Laparoscopy in Gynecologic Emergencies

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5.1 Introduction

An acute abdomen results usually from peritoneal irritation due to inflammation or rupture of an abdominal organ or obstruction of a hollow organ. In hospital practice, patients with acute abdominal pain either go spontaneously to the emergency room or are sent there by their family doctor with a provisional diagnosis, which reportedly has no more than a 50 % chance of being correct [1].

Determining the cause of lower acute abdominal pain is one of the greatest challenges faced by physicians in emergency services. It is a common reason for hospitalization since 67 % of all patients show nonspecific lower acute abdominal pain. Among women, for anatomic, physiological, and pregnancy reasons, it is the most frequent cause of hospitalization [2].

In women, acute pain can be essentially caused by pelvic inflammatory disease (PID), appendicitis, ectopic pregnancy, abortion, torsion of adnexa, endometriosis, and hemorrhagic ovarian cysts.

"Wait and see" has been the most widely used clinical, or paraclinical, method of observation of patients with nontypical clinical signs. The predictive value of clinical diagnosis reached with this method, which varies with the underlying cause, has been estimated between 68 % and 92 %. On the one hand, this method entails

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risk to patients because of possible complications such as peritonitis, hemorrhage, or infertility; on the other hand, laparotomy might be unnecessarily performed.

Laparoscopy is an alternative way of making an early diagnosis of the cause of pain and treating the underlying disease. The accuracy of laparoscopy in acute pelvic pain varies within a range of 65–97 %. It depends on the complete visualization of the whole abdominal pelvic cavity and the diagnostic standard to which it is compared. However, laparoscopy should not be considered as a routine diagnostic tool for every case of acute abdomen, as it carries its own morbidity and requires a general anesthesia. Although it is incorrect to hypothesize that all patients with acute abdominal pain would benefit from laparoscopic surgery, it is evident that over the years an increasing number of patients have been managed successfully in emergency thanks to the laparoscopic approach [3].

5.2 Clinical Evaluation

In cases of pelvic pain, taking a thorough patient history is mandatory prior to physical examination. The obstetric history is important, particularly if the woman has suffered a late miscarriage, ectopic pregnancy, or undergone a Cesarean section. The number and outcome of all pregnancies should be noted together with eventual complications suffered such as abortion, prenatal and postnatal infections (endometritis), and thromboembolism.

The gynecologic history should focus on conditions such as pelvic inflammatory and infective processes which are relatively common in women of reproductive age. Previous surgical interventions such as laparoscopy, hysteroscopy, and surgical and medical termination of pregnancy, particularly if recent, have to be taken into careful consideration. The patient's menstrual history should be checked completely, gathering information relating to her menarche (first menstruation), menstrual cycle pattern, and menopausal symptoms. The date of her last menstruation should be recorded as well. The surgeon should enquire as to whether the woman has used any contraceptive methods and their nature. A delay in the menstruation should lead the surgeon to suspect an ectopic pregnancy, even when the urine pregnancy test result is negative. In such circumstances, a serum beta-hCG evaluation would confirm or exclude the diagnosis of a pregnancy. An ectopic pregnancy should also be suspected in the presence of a positive pregnancy test where an intrauterine contraceptive device (IUCD) or oral contraception has been used. Other irregularities in the menstrual cycle should be recorded.

Clinical examination can confirm or refute a diagnosis suggested by the patient history. Generally, a painful abdomen with localized or widespread tenderness, rebound tenderness, and reduced bowel movements should be considered a surgical problem. Urgent hematologic and abnormal ultrasound will help to establish the correct diagnosis. The clinical assessment must always be completed by checking for hernias in the groin or in the site of previous surgery. Rectal and vaginal examination should not be unduly painful and the reason for performing it must be explained to the patients. The vaginal examination should be avoided in very young

patients and in those with virgo intacta. The physical examination will include palpating the cervix, the uterus, and the adnexa. Local tumor, fluid collection, and signs of pelvic and peritoneal tenderness will be searched for. Signs of tenderness may indicate the presence of inflammations and infections and suggest peritonitis.

Laboratory investigations should include a full blood count. The red blood cell count and hematocrit will give information on possible anemia. Leukocytosis is always present in cases of infections and inflammations such as salpingitis, PID, and pelvic abscesses. It is also often present in the initial stages of an ovarian cyst rupture and in ovarian torsion. Blood cross-matching is advisable before surgery. Likewise, the clotting screen is also necessary in the presence of heavy blood loss or if acute anemia is suspected. The serum human chorionic gonadotropin (beta-hCG) should be urgently tested, particularly in women with irregular menstrual cycles or those using contraception. The serum beta-hCG test should be carried out even when a negative urine pregnancy test result has been obtained, due to a false-negative rate of 5 %. Testing for CA-125 is not required in an emergency setting. However, it is worth knowing that a raised CA-125 is a specific marker of peritoneal reactions. Levels can be elevated up to hundred times in endometriosis and pregnancy and a thousand times in ovarian cancer.

5.3 Most Common Gynecologic Emergencies

The most common gynecologic emergencies causing acute pelvic pain are reported below:

1. Adnexal–ovarian torsion
2. Pelvic inflammatory disease (PID)
3. Ectopic pregnancy
4. Endometriosis
5. Hemorrhagic ovarian cysts

5.3.1 Adnexal Torsion

5.3.1.1 Etiology

The adnexa of the uterus, formed by the ovaries and fallopian tube, are prone to torsion. Ovary and/or fallopian tube torsion happens when the adnexa suffer a complete or partial rotation on its ligamentous support, resulting in compromise of their blood supply and in sudden onset of pelvic pain. Adnexal torsion can be unilateral or bilateral, with the last one being extremely rare. It is the fifth most common gynecological emergency [4], with a reported incidence ranging from 2.7 % to 3.0 % [4, 5]. Adnexal torsion can affect women of all ages 28–31, but it is more frequent among women of reproductive age 26. Most of these women desire future fertility; thus, an accurate diagnosis and prompt treatment are important in an attempt to preserve ovarian function.

The major risk factors for adnexal torsion are an ovarian mass (physiologic cyst or neoplasm) [6], pregnancy and ovarian stimulation [6], previous pelvic surgery, particularly tubal ligation [6], past history of ovarian torsion [7], hypermobile adnexa [8], and an excessive length of the utero-ovarian ligament, particularly in the pediatric population [9].

5.3.1.2 Signs and Symptoms

Patients presenting with adnexal torsion complain of an acute, intermittent, unilateral pelvic pain. This pain may be exacerbated by positional shifts. Approximately, 70 % of patients have associated gastrointestinal complaints including nausea and vomiting, which can lead some providers to include in their differential appendicitis, bowel obstruction, or mesenteric ischemia. The episodes may have intermittently persisted for the past few days to weeks. On physical examination, a tender, unilateral adnexal mass is appreciated in roughly 70 % of patients [10]. This tender mass becomes enlarged because in a partial torsion, there is enough arterial pressure for blood to flow into the adnexa. The venous blood is unable to return, however, because of the pressure dampening of the torsion. If the torsion persists or progresses, then the arterial blood flow is unable to oxygenate the ovary and the tissue begins to undergo necrosis. Many women only develop a fever once necrosis ensues.

5.3.1.3 Diagnosis

Adnexal torsion remains as one as the most challenging conditions to diagnose preoperatively. Traditionally, diagnosis has stood on the clinical and sonography findings. Numerous retrospective analyses were undertaken to evaluate the clinical profile of adnexal torsion. Abdominal pain was the most common symptom (77.8–98 %), followed by nausea and vomiting (46–80.5 %), mass in clinical examination (22.2–72 %), elevated white blood count (22.1–75 %), lower urinary tract symptoms (14.5 %), fever (5.6–7.8 %), and abnormal genital tract bleeding (4 %) [4, 5]. A gynecological ultrasound is usually the first imaging tool used in the approach of pelvic pain. The sonography findings that may be found in adnexal torsion are ovarian enlargement, visualization of a cyst, solid or complex mass at the location of the adnexa, abnormal ovarian position in the pouch of Douglas, thickening of the adnexal wall, peripherally enlarged follicles, cystic hemorrhage, and free pelvic fluid [5]. Lo et al. reported that an adnexal or pelvic mass could be detected using gynecological ultrasound in almost all of the patients (98.3 %) [4]. Oltmann et al. stated that the finding most consistent with torsion on transvaginal ultrasound (TVU) was simply the presence of an enlarged ovary or adnexal mass and confirmed that the sole presence of a mass larger than 5 cm had the best sensitivity for torsion (83 %) [11].

Color doppler ultrasound detects the ovarian blood flow, while spectral Doppler can enable the differentiation between venous and arterial flow in the ovary. These techniques have been suggested as an additional tool to improve the accuracy of diagnosing ovarian torsion. The absence of venous, or arterial and venous flow in an enlarged or cystic ovary on color and spectral doppler studies, is highly predictive

of ovarian torsion [12]. Studies reported that, although highly specific, doppler sonography was not sufficiently sensitive. A normal flow by doppler sonography does not rule out ovarian torsion and should not delay surgical exploration if the patient presents with suggestive signs and symptoms.

Computerized tomography scan (CT scan) and magnetic resonance image (MRI) can detect ovarian torsion, but they are not necessary in most cases and should not delay treatment. Moreover, CT scan is contraindicated in pregnant women. Tumor markers, such as beta-human chorionic gonadotropin (β-HCG), alpha-fetoprotein (α-FP), cancer antigen 125 (CA-125), and lactate dehydrogenase (LDH), are not routinely screened in an emergency setting.

At the present time, there is no reliable method enabling the diagnosis of adnexal torsion to be confirmed preoperatively. Studies still report a poor correlation between preoperative diagnosis and surgery findings: Bar-On et al. found that women who underwent laparoscopy for suspected ovarian torsion were correctly diagnosed in only 46.1 % of cases [13]; Cohen et al. stated that among 100 emergency laparoscopies performed due to acute abdomen, ovarian torsion was the most difficult to diagnose preoperatively, with only 44 % of cases being confirmed by laparoscopy [14]; Houry et al. reported that, among women with ovarian torsion, the diagnosis was initially considered in 47 % of patients [6], while White et al. found that it was considered in only 19 % of patients [7]. Thus, diagnostic laparoscopy can reduce the uncertainty of diagnosis in ovarian torsion. Also, it offers a lot of other advantages: enables a rapid and accurate assessment [15], reduces the incidence of negative laparotomies, reduces morbidity and mortality from the underlying disease [16], and, most of all, enables treatment.

5.3.1.4 Treatment

Surgical approach by laparoscopy is the standard of care for adnexal torsion; it allows the physician to diagnose adnexal torsion in a first step and to treat it in a second step. Multiple studies have confirmed the safety and efficacy of the laparoscopic approach for adnexal torsion in children [9, 17] and pregnant patients [18].

Results of Lo et al. show that patients undergoing laparoscopy had a smaller ovarian mass, a shorter hospital stay, and fewer of them suffered from postoperative fever, comparing to patients undergoing laparotomy [4]. Oltmann et al. also reported that a preoperative imaging mass size of less than 5 cm was associated with the use of a laparoscopic approach. They also found that laparoscopy rates increased from 18 % in the 1993–2000 to 42 % in the 2001–2008 period, reflecting the change over time in surgical practice [11]. Laparoscopy approach has demonstrated to be superior to laparotomy as it results in lower rate of febrile morbidity, reduces consumption of analgesic drugs, and shortens hospital stay [19, 20].

Intraoperative management of adnexal torsion has been largely debated. In the past, treatment consisted of radical surgery. An ipsilateral oopherectomy by laparotomy was the standard of care, due to both concerns regarding thromboembolic phenomena and "black-bluish" appearance of twisted adnexa [19]. Nowadays, treatment is rather conservative. It is initiated by untwisting the adnexa, even when

it appears necrotic, and completed, as required, by treatment of any cyst present and/or oophoropexy. All these steps are easily accomplished by laparoscopy [21, 22].

In a pregnant patient, there have been successful cases of laparoscopic adnexal torsion reduction. The incidence of adnexal torsion in pregnancy is 1 in 5000 pregnancies. Many authors recommend entering in an open manner as opposed to Verres needle or in a direct approach; however, there has been documentation of complications in all three approaches. In pregnant patients, precautions should be taken as the uterus may be in the abdominal cavity and surgical pneumoperitoneum poses the risk for decreased uterine blood flow secondary to increased intra-abdominal pressure [18, 23]. Fetal cardiac activity should be documented before and after the procedure and the patient should be positioned in the dorsal supine position with left lateral tilt during the operation.

5.3.2 Pelvic Inflammatory Disease

5.3.2.1 Etiology

Pelvic inflammatory disease refers to the acute infection of the upper genital tract in women. It includes any combination of cervicitis, endometritis, salpingitis, tubo-ovarian abscess, and pelvic peritonitis [24]. Originally, PID was associated with *Neisseria gonorrhea* and *Chlamydia trachomatis* infection. Nowadays, it is recognized that these microorganisms cause only two-thirds of cases. *Gardnerella vaginalis*, *Mycoplasma genitalium/hominis*, Ureaplasma spp., Diphtheroids, Prevotella, Bacteroides, other anaerobes, and streptococci may also be involved [24]. It is the most common infectious disease affecting young women, accounting for 94 % of sexually transmitted disease-associated morbidity in well-resourced countries. This condition can cause significant reproductive health sequelae, including tubo-ovarian abscesses, pelvic adhesions, recurrent PID, chronic pelvic pain, infertility due to obstruction of fallopian tubes, and ectopic pregnancy in an increased factor of 7–10 [25]. Such complications are related to disease severity and timing of diagnosis. Prompt investigation is essential in order to attenuate disease impact.

5.3.2.2 Signs and Symptoms

Approximately, 90 % of patients present with the chief complaint of abdominal pain and approximately 75 % of those patients have an elevated white count. Other signs and symptoms can be vaginal discharge, abnormal uterine bleeding, nausea, vomiting, and fever.

5.3.2.3 Diagnosis

The accuracy of different signs and symptoms in predicting the presence of PID has been extensively evaluated using laparoscopy as the gold standard [26, 27]. Currently, the clinical diagnosis of PID is based on recommendations from the Center for Disease Control and Prevention (CDC). Minimum diagnostic criteria (presence of cervical motion, uterine and adnexal tenderness) have been set with

a high sensitivity and low specificity, in order to detect as many cases of clinical disease as possible. If all these criteria are present in sexually active young women, empiric treatment should be instituted. The CDC also provides a list of additional criteria that may help to improve diagnostic specificity: elevated oral temperature (>38.3 °C), abnormal cervical or vaginal discharge, elevated erythrocyte sedimentation rate, elevated C-reactive protein concentration, and laboratory documentation of cervical infection with *Neisseria gonorrhoeae* or *Chlamydia trachomatis* [24].

Peipert et al. showed that the clinical finding of adnexal tenderness had a sensitivity of 95.5 %, which was superior to that of the CDC's minimal clinical criteria (83 %) [28].

There is not a pathognomonic laboratory test for upper genital tract infection. Ultrasound examination is able to detect thickening of fallopian tubal walls and tubo-ovarian abscesses and rule out other possible diagnoses like ovarian cysts and ovarian torsion [29]. However, the sensitivity and specificity of ultrasound features is highly dependent on the severity of the disease [29].

Laparoscopic exploration is warranted whenever the diagnosis is unclear and the symptomatology is unremitting, especially in young women for whom the preservation of fertility is important. Laparoscopic visualization of the triad of edema, hyperemia, and a purulent exudate from the ends or surface of the fallopian tube has been considered the gold standard for PID diagnosis [30, 31]. Laparoscopy can be used to directly visualize pelvic anatomy and diagnose PID without aggravating the inflammatory process and exclude other pathologies (which may be present in approximately 20 % of patients) [32]. However, its sensitivity varies depending on the stage of illness, being less sensitive in milder forms where diagnostic criteria are less objective. In cases where there is no visual evidence of salpingitis by laparoscopy, endometrial biopsy is warranted because some women with PID can have endometritis alone.

Gaitán et al. reported that endometrial biopsy showed 75 % of global accuracy, comparing with a global accuracy of 91 % with laparoscopy. Laparoscopy showed an optimum specificity (100 %), proving to be very useful in excluding other causes of abdominal pain in patients presenting with an atypical course [31].

Among these lines, in cases of abdominal pain of unknown cause where there is a suspicion of PID, laparoscopic surgery has become a diagnostic tool that permits not only confirmation of the process but also to take a microbiologic culture from the fallopian tubes to apply specific antibiotic therapy, a classification of the severity of the disease, the evaluation of the future fertility status of the patient, and therapeutic options, such as lysis of adhesions, aspiration of tubo-ovarian abscess, and irrigation of the peritoneal cavity [15, 25].

In patients without PID, laparoscopy permits rapid recognition and treatment of differential pathologies like appendicitis, ovarian cyst, ovarian torsion, and endometriosis, avoiding unnecessary antibiotic therapy. Costs, limited access, surgical risks, and the fact that not all institutions have the facilities or scheduling to submit all patients with acute abdominal pain to diagnostic laparoscopy prevent the universal use of laparoscopy for the diagnosis of PID [16]. However, the costs can

be balanced by a shorter hospital stay and a reduction in unnecessary abdominal imaging.

5.3.2.4 Treatment

Tubo-ovarian abscess is not a disease entity, but rather a finding in the spectrum of PID. Treatment includes analgesia, fluids, and intravenous broad-spectrum antibiotics.

Although 60–80 % will resolve without surgical intervention, it is prudent to identify those individuals who require immediate surgical intervention because delay can be fatal [12].

Currently, there are three situations where surgical intervention is recommended: a concern for an alternative surgical emergency, failure of clinical response after 48–72 h of medical therapy, or ruptured tubo-ovarian abscess with generalized peritonitis and septic shock. A review on the management options for tubo-ovarian abscess reported that laparoscopy should be considered in all patients with tubo-ovarian abscess who desire future conception. They reported pregnancy rates ranging from 32 % to 63 % in patients treated with medical therapy followed by immediate laparoscopy drainage within 24 h, comparing to pregnancy rates ranging from 4 % to 15 % in patients treated with medical management alone, both without suspected rupture. They also report the major advantages of an immediate laparoscopy: it allows an accurate diagnosis and effective treatment under magnification with minimal complications and shows faster response rates with shorter hospitalization times and decreased infertility [33]. Surgical procedures can include laparoscopy with drainage of purulent fluid, adhesion lysis, tubal lavage, dissection and excision of necrotic tissue, and thorough irrigation of the peritoneal cavity before completion of the procedure [32, 34]. A particularly simple, safe, and efficacious alternative approach is the use of ultrasound-guided transvaginal drainage of the abscess in combination with antibiotics.

5.3.3 Ectopic Pregnancy

5.3.3.1 Etiology

Ectopic pregnancy occurs when the embryo fails to implant within the uterine cavity. The majority of ectopic pregnancies (95 %) are located in the fallopian tube. The rising incidence of ectopic pregnancy in the past 30 years has been attributed to a number of factors including a greater prevalence of sexually transmitted disease (PID), tubal sterilization and reversal, delayed childbearing, assisted reproductive technologies, and more successful clinical detection [35]. Ectopic pregnancy is the leading cause of maternal mortality during the first trimester of pregnancy [36]. Although spontaneous resolution of ectopic pregnancy can occur, patients are at risk of tubal rupture and catastrophic hemorrhage. Most fatal cases result from delayed diagnosis and inappropriate management. However, recent improvements made in diagnostic techniques have led to a marked reduction in mortality rates.

5.3.3.2 Signs and Symptoms

Patients who have ectopic pregnancies usually show abdominal pain, amenorrhea, and irregular vaginal bleeding. On physical examination, the most common findings include ipsilateral adnexal tenderness, abdominal tenderness, and an adnexal mass [37].

Not all patients who have an ectopic pregnancy, even those who have a hemoperitoneum, have rebound tenderness or peritoneal signs. Also of note, vigorous pressure during bimanual examination can cause a previously unruptured ectopic pregnancy to rupture; therefore, gentle examination is required.

5.3.3.3 Diagnosis

In women of early pregnancy/history of amenorrhea presenting with acute pelvic pain and/or vaginal bleeding, a diagnosis of ectopic pregnancy should always be considered. On physical examination, an adnexal mass may be palpated. The diagnosis of ectopic pregnancy has evolved since the 1980s. Advanced ultrasonography techniques as well as improved β-HCG measurements have largely replaced laparoscopy as primary diagnostic tools. These tests allow us to detect an early ectopic pregnancy before clinical symptoms have the chance to set in [34]. These days, the role of laparoscopy is limited to cases in which the diagnosis is still in doubt. In such cases, a choice must be made between expectant observation and laparoscopic confirmation.

5.3.3.4 Treatment

To date, the management options of tubal ectopic pregnancy are threefold: expectant management, medical treatment, or surgery. These three options have been compared in terms of efficacy, financial costs, and future fertility. The criteria for choosing between therapeutic modalities in ectopic pregnancy remain unsettled. Expectant management has been advocated based on the knowledge that an early ectopic pregnancy can be self-limiting, resulting in tubal abortion or re-absorption. It has been advised in a selective group of patients asymptomatic with serum β-HCG cutoff level relatively low and declining. Medical treatment with methotrexate has been widely used in patients with minimal symptoms, who are hemodynamically stable, have no more than a moderate amount of intra-abdominal free-fluid on TVU scan, and have β-HCG concentrations <3000 IU/L [38]. The major contraindications for medical management are β-HCG level greater than 15,000 IU/L, fetal cardiac activity, and free fluid in the cul-de-sac on TVU. Surgical management is indicated if the patient is not eligible for medical therapy, if medical therapy has failed, or if there are symptoms and signs of tubal rupture [38].

Ectopic pregnancy represents a hallmark in the history of laparoscopic surgery: it was one of the first surgical pathology being treated through a laparoscope [39]. Nowadays, laparoscopy is the accepted approach to perform both a salpingostomy and salpingectomy. Mol et al. reported that although laparoscopic approach was significantly less successful than the open surgical approach in eliminating trophoblastic tissue, it was significantly less costly. The cost savings after laparoscopic surgery resulted from a significantly shorter operation time, less perioperative blood

loss, shorter duration of hospital stay, and shorter convalescence time. Laparoscopy was the most cost-effective treatment in women with tubal ectopic pregnancy. The fertility outcome was comparable to laparotomy [40]. Laparoscopy also results in less postoperative adhesion formation and impairment of the pelvic status than laparotomy [35].

Laparoscopic surgery is the gold standard for the treatment of ectopic pregnancy in hemodynamically stable women. However, it is estimated that approximately 15 % of women with ectopic pregnancy experience hypovolemic shock. In these cases, both the volume of hemoperitoneum and the hemodynamic status of the patient have been critical factors in deciding whether to perform a laparoscopy or a laparotomy. Although historically contraindicated, numerous case reports and studies have proven that laparoscopy can be successful in cases of ruptured ectopic pregnancy with hemodynamic instability [41, 42]. Laparoscopy has also been contraindicated in certain situations such as interstitial and cornual pregnancy and severe adhesions. The improvement of surgeons' skills and instrumentation has made these contraindications obsolete. Laparoscopy efficacy has been reported in interstitial and cornual pregnancies in various case reports [43, 44]. Thus, laparoscopy leaves little space for laparotomy in ectopic pregnancy management.

There is a controversy on whether to perform a conservative treatment (salpingostomy) or a radical treatment (salpingectomy) in ectopic pregnancy. The possible advantage of radical approach would be to eliminate the possibility of recurrence, but with lower rates of fertility (66 %). In conservative approach, rates of 8 % of persistent ectopic pregnancy have been reported, but with higher rates of fertility (89 %). So the conservative approach should be preferred whenever future fertility is required. Most authors agree that salpingectomy should only be performed in women with uncontrolled bleeding, recurrent ectopic pregnancy in the same tube, a severely damaged tube, or a tubal gestational sac greater than 5 cm in diameter [36].

5.3.4 Endometriosis

5.3.4.1 Etiology

Endometriosis, the presence of endometrial glands and stroma outside of the endometrial cavity, represents one of the most challenging gynecologic conditions to manage given its insidious onset, surgical diagnosis, association with pelvic pain and infertility, and often progressive nature.

The cause of endometriosis is unclear. There are several theories postulated to explain its pathogenesis. These include retrograde menstruation and implantation, the metaplasia theory, lymphatic and vascular spreading, and genetic predisposition [45, 46].

Endometriosis is a chronic disease affecting at least 10 % of reproductive-aged women, but is found in approximately 40 % of infertile women and up to 90 % of women with pelvic pain [47]. Risk factors include family history, low body mass index, alcohol use, smoking, particularly in the setting of infertility, Caucasian

race, prolonged estrogen exposure as with early menarche or late menopause, and nutritional/environmental factors.

5.3.4.2 Signs and Symptoms

During menstruation these ectopic tissue areas undergo changes such as edema and bleeding, causing symptoms like acute pelvic pain, dysmenorrhea, dyspareunia, signs of peritoneal irritation, dyschezia, rectal pain and bleeding, each being dependent upon the location of endometriosis. Chronic symptoms with acute bouts of pain are characteristics of endometriosis affecting the ovaries with bleeding, torsion, or rupture of an endometrioma.

5.3.4.3 Diagnosis

Apart from the clinical evaluation, diagnosis is helped by transvaginal or transabdominal US and by MRI. Laparoscopy is the gold standard to evaluate pelvic endometriosis as it allows the collection of histologic specimens needed to confirm diagnosis. Deep infiltrating or subperitoneal endometriosis is not always visible at laparoscopy and MRI can therefore be helpful in such conditions. Laboratory investigations are restricted to serum CA-125 which usually increases to values of up to 100–200 IU/mL, but is not useful for the diagnosis. The role of CA-125 is limited to the follow-up of recurrences.

5.3.4.4 Treatment

Medical treatment with NSAIDs reduces the production of local prostaglandin, therefore reducing inflammation but more importantly reducing the pain. The medical treatment of endometriosis consists of ceasing ovarian estrogen production. Estroprogestinic preparations are the most useful drugs as they can be used for months if common contraindications such as obesity, breast cancer, smoking, and high blood pressure do not exist.

Medical treatment by danazol or a GnRH analog are also very effective as a means of stopping ovarian function and estrogen production, but are associated, due to hypo-estrogenization, with undesired side effects including osteoporosis, vaginal dryness, hot flushes, and other vasomotor symptoms. The use of danazol or a GnRH analog if protracted for more than 6 months should be associated with an estroprogestinic preparation to reduce the menopausal symptoms, osteoporosis, and fracture risk. The medical treatment is only effective in minimal endometriosis, while moderate and severe forms need to be treated by surgery [48].

Surgical treatment consists of trying to remove as much endometriotic tissue as possible. It is rare to perform emergency surgery for pelvic pain exclusively due to endometriosis, unless it is secondary to an operation performed for hemoperitoneum due to an ovarian cyst rupture (endometriomas) or for suspected appendicitis. At surgery the removal of endometriosis requires careful manipulation of the organs involved. A careful approach needs to be applied during surgery for endometriosis infiltrating the serosa of the bowel, above the urethra and bladder and above major blood vessels [49].

Laparoscopy allows a mapping of the disease and the collection of material for histology that will eventually confirm the diagnosis. Surgical staging of endometriosis consists of a scoring to be attributed to each site, localization, and extension of the lesion. The most commonly used scoring system suggested by the American Fertility Society helps in the evaluation of patient fertility prognosis [50].

In young women, surgical treatment of ovarian endometriosis must not compromise the reproductive function of the ovary and electrosurgery should be minimally used. The laparoscopic approach is favored compared to open surgery as it allows clearer visibility and access to the pelvic cavity and reduces the postoperative morbidity and hospital stay. Moreover, laparoscopy may increase chances of future pregnancy and live birth [51, 52].

It is important to remember that the endometriotic tissue has the capacity to implant and therefore careful peritoneal cavity washing and adequate removal of the surgical specimens should be performed to reduce the risk of distal implant on scars and trocar access points.

5.3.5 Hemorrhagic Ovarian Cysts

5.3.5.1 Etiology

Approximately 2–4 days after ovulation, the ovary becomes increasingly vascular. With neovascularization, blood from the vascular theca zone often fills the cavity of the cyst. Often, the cyst reabsorbs the blood; however, if the amount of bleeding is large or a cyst ruptures the bleeding may continue, producing a hemoperitoneum. Increased caution should be taken in patients who are anticoagulated.

5.3.5.2 Signs and Symptoms

Pertinent history should include when the patient's last menstrual period took place. Pain can occur with ovulation of a follicular cyst, otherwise known as Mittelschmerz syndrome. Enlarging ovarian follicles often produce a colicky or dull unilateral tenderness in the lower abdomen or pelvic region. Rarely, patients may present with hypovolemia and hemodynamic instability. Nausea and/or vomiting are associated as nonspecific symptoms. A bimanual examination should be performed to evaluate the size of the cyst and tenderness. On physical examination, a corpus luteal cyst can mimic an ectopic pregnancy. Originally described by Halban, a triad of symptoms includes a delay in menses, followed by spotting, unilateral pelvic pain, and a small, tender, adnexal mass [53].

5.3.5.3 Diagnosis

Diagnosis of a hemorrhagic or ruptured cyst is often made by narrowing the differential. Transvaginal ultrasound often demonstrates an adnexal mass; however, the ovary may be normal in size if rupture has decompressed any cysts. In these cases, a large amount of pelvic fluid is usually noted [54]. A quantitative pregnancy test can rule out an ectopic pregnancy. A CBC should be taken to assess the current blood count. An elevated white count is rarely seen in a ruptured luteal cyst. Once

Table 5.1 Indications for different surgical approaches

Laparotomy
High suspicion for malignancy
Large cysts
History of or risk factors for abdominopelvic adhesions
Hemodynamically unstable patient—hypovolemia
Significant cardiopulmonary disease
Obesity
Laparoscopy
Minimizing the risks of subsequent infertility resulting from pelvic adhesions
Every effort should be made to conserve ovarian tissue

pregnancy is ruled out, an abdominal/pelvic CT with contrast can further assist in evaluating other potential causes, including acute appendicitis.

5.3.5.4 Treatment

Initial management of a suspected follicular or hemorrhagic cyst is supportive management and continued observation with a repeat pelvic ultrasound in approximately 4–6 weeks to document resolution. Oral contraceptive medication can be started in patients to halt further ovulation.

Indications for immediate operative intervention include a large amount of peritoneal fluid found on a transvaginal ultrasound, hemodynamic instability, and severe pain. Delayed operative management is indicated for patients in whom pain is not improving with conservative management or for persistent tumors to rule out a neoplastic process. A cystectomy is recommended as opposed to a unilateral salpingo-oophorectomy in reproductive-aged women. Laparoscopic evaluation is usually feasible; however, if cancer is suspected, laparotomy may be necessary to ensure intact removal and for staging purposes [53]. The indications for laparotomy or laparoscopy are summarized in Table 5.1. Intraoperative spillage of a malignant tumor does not necessarily worsen prognosis, but it does necessitate adjuvant chemotherapy. If the cyst is benign, a ruptured cyst may still cause postoperative abdominal pain secondary to chemical peritonitis.

5.4 Discussion and Conclusion

Anteby et al. highlighted the value of laparoscopy in the evaluation of acute pelvic pain in 1974. Since then, great advances in anesthesia care and cardiovascular monitoring, together with the development of a great number of devices and different techniques, have made possible the use of diagnostic and therapeutic laparoscopy procedures for gynecologic emergencies.

Nowadays, early diagnostic laparoscopy in the emergency setting improves diagnostic rates and reduces hospital stays and costs, when compared to other

diagnostic modalities. Still, laparoscopy is an invasive technique and it should only be used after a first-line investigation combining clinical and sonography examination.

Therapeutic laparoscopy procedures in gynecology emergencies are now universal practice. The efficacy and safety are comparable to laparotomy procedures but with several additional advantages: shorter operation times, impairment of pelvic status with less postoperative adhesions; few postoperative pain, fever, and blood loss; reduction on consumption of analgesic drugs; fast recovery rates; shorter hospital stays; better cosmetics outcomes; and lower costs. However, the safest approach should always be the one that the surgeon feels more comfortable with, and this should always be a factor regarding the type of intervention.

In a pregnant woman laparoscopy and laparotomy may increase the possibility of spontaneous abortion in the first trimester and premature delivery in the last trimester of pregnancy, respectively. It is, however, a common opinion that the use of laparoscopy is preferable to laparotomy. In this regard, the advantages of laparoscopy over open surgery are represented by a reduced administration of anesthetic drugs, a reduced need for postoperative analgesia, a low incidence of infective complications, and a faster recovery. Major risks of surgery in pregnant women include uterine injuries due to the increased uterine size, with or without rupture of the amniotic membrane, bleeding, and gaseous embolism, as well as technical difficulties related to the limited working space [55]. Therefore, when operating on a pregnant woman, all the necessary precautions must be taken prior to the use of laparoscopy including a low intra-abdominal pressure and deep vein thrombosis prophylactic measures even for minor procedures.

In conclusion, it is important to remember that the multidisciplinary approach to the patient is essential for establishing the correct diagnosis and treatment in the shortest time. The use of modern laboratory and radiologic resources associated with the progress in endoscopic surgical techniques provides both general surgeons and gynecologists with all the means necessary to ensure the best surgical result.

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