.[57] The regulatory T cells, which have an anti-inflammatory effect, perish in obese adipose tissue.[58]

The inflammatory processes described are not limited to adipose tissue but can lead to an increased CRP level and even signs of systemic inflammation due to an increase in interleukins and tumor necrosis factors.[59]

### 1.3.1.2 Pathologically Increased Hormone Production

A carcinogenic effect of the peptide hormones adiponectin and leptin, which are increasingly released by adipocytes in obesity, is being discussed:

- A physiological adiponectin level has an anti-inflammatory and possibly oncoprotective effect. A disturbance of this physiological adiponectin level (as in obesity) could have an oncogenic effect.
- An excess of leptin stimulates angiogenesis.[57]

#### 1.3.1.3 Resisting Cell Death

In pathologically increased fatty tissue, the content of long fatty acids is abnormal. This leads to increased peroxisome stress, oxidation, and the accumulation of reactive oxygen species, which inhibits apoptosis via various metabolic pathways and promotes cell proliferation.[53]

### 1.3.2 Obesity and Pregnancy

Compared to women of normal weight, pregnancies in obese and overweight women are associated with an increased rate of complications and risks for mother and child.[60] Obesity can lead to spontaneous pregnancy loss and fetal anomalies.[61,62] Obese women have increased insulin resistance, which manifests clinically as glucose intolerance and macrosomia of the child.[60]

Obese women have an increased risk of complications, wound healing disorders, and infections during and after cesarean delivery.[63] Postpartum, they have an increased risk of pulmonary embolism and also venous thromboembolism.[64]

### 1.3.3 Obesity and Contraception

Numerous studies[65–67] conducted confirm the assumption that the effectiveness of hormonal contraceptives (especially combined oral contraceptives) can be impaired in overweight women due to the altered drug metabolism. In addition, the increased risk of thromboembolic and cardiovascular events must be taken into account when choosing a contraceptive method.[65]

## *1.4 Bariatric Surgery*

According to the American Society of Clinical Oncology[68], obesity is one of the most important factors in cancer mortality. Bariatric surgery and subsequent weight loss have been associated with a lower risk of obesity-related cancers and a 40-50% decrease in cancer-specific mortality.[69] According to the American Society of Metabolic and Bariatric Surgery (ASMBS)[70], bariatric surgery is recommended for people with a BMI of 35 kg/m2 or higher. For people with a BMI between 30 and 35 kg/m2, bariatric surgery should only be recommended if no permanent weight reduction has been achieved so far (with non-surgical methods). Furthermore, there is no upper age limit. Bariatric surgery should also be recommended for older patients after careful examination of the indication and consideration of possible concomitant diseases.[70] Especially for people suffering from obesity permagna (a BMI of 40 kg/m² or more), bariatric surgery is often the only way to lose weight in the long term.[50]

Common bariatric surgeries are:

- Gastric bypass
- Sleeve gastrectomy
- Gastric banding
- Duodenal switch
- Gastric Balloon

A meta-analysis[71] conducted in 2023, which included 32 studies, showed that bariatric surgery can help obese people lose weight in the long term and also improve metabolic syndrome. Bariatric surgery can help to reduce the risk of developing cancer, including ovarian cancer.[71]

### 1.4.1 Pregnancy after Bariatric Surgery

In general, women who become pregnant after bariatric surgery have better maternal and fetal outcomes than women who suffer from untreated obesity.[72] However, pregnancy immediately after bariatric surgery is not recommended. The woman's maximum weight loss should always be awaited, and she should be

informed about possible micronutrient deficiencies. A micronutrient deficiency can lead to fetal deficiency symptoms.[73]

According to the American College of Obstetricians and Gynecologists[74] (ACOG), you should wait at least 12 to 14 months after bariatric surgery before becoming pregnant. During this time, a safe method of contraception should be used.

### 1.4.2 Gastric Bypass

Laparoscopic gastric bypass is one of the most performed types of bariatric surgery worldwide. Five trocars are placed, and a small pouch is created from the stomach, which is then connected directly to the small intestine (Fig. 7).[75,76] The swallowed food is passed from the small stomach pouch into the small intestine. The ingested food thus bypasses most of the stomach and the first section of the small intestine. Indications for gastric bypass are the lack of success through diet and exercise or serious health problems due to body weight.[75]

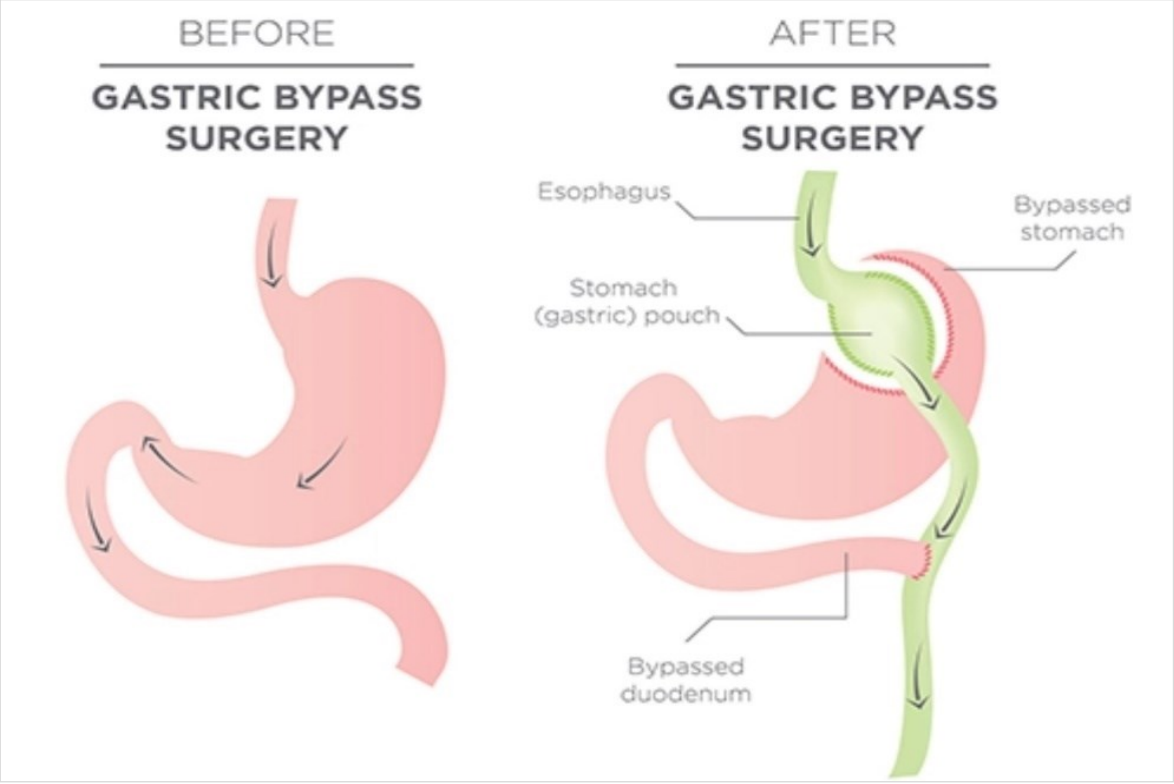


**Figure 7. Gastric bypass surgery [77]**

### 1.4.3 Sleeve Gastrectomy

Sleeve gastrectomy is one of the most performed bariatric procedures due to its low complication rate. In most cases, the operation is performed through 5 laparoscopic ports.[78] In this procedure, 80-85% of the stomach is removed and only a thin "tubular" stomach remains (Fig. 8). Due to the stomach reduction, only a reduced amount of food and calories can be absorbed. This leads to weightloss.[76,79]

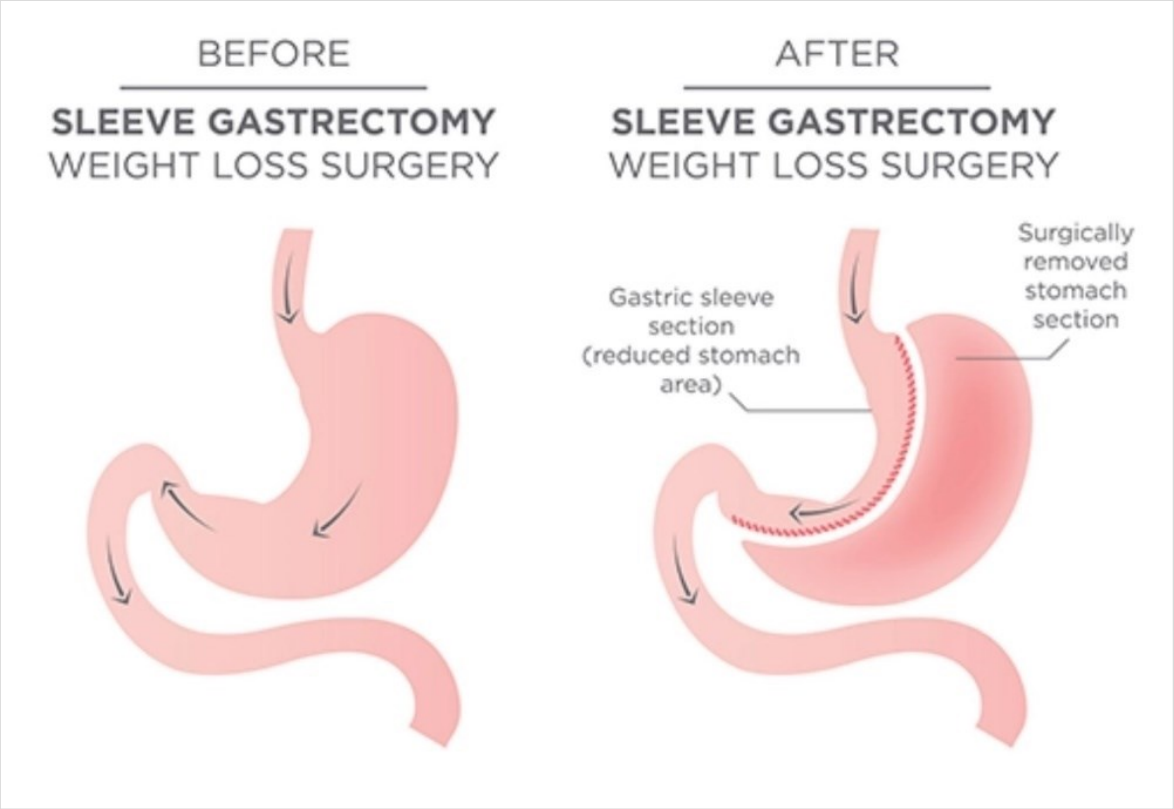


**Figure 8. Sleeve gastrectomy surgery [64]**

### 1.4.4 Semaglutide as an Alternative

In Austria, the active ingredient semaglutide is available for the treatment of obesity. A doctor has to write a prescription and check the indication:

- BMI of 30kg/m² or higher
- BMI of 27 kg/m² or higher and an additional concomitant disease attributable to obesity[80]

The active substance is administered as a subcutaneous injection called Ozempic®. In addition to treatment with semaglutide, patients must follow a calorie-restricted diet and increase their physical activity.[81]

### 1.4.4.1 Mechanism

Semaglutide is a genetically engineered GLP-1 receptor agonist and has a similar effect to GLP-1, a hormone produced in the intestine. The activation of these GLP-1 receptors triggers the release of insulin via a signaling cascade and lowers blood sugar. Gastric juice secretion and gastric emptying are inhibited, which triggers a feeling of satiety and suppresses the desire to eat.[81,82] Studies[83,84] have shown that 2.4 mg of semaglutide per week can lead to significant weight loss (15% of initial weight) in obese people. In addition, there was an improvement in concomitant diseases and performance.

GLP-1 receptor agonists in combination with the proven effectiveness and safety of bariatric surgery appear to have great potential in treating obesity.[85]

### 1.4.4.2Side Effects

Semaglutide is not approved for weight loss in healthy people. Numerous side effects can occur, such as bloating, nausea, vomiting, or diarrhea.[80]

# 2 Material and Methods

A pilot project was conducted to evaluate whether the fallopian tubes can be visualized, accessed, and potentially removed during bariatric surgery. Thirty-one female patients participated in this multicenter, prospective study. The study was conducted at two centers: Krankenhaus der Elisabethinen Graz (twenty patients) and LKH Hochsteiermark, Standort Leoben (eleven patients).

## *2.1 Procedure*

The study population consisted of appropriate women who underwent bariatric surgery. Inclusion and exclusion criteria (Table 2) were reviewed. Appropriate information was provided to the patients, and consent forms were obtained for participation in the clinical trial.

**Table 2. Inclusion and exclusion criteria**

| Inclusion criteria | Exclusion criteria |
|---|---|
| – Women 18 years and older scheduled for laparoscopic bariatric surgery<br>– Good knowledge of German, ability to consent | – Women under 18 years<br>– Insufficient command of German |

After completion of the bariatric surgery (gastric bypass or sleeve gastrectomy), patients were positioned in a head-down, so-called Trendelenburg position. The camera was directed toward the lesser pelvis. At the point of (non-)visualization of the adnexa, anesthesia parameters were documented. If the adnexa could be visualized, attempts were made to reach the fallopian tubes with one or two instruments via an existing port. No interventions were performed on the fallopian tubes. The potential risk to patients was low because this study involved no interventions other than assessing whether the tubes could be made visible and reachable. The procedure was terminated if the patient shifted on the operating table during tilting.

### 2.1.1 Database

Patient data were protected by using pseudo-anonymized case report forms (attached). The case report forms were completed intra- and postoperatively by the respective surgeon and anesthesiologist and then transferred.

The CRF recorded:

- Patient data:
    - age, height, weight, BMI
    - parity
    - previous pelvic or abdominal surgeries
- Type of bariatric surgery
- Number of trocars placed
- Can the tubes be visualized
- Can the tubes be accessed with one or two instruments over an existing trocar
- The time between the end of bariatric surgery and (non-)visualization of the tubes in minutes
- Shift of the patient on the operating table
- Anesthesia parameters at the time of (non-)visualization:
    - Inspiratory pressure
    - Peak inspiratory pressure
    - Tidal volume
    - Ventilation rate per minute
- Additional notes or comments

## *2.2 Intention*

This pilot project aims to evaluate whether the fallopian tubes can be visualized and accessed through existing trocars at appropriate women during bariatric surgery (primary outcome, Table 3). The additional time required for this, as well as the anesthetic parameters, were also recorded (secondary outcome, Table 3).
To investigate whether prophylactic salpingectomy can be performed as part of laparoscopic bariatric surgery, as is already established for related gynecologic surgeries.

**Table 3. Primary and secondary outcomes**

| |
|---|
| **Primary outcome** |
| • Rate of visualization/ access of the adnexa |
| **Secondary outcome** |
| • Additional time for visualization/non-visualization of the adnexa<br>• Anesthesia parameters |

### 2.2.1 Benefits

In 2016, laparoscopic bariatric surgery was performed on over 2000 women in Austria. Over 60% of these women were over 35 years old at the time of surgery.[86] Safe contraception is challenging in obese women, pregnancy is more complicated and is not recommended within the first one to two years after bariatric surgery.[87,88] Furthermore, obesity is associated with an increased risk of ovarian cancer.[51–55] Prophylactic bilateral salpingectomy would have the benefit of providing safe contraception and reducing the risk of ovarian cancer in suitable women.

## *2.3 Ethical Approval*

The study protocol was approved by the Ethics Committee of the Medical University of Graz.

# 3 Results

Thirty-one women participated in the study. They all underwent laparoscopic bariatric surgery (gastric bypass or tubular stomach), received adequate information, and signed the informed consent form. After completion of bariatric surgery, successful visualization of the fallopian tubes was possible in 26 women. In 23 women, the fallopian tubes could be reached with two instruments (Fig. 9).

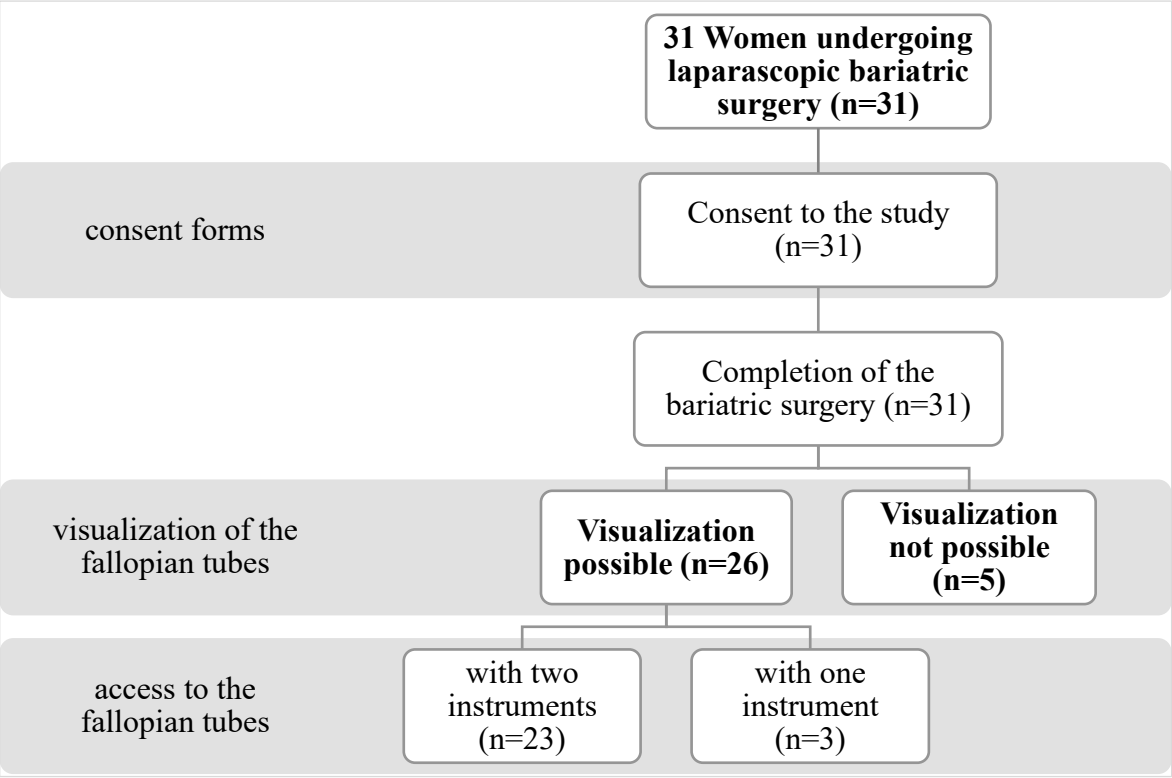


**Figure 9. Flow diagram**

Table 4 provides a more detailed overview of the results and values documented in the CRF.

**Table 4. Overview: Outcomes showing averages (range)**

| **Bariatric Surgery** | **No. of Patients (n=31)** |
|---|---|
| **Age** (years) | 38 (20-59) |
| **BMI** (kg/m²) | 42 (34-50) |
| **Previous Pelvic Surgery** | 16/31 (52%) |
| **Bariatric Procedure**<br>• Gastric Bypass<br>• Sleeve Gastrectomy | <br>30 (97%)<br>1 (3%) |
| **Successful Visualization of the Tubes** | 26/31 (84%) |
| **Successful access to the Tubes**<br>• With one Instruments<br>• With two Instruments | <br>3/26 (12%)<br>23/26 (88%) |
| **Time for (Non-)Visualization** (min) | 3.5 (1-8) |
| **Anesthesia Parameters**<br>• Inspiratory Pressure (mmHg)<br>• Peak Insp. Pressure (mmHg)<br>• Tidal Volume (milliliters)<br>• Ventilation Rate (per minute) | <br>22.5 (8-31)<br>26.5 (21-35)<br>510 (350-850)<br>13 (11-16) |

## *3.1 Visualization and Accessibility Rate*

The tubes were successfully visualized in 26 participants (84%, Fig. 10). For this purpose, the women were placed in the Trendelenburg position after completion of bariatric surgery and the camera was directed toward the lesser pelvis. The fallopian tubes could be reached with two instruments in 23 women (88%, Fig. 11) and with one instrument in the remaining 3 women (12%, Fig. 11). Overall, the tubes could be reached with two instruments in 23 of 31 women (74%). The additional time required to visualize and reach the fallopian tubes averaged 3.5 minutes (range: 1 to 8 minutes).

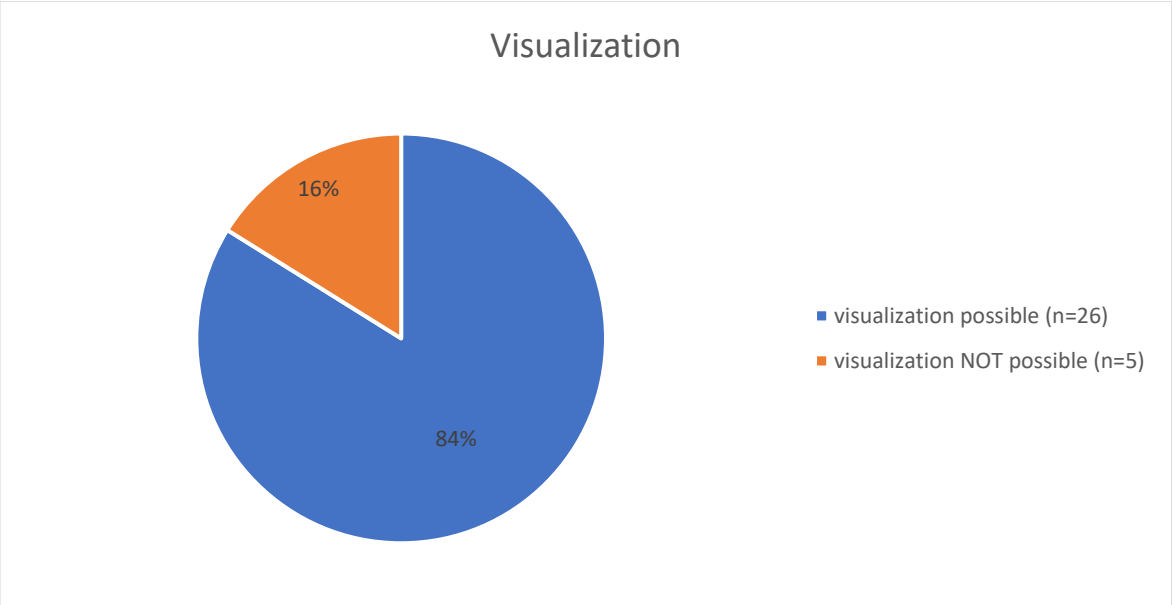


**Figure 10. Visualization rate**

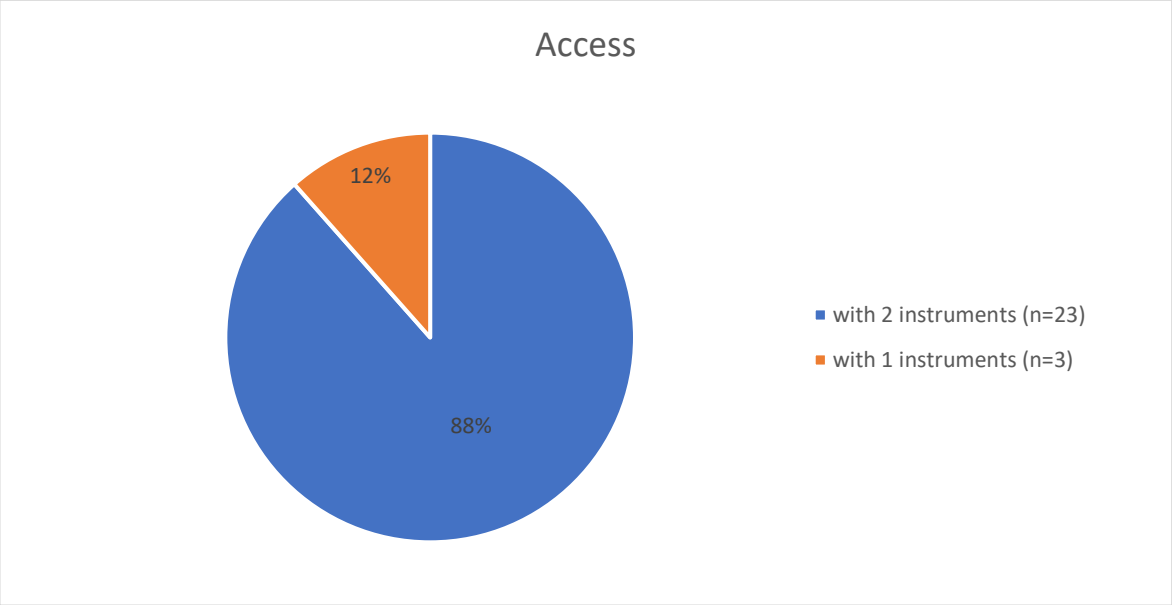


**Figure 11. Accessibility rate**

## *3.2 Preoperative and Intraoperative Data*

Using a pseudo-anonymized CRF, data relevant to the study were documented preoperatively and intraoperatively.

### 3.2.1 Preoperative Data: Age, BMI, parity

Before surgery, the women's age, BMI, and parity were documented. On average, participants were 38 years old, had a BMI of 42, and had given birth once (Table 5). Age and parity were similar in both groups (successful visualization vs. unsuccessful visualization of the tubes). BMI was higher in the group of unsuccessful visualization.

**Table 5. Preoperative data showing averages (range)**

| | Study population | Visualization possible | Visualization not possible |
|---|---|---|---|
| **Age** (years) | 38 (20-59) | 38 | 41 |
| **BMI** (kg/m²) | 42 (34-50) | 41 | 45 |
| **Parity** (children per woman) | 1 (0-4) | 1 | 1 |

#### 3.2.1.1 Previous Surgeries

Sixteen study participants (52%) had at least one previous pelvic surgery. The remaining fifteen study participants (48%) had no previous pelvic surgery (Fig. 12).

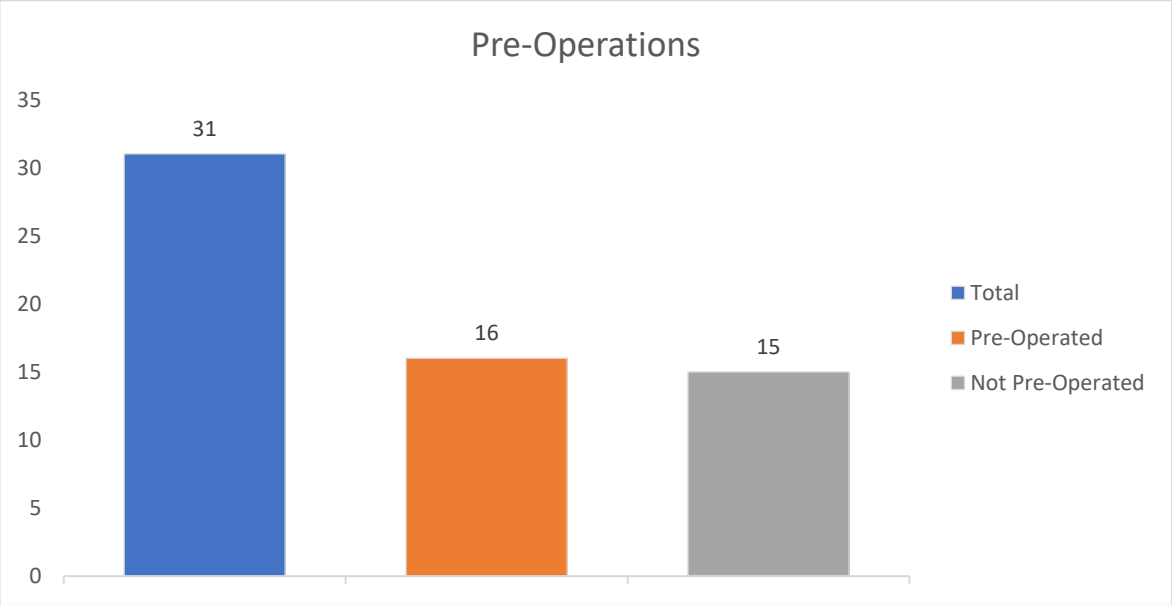


**Figure 12. Pre-operated participants**

Documented pre-surgeries were: Sectio, tubal ligation, cyst excision, AE (appendectomy), and LAVH (laparoscopically assisted vaginal hysterectomy) (Fig. 13).

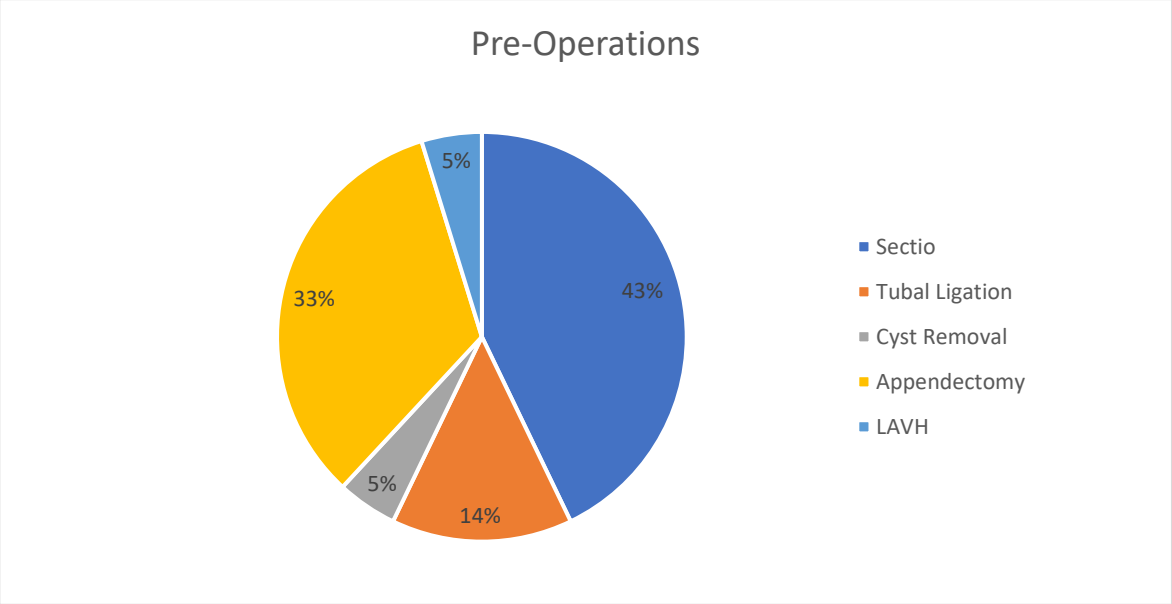


**Figure 13. Pre-Operations**

### 3.2.2 Intraoperative Data: Time for Visualization

The time between the end of bariatric surgery and (non-)visualization of the fallopian tubes averaged 3.5 minutes. The range was from one to eight minutes.

#### 3.2.2.1 Anesthesia Parameters

At the time of (non)visualization of the fallopian tubes (in Trendelenburg position), the following anesthetic parameters were documented:

- Inspiratory pressure (mmHg)
- Peak inspiratory pressure (mmHg)
- Tidal volume (liters)
- Ventilation rate (per minute)

The recorded values were within an acceptable range in all patients. It must also be considered that these were overweight women. Accordingly, the reference values for bariatric surgery are given (Table 6, Fig. 14).

**Table 6. Anesthesia parameters showing averages and range**

| | Study population | |
|---|---|---|
| | **averages** | **range** |
| **Insp. Pressure** (mmHg) | 22.5 | 8-31 |
| **Peak insp. Pressure** (mmHg) | 26.5 | 21-35 |
| **Tidal Volume** (milliliters) | 510 | 350-850 |
| **Ventilation rate** (per minute) | 13 | 11-16 |

If there had been problems with ventilation in the Trendelenburg position and the values were unacceptable, the attempt to visualize and reach the fallopian tubes would have been stopped immediately.

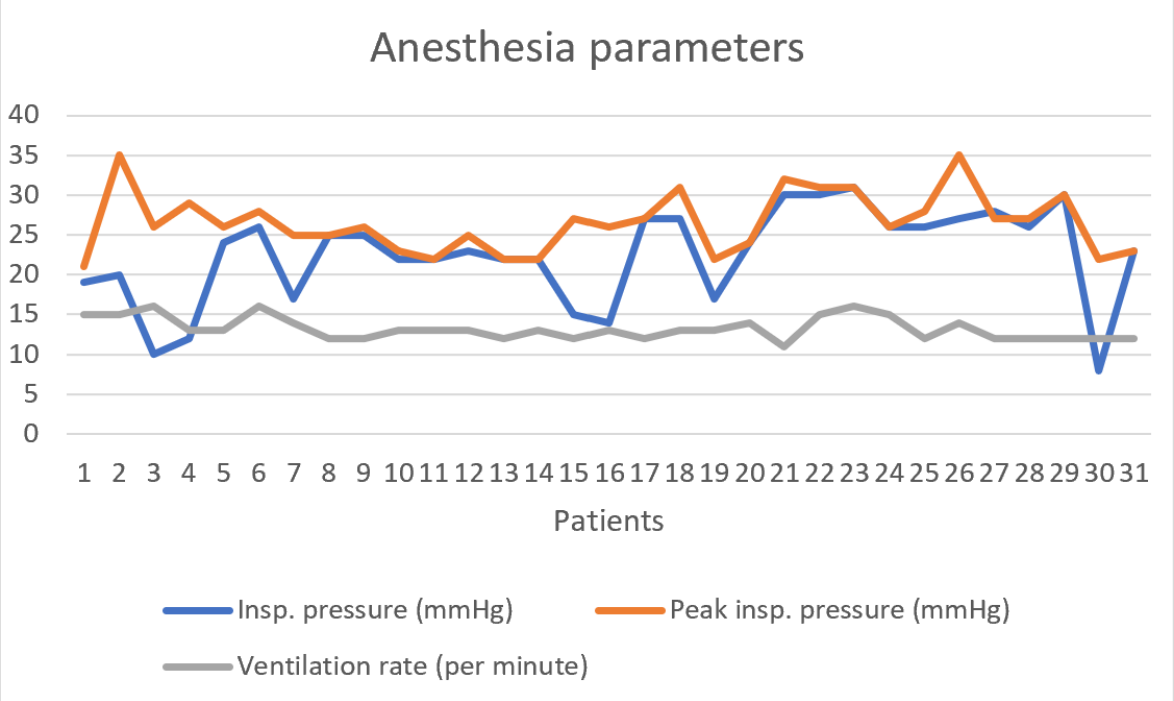


**Figure 14. Anesthesia parameters**

### 3.2.2.2 Shift

None of the women shifted on the operating table during the head-down positioning. This would have been a reason for termination, as no head-down positioning would have been possible without endangering the patient.

## *3.3 Bariatric Surgeries*

Thirty women (97%) who participated in the study underwent gastric bypass (Fig.13). This bariatric procedure involved the placement of five trocars (including optics), which were used to visualize and reach the fallopian tubes. Thus, no new trocars were placed for the study, but the existing ones were used. In one woman (3%), a sleeve gastrectomy was performed (Fig. 15). For this, four trocars (including optics) were placed. It was possible to visualize and reach the fallopian tubes through the existing four trocars.

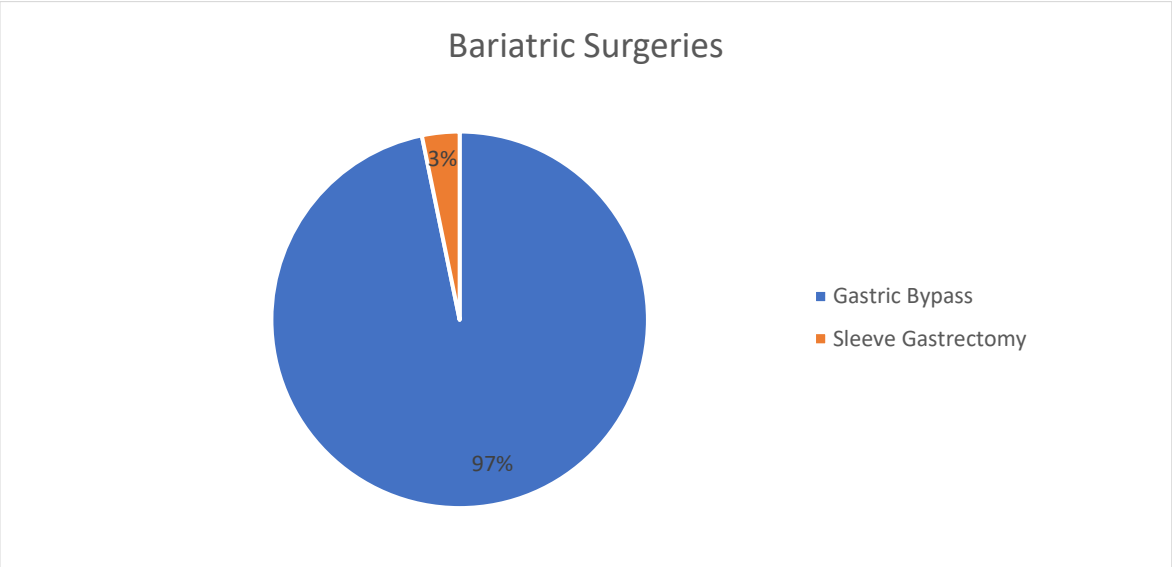


**Figure 15. Bariatric Surgeries**

## 3.4 Non-Visualization

In five women (16%), the tubes could not be visualized during bariatric surgery. The reasons were: too obese, very full bladder, or adhesions due to previous surgery. In one patient, no reasons for non-visualization were documented (Fig. 16).

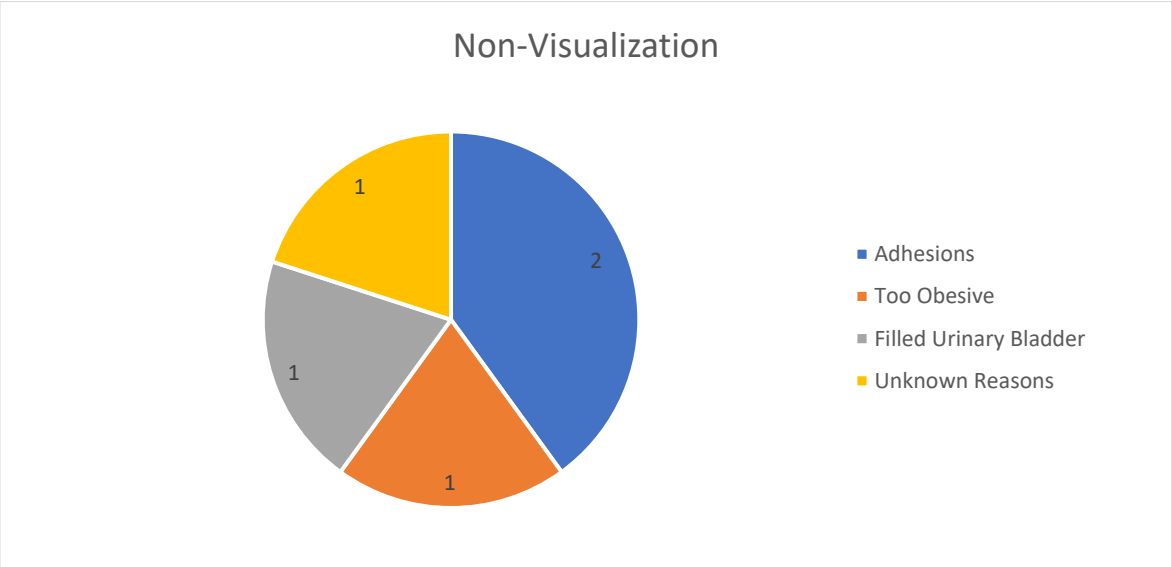


**Figure 16. Reasons for Non-Visualization**

Four of the five women in whom it was not possible to visualize and reach the tubes had already undergone a previous operation. Two of them had even had more than one previous abdominal or pelvic operation. It can therefore be concluded that there is a connection between the previous abdominal or pelvic operations, the resulting adhesions, and the visibility and access to the fallopian tubes.

# 4 Discussion

The aim of this prospective multicenter study with 31 participating women was to investigate the feasibility of a prophylactic bilateral salpingectomy in the context of laparoscopic bariatric surgery. It was investigated whether the fallopian tubes can be visualized intraoperatively through the placed trocars and reached with instruments.

At the time of bariatric surgery, the average age of the women was 38 years, and the average BMI was 42 kg/m². More than half of the participants (52%) had had at least one previous pelvic operation (caesarean section, tubal ligation, cyst excision, AE, LAVH) and had already given birth to at least one child (55%). Almost all women (97%) had undergone gastric bypass, only one woman (3%) had undergone sleeve gastrectomy.

## *4.1 Background*

Overweight and obesity are a global problem. The WHO[47] assumes that the number of overweight and obese people will continue to rise in the future. This is accompanied by obvious problems such as a reduced quality of life, orthopedic complications, an increased risk of cardiovascular events, and increased mental and physical stress. Contraception in obese women can be difficult, and pregnancy and childbirth can be associated with more risks and complications for mother and child. Pathological changes in adipose tissue also lead to a promotion of carcinogenesis and an increased risk of tumor diseases. (Fig. 6) In particular, a tumor-promoting inflammatory reaction, increased hormone production, the promotion of angiogenesis and the bypassing of natural cell death appear to play an important role.

In addition to lifestyle changes (a healthy and balanced diet and more physical activity), obesity treatment also includes medication and bariatric surgery. Approved drugs such as semaglutide open up new avenues for (long-term) weight loss for those affected. Semaglutide is injected subcutaneously and works similarly to a hormone produced in the intestine. The medication creates a feeling of fullness, delays gastric emptying, and shows good results in those affected[83,84]. However,

these drugs are subject to strict guidelines, require a prescription, and are only approved for the right indication (BMI over 30kg/m² or BMI over 27kg/m² with concomitant disease).

Bariatric surgery such as gastric bypass or sleeve gastrectomy can lead to long-term weight loss, especially in people with permagna obesity. Weight loss is also associated with a reduction in the risk of cancer (including ovarian cancer). Pregnancy in the first one to two years after bariatric surgery is not recommended.

Serous ovarian carcinoma is still the deadliest gynecological tumor disease. High-grade serous carcinomas (HGSC) of the ovary in particular are aggressive, develop quickly and have a poor prognosis. The tumor is usually only discovered at an advanced stage (FIGO stage III or IV), early detection is rare, the symptoms are unspecific and there is still no functioning screening program. The serum level of the carbohydrate antigen 125 also plays a subordinate role in the diagnosis but can be an indication of the prognosis.

It is now known that HGSC originates in the fallopian tubes and spreads from there. These intratubal carcinoma precursors are referred to as serous tubal intraepithelial carcinoma (STIC), which can then spread throughout the pelvis (peritoneal surface). Prophylactic removal of the fallopian tubes (and therefore also the STICs) significantly reduces the risk of later developing ovarian cancer or peritoneal cancer.

Prophylactic removal of the fallopian tubes as part of appropriate gynecological surgery is already well established and has been recommended by the Austrian Society of Gynecology and Obstetrics (OEGGG) since 2015.

Women with an increased risk of ovarian cancer (BRCA1, BRCA2, Lynch syndrome) are offered a prophylactic bilateral salpingectomy (PBS) to prevent ovarian cancer. Women with a normal population-related risk of ovarian cancer should also be informed about the possibility of PBS and the associated ovarian cancer prophylaxis.

## *4.2 Study Outcome*

This prospective, multicenter study with 31 patients shows that it is possible to visualize and reach the fallopian tubes during laparoscopic bariatric surgery (84% visualization rate of the fallopian tubes, 88% of which can be achieved with two instruments).

The additional time required to visualize and reach the fallopian tubes is low (1-8 minutes), and it is also possible to ventilate obese patients in the Trendelenburg position without endangering the patients or causing them to shift on the operating table. The anesthesia parameters recorded intraoperatively remain within an acceptable range, even in patients with an extremely high BMI (up to 50 kg/m²) and there were no complications during the operation. It has also been shown that the trocars placed during bariatric surgery are sufficient for visualization and reaching the fallopian tubes and that no new trocars need to be placed. Five trocars are used for the gastric bypass operation and four trocars for the sleeve gastrectomy. The complication rate appears to be low. This suggests that bilateral prophylactic salpingectomy (PBS) at the time of laparoscopic bariatric surgery would be potentially feasible.

### 4.2.1 Limitations

The biggest limitation of this study is the small number of only 31 participating women. A larger group of study participants would be more meaningful. The feasibility of prophylactic bilateral salpingectomy was investigated almost exclusively in laparoscopic gastric bypass surgery (97%). Only one woman underwent laparoscopic sleeve gastrectomy (3%).

No statement can be made about the feasibility of prophylactic bilateral salpingectomy in other laparoscopic bariatric procedures (such as gastric banding or duodenal switch).

### 4.2.2 Failure

In five women (16%), the fallopian tubes could not be visualized on both sides during laparoscopic bariatric surgery. These women were extremely obese, had severe

adhesions due to previous pelvic surgeries or a very full bladder. In the case of one woman, the reason for non-visualization is unknown. In three women, the fallopian tubes could only be reached unilaterally with instruments.

However, it should be noted that no invasive procedures (such as adhesiolysis or placement of a urinary bladder catheter) were performed in this study, otherwise the rate of non-visualization would probably be even lower.

## *4.3 Conclusion*

This pilot project was able to show that it is possible to visualize and access the fallopian tubes (and thus probably also the PBS) as part of non-gynecological laparoscopic surgery (bariatric surgery). The study involved 31 women, all of whom were of legal age and able to give informed consent. Data was collected intraoperatively and postoperatively. The visualization rate of the tubes was 84%, in the majority of them (88%) the tubes could be reached with two instruments through the existing trocars. The additional operating time was low, averaging 3.5 minutes, and there were no complications. The anesthesia parameters remained within the acceptable range (Table 4). In a further study, the actual removal of the fallopian tubes in the context of bariatric surgery could be investigated further.

A similar study[46] published in 2018 shows that PBS is also possible as part of laparoscopic cholecystectomy. Around 60% of women (with completed family planning) requested PBS as part of this elective surgery after being informed about the risk reduction for ovarian cancer. There were no intraoperative or postoperative complications attributable to PBS and the additional time required for salpingectomy was minimal. Further studies could demonstrate the potential and benefits of PBS in the context of non-gynecological surgery in appropriate women.

It appears reasonable to offer prophylactic bilateral salpingectomy to appropriate women as part of other non-gynecological procedures to reduce deaths from ovarian cancer. The prerequisite for this would be precise information about the existing risks and benefits of fallopian tube removal. This could be aimed in particular at women who no longer wish to have children, are at an appropriate age, and are undergoing elective surgery.

The existing trocars of a large number of laparoscopic operations would probably be sufficient for PBS. It would be desirable for future studies to examine this potential and benefit, for example, the feasibility of prophylactic bilateral salpingectomy in the context of laparoscopic cholecystectomy, appendectomy or hernia surgery.

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## Attachment – Case Report Form

# CRF: Prä- und Intraoperativ

**Patientin** Initialen: ____ ____ Geb. (TT.MM.JJ): ____ . ____ . ____

- Grösse: _____ cm Gewicht: _____ kg BMI _____ Parität: _____
- Voroperationen im Becken: **N / J** welche:

**Operation** **OP**-Datum _____ . _____ . 2022

- Bariatrische OP 1 = sleeve gastrectomy 2=gastric bypass 3= gastric banding 4 = other 1 / 2 / 3 / 4
- Wie viele Trokare werden für die bariatrische OP gesetzt (insgesamt, inkl. Optik)? 1 / 2 / 3 / 4 / 5
- Können die Tuben/Adnexe visualisiert werden? J / N
- Können die Tuben/Adnexe mit **1** oder **2** Instrumenten (zB Pinzette) durch ein bestehenden Trokar **erreicht** werden, oder nicht (**0**)? 0 / 1 / 2
- **Zeit** Ende Bariatrie – Visualisierung/Nicht-Visualisierung der Tuben ____ Min.
- **Anästhesie-Parameter** zum Zeitpunkt der Visualisierung / Nicht-Visualisierung

  $P_{insp}$ _____ mmHg $P_{max}$ _____ mmHg $V_t$ _____ L Beatmungsfrequenz ____ /Min.
- Shift der Patientin am OP-Tisch? (Abbruchsgrund) J / N

Sonstiges/Bemerkungen/Probleme/Komplikationen: