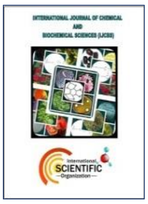
International Journal of Chemical and Biochemical Sciences
(ISSN 2226-9614)
Journal Home page: www.iscientific.org/Journal.html

# An Overview on Role of Sugarbaker's Peritoneal Cancer Index in Management of Ovarian Cancer

***Eman Amin El Gindy, Hussein Mohamed Abdeldayem, Salah El Sayed Kamal Shahin*, Ahmed H. Elsayad***

*Obstetrics and Gynecology Department, Faculty of Medicine, Zagazig University*

**Abstract**

Great advances in technology offer meticulous options of minimally invasive surgery to empower the gynecologists to manage patients of early ovarian cancer. Laparoscopy affords improved visualization of the pelvic peritoneum, diaphragm and the deep pelvic structures, and offers many advantages in the avoidance of long abdominal incision, including shorter hospital stay and a more rapid recovery time. Most studies showed that laparoscopy did not compromise the survival and recurrence prognosis in comparison with open abdominal approach of staging surgery. Contrarily, laparoscopy precludes the advantage of open surgery, such as manual examination of the full extent of the bowel and palpation of lymph nodes. Besides, laparoscopy technically hampers the removal of large ovarian mass, and laparoscopic cancer surgery has a potential risk of trocar site metastasis. As the trend shows that laparoscopy has been playing an important role in treating early ovarian cancer, we could expect laparoscopy to become an attractive surgical option in the future for ovarian cancers.

**Keywords:** Laparoscopy, Ovarian Cancer, Fagotti Score, Sugar baker's Peritoneal Cancer Index.

**Full length article** **Corresponding Author*, e-mail: Salah.elsayed.kamal.shahin@gmail.com

## 1. Introduction

A variety of techniques are used in minimally invasive surgery (MIS), including robotics, mini-laparoscopy, traditional laparoscopy, and single-port laparoscopy. Based on factors such product availability, patient characteristics, tumor extension, and the type of operation required, surgeons select the best course of action [1]. Laparoscopy carries a minimal risk of major problems; these are primarily connected to the initial abdominal access and typically involve bowel and vascular damage. These risks may be avoided by carefully choosing patients, being aware of surgical anatomy, and using the right abdominal access procedures [2]. Abdominal access injuries range from 5 to 30 per 10,000 procedures: intestine injuries account for 4.4 per 10,000, vascular injuries for 3.1 per 10,000, and umbilical trocar insertion injuries for 3 per 1000 [2]. Diaphragmatic hernia, very large abdominal or pelvic masses, severe obesity, previous abdominal surgery, pelvic inflammatory disease, and diverticulitis are the most significant risk factors for laparoscopy failure [1].

Shorter hospital stays, lower rates of perioperative morbidity and wound infection and incisional hernias, less pain following surgery, and quicker healing are some benefits that laparoscopy may provide [3]. Furthermore, the feasibility of laparoscopic surgeries is increased by optical magnification of the abdominal veins and structures, as well as the availability of modern equipment's like improved bipolar, ultrasound instruments, and topical hemostatic agents [4]. There are particular benefits to using a laparoscopy for ovarian cancer. Adjuvant chemotherapy can begin earlier since it takes less time for smaller incisions to heal, there is a decreased chance of adhesion formation, it can be used in situations of fertility sparing, and it makes accessing the retroperitoneum easier [5]. There are specific hazards associated with laparoscopy, such as tumor implantation at the port site.

However, this risk appears to be very low (0.97%) and shouldn't prevent women with gynecologic cancers under the care of gynecologic oncologists from undergoing laparoscopy. Excisional surgery may be used to manage this issue, which does not impact overall survival [1]. Certain preventive measures have been suggested in this context to lessen the incidence of port site metastases. These include suctioning of ascites prior to trocar removal, peritoneal closure of port sites, and port site excision during debulking surgery, trocar rinsing, trocar fixation, and a decrease in the number of instrument transfers [1]. Laparoscopy has been used in ovarian cancer treatment to manage early stage disease, advanced stage disease at primary diagnosis and after neoadjuvant chemotherapy (NACT), and recurrent malignancy [1]. We outline the current recommendations for laparoscopy depending on the various stages of ovarian cancer in the sections that follow.

### *1.1. Early stage ovarian cancer*

Even though localized tumors account for just 20 to 25% of instances of ovarian cancer, patients with these tumors have better 5-year survival rates than those with advanced illness [6]. Due primarily to the lack of randomized controlled trials, the Cochrane Collaboration's analysis was unable to identify any high-quality data that would have quantified the risks and benefits associated with laparoscopy for the treatment of early-stage ovarian cancer (ESOC) [7]. Laparoscopic surgical staging is a safe and technically feasible procedure, according to available data from retro/prospective series of patients with epithelial serious ovarian cancer who had laparoscopy [1]. In order to lower the rate of complications and minimize the risk of conversion to an open procedure—which is predicted to be approximately 3.7% for patients affected by assumed ESOC—careful screening of individuals who are eligible for a laparoscopic technique is critical [8].

### *1.2. Advanced ovarian cancer*

#### *1.2.1. Staging*

About 75 to 80 percent of women with ovarian cancer present with advanced disease due to a lack of screening for early identification and the absence of symptoms in the early stages of the disease [1]. Treating these patients with primary debulking surgery (PDS) and platinum/paclitaxel-based chemotherapy is considered the gold standard. It is advised to use a multidisciplinary strategy to achieve total cytoreduction. NACT may be applied in certain circumstances [1]. The rationale for a laparoscopic evaluation before cytoreductive surgery includes the following:

1. Laparoscopy makes it simple to evaluate intraperitoneal diffusion of disease, and surgeon may feel more comfortable doing the procedure if they can see cancer's progress directly.
2. By using this method, patients may avoid needless laparotomies that could lead to suboptimal cytoreduction.
3. Individuals who determined to not be suitable candidates for cytoreduction can go straight to NACT without needing to recover from complications arising from laparotomy.
4. With a laparoscopy, tissue can be collected for molecular analysis and a conclusive diagnosis.

In order to estimate the likelihood of achieving optimal cytoreduction based on the presence of an omental cake, peritoneal carcinomatosis, diaphragmatic carcinomatosis, mesenteric retraction, bowel infiltration, stomach infiltration, and liver metastases, Fagotti et al. proposed a straightforward scoring system based on a laparoscopic predictive index value (PIV) [9]. If there were any parameters, they were each given two points. With a specificity of 100%, positive predictive value of 100%, and negative predictive value of 70%, a score higher than 8 indicated suboptimal surgery [9]. The model was then prospectively validated after this method was validated in an external cohort of 55 French patients with stage III–IV ovarian cancer [10]. Is it possible to apply preoperative laparoscopic assessment as normal practice at locations other than large academic institutions? This is one possible area of concern. In order to respond to this query, Fagotti et al. conducted a prospective, multicenter study (Olympia-MITO 13) to assess the use of PIV based on laparoscopy in 120 patients among four satellite facilities.

Mesenteric retraction was the most challenging characteristic to evaluate; yet, in three of the four satellite centers, an accuracy rate of 80% or above was attained [11]. A final step was required to ascertain definitive role of staging laparoscopy (S-LPS) in advanced ovarian cancer: to look into the possibility that introducing this kind of care might worsen the prognosis for these patients. In order to do this, a retrospective survival analysis of 300 women with primary peritoneal carcinoma, fallopian tube, or ovarian cancer at stages IIIC and IV according to International Federation of Gynecology and Obstetrics (FIGO) released in 2013 [11]. There were no complications associated with the laparoscopic procedure, according to study's authors. Women who had R0 resection at PDS had a median progression-free survival (PFS) of 25 months (95% confidence interval [CI], 15.1–34.8 months) [11]. The accuracy of the S-LPS findings in evaluating disease respectability in individuals with suspected advanced EOC was recently summarized in a Cochrane study [12]. Analysis was done on 18 studies involving 14 patient groups.

Overall, S-LPS performed comparably to normal laparotomy in terms of accuracy, with exception of evaluating particular anatomical locations (such as the retro-hepatic areas). The authors came to conclusion that S-LPS should be used as a routine method in clinical practice since it could be beneficial [12]. With a category 2B level of evidence, the National Comprehensive Cancer Network (NCCN) guidelines include S-LPS as a tool to assess whether patients with advanced ovarian cancer should have PDS or NACT. To sum up, S-LPS is a simple and comparatively low-morbid method for evaluating advanced EOC patients prior to surgery. It is capable of precisely predicting which patients would benefit from NACT if they had an inadequate cytoreduction at the time of PDS [13]. When combined with other pre-operative measures (serum CA125 and radiological imaging), S-LPS can predict suboptimal surgery with an accuracy of up to 96%. This may play a role in determining the optimal course of care for advanced EOC patients, which is particularly relevant for those with poor performance status or "high-volume" stage IIIC or stage IV condition [13]. However to determine if S-LPS could be used as a standard clinical procedure in treatment of primary EOC, further high-level data is necessary [13].

##### *1.2.1.1. Primary debulking*

Only a few articles have been published describing primary laparoscopic cytoreduction. In a trial series of 17 out of 32 patients with advanced ovarian cancer who underwent MIS and had their tumors successfully debulked at laparoscopy, Nezhat et al. reported an optimum cytoreduction rate of 88%. Compared to laparotomy group, patients who underwent a laparoscopy experienced less blood loss, a shorter hospital stay, and no port-site metastases. Laparoscopic group's DFS did not show a decline from laparotomy group's [14]. In a study of twenty-five patients undergoing primary laparoscopic debulking, Fanning et al. found a 92% cytoreduction rate, with only two procedures converting to laparotomies. This case series did, however, have a few drawbacks: the author came to the conclusion that 24% of patients experienced postoperative complications.

And that only 36% of the patients had no residual illness [15]. Robotic surgery seems to be sufficient for debulking, exploring the abdomen and pelvis, and carrying out sophisticated treatments like lymphadenectomy and omentectomy, according to a review of the literature by Rabinovich [3]. According to the author, the primary benefit of laparoscopy over laparotomy is a quicker recovery after surgery. Nevertheless, there are a number of limitations with this trial, including as its retrospective design, evidence of biases in patient selection, and the absence of long-term follow-up to evaluate OS and PFS [3]. Currently, individuals with advanced ovarian cancer are not advised to undergo MIS for primary cytoreduction. To determine if primary laparoscopic-assisted cytoreduction is feasible, large prospective trials are required, taking into account the actual consequences on the quality of life, surgical and oncologic outcomes, and patients' quality oflife (LE IIIB) [1].

#### *1.2.2. Interval debulking surgery*

According to current guidelines, in certain circumstances, NACT should be administered first, then IDS, in order to decrease tumor size and improve the likelihood of optimal cytoreduction. During IDS, a laparoscopy may be done to evaluate the patient's reaction to chemotherapy and to finish the surgery [1]. There are currently no RCTs available to describe the oncologic impact of minimally invasive IDS in terms of survival rate, and the literature only includes a small number of studies with very few patients on the role of laparoscopy at the time of IDS [16]. Better perioperative outcomes, such as median blood loss, median hospital stay, and intraoperative complications, are found in a retrospective evaluation of data from 30 patients who underwent laparoscopic cytoreduction following NACT than in laparotomy series [17]. When preparing the appropriate course of action for patients who exhibit a partial or stable response to NACT, the application of S-LPS during IDS may prove beneficial. To determine whether laparoscopic IDS can be performed safely in these patients, more RCTs are required [1].

### *1.3. Recurrent ovarian cancer*

Laparoscopy is useful for patients with recurrent ovarian cancer and has multiple uses in this population, including [1]:

1. To assess the extent of disease (especially peritoneal carcinomatosis).
2. To assess potential cytoreduction.
3. To reduce morbidity and mortality in cases of surgical treatment.
4. To reduce the length of time before starting systemic chemotherapy.
5. To integrate different treatments, such as hyperthermic intraperitoneal chemotherapy (HIPEC).

More importantly, it allows tumor biopsies for molecular analysis to individual izebiologic therapy for each patient.

#### *1.3.1. Staging*

Combining S-LPS with fluorodeoxyglucose positron emission tomography (FDG-PET/CT) can help diagnose patients with peritoneal miliary carcinomatosis, small bowel or peritoneum extension of disease (S-LPS), extra-abdominal disease, and/or parenchymal/lymph node metastases (FDG-PET/CT) [18].

#### *1.3.2. Treatment*

Given that the majority of patients with recurrent ovarian cancer have a poor prognosis, laparoscopy may be more beneficial for this subset of patients than laparotomy in terms of both clinical and financial outcomes as well as improved physical and psychological effects that preserve survival [1]. The viability of laparoscopy in debulking recurrent ovarian cancer has been demonstrated in a number of case series in recent years [19]. In cases of localized recurrent ovarian cancer, these studies showed that laparoscopy, performed by skilled surgeons in tertiary referral centers, is a safe and viable method for achieving cytoreduction [1]. The most popular laparoscopic prediction models for assessing the spread of ovarian cancer are the Fagotti score and the Sugarbaker-described peritoneal carcinomatosis index (PCI) [20]. Since its initial description by Sugarbaker in 1998, the peritoneal cancer index (PCI) has become the accepted method for characterizing mesothelioma and carcinomatosis of colorectal cancer [21]. As a result, we thought that PCI would be a useful technique for precisely assessing peritoneal spread in AOC [21]. Fagotti's score has historically been used by gynecologic oncologists in Europe for predicting cytoreductive surgery during laparotomy for gynecologic cancers [22].

### *1.4. Scores*

#### *1.4.1. Fagotti Score*

The Fagotti Score is based on the evaluation of seven parameters: omental cake, peritoneal carcinomatosis, diaphragmatic carcinomatosis, mesenteric retraction, stomach infiltration, bowel infiltration, and liver metastases. Each parameter is valued with a 0 if absent or 2 if present. The total value is between 0 and 14. A value above or equal to 8 is related to suboptimal surgery [9].

#### *1.4.2. Sugarbaker Score (PCI)*

The abdomen is divided into nine regions: central (0), right hypochondrium (1), left hypochondrium (3), epigastrium (2), left flank (4), left iliac fossa (5), pelvis (6), right iliac fossa (7), and right flank (8). Four regions corresponding to the digestive tract are added: upper jejunum (9), lower jejunum (10), upper ileum (11), and lower ileum (12). Each area scores O if there is no evidence of a tumor; 1 with a tumor smaller than 0.5 cm, 2 with a tumor up to 5 cm, and 3 with a tumor larger than 5 cm or confluent. The value obtained is between 0 and 39. The "cut off" established in the bibliography is 10 and 20 [21-23].

| Tumour site distribution | Laparoscopic predictive index score = 2 | Laparoscopic predictive index score = 0 |
|---|---|---|
| Peritoneal carcinomatosis | Unresectable massive peritoneal involvement plus miliary pattern of distribution | Carcinomatosis involving a limited area surgically removable by peritonectomy |
| Diaphragmatic disease | Widespread infiltrating carcinomatosis or confluent nodules to most of the diaphragmatic surface | Isolated diaphragmatic disease |
| Mesenteric disease | Large infiltrating nodules or involvement of the root of the mesentery assumed based on limited movements of various intestinal segments | Small nodules potentially treatable with argon-beam coagulation |
| Omental disease | Tumour diffusion up to the large curvature of the stomach | Isolated omental disease |
| Bowel infiltration | Bowel resection assumed to be required or miliary carcinomatosis at the mesenteric junction | No bowel resection required and no miliary carcinomatosis at the mesenteric junction |
| Stomach infiltration | Obvious neoplastic involvement of the gastric wall | No obvious neoplastic involvement of the gastric wall |
| Liver metastasis | Any surface lesions | No surface lesions |

**Figure 1:** Fagotti Score

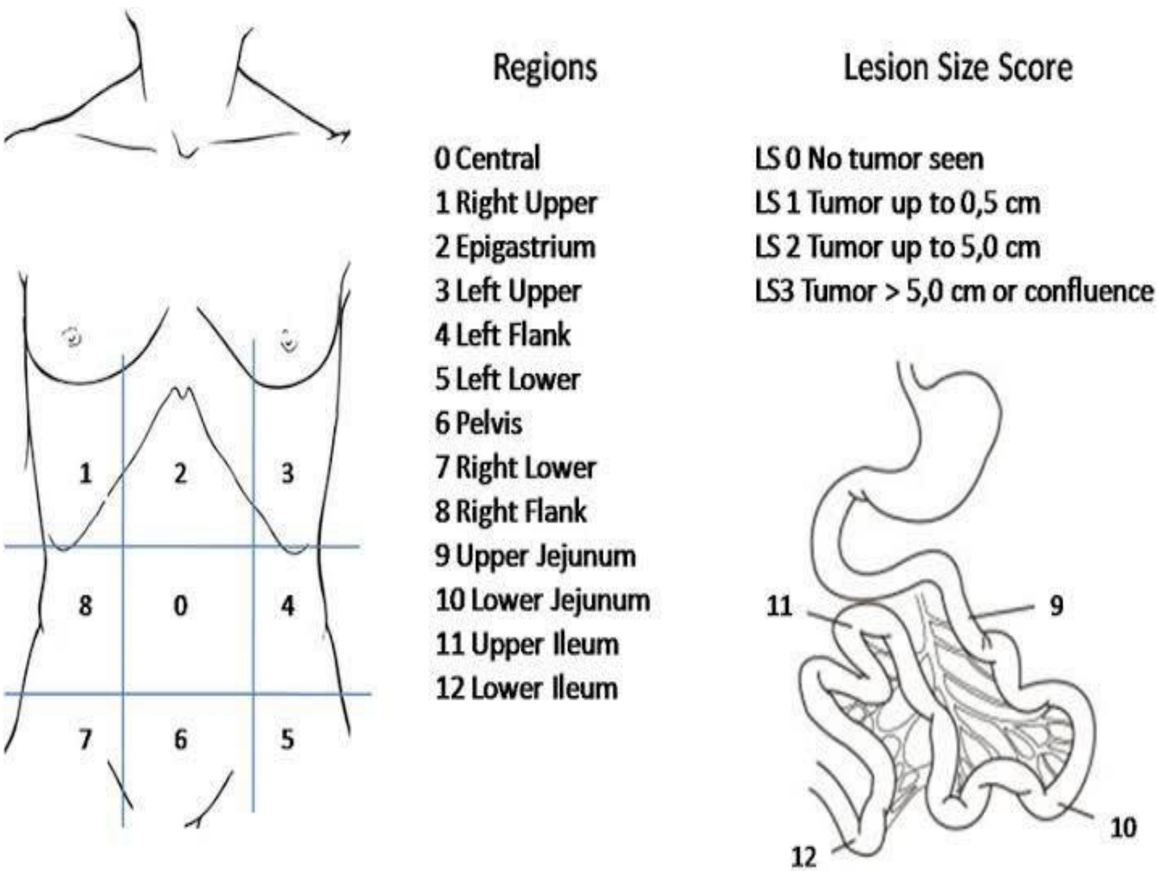



**Figure 2:** Sugarbaker Score (PCI)

## References


[1] A. Fagotti, F. Perelli, L. Pedone, G. Scambia. (2016). Current recommendations for minimally invasive surgical staging in ovarian cancer. Current Treatment Options in Oncology. 17(1).

[2] G. Ahmad, D. Gent, D. Henderson, H. O'Flynn, K. Phillips, A. Watson. (2015). Laparoscopic entry techniques. Cochrane Database of Systematic Reviews.

[3] A. Rabinovich. (2015). Robotic surgery for ovarian cancers: individualization of the surgical approach to select ovarian cancer patients. The International Journal of Medical Robotics and Computer Assisted Surgery. 12(3): 547–553.

[4] M. Gabay, B.A. Boucher. (2013). An essential primer for understanding the role of topical hemostats, surgical sealants, and adhesives for maintaining hemostasis. Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy. 33(9): 935–955.

[5] C.J. Lin, H.J. Chen. (2013). The investigation of laparoscopic instrument movement control and learning effect. BioMed Research International. 2013: 1–16.

[6] R. Siegel, J. Ma, Z. Zou, A. Jemal. (2014). Cancer statistics. 2014. CA: A Cancer Journal for Clinicians. 64(1): 9–29.

[7] F.S. Falcetta, T.A. Lawrie, L.R. Medeiros, M.I. da Rosa, M.I. Edelweiss, A.T. Stein, A. Zelmanowicz, A.B. Moraes, R.R. Zanini, D.D. Rosa, J. Platt. (2016). Laparoscopy versus laparotomy for FIGO stage I ovarian cancer. Cochrane Database of Systematic Reviews. 2022(1).

[8] H.J. Park, D.W. Kim, G.W. Yim, E.J. Nam, S. Kim, Y.T. Kim. (2013). Staging laparoscopy for the management of early-stage ovarian cancer: a metaanalysis. American Journal of Obstetrics andGynecology. 209(1): 58.e1–58.e8.

[9] A. Fagotti, G. Ferrandina, F. Fanfani, A. Ercoli, D. Lorusso, M. Rossi, G. Scambia. (2006). A laparoscopy-based score to predict surgical outcome in patients with advanced ovarian carcinoma: A Pilot Study. Annals of Surgical Oncology. 13(8): 1156–1161.

[10] A. Fagotti, G. Ferrandina, F. Fanfani, G. Garganese, G. Vizzielli, V. Carone, M.G. Salerno, G. Scambia. (2008). Prospective validation of a laparoscopic predictive model for optimal cytoreduction in advanced ovarian carcinoma. American Journal of Obstetrics and Gynecology. 199(6): 642.e1–642.e6.

[11] A. Fagotti, G. Vizzielli, P. De Iaco, D. Surico, A. Buda, V.D. Mandato, F. Petruzzelli, F. Ghezzi, S. Garzarelli, L. Mereu, R. Viganò, S. Tateo, F. Fanfani, G. Scambia. (2013). A Multicentric trial (Olympia–MITO 13) on the accuracy of Laparoscopy to assess peritoneal spread in ovarian cancer. American Journal of Obstetrics and Gynecology. 209(5): 462.e1–462.e11.

[12] R. Van de Vrie, M.J. Rutten, J.D. Asseler, M.M. Leeflang, G.G. Kenter, B.W.J. Mol, M. Buist. (2019). Laparoscopy for diagnosing resectability of disease in women with advanced ovarian cancer. Cochrane Database of Systematic Reviews. 2019(3).

[13] M. Morotti, G. Valenti, V.K. Mavroeidis, T. Shi. (2022). The role of exploratory laparoscopy in surgical planning for ultra- radical surgery for ovarian cancer: a narrative review. Gynecology and Pelvic Medicine. 5: 10–10.

[14] F.R. Nezhat, S.M. DeNoble, D.N. Brown, E. Soto, C.S. Liu, J.E. Cho, L. Chuang, H. Gretz. (2010). The safety and efficacy of laparoscopic surgical staging and debulking of recurrent ovarian, fallopian tube and primary peritoneal cancers. Journal of Minimally Invasive Gynecology. 17(6): S44.

[15] J. Fanning, E. Yacoub, R. Hojat. (2011). Laparoscopic-assisted cytoreduction for primary advanced ovarian cancer: Success, morbidity and survival. Gynecologic Oncology. 123(1): 47–49.

[16] G. Favero, N. Macerox, T. Pfiffer, C. Köhler, V. da Costa Miranda, M.D.P. Estevez Diz, J.T. Fukushima, E.C. Baracat, J.P. Carvalho. (2015). Oncologic concerns regarding laparoscopic cytoreductive surgery in patients with advanced ovarian cancer submitted to neoadjuvant chemotherapy. Oncology. 89(3): 159–166.

[17] G. Corrado, E. Mancini, G. Cutillo, E. Baiocco, P. Vici, D. Sergi, L. Patrizi, M. Saltari, A. Baffa, E. Vizza. (2015). Laparoscopic debulking surgery in the management of advanced ovarian cancer after neoadjuvant chemotherapy. International Journal of Gynecologic Cancer. 25(7): 1253–1257.

[18] F. Fanfani, G. Monterossi, A. Fagotti, V. Gallotta, B. Costantini, G. Vizzielli, M. Petrillo, M. V. Carbone, G. Scambia. (2014). Positron emission tomography–laparoscopy based method in the prediction of complete cytoreduction in platinum sensitive recurrent ovarian cancer. Annals of Surgical Oncology. 22(2): 649–654.

[19] P.F. Escobar, K.L. Levinson, J. Magrina, M.A. Martino, R.P. Barakat, A.N. Fader, M.M. Leitao. (2014). Feasibility and perioperative outcomes of robotic-assisted surgery in the management of recurrent ovarian cancer: A multi-institutional Study. Gynecologic Oncology. 134(2): 253–256.

[20] S. Greggi. (2019). A Randomized trial of lymphadenectomy in patients with advanced ovarian neoplasms. New England Journal of Medicine. 380(9): 822–832.

[21] A. Llueca, J. Escrig, A. Serra-Rubert, L. Gomez-Quiles, I. Rivadulla, R. Játiva-Porcar, R. Del Moral. (2018). Prognostic value of peritoneal cancer index in primary advanced ovarian cancer. European Journal of Surgical Oncology. 44(1): 163-169.

[22] C. Varnoux, C. Huchon, A.S. Bats, C. Bensaid, A. Achouri, C. Nos, F. Lécuru. (2013). Diagnostic accuracy of hand-assisted laparoscopy in predicting resectability of peritoneal carcinomatosis from gynecological malignancies. European Journal of Surgical Oncology (EJSO). 39(7): 774-779.

[23] M.T. Climent, A. Serra, J. Gilabert-Estellés, J. Gilabert-Aguilar, & Llueca, A. (2021). Comparison of peritoneal carcinomatosis scoring methods in predicting resectability and prognosis in gynecologic malignancies. Journal of Clinical Medicine. 10(12): 25-53.