

# The Fagotti's Score to Predict the Possibility of Optimal Cytoreduction in Advanced Epithelial Ovarian Cancer

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## ABSTRACT

Ovarian cancer is the most common cause of lethality among women with gynecological cancers. In Europe, it ranks fifth in frequency in women after malignancies of the mammary gland, colon, lung and uterine body. Generally, it is diagnosed at an advanced stage (III-IV) due to the non-specificity of symptoms in the early stage and the lack of effective screening methods. The majority of patients with advanced epithelial ovarian cancer are indicated either for neoadjuvant chemotherapy followed by optimal cytoreduction or optimal cytoreduction followed by adjuvant chemotherapy. This necessitates laparotomy or laparoscopy for the purpose of histological verification of the tumor and assessment of optimal cytoreduction. A laparoscopically based system has been created, anticipating the possibility of optimal cytoreduction. In the present article, we describe the Fagotti's laparoscopic score in advanced epithelial ovarian cancer and briefly discuss its strengths and limitations.

**Key words:** advanced ovarian cancer, Fagotti's score, optimal cytoreduction, laparoscopy

## INTRODUCTION

Ovarian cancer is the most common cause of death among women with gynecological cancers (1). In Europe, it ranks fifth in frequency in women (1) after malignancies of the mammary gland, colon, lung and uterus. Generally, it is diagnosed in an advanced stage of the disease with peritoneal or lymph node metastases in the upper abdomen due to the non-specificity of symptoms in the early stage and the lack of effective screening methods (1). The majority of patients with advanced epithelial ovarian carcinoma (AEOC) are indicated either for neoadjuvant chemotherapy followed by optimal cytoreduction (RO) or optimal cytoreduction followed by adjuvant chemotherapy. The latter is the cornerstone in the management of AEOC as it is associated with increase survival (1-3). Unfortunately, clinical examination, laboratory tests and different imaging modalities are not always sufficient to differentiate the two cohorts of patients – the ones that are firstly indicated for neoadjuvant chemotherapy

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followed by optimal cytoreduction and the others that are candidates for optimal cytoreduction followed by adjuvant chemotherapy. This necessitates laparotomy or laparoscopy in order to predict the possibility of optimal cytoreduction and histological verification of the tumor. A laparoscopically based system has been created, anticipating the possibility of optimal cytoreduction (2,4). In the present article, we describe the Fagotti's laparoscopic score in AEOC and briefly discuss its strengths and limitations. Additionally, we provide laparoscopic figures of the anatomical zone of the abdomen affected by disseminated ovarian cancer.

### ***Explorative Laparotomy vs Exploratory Laparoscopy***

The inferiority of exploratory laparotomy compared to exploratory laparoscopy in patients with AEOC is the following (2):

1. Longer recovery and longer hospital stay;
2. High incidence of complications of the anterior abdominal wall – hematomas, abscesses, hernias, eventrations (common - due to low levels of serum albumin in these patients);
3. Poorer postoperative pain control;
4. Slower postoperative recovery and poorer quality of life;
5. Delay of neoadjuvant treatment.

Minimally invasive surgery offers the advantage of shorter hospital stay, decreased perioperative recovery, less postoperative pain, lower rates of wound infections and hernias. (3) The hospital stay after laparoscopic evaluation is shorter compared to laparotomic one. Therefore, patients, who underwent exploratory laparoscopy are initiated for adjuvant/neoadjuvant treatment faster compared to the laparotomy cohort arm.

### ***Fagotti's Laparoscopic Score***

In 2006, Anna Fagotti et al. introduced a laparoscopic scoring system evaluating the possibility of optimal cytoreduction in AEOC. The system has been well accepted and has rapidly gained popularity in the gynecologic oncology community. The aim of the Fagotti's laparoscopic score was to create a more objective quantitative laparoscopic model for predicting the chances of optimal cytoreductive surgery in AEOC (4).

The Fagotti's scoring system is based on the presence or absence of metastases in 7 anatomical regions:

1. Greater omentum;
2. Parietal peritoneum (the exception is the

- diaphragmatic parietal peritoneum);
3. Parietal peritoneum of the diaphragmatic parietal peritoneum;
4. Mesentery;
5. Stomach;
6. Small and large intestines;
7. Liver.

The anatomical regions evaluated by the Fagotti's score are shown in *fig. 1*.

In the presence of massive metastases, the anatomical area is evaluated with 2 points, and in the absence or isolated metastases – with 0 points. The maximal score of points is 14 and the minimum is 0. The pelvis is excluded from the system, as in AEOC, the pelvic tumors are always resectable (by Hudson's operation or/without rectal/sigmoid resection). The authors concluded that a score equal to or greater than 8 points is associated with suboptimal cytoreduction and the presence of residual tumor. It is necessary to emphasize that during the creation of the Fagotti's, system for optimal cytoreduction was considered R<1 cm (4). The scoring system of the Fagotti's laparoscopic score in AEOC is shown in *table 1*.

#### *Greater omentum*

Evaluation of the greater omentum includes the tumor infiltration of the greater omentum up to the large curvature of the stomach (infiltration of supra-



**Figure 1 - Anatomical areas in the Fagotti's score examining the presence of metastases (authors' own material):**  
 1. Omentum; 2. Parietal peritoneum; 3. Diaphragmatic parietal peritoneum; 4. Mesentery; 5. Stomach; 6. Small and large intestines; 7. Liver

**Table 1 - Fagotti's scoring system in advanced epithelial ovarian cancer**

Anatomic region	2 points	0 points
Greater omentum	Omental cake	Absence or isolated single metastases
Parietal peritoneum	Massive miliary metastases or nonresectable metastases	Absence or isolated metastases in one anatomical region – paracolic guts
Diaphragmic parietal peritoneum	Massive carcinomatosis or nonresectable metastases	Absence of metastases
Mesentery	Confluent carcinomatosis of the mesentery or presence of a tumor in the region of the mesenteric root	Absence or single metastases with insignificant size
Stomach	Macroscopically visible metastasis involving the wall of the stomach	Absence of metastases or single metastases disseminating only the visceral peritoneum of the stomach
Small and large intestines	Presence of metastases, in which the resection of intestines is not feasible or in case of massive miliary or confluent carcinomatosis	Absence of metastases or single metastases in the visceral peritoneum, which don't lead to resection of the intestines and can be eliminated by bipolar coagulation
Liver	Presence of superficial metastases involving the Glisson's capsule	Absence of metastases on the surface of the liver

colic omentum). Score 2 – “omental cake” with metastases reaching the grater curvature of the stomach (*fig. 2*). Score 0 – no metastases or isolated single metastases (5).

*Parietal peritoneum*

Score 2 – massive miliary parietal carcinomatosis or unresectable massive and multiple metastases in the parietal peritoneum (*fig. 3*).

Score 0 – an absence of metastases or cases of peritoneal carcinomatosis covering isolated anatomical areas – the paracolic gutters (5).

*Diaphragmic parietal peritoneum*

Score 2 – massive miliary parietal carcinomatosis or unresectable massive confluent metastases on the diaphragmic parietal peritoneum (*fig. 4, 5*).

Score 0 – an absence of metastases (5).

*Mesentery*

Score 2 – a presence of confluent carcinomatosis along the mesentery or the presence of a tumor in the area of the mesenteric root (*fig. 6*).

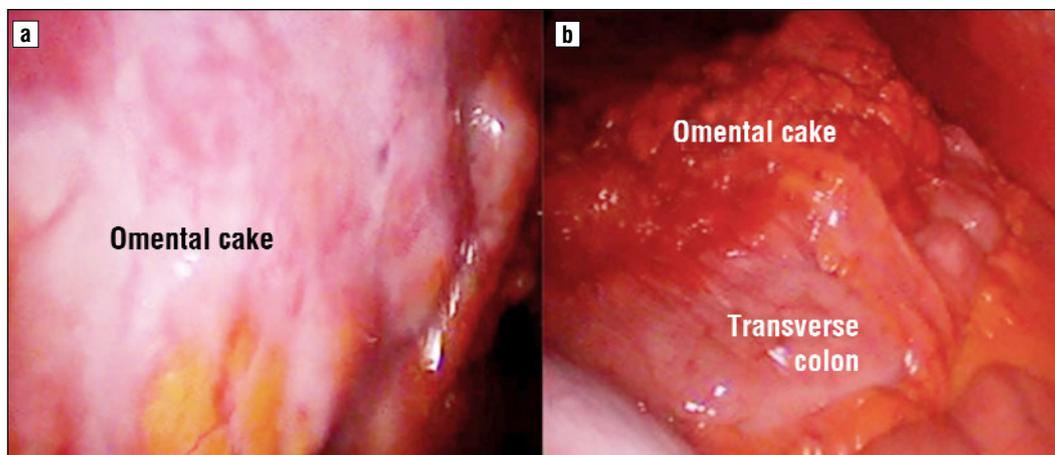
Score 0 - absence of metastases or the presence of single insignificant metastases that can be treated with bipolar coagulation (5).

Evaluation of the mesentery is performed by laparoscopic small bowel traction to the anterior abdominal wall or cranially. In the presence of rigidity and mesentery retraction the score is 2.

*Stomach*

Score 2 – a presence of macroscopically visible metastasis infiltrating the stomach wall (*fig. 7*).

Score 0 – absence of metastases or presence of single superficial metastases involving only the visceral peritoneum (5).



**Figure 2 - Omentum - "omental cake" – score 2 (authors' own material). a, b – "omental cake" in patients with advanced epithelial ovarian cancer.**

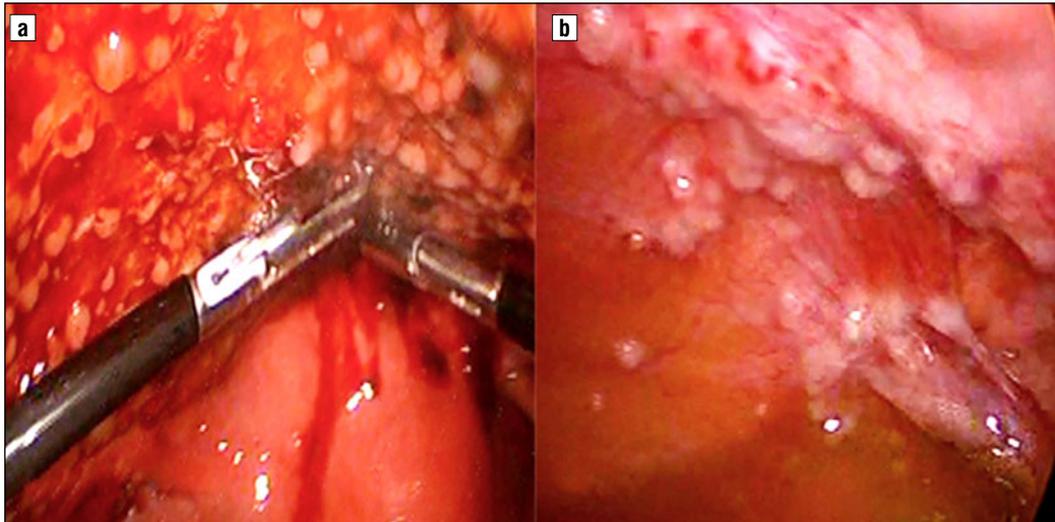


Figure 3 - Massive carcinomatosis of the parietal peritoneum in patients with advanced epithelial ovarian cancer – score 2. (a, b - authors' own material)

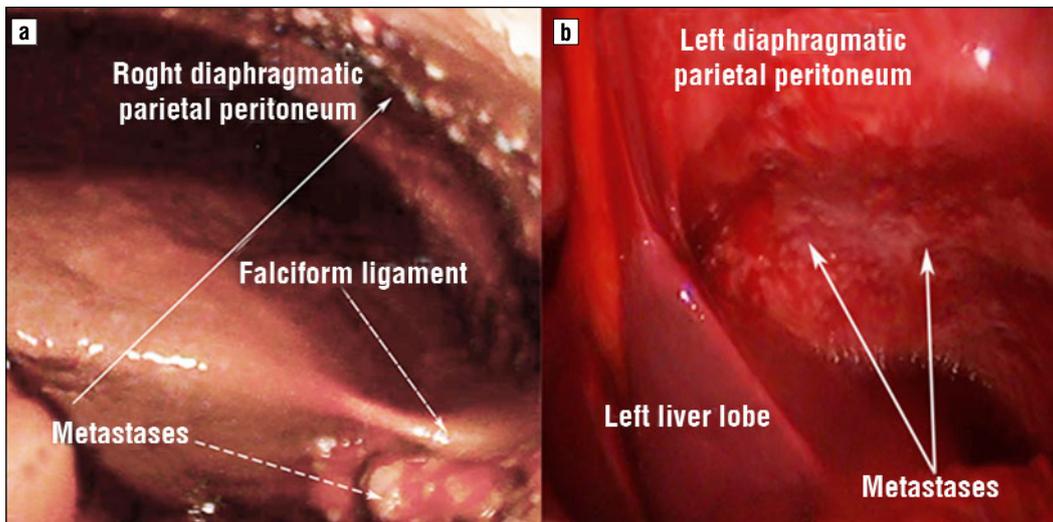


Figure 4 - Massive military parietal carcinomatosis on the right (a) and left (b) diaphragmatic parietal peritoneum (authors' own material). Score 2 in both figures.

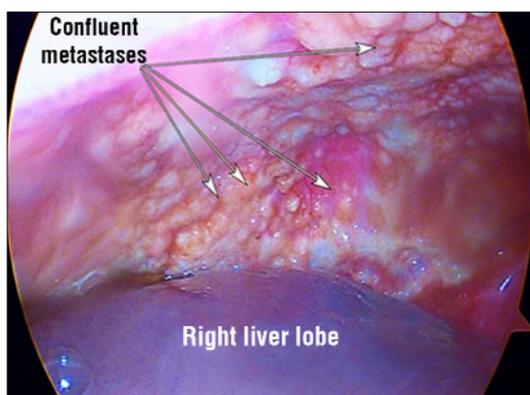


Figure 5 - Unresectable massive confluent metastases on the right diaphragmatic parietal peritoneum – score 2 (authors' own material).

#### *Small and large intestines*

Score 2 – a presence of multiple confluent metastases or the presence of massive miliary carcinomatosis (fig. 8).

Score 0 – no metastases or single visceral peritoneum metastases that do not require bowel resection and can be removed by bipolar coagulation. (5)

#### *Liver*

Score 2 – in the presence of superficial (involving Glisson's capsule) liver metastases.

Score 0 – absence of metastases on the surface of the liver.

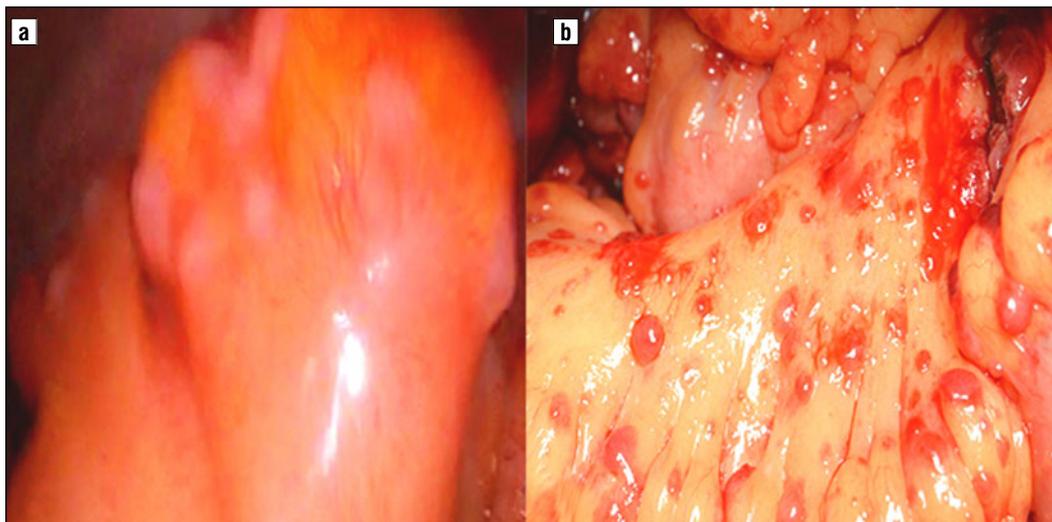


Figure 6 - Multiple mesenteric metastases (figure A,B) – score 2 (authors' own material)

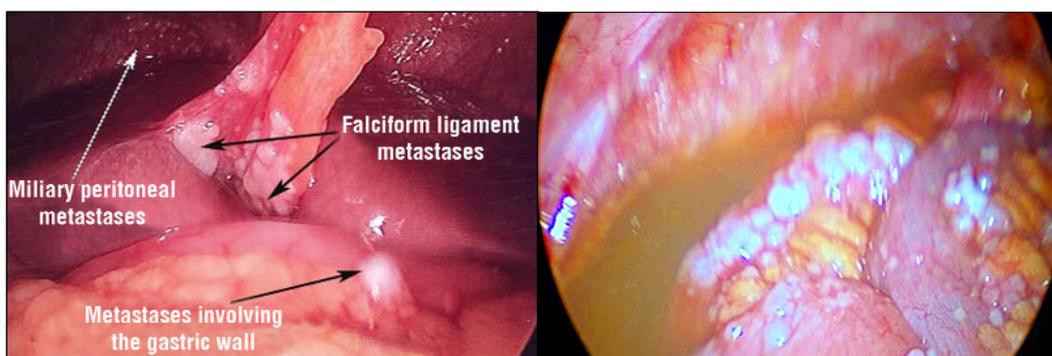


Figure 7 - Metastases involving the gastric wall – score 2 (authors' own material)



Figure 8 - Massive confluent intestinal metastases in patient with advanced epithelial ovarian cancer – score 2 (authors' own material)

### *Laparoscopic Aspects of Fagotti's Score*

When Fagotti scoring system scoring is performed, we always use open laparoscopic access (Hasson's technique) (1) below or above the level of the umbilicus for the following reasons:

1. Patients with advanced ovarian carcinoma have ascites - aspiration of the ascites fluid before insufflation is desirable (2).
2. The frequent presence of adhesions of the omentum and the intestine within the anterior abdominal wall due to the advanced stage of the disease.

Access through the navel is not desirable due to the possible implantation of metastases at the trocar site, the so-called "port site metastases" (2).

When cutting the peritoneum, we always feel with

circular movements with a finger the place of insertion of the first trocar in the abdominal cavity.

The Fagotti's scoring system is used to differentiate the following patients (2):

1. Patients candidates for optimal cytoreduction and adjuvant chemotherapy.
2. Patients candidates for neoadjuvant chemotherapy and eventual subsequent cytoreduction.
3. Patients, who have already underwent neoadjuvant chemotherapy and subsequent evaluation for the possibility of secondary optimal cytoreduction.

### *Update of the Fagotti's Scoring System*

In 2015, an article was published with an update of the Fagotti's scoring system, which highlighted that the

involvement of the mesenteric root by the tumor has always been a contraindication for surgical treatment of AEOC, and its presence in the Fagotti's scoring system is not feasible. Additionally, the presence of multiple miliary metastases in the visceral peritoneum of the small intestine and mesentery also leads to suboptimal cytoreduction and the presence of macroscopic residual tumor (6).

These zones were excluded from the new Fagotti's scoring system as they lead to suboptimal debulking. One of the main reasons is that, currently no residual macroscopic tumor is considered for optimal cytoreduction (6). Additionally, the tumor involvement of the lesser omentum and the spleen was incorporated to the stomach anatomical area of the updated Fagotti's laparoscopic scoring system (6,7). Rectal and sigmoid metastases leading to recto-sigmoid resection were excluded from the score because they are located in a pelvis and are part of the standard Hudson's procedure, when resection of the rectum/sigma is indicated (7). The size of the superficial liver metastases should be more than 2 cm in the update of the score (5). Update of the score is summarized in *table 2*.

The recent improvement of the upper abdominal surgery among oncogynecologists has increased the score, which is associated with optimal debulking surgery (R0) – equal to or less than 10 (6,7). Fagotti's often mentions that the main purpose of the scoring system is rather to avoid unnecessary laparotomies (in Fagotti's score more than 10). Regarding the possibility of optimal cytoreduction - the sensitivity of the method is comparatively lower (4,7).

**DISCUSSION**

In this review article, we want to emphasize the strengths and limitations of the Fagotti's laparoscopic

scoring system. The main standard of care in AEOC patients is primary cytoreductive surgery followed by adjuvant chemotherapy. The Fagotti's laparoscopic scoring system was widely accepted among oncogynecologists.

Most authors concluded that there is no accurate scoring system to predict the possibility of optimal cytoreduction (8, 9). Laparoscopic evaluation of AEOC is not included in most treatment guidelines for the disease (9). The authors mention that laparoscopy is useful tool in order to avoid unnecessary laparotomy in cases of advanced disease when it is impossible to achieve optimal cytoreduction and it is a useful in the decision making on treatment selection (8,9).

Although the Fagotti's scoring system is the most widely used laparoscopic score, there are other scoring systems that predict the chance of achieving optimal cytoreduction in AEOC (10-13). However, some of these scoring system are based either on laparotomic evaluation or imaging modalities and laboratory test.

The Eisenkop score intraoperatively evaluates 5 anatomic regions – the right and left upper quadrants, pelvis, retroperitoneum and central abdomen. Each region is valued between 0 and 3 points (10).

Jacquet and Sugarbaker were the first to propose the Peritoneal Cancer index (PCI) (11). It is assessed by inspection of the peritoneum during laparotomy, and it includes 9 abdominal regions. A higher PCI is associated with suboptimal cytoreduction and high risk of complications and reduced survival rate (11).

The Suidan score system is a non-invasive model based on eight radiological criteria through CT assessment and three clinical criteria (age ≥ 60 years, CA-125 ≥ 500 U/mL, ASA 3–4) (12). These radiological findings consist of lesions in the splenic hilum, gastrohepatic ligament/porta hepatis, retroperitoneal lymph nodes above the renal hilum, diffuse small bowel adhesions or

**Table 2 - Update of the Fagotti's scoring system in advanced epithelial ovarian cancer**

Anatomic region	2 points	0 points
Greater omentum	Omental cake	Absence or isolated single metastases
Parietal peritoneum	Massive miliary metastases or nonresectable metastases	Absence or isolated metastases in one anatomical region – paracolic guts
Diaphragmic parietal peritoneum	Massive carcinosis or nonresectable metastases	Absence of metastases
Stomach, spleen, lesser omentum	Macroscopic metastasis involving the stomach wall, spleen or omentum minus	Absence of metastases
Small and large intestines	Presence of metastases, where the resection of intestines is not feasible or in case of massive miliary carcinomatosis (rectum and sigmoid colon are excluded from the scoring)	Absence of metastases or single metastases in the visceral peritoneum, which don't lead to resection of the intestines and can be eliminated by bipolar coagulation
Liver	Presence of superficial metastases more than 2 cm involving the Glisson's capsule	Absence of metastases on the surface of the liver

**Table 3 - Application of the Fagotti's laparoscopic score in advanced epithelial ovarian cancer according to different studies**

Studies	Objective	Results
Tomar et al. (1)	The efficacy of laparoscopy in detecting inoperable disease in patients undergoing interval cytoreduction for AEOC	The Fagotti's score is an effective method for predicting inoperability in patients, who undergo interval cytoreduction for AEOC
Petrillo et al. (6)	The efficacy of staging laparoscopy to predict suboptimal cytoreduction in AEOC after the introduction of upper abdominal surgery	Staging laparoscopy is an effective tool to predict complete cytoreduction in patients with AEOC. The updated Fagotti's score showed a lower rate of inappropriate explorative laparotomies (cut-off value of 10)
Llueca et al. (15)	To evaluate the possibility of performing complete cytoreduction in patients with AEOC by using the prognostic value of three predictive models (Fagotti index and the R3 and R4 models)	The three models demonstrating high accuracy of predicting complete cytoreduction
Di Donna et al. (13)	To compare the best scoring method (imaging (CT), laparoscopic, laparotomic) for predicting outcomes of cytoreductive surgery in women with AEOC	The laparoscopic score showing high accuracy for optimal debulking in AEOC patients, who undergo either primary or interval cytoreduction
Feng et al. (3)	To compare multiple predictive models for complete cytoreduction in AOEC	Staging laparoscopy was accurate in decision making for primary debulking surgery (predictive index value < 8)

AEOC; advanced epithelial ovarian cancer, CT: computer tomography

thickening, abdominal ascites, gallbladder fossa/liver intersegmental fissure lesion, lesser sac lesion more than 1 cm and root of the superior mesenteric artery lesion (12).

There are others scoring system, which estimates the surgical complexity during AEOC debulking surgery (14).

Diagnostic imaging can provide a preoperative systematic report of tumor dissemination and has a high diagnostic performance for prediction of bulky disease, but it is less accurate for small-volume carcinomatosis, which may lead to unnecessary laparotomies. Laparoscopy has its place in combination with imaging in cases where imaging results regarding respectability are unclear (7). Laparoscopy can be used as a second-stage diagnostic tool to exclude carcinomatosis on bowel and its mesentery. Nevertheless, The Fagotti's scoring system has some limitations. (2) In case of multiple adhesions due to previous surgeries or previous inflammatory diseases, the laparoscopic evaluation of some of the anatomical areas could not be feasible (1). Some anatomical areas are difficult to access by laparoscopy (7) - the omental bursa, the splenic hilum, porta hepatis, gastrosplenic ligament. The retroperitoneal lymph nodes (pelvic, paraaortic, celiac) are not included in the Fagotti's scoring system, because of the failure of laparoscopy to carefully access these spaces. Deep vascular infiltration by metastatic lymph nodes can be a reason of unresectability, nevertheless the lymph-nodal evaluation was excluded from the score (4).

Despite the low accuracy of imaging modalities in

the prediction of residual disease, the preoperative imaging maintains an important diagnostic role in the evaluation of tumor spread in anatomical sites not explorable with laparoscopy (such as the retroperitoneum, the retro-hepatic area and the porta hepatis), and in the diagnosis of parenchymal and lymphatic metastasis (13,15). Indeed, a multimodal approach is crucial for the pre-operative evaluation of patients with AEOC and laparoscopy is the best tool to evaluate the diaphragmatic, peritoneal and omental spread of the disease (3,13,16).

The worldwide application of the Fagotti's laparoscopic score in AOEC patients according to different studies is summarized in *table 3*.

## CONCLUSION

The Fagotti's laparoscopic scoring system in women with AEOC leads to a reduction in cases of redundant laparotomy in inoperable patients. Moreover, it is safe and easily available surgical procedure, which decrease the hospital duration, improve the quality of life and reduce complications in inoperable patients. The laparoscopic score system should be always combined with preoperative clinical, paraclinical and imaging modalities.

### *Author's Contribution*

All authors have accepted responsibility for the entire content of this manuscript and approved its submission.

### **Competing Interests**

Authors state no conflict of interest.

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### **Data Availability**

The authors declare that all related data are available concerning researchers by the corresponding author's email.

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