

## Advances in surgical pathology of the ovary

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### Laparoscopic surgery of the ovary: The pathologist's role

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Inspection of the abdominal cavity and the pelvic organs by means of a lensed instrument has been known by many different names. Currently, the available instruments are called laparoscopes and the technique, laparoscopy.

In 1834, Blundell first removed a portion of the Fallopian tube for sterilization. Subsequently, in 1880, Lundgren performed an actual tubal ligation. Currently, laparoscopy has become a minimally morbid and simple procedure for tubal sterilization. In 1982, according to the National Center for Health Statistics, sterilization was the most common contraceptive practice among women between the ages of 15 and 44 years in the United States. Although this technique has long been performed to examine patients with abdominal and pelvic diseases, only recently has it become a diagnostic and therapeutic tool, due to the development of pneumoperitoneum, video endoscopy, electrosurgery and laser technologies. Today, laparoscopy has revolutionized the practice of gynecology, particularly in the field of reproductive surgery. In terms of the ablation of lesions, functional recovery and the achievement of pregnancy, the results of endosurgery are identical to those of open surgery but with the further benefits of reduced hospitalization and morbidity.

The creation of pneumoperitoneum is a crucial step. The typical site for the insertion of the insufflation needle is the umbilical area and either carbon dioxide or nitrous oxide may be used for insufflation. Few techniques differ in the method of entering the abdomen, equipment used, timing of insufflation and type of abdominal closure. The addition of the low weight video camera enhanced the use and popularity of operative laparoscopy. The surgeon operates from the video monitor and the role of the assistant is extremely important. Video equipment gives a panoramic view of the abdomen from every angle and by using differently sized lenses, ample magnification is obtained.

Electrosurgery is the controlled transfer of energy to tissue in the form of electrons in contrast to electrocautery and endothermy in which the transfer of energy is in the form of heat. With the unipolar electrosurgical method, which immediately became the standard technique for the electrocoagulation and electrosection of the Fallopian tube at the cornu, a high-voltage, high-frequency current was used and a ground plate (return electrode) attached to the patient completed the electrical circuit. This method has been almost totally replaced by the safer bipolar system, which does not require a separate return electrode. The coagulated tissue should be surrounded by the forceps to reduce bowel burns and other accidental injuries. The tissue effects include vaporization, coagula-

tion, fulguration and cautery. The system has also been adapted to the laser, in which the tissue effect depends on absorption and transformation of light energy. Video-laseroscopy offers many advantages over traditional macro- and microsurgery and is currently widely used.

Laparoscopy has created a picture window in the abdomen and opened new surgical possibilities. Routine endoscopic surgical procedures include adhesion lyse, bowel repair, treatment of hydrosalpinx and ectopic pregnancy, removal of endometriosis, ovarian cysts and uterine fibroids. In addition, tubes, ovaries, particularly in cases of torsion, pelvic and abdominal nodes, as well as the appendix can all be removed. Occasionally, subtotal and total hysterectomies have been performed.

Numerous studies have emphasized the role of laparoscopy in the diagnosis and treatment of benign adnexal masses and ovarian cysts. Treatment includes aspiration of the cyst fluid and fenestration (which are currently rarely performed) as well as cyst excision. The most frequent ovarian masses removed include dermoids, epithelial and functional cysts and, with increasing frequency, borderline epithelial tumors. The prerequisite of this approach is the preoperative evaluation of the patient to avoid the discovery of an unexpected malignant tumor. There are several guidelines for preoperative differential diagnosis between benign and malignant tumors (particularly ovarian tumors), such as a combination of sophisticated ultrasonography and serum tumor markers. The incidence of unexpected malignancy at laparoscopy is low (0.4-2.9%).

The indications for gynecologic endoscopic surgery of malignant tumors have increased in recent years but this procedure is not yet universally accepted. In some centers, laparoscopic salpingo-oophorectomy is followed by vaginal hysterectomy for atypical hyperplasia and low-grade endometrioid carcinoma. Laparoscopic lymphadenectomy may follow hysterectomy in low-stage high-grade endometrial carcinoma with myometrial invasion and may be used in cases of cervical and vaginal cancer. The role of laparoscopy in ovarian cancer is still being debated since this technique is inferior to laparotomy and carries the risk of tumor dissemination. However, it can be used in selected cases.

Endosurgery would allow a new approach in which diagnosis and therapy could be achieved simultaneously rather than consecutively. The pathologist can be consulted for i) conventional diagnosis on biopsies or surgical specimens; ii) intraoperative diagnosis on frozen sections; and ii) consultation in the operating room at the video camera during laparoscopy. In each of these situations, his role should be adjusted to the endoscopist's requests.

Peritoneal endometriosis can be diagnosed, classified and followed by laparoscopy. The pathologist may be requested by the laparoscopist to confirm typical as well as subtle endometriosis and even to provide more sophisticated information, such as evaluation of the degree of hormonal stimulation on conventional slides using quantitative immunohistochemistry and receptor studies, morphometric evaluation of vascularization before and after gonadotropin-

releasing hormone agonist therapy and three-dimensional architecture of the ectopic endometrium. Ovarian and extra ovarian endometriosis can be classified into superficial, hemorrhagic and deeply infiltrating. Adhesions are classified laparoscopically and an evaluation of their age (fibrosis) and nerve proliferation can be requested from the pathologist.

Tissue on either frozen or permanent sections may be altered by artifact and clinical information is, therefore, essential. For instance, tubal fimbriae and mesothelial hyperplasia are difficult to distinguish from papillary serous proliferations. In ovarian biopsies, theca external cells may mimic a primary stromal tumor. In leiomyomas, as well as in samples of ovarian stroma, the cellular vacuolization that results from electrosurgery can be confused with mucin droplets ("signet-ring like cells"). The presence of the pathologist in the operating room is important in difficult cases, particularly in borderline tumors of the ovary. Experienced gynecologic pathologists may have some initial difficulty, since examination with the naked eye differs from the video image due to the magnifying effect of the lens.

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## Mucinous borderline tumors

Mucinous borderline tumors (MBTs) are almost as common as serous borderline tumors and constitute 40-50% of all mucinous malignant tumors (1) and 71% of those that are stage I (4). Recently, MBTs have been subclassified into two different clinicopathological forms: the most common form is composed of intestinal-type epithelium and has been designated MBT of the intestinal type (IMBT). A second and less common variant of MBT contains endocervical-type epithelium and has been named MBT of the endocervical type (EMBT) (5).

IMBT (85% of MBTs), occur most frequently in the fourth to seventh decades of life with an average age of 41 years (4, 5). Most of them (80-90%) are stage I and less than 10% are bilateral (4, 5). It should be realized that metastatic mucinous tumors in the ovary often mimic primary ovarian mucinous neoplasms, particularly adenocarcinomas of the pancreas and large intestine (6, 7). The metastatic tumor may appear deceptively "benign", "borderline" or malignant. Bilaterality is exceptional in stage I ovarian mucinous tumors; consequently, tumor involvement of both ovaries should arouse the suspicion of metastatic carcinoma.

Grossly, these tumors average 19 cm in diameter and are usually multilocular (4). They cannot be distinguished from mucinous cystadenomas and cystadenocarcinomas. These tumors should be sampled extensively since variations in the degree of epithelial proliferation and nuclear atypia (from benign to borderline, and to carcinoma) are common within an individual neoplasm. Microscopically, IMBTs are composed of cysts and glands lined by atypical epithelium of intestinal type. The cysts may contain papillae, which are typically thin and branching. The lining epithelium almost always contains goblet cells. The epithelial cells are usually stratified to two or three layers, nuclear atypia is mild to moderate and mitotic figures vary from few to numerous.

The criteria used to distinguish IMBTs from mucinous carcinomas have varied, resulting in considerable confusion in the literature. In the classification of the World Health Organization (WHO) (8), the former were defined as showing a degree of epithelial proliferation greater than that seen in benign cystadenomas, but lacking "destructive" stromal invasion. Nevertheless, the morphological evaluation of stromal invasion is more difficult for these tumors than for stromal borderline tumors (SBTs); the stroma, instead of being desmoplastic, may resemble ovarian stroma, and in cystadenomas, the irregular distribution of the glands in the stroma may suggest that invasion has occurred. To resolve this problem, Hart and Norris (9) proposed that noninvasive carcinoma should be diagnosed when the lining epithelial cells show a nuclear stratification of four or greater. Subsequently, Hart (4) added other cytologic and architectural criteria to support the diagnosis of noninvasive carcinoma. These criteria included malignant features of the epithelial cells, an obvious cribriform pattern and the presence of solid cellular papillae without fibrovascular cores. Using these criteria, these authors were able to distinguish accurately between IMBT, which had an excellent prognosis (96% 10-year survival for stage I tumors) and mucinous carcinomas, which were associated with only a 67% survival (9). These "Hart-Norris" criteria became widespread in the United States but many pathologists elsewhere followed the WHO criteria. Because of this disparity in criteria, the cumulative data in the literature does not allow reliable conclusions to be drawn about which of the two sets of criteria (WHO vs. Hart-Norris) better distinguishes IMBT from noninvasive carcinomas (10). Nevertheless, the comparative analysis of some series in which

## Recent advances in mucinous tumors

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Mucinous tumors account for 10-15% of all ovarian tumors (1). Approximately 75% are benign, 10% are borderline and 15% are carcinomatous (1). Although they generally occur in older women (mean ages 51-54 years); mucinous borderline tumors and carcinomas are more common in the first two decades of life than analogous serous tumors (1).

Some mucinous tumors may be of germ cell origin but neometaplasia of the ovarian surface epithelium is an alternative explanation for their development (1). Mucinous ovarian tumors may be associated dermoid cysts, Brenner tumors and mucinous tumors of other organs such as the uterine cervix and the appendix (1). Mucinous tumors are among the most common non endocrine ovarian tumors associated with hormonal manifestations (2). The serum level of alpha-inhibin is considered to be a tumor marker for mucinous borderline tumors and carcinomas (3).