
Trocar metastases in laparoscopic approach for gynecologic malignancies. A short review of the literature

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Summary

Introduction: Compared to laparotomy, laparoscopy has many benefits for patients, such as shorter recovery and lower morbidity rates. Port site metastases after laparoscopic approach in the treatment of gynecologic malignancies are uncommon. The purpose of this review is to identify and summarize possible risk factors for port-site metastases in patients undergoing laparoscopic surgery in the ambit of gynecologic oncology. **Discussion:** The precise incidence of port-site metastases is not well known because many patients are not followed-up during the whole postoperative period. Possible risk factors that can increase the risk of port-site metastases can be the presence of large masses in the abdomen, especially in the presence of concomitant ascites and in patients treated for ovarian carcinomas. Different theories have been postulated in order to explain the development of port site metastases during laparoscopy for oncological patients. **Conclusions:** Patient selection is an essential factor that can influence the incidence of port site metastases in gynecological patients. Robust data regarding port site metastases in gynecologic oncology are needed.

Key words: Laparoscopy; Port site metastases; Gynecologic oncology.

Introduction

During the last years, laparoscopy for the treatment of gynecological malignancies has become the first surgical approach in selected patients. Compared to laparotomy, laparoscopy has many benefits for patients, such as shorter recovery and lower morbidity rates [1]. At the beginning of its use in gynecologic surgery, laparoscopy approach had only a diagnostic value, whereas today laparoscopic surgery has evolved and can be used either for staging of gynecologic malignancies or even in various therapeutic procedures.

The first ever documented case of port site metastases in the literature, is in 1978 from Dobronte *et al.* in a woman treated laparoscopically for ovarian cancer [2]. Port site metastases after laparoscopic approach in the treatment of gynecologic malignancies are uncommon. It has been estimated that the incidence of trocar metastases in all patients undergoing a gynecologic oncology laparoscopic surgery for malignancies is about 1-2% [3, 4]. Many theories have been postulated in order to explain this complication. The stage of the disease or the location of the primary tumor, are only some of the theories concerning the risk of trocar metastases [5].

It is important to mention that tumor recurrence in the site of surgical incision can occur even after laparotomies [6, 7]. However, for a metastasis to be considered as “port-site”, it must be localized in the abdominal wall in the po-

sition of the trocar sites, while not associated with peritoneal carcinomatosis [8].

The purpose of this review is to identify and summarize possible risk factors for port-site metastases in patients undergoing laparoscopic surgery in the ambit of gynecologic oncology.

Patients' profile

In order to understand the mechanism of port-site metastases after oncological surgery, it is crucial to distinguish which patients develop these lesions more frequently and if there are any factors that can induce their appearance. The precise incidence of port site metastases is not well known because many patients are not followed-up during the whole postoperative period. Other health professionals can be involved in the further treatment of these patients, because of the nature of their metastatic disease (for example, oncologists or general surgeons).

In a study published in 1999, in order to clarify the profile of patients with port site metastases, no differences were found between diagnostic or operative laparoscopic in terms of emergence of port site metastases [9]. However, the same study showed that the majority of the patients, already had an extensive disease at the time of laparoscopy (associated with intraperitoneal carcinomatosis), a finding that obviously influenced the results of this study.

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Possible risk factors that can increase the risk of port-site metastases can be the presence of large masses in the abdomen, especially in the presence of concomitant ascites and in patients treated for ovarian carcinomas [10].

Patients with ovarian cancer

In patients suspected to have an ovarian carcinoma, laparoscopy can be used as a diagnostic tool, in order to confirm the diagnoses before a primary debulking. Port site metastases in women with ovarian carcinoma, have been documented in the literature, in advanced disease or even in cases of low malignant potential tumors [11, 12]. A possible explanation of this can be the dissemination of malignant cells, when ascites is present, from small skin incisions. Additionally, laparoscopy is becoming more and more used for the treatment of adnexal masses initially thought to be benign [13, 14]; therefore, it is crucial to minimize the risk of rupture of the mass during the effort to remove it [15].

Patients with cervical and uterine cancer

Patients with cervical cancer, can be treated laparoscopically with radical hysterectomy and lymph node dissection - an operation firstly described by Querleu in 1989. The risk of metastases in the site of the trocar insertion can be influenced by the stage, histological type, and the presence of lymph node metastases [16-20].

Etiology

A number of possible mechanisms have been postulated in order to explain the development of port site metastases during laparoscopy for oncological patients:

Hematogenous spread

It has been documented that cancerous cells can reach blood circulation and, thus, induce metastases [5]. In the case of laparoscopic surgery, this has been explained as follows: pneumoperitoneum, with a positive pressure into the peritoneal cavity can lead to a passage of neoplastic emboli into the blood circulation through shunts from lymphatic to venous vessels and by damaging the mesothelial cell layer [21, 22]. From cells that arrive in general circulation (1%), only a small percentage (0.1%) are capable of inducing metastases [23]. In the context of pneumoperitoneum, the optimum gas for insufflation used currently is carbon dioxide (CO₂). This gas is relatively inexpensive, soluble in plasma, and easily available. Additionally, is a relatively safe gas in terms of hepatic and renal blood flow, whereas its main advantage is its low potentiality of causing embolisms, since hemoglobin has a stronger affinity for CO₂ than other laparoscopic gasses used in the past. In an experimental study conducted a few years ago, comparing different gasses used in laparoscopic procedures (He, N₂O), CO₂ was not the safest in terms of port site recur-

rences [24]. By comparing different studies in the literature, it is easily deduced that it is not the type of gas used in creating the pneumoperitoneum, but the fact of the pneumoperitoneum itself as a risk factor for port site metastases.

Wound implantation

According to this theory, malignant cells can colonize the wound area through different ways; for example, through instruments used during operation. According to another study, abdominal wall metastases were larger in the site of tumor extraction compared to those of the other trocars insertion [25, 26]. Despite the rationale of this mechanism, there are some studies that are against this theory. More precisely, there have been documented cases of port site metastases during laparoscopy done without any manipulation the mass with the instruments [15]. The only thing that is certain is the need of adapting suitable precautions during laparoscopy in oncological patients, such as using protective bags in order to extract the surgical preparation, especially in cases with cystic formations of the adnexa for which we do not know the potential malignancy of the lesion.

The "chimney effect"

This definition refers in the presence of malignant cells at the port sites because of leakage of gas among the trocars. The positive abdominal pressure during laparoscopic surgery facilitates the migration of malignant cells through weak points, mainly the wounds of trocar insertion. This condition can be easily prevented by correct fixation of the trocars and by deflating the abdomen before extracting the trocars [21, 27].

Surgical trauma and local immune reaction

The normal immune defense in the peritoneum is provided by the activation of the 'complement cascade', by the mechanical clearance, and the action of defense cells such as macrophages or neutrophils [28]. Several studies have demonstrated that the immune defense after surgery is clearly better after a laparoscopic procedure than after a laparotomy [29]. By modulating the immune response in vitro, it has been suggested that tumor growth and port site metastases were less common after administration of intraperitoneal endotoxin [30].

Another important parameter that has been evaluated during laparoscopy, is the cytokines' levels in comparison to those during laparotomy. Interleukin-6 was significantly lower in the patients that underwent laparoscopy; molecules of the interleukin family are essential in the activation of lymphocytes and capable of killing tumor cells [31]. Additionally, CO₂ used for creating pneumoperitoneum can compromise the role of macrophage and TNF- α as also subcutaneous pH levels [32]. Moreover, an extremely important role in the pathogenesis of port site metastases, is the surgeon himself. Inappropriate use of the trocars (removal and reintroduction) can facilitate the spread of malignant

Table 1. — Recommendations in order to prevent port site metastases.

1. Trocar fixation
2. Obtain free margin after resecting the tumor
3. Use of protective bags when removing the mass
4. Deflate pneumoperitoneum when the trocars are still in place
5. Close all layers after trocar removal
6. Use 5% povidine-iodine when reintroducing instruments

cells. It is also important to close all the layers after trocar removal, including peritoneum [33]. Finally, hypoxia of the abdominal wound and acidosis, induces overexpression of IL-8 and VEGF, which regulates angiogenesis [34].

Conclusions

Port site metastases are relatively rare and the incidence of these is not very well defined. In recent years, many investigators have attempted to identify methods for containing the possible spread of malignant cells. The use of povidone-iodine, methotrexate, aspirin, sodium hypochlorite, and indomethacin has been proposed [35]. However, the exact role of these agents must be proven.

Recently, the use of heparin as an anti-adhesion agent has also been proposed. Many experiments conducted in rats, have demonstrated that the use of low-molecular-weight heparin reduces the rates of tumor growth and intraperitoneal metastases [36]. The possible explanation of this is that heparin binds to fibronectin, which is the principal extracellular protein involved in tumor cell adherence, especially in the site of injured peritoneum [37].

Modifications in the surgical technique can also reduce the incidence of port site metastases. Many studies have shown that by closing all layers after trocar removal, that the prevention of port site metastases is much more likely compared to those cases where only the skin was closed at the end of the procedure [38]. Furthermore, the use of appropriate materials in order to remove the surgical specimens is crucial in order to avoid the contact with the trocar site. Many investigators have proposed and adopted this technique, even if some studies exist that have refuted this protective effect of plastic bags by comparing laparoscopic vs. laparotomy procedures [38].

In Table 1, the authors present some recommendations based in literature, in order to reduce the risk of port site metastases. Finally, patient selection is an essential factor that can influence the incidence of port site metastases in gynecological patients. For example, ovarian cancer patients must be appropriately selected for laparoscopic approach, as the risk of laparoscopic rupture of the tumor capsule is very high, especially when the surgeon is not familiar enough with laparoscopic procedures.

It is not currently possible to identify precise risk factors

of port site metastases, neither to conclude regarding incidence of this phenomena. In additional, robust data regarding port site metastases in gynecologic oncology are needed.

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