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REZUMAT

Place of laparoscopy in diagnostic and therapeutic algorithm of surgical acute abdomen

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Knowledge accumulation and technological progress in laparoscopic surgery over a relatively short period of time (less than 30 years since the first laparoscopic cholecystectomy) have enormously extended the indications of laparoscopic approach in a wider range of disorders belonging to various specialties. Thus, the introduction of laparoscopy in diagnostic and therapeutic arsenal of the surgical acute abdomen has appeared as a natural evolution, while the clinical diagnosis of abdominal emergencies often encounter difficulties even though many of them have been removed by modern, high performance imaging investigations (ultrasound, CT, MRI). Viewed from this perspective, laparoscopy appears to be the method of choice for evaluating patients with traumatic or nontraumatic surgical acute abdomen, providing additional benefits of minimally therapeutic procedures for lesions detected by diagnostic laparoscopy.

For the surgical acute abdomen, laparoscopy is primarily a diagnostic procedure, which can be continued with laparoscopic therapeutic procedures, according to the lesions detected during intraoperative exploration, so that, in current practice, laparoscopy can be performed in three different circumstances:

– patients with established preoperative diagnosis and clear surgical indication where, depending on injuries, patient status, equipment and experience of the surgical team, can be
performed both diagnostic and therapeutic laparoscopy;
– patients with unclear preoperative diagnosis but obvious surgical indication – diagnostic ± therapeutic laparoscopy;
– patients with unclear both preoperative diagnosis and surgical indication, where therapeutic approach (conservative treatment, laparoscopy, laparotomy) is determined based on disease evolution and therapeutic response in dynamics.

Optimal timing for surgery, the criteria underlying the option for open or laparoscopic surgery and surgical technical and tactical aspects are different for each of the major syndromes and acute abdominal conditions, warranting separate discussion of the results for each condition.

**Laparoscopy in acute appendicitis.** Although almost 40 years has passed since the first laparoscopic appendectomy (Semm 1983) and its advantages are well known (reduced postoperative pain, earlier postoperative oral intake and bowel movements, short hospitalization and earlier social reintegration), it has been hardly accepted in current practice, on the one hand due to the increased cost and duration of training and, on the other hand, because classical appendectomy through McBurney incision has withstood the test of time and is still considered by many surgeons the gold standard in the treatment of acute appendicitis, with its simple postoperative evolution, low postoperative morbidity and mortality [11, 106, 107, 108]. Nevertheless, equipment improvement, operative technique standardization and results of large prospective studies about conventional
versus laparoscopic appendectomy, have made the latter an increasingly favored option, although controversies between the two still persist and are largely debated in the literature.

Our study, including 673 patients with acute appendicitis operated over a period of 4 years (2007-2010), of which 264 (39%) operated laparoscopically, allowed us to draw some findings and conclusions that we consider as answers to main issues debated in the literature.

Having to choose between two treatment options: laparoscopic appendectomy and open surgery, despite the fact that there are authors who support that any patient suspected of acute appendicitis may benefit from laparoscopic surgery [12, 13, 109, 110], in the selection of patients for laparoscopic surgery we considered the indications and contraindications of the method, as stated in the literature [12, 13, 14, 15, 111, 112, 113]. Thus, we opted for laparoscopic appendectomy in patients with uncertain clinical picture of acute appendicitis, in women of reproductive age or perimenopause (some genital diseases may mimic acute appendicitis, thus avoiding unnecessary laparotomy, and many of the discovered gynecological diseases can be resolved laparoscopically), obese patients (laparoscopy can avoid large incisions and the risk of incisional surgical site infections), in patients performing heavy physical activity. We avoided the laparoscopic approach in patients with absolute contraindications (hemodynamic instability, severe sepsis, severe lung disease and/or lack of experience of the surgical team) or relative ones (abdominal distension, generalized peritonitis, multiple prior operations in the submezoocolic compartment, pregnancy, uncorrected coagulopathy, etc.). As the
experience of the team had grown, we successfully performed laparoscopic appendectomies in some circumstances considered contraindications such as recent generalized peritonitis in young patients without associated comorbidity, or using the "open" technique in patients with only one previous abdominal intervention.

If laparoscopic appendectomy performed by standard technique with three trocars did not usually posed any difficulties for catarrhal and phlegmonous forms with normal topography, there are some particular situations that require special attention and discussion. Thus, acute gangrenous appendicitis and especially its complicated forms (blocked or perforated) is still the subject of controversy regarding tactical options between proceeding with laparoscopy or conversion to open surgery. Although there is no absolute consensus, most authors agree that facing a perforated gangrenous appendicitis intraoperatively discovered, surgeon must decide if laparoscopic approach worth to go on or not, and not to convert as a principle. Tailored on this principle, in the 65 (70.65%) gangrenous appendicitis, complicated (55 perforations, 10 blocked), intraoperatively diagnosed, I performed laparoscopic appendectomy in 51 (78.46 %) cases.

Regarding the indications of laparoscopic appendectomy in perforated appendicitis complicated with generalized or localized peritonitis, oppinions in the literature are controversial. Many authors consider the presence of peritonitis as a formal contraindication for laparoscopic surgery and open surgery or conversion recommended if preoperative diagnosis has not been established. These authors support their attitude on a number of animal studies that have shown that intraperitoneal insufflation of CO₂ decreases the ability of
peritoneum to prevent bacteremia and endotoxinemia if peritonitis is older than 12 hours and that CO$_2$-induced pneumoperitoneum depresses lipozaharid-stimulated cytokines released by stimulated macrophages, thus reducing the inflammatory response [76, 77, 114, 115], while other studies have shown that pneumoperitoneum would be very beneficial by reducing the acute phase of the inflammatory response [78, 116, 117, 118, 119, 120, 121]. On the other hand, laparoscopic surgery offers the possibility of a wide peritoneal lavage and an efficient drainage, while the higher incidence of residual intraperitoneal abscesses after laparoscopic surgery compared with open surgery is balanced by careful clinical follow-up and modern imaging techniques that allow both an early diagnosis and treatment by ultrasound or CT guided percutaneous drainage. We succeeded with laparoscopic appendectomy in 70 (83.3%) cases of 84 appendiceal peritonitis and we had to convertin only 14 cases.

Regarding the therapeutical approach to other lesions than acute appendicitis, found intraoperatively (76 cases = 38.78 %), most of them seen in women, with reproductive system origin (38 cases = 14.39 %), this was tailored depending on the lesion, pathological form of the appendicitis, presence of peritonitis and its type, age and general status of the patient; in 31 (11.74 %) cases we completed the appendectomy with other operations (adhesiolysis, gynecological interventions, cholecystectomy, umbilical hernia cure). A special comment deserves the association of gynecological disease with acute appendicitis in young women, especially when intraoperative exploration shows an appendix with borderline changes or normal appearance and genital disease may explain the clinical
manifestations, so the surgeon must decide whether to perform appendectomy together with solving the genital lesions. In the era of open surgery, the appendectomy was absolutely indicated because the subsequent scar in the right iliac fossa might delay or erroneously exclude the diagnosis of acute appendicitis. Laparoscopic surgery allows two options - appendectomy or sparing the appendix, but most of the authors favour the appendectomy on the following considerations [79, 80, 81, 122, 123, 124, 125, 126]: there may be an inflammatory process even if the appendix appears macroscopically normal; careful inspection of the appendiceal region often requires dissection and mobilization of the appendix, thus may cause injuries and leaving it in place is not a wise solution in these cases; appendectomy for a normal appendix is usually a fast operation, with uneventful postoperative course and rapid recovery and many studies have shown that in the absence of a plausible explanation, leaving the appendix in place may be followed by recurrence of symptoms after 8 months in up to 16% of cases.

Drainage of the peritoneal cavity after laparoscopic appendectomy is not considered mandatory by many authors [82, 83, 127, 128] supporting their attitude, on the one hand, by a copious peritoneal lavage completed with a rigorous aspiration of the entire peritoneal cavity at the end of the operation, seen as enough gestures even in gangrenous perforated appendicites and, moreover, peritonitis. On the other hand, any residual intraperitoneal collection can be easily managed today by modern imaging, CT- or ultrasound-guided percutaneously drained or laparoscopically approached again. We systematically drained the peritoneal cavity (87.09%) and correctness of our attitude
is demonstrated by the fact that in the 216 laparoscopic appendectomies completed, including all anatomical and clinical acute appendicitis, we recorded only two postoperative intra-abdominal abscesses (0.92%), whereas the incidence in the literature is estimated to 9 %[14].

Conversion (5.69% in our statistics) should not be considered a failure, but rather a caution and maturity of the surgical team and there are standard indications for conversion in the literature, which we have taken into account [13]: old, fibrous, adhesions, resulted after repeated previous inflammatory processes; generalized old peritonitis with multiple abscesses between intestines; gangrene or necrosis of the appendiceal base; retrocecal appendicitis; poor view and exposure of the appendix; uncontrollable bleeding; damage to the small intestine; associated pathology which difficult laparoscopic approach.

To summarize the results of laparoscopic surgery through a comparative study with open surgery, although the duration of surgery was longer for laparoscopic surgery, we found a significant reduction of postoperative pain, postoperative morbidity rate significantly lower (2% vs. 6.5%) and return to work much earlier after laparoscopic surgery (10.5 vs. 18.4 days) compared to open surgery. We found no significant differences in terms of postoperative oral intake and bowel movements between the two types of surgery and length of hospital stay was about the same.

**Laparoscopic cholecystectomy for acute cholecystitis** was contraindicated in the past due to difficulties related to gallbladder adhesions to neighbor viscera, reduced possibilities of manipulation due to thick walls, fibrosis of the hepatic bed and difficulties in
exposure of the anatomical structures in the triangle of Calot, due to edema and adhesions, leading to potential intraoperative incidents and accidents like lesions of common bile duct, liver or neighbor viscera. Gradually, with the improvement of surgical equipment, experience and awareness of specific complications of laparoscopic surgery, laparoscopic cholecystectomy for acute cholecystitis has become increasingly safer, followed by a significant decrease in postoperative morbidity and mortality rates as well as decrease hospital stay, so that nowadays all the guidelines recommend it as the main therapeutic option in acute cholecystitis [44, 84, 129, 130, 131, 132].

Although there have been analyzed in detail all aspects of the etiopathogeny, pathology and diagnosis for all the 418 cases with acute cholecystitis, when we talk about the treatment, bearing in mind that over the research time interval (2007-2010), after 10 years of experience, laparoscopic cholecystectomy had had become the intervention of choice in acute cholecystitis, present study try to clarify several issues related to indication for surgery and technical and tactical surgical peculiarities.

In these circumstances, the option for laparoscopic cholecystectomy being undisputable, the only problem about the indication was timing of surgery and from this point of view, in accordance with the literature, we adhere to early cholecystectomy (during the first 3 days from the onset) which we performed in 78.94% of the cases, for the following reasons [20, 21, 22, 23, 24, 25, 26, 133, 134, 135, 136, 137]: inflammatory edema facilitate dissection of the gallbladder from the hepatic bed; after the first 3 days from the onset, inflammatory tissue is dense and hyperemic, which
makes the dissection difficult and increases the risk of bleeding, and the conversion rate, postoperative morbidity and length of stay were significantly higher after cholecystectomies performed after 4-7 days of „cooling off”.

Personal experience combined with literature data allowed us to individualize some technical and tactical operative particularities that we want to point out.

Insertion of trocars and the establishment of pneumoperitoneum can be a difficult moment in patients having a degree of meteorism due to dynamic ileus, especially in gangrenous forms with pericholecystic abscess or subhepatic localized peritonitis, patients with previous interventions in supra- or inframesocolic spaces and in these situations we preferred the introduction of optical trocar by "open" technique.

Subhepatic perivisceritis (55.28% of cases: pericolecistitis – 26.07%, supramesocolic perivisceritis – 23.44% and Fitz-Hugh-Curtis syndrome – 1.43%) comprising the gallbladder, the inferior face of the liver, duodenum and transverse colon, changed normal anatomy of the region and impeded the identification of biliary and vascular elements and imposed a laborious adhesiolysis under permanent control of hemostasis. Sometimes, presence of hepato-diaphragmatic adhesions imposed a careful adhesiolysis to avoid disruption of the Glisson’s capsule during handling of the gallbladder and to avoid the interhepato-phrenic fluid retention and, a possible source of postoperative subphrenic abscess.

Emptying of the gallbladder by puncture allows its decompression, increases the workspace and facilitates its prehension, quite difficult even under these circumstances due to inflamed thick wall. In such cases,
we used a strong forceps - "alligator forceps" - even if this led to gallbladder tear, bile and pus leaks and possible spillage of several calculi into subhepatic space, thus compelling us to carefully wash out the peritoneum at the end of the operation.

Inflamed, bulking, gallbladder, may be adherent to the common bile duct, duodenum or both, making dissection difficult and prone to damage these structures. There are several maneuvers that can be used to reduce the risk of such injuries: colecistostomy, partial laparoscopic cholecystectomy and anterograde cholecystectomy with dissection of the gallbladder from fundus to neck [88, 138, 139, 140, 141, 142, 143, 144]. We used the so-called "bipolar cholecystectomy" in which alternate with the anterograde/retrograde dissection to the correct identification of biliary and vascular elements, which allows for safe clipping.

Gallbladder mobilization, an apparent easy step in laparoscopic cholecystectomy, can pose real problems in acute cholecystitis usually caused by the lack of cleavage plane due to an intense inflammatory process or bleeding from the neighborhood, sometimes difficult to manage, following accidental dissection into liver parenchyma, tear of accessories vessels with important caliber or lesion of deep, dorsal branches of the cystic artery. These inconveniences can be prevented by delicate, careful dissection, alternating thermocauter with blunt instrumental dissection (atraumatic forceps, mounted pad, tip of the aspirator, etc.) and an accurate hemostasis, using mono- or bipolar electrocoagulation, application of surgical sealants or even conversion to open surgery.

We usually remove the gallbladder through the epigastric trocar port (working port) or optical trocar port
Gallbladder was previously introduced in a plastic bag or a surgical glove to prevent contamination of the abdominal wall especially in gangrenous or phlegmonous forms and avoid loss of gallstones or purulent bile leak in the abdomen if the gallbladder broke during maneuvers of biliary calculi extraction with Desjardin’s forceps. A very distended gallbladder, frile and filled with stones is often difficult to extract through the trocar hole and this was why I never hesitated to enlarge the hole by 1-2 cm, ensuring safe gallbladder removal. Total layer suture prevents the occurrence of postoperative incisional hernias.

Complete toilet with enough saline lavage and drainage of subhepatic space with 1-2 drain tubes were ordinary gestures for us in all cases, on the one hand to avoid the possibility of the development of postoperative abscesses, on the other hand to have a control of possible bleeding or bile leaks the days following surgery.

**Laparoscopic approach for perforated duodenal ulcer.** Perforation, the most common evolutive complication of duodenal ulcer, generating significant postoperative morbidity and mortality [88, 90, 145, 146, 147], still recognize surgery as the main treatment option, with the major objectives - closure of perforation hole and peritonitis treatment, objectives that can be achieved by open or laparoscopic approach.

The introduction of modern medical ulcer therapy (proton pump inhibitors, anti- helicobacter pillory chemotherapy), has greatly limited the indications of so called "pathogenic operations" like vagotomy with pyloroplasty or gastric resections, stabile cure of the disease and prevention of complications by interception of pathophysiological mechanisms remains the
responsibility of gastroenterology, so surgical treatment of perforated peptic ulcer may be limited under these conditions only to complications treatment (closure of the perforation and peritonitis treatment) and the laparoscopic approach is an option that should be more often considered.

Personal casework analysis (31 operated laparoscopic duodenal ulcers compared with 124 cases classically solved) allowed us a few observations and comments.

Surgery is still the main treatment option in peptic ulcer perforation and laparoscopic approach, with well-established indications, are now a viable alternative with excellent postoperative results.

To state the indications for laparoscopic approach of the perforated ulcer we consider the age and biological status of the patient, the duration of the suffering ulcer, the duration and severity of peritonitis, principally reserving the minimally invasive surgery for patients enrolled in ASA risk class I and II, while old ulcers, with long-suffering and confirmed evolutive complications (stenosis and / or bleeding), patients with history of supramesocolic space operations, old peritonitis (over 24 hours from the onset of perforation) with severe septic syndrome, as well as the existence of significant comorbidities, were considered contraindications. In fact, peritonitis older than 24 hours, septic shock and coexistence of significant comorbidities, known in the literature as Boey criteria [48, 93, 148, 149, 150], are formal contraindications for laparoscopic surgery, being the main factors that significantly increase the rate of conversion, postoperative morbidity and mortality.
Few technical and tactical operative problems deserve special attention, since there is no absolute consensus to date. Thus, in terms of operative number (3 or 4) and position of trocars, there are variations depending on the surgeon's preference, but we have adopted the French position for cholecystectomy with the first surgeon between the patient's legs, camera on the left and another assistant on the right. We used four trocars (2 x 10 mm, 2 x 5 mm) placed as follows: 10 mm optical trocar to the navel, a 5 mm trocar subxifoidian, another 5 mm trocar on the right midclavicular lane and the last 10 mm trocar in the left hipocondrum.

There are many technical ways of closing the perforation; in all cases we used a simple, nonabsorbable, three-stitch suture and intracorporeal knot, complemented by omentoplasty. I used neither simple sealing with patch of great omentum or round ligament nor chemical sealing with fibrin gel, processes that are rated with up to 16% risk of fistula [100, 151, 152]. We have no experience with the closure of the perforation by double approach (laparoscopic and endoscopic), which carries the great omentum through perforation hole into gastric lumen using a Dormia probe, method that offer the additional advantage of complete intraluminal exploration and identification of concomitant gastric lesions, which could complicate the postoperative evolution of the patient [90, 93, 101, 102, 153, 154].

Treatment of peritonitis, the second major objective of perforated ulcer treatment involves at least two items with equal importance: peritoneal cavity lavage with large amounts (2-10 liters) of warm saline and drainage. If there is no controversy regarding peritoneal lavage, the opportunity of drainage is still a topic of discussion. Although most authors favour multiple
peritoneal drainage, there are authors [19, 155, 156, 157], who consider that drainage is not necessary, given that modern imaging supervision and can easily identify any postoperative peritoneal fluid collection that can be solved by ultrasound or CT-guided percutaneous drainage; we mandatorily used the double drainage tube placed in the subhepatic and Douglas sac.

Conversion rate, ranged in the literature [96, 97, 99] between 0 and 29.1% (16.13% in our study) may be imposed by: ulcer morphology (large, important edema, scleral edges, stenosing character, etc.), difficult identifying of ulcerative lesion, severity of peritonitis (conversion rate can reach 33% in peritonitis older than 24 hours), accidental injury of the stomach, ileum, colon, gallbladder or liver, etc.

Although with the improvement of surgical team expertise duration of laparoscopic surgery decreases, our experience and published data [93, 94, 95, 158, 159] have shown a significantly increased duration versus open surgery (on average, 68 minutes for laparoscopic surgery versus 54 minutes for open surgery in our study).

Removal of naso-gastric suction tube, postoperative resume of oral intake and bowel movements are moments that mark the postoperative evolution of the patient. Upper gastrointestinal suction tube was maintained postoperatively until the postoperative gastric stasis was 0 or close to zero, usually concomitant with spontaneous resumption of transit and has enabled the resumption of oral nutrition. All these events occurred significantly faster after laparoscopic surgery than after open surgery, and in terms of prolonged postoperative ileus, it was noticed in 8 cases after conventional surgery and only in 3 cases after laparoscopic surgery.
Postoperative course and rates of postoperative morbidity and mortality are the most compared parameters between the two types of approaches, conventional surgery vs laparoscopic surgery. Postoperative mortality was 0 in both analyzed groups, but postoperative morbidity recorded significant differences: laparoscopic surgery had a postoperative morbidity rate of 19.3% compared to 38.7% after open surgery. Regarding postoperative morbidity, a first observation shows that respiratory infections were encountered with equal incidence in both groups (2 cases each), though the literature mentions a reduction in the incidence of respiratory complications as one of the benefits of laparoscopic surgery [93, 160, 161, 162, 163]. The incidence of parietal infections, the second common postoperative complication after surgery of perforated duodenal ulcer was significantly higher after open surgery (10 cases, including 3 with blocked evisceration) than laparoscopic surgery (3 minor parietal suppurations at the site of optical trocar insertion). We recorded one subfrenic abscess after laparoscopic surgery, which required reintervention (laparoscopic drainage).

Postoperative medical treatment for interception of pathophysiological mechanisms of ulcer disease is mandatory.

Duration of hospital stay was significantly shorter after laparoscopic surgery, our data closing those of Kathouda [163, 164], who reported significant differences in favor of laparoscopic surgery compared to open surgery. Regarding the professional reinsertion, which we appreciated depending on the duration of the paid sick days at discharge and later extended through outpatient service, it was significantly shorter (16.9 days on
average) after laparoscopic surgery than after open surgery (34.5 days on average).

Endoscopic control at 6 weeks was performed in a total of 16 patients (61.5%) and showed complete healing of ulcers, without stenosis at the sutures site.

**Laparoscopy in acute abdomen of gynecologic causes.** Gynecology was one of the areas that benefited most from the advantages of early laparoscopy. Initially limited to the diagnosis of chronic pelvic pain, infertility and sterilization procedures, it imposed subsequently as a method of diagnosis and treatment of ectopic pregnancy [42, 165, 166, 167]. In the last 15-20 years, laparoscopy has become the preferred method of treatment for an increasingly wide range of disorders of female genital tract pathology from tubal reconstructive surgery to hysterectomy for cervical cancer, in the same time proving its feasibility, efficacy and safety in the management of gynecologic surgical emergencies. The main issues raised by the emergency gynecological minimally invasive surgery are hemodynamic status of the patient, potential complications related to peritoneal cavity approach and anesthetic risk, severe abdominal distension and iterative surgery in patients’ history, all formal contraindications to the laparoscopic approach.

Elective surgical treatment of gynecological emergencies belongs to specialized departments, their admissions in general surgery departments being often accidental, imposed by acute pelvic pain of unknown cause, with or without peritonitis or occlusive syndrome, usually limited to lower abdomen or, exceptionally, at the express request of the patients.

Not being a gynecologic department, those 32 patients with gynecologic surgical emergencies (4.13% of
all patients with acute surgical abdomen) admitted in our department, more or less incidental, and operated laparoscopically, led us to draw several findings that we want to comment below.

Most cases were young patients at the age of fertility, in the 3rd and 4th decades of life, with a history of known genital pathology.

The clinical picture, usually polymorphic, was dominated by pain of variable intensity. Present in all cases, diffused throughout the lower abdomen (10 cases) or localized (right iliac fossa, hypogastrium, left iliac fossa and pelvis), pain was accompanied by one or more of the following signs: nausea and vomiting, fever and chills, dizziness, faintness or feeling faint, metrorrhagia, bladder signs and stopped bowel movements. Of objective signs, I noticed almost constant presence of changes in tonus of the abdominal wall (defense or muscle contracture in 24 cases = 75%), with various location (subumbilical, left or right iliac fossa), accompanied by shifting dullness and bloating. Vaginal and / or rectal examination revealed bulging, fluctuant and sensitive Douglas sac in 19 cases, palpable, painful, enlarged, pseudotumoral, uni- or bilateral adnexa in 10 cases and enlarged, fibromatous uterus in 3. In fact, the aforementioned clinical signs were grouped into three major acute abdominal syndromes: the syndrome of internal bleeding, peritonitis syndrome and visceral torsion syndrome.

Analysis of concordance between preoperative diagnosis, which imposed surgical indication (established clinically, biologically and by ultrasound) and intraoperative findings showed us that in cases of acute abdomen of gynecologic causes, laparoscopy is primarily one of diagnosis, as reported in the literature [42, 44,
The acute pelvic pain of unknown cause (13 cases = 40.62%), with or without peritonitis and/or occlusive syndromes, was the main reason for diagnostic laparoscopy. Lesions found intraoperatively were hydro/pyosalpinx, pelviperitonitis, twisted or ruptured ovarian cyst with haemoperitoneum. In 7 cases the preoperative diagnosis was acute appendicitis, but intraoperative exploration revealed a broken yellow body with haemoperitoneum, right ruptured tubo-ovarian abscess or pyosalpinx and localized pelvic peritonitis, ruptured ectopic pregnancy with haemoperitoneum or torsion of adnexa or ovary. Only in 37.5% of cases (12 patients) preoperative diagnosis of ruptured ectopic pregnancy with haemoperitoneum was confirmed by intraoperative exploration.

For choosing the type of surgery were considered two factors: type of morphological lesion observed intraoperatively and haemodynamic status of the patient. We mention that although the literature considers hemorrhagic shock as a contraindication for laparoscopic surgery, we performed laparoscopic surgery in this situation, protected by good fluid perioperative resuscitation, without major incidents. In tubal pregnancy with intact Fallopian tube, laparoscopic intervention was conservative, consisting of salpingostomy (1 case), while for ruptured tubal ectopic pregnancy with haemoperitoneum intervention of choice was salpingectomy with toilet and drainage of the peritoneal cavity (12 cases). For pelvic inflammatory disease, where we included ruptured pyosalpinx, tubo-ovarian abscess and pelviperitonitis, laparoscopy is the gold standard therapeutic mode and the main therapeutic gestures performed laparoscopically are: harvesting pus for bacteriological examination, adhesiolysis, toilet,
peritoneal lavage and drainage, gestures I have practiced in all cases (10 cases), to which I added anexectomy in 7 cases, required by the lesion. I paid special attention to tubo-ovarian abscesses, sequelae of inadequately treated pelvic inflammatory disease, defined as purulent collections with the walls formed of the tube and ovarian parenchyma, where laparoscopy may be a method of diagnosis and treatment (drainage) if the abscess is not broken. For ruptured abscess, with vital risk, diagnostic laparoscopy may be useful, but the need for excision including ovary, fallopian tube and uterus make elective laparotomy to be of choice. For these reasons the two tubo-ovarian abscesses were converted to open surgery [103, 171, 172, 173]. Torsion of the ovarian cyst and the adnexa (4 cases) were resolved by adnexitomy after intraoperative exploration found that twisted viscera were no viable. Ovarian cyst excision, hemostasis, toilet and peritoneal drainage were therapeutic attitude in ruptured ovarian cysts with haemoperitoneum. Note that excision specimen was sent to histopathology in both operated cases, given that these cysts could be malignant.

The conversion rate was 9.37% (3 cases), ranged within the data in the literature, which indicates values between 4 and 33% [42, 174, 175]. The 3 converted cases were two tubo-ovarian abscessed aforementioned and one tubal pregnancy who underwent neosalpingostomy to preserve fertility.

Although our series is small (presentation of gynecologic emergencies in general surgery departments are occasional) comparing our data with the literature, we believe that the laparoscopic approach could be a reasonable alternative for most cases of acute abdomen of gynecological cause, with the following advantages: good view of the entire peritoneal cavity, allowing precise
diagnosis of the lesion (other than established preoperatively in 62.5% of cases); avoidance of useless preoperative investigations and delay of the surgical treatment; offers the possibility of a complete toilet of the peritoneum (lavage + active suction) and an effective peritoneal drainage; has low postoperative morbidity and mortality; postoperative recovery is fast; short average length of stay and the obvious cosmetic advantages.

**Laparoscopy in abdominal trauma.** The idea of using the advantages of minimally invasive surgery in abdominal trauma emerged long before laparoscopy to become a stand-alone surgical technique [45]. However, the place and role of laparoscopy in abdominal trauma is still the subject of discussion and there is not yet a full consensus on this. Some authors [47] consider that there are not enough arguments in favor of laparoscopy in unstable patients and doubt the utility of laparoscopy in blunt abdominal trauma, showing that accuracy of abdominal puncture and peritoneal lavage, the ultrasound as a screening method in the emergency department and precision of spiral CT to define visceral lesions greatly limits the indications of laparoscopy as first-line diagnostic method. It can be used as an adjunct to CT scan especially in the presence of peritoneal effusions and absence of evident visceral lesions.

The main dilemma in abdominal trauma is the opportunity of exploratory laparotomy and fear of missing a surgical lesion has increased its indications, with the main objective to provide a full evaluation of lesions and definitive treatment of all injuries. The challenge in abdominal trauma is the optimal management of open abdominal trauma (penetrating abdominal wounds with unclear intraperitoneal trajectory tangential thoracic and/or abdominal lesions) in hemodynamically stable
patients and tactics requiring exploration of these wounds is encumbered by a rate of 30-40% futile laparotomies, unacceptable given the current wide range of diagnostic tools: local wound exploration, abdominal puncture and peritoneal lavage, ultrasound, CT and laparoscopy [47, 177]. More than that, both retrospective and prospective studies showed that futile laparotomies are linked to a high rate of postoperative complications, considered in the literature between 21-43%, depending on the author [51, 52, 53, 54, 55]. Accordingly, over the recent decades, there were defined the place and role of laparoscopy in abdominal trauma, establishing its advantages and limitations. Thus penetrating abdominal stab wounds, diaphragmatic injuries and bowel trauma can pose difficulties on surgeon’s decision-making process, situations where exploratory laparoscopy provide critical information, prevents delays in the definitive treatment of visceral lesions and may be the way to cure definitively the visceral lesions (rupture of the mesentery, injury of the diaphragm, hollow and/or parenchymatous viscera) in hemodynamically stable patients [56, 57]. The main advantages of diagnostic laparoscopy in abdominal trauma are: ability to detect peritoneal lesions, direct visualization of the injured viscera, evaluation of active bleeding and avoidance of unnecessary laparotomies (40-60%).

Diagnostic laparoscopy is indicated as a principle in the absence of general absolute contraindications, for hemodynamically stable patients presenting with suspicion of abdominal visceral injuries and inconclusive clinical and imaging data. Nowadays are stated indications for laparoscopy in trauma to hemodynamically stable patients, and the indications and therapeutic algorithms depending on the type of injury, closed or
open [51, 178]. The primary indications of diagnostic laparoscopy in hemodynamically stable traumatised patients include closed abdominal trauma, open abdominal trauma with suspicion or certainty of penetrating wounds, penetrating thoraco-abdominal wounds, abdominal injuries by firearms with uncertain intraperitoneal trajectory (tangential wounds), suspected diaphragmatic injuries and patients selected for nonoperative management but with progressive deterioration of clinical, biological and imaging data. There also stated guidelines and algorithms for diagnosis and specific treatment for the two types of abdominal trauma, closed and open. Thus, in closed abdominal trauma, diagnostic laparoscopy is indicated in hemodynamically stable patients with parenchymatous visceral lesions and haemoperitoneum slowly and progressively growing, in patients with suspected visceral lesions, and in patients with unclear abdomen (discrepancy between imaging data and the clinical signs, with deterioration of the latter), while for the opened abdominal trauma, diagnostic laparoscopy is indicated in hemodynamically stable patients with stab wounds (confirms peritoneum injury and allows the detection of lesions visceral, which, depending on the type and severity, can be solved or not laparoscopically), in thoraco-abdominal penetrating wounds and tangential wounds by firearms, where the laparoscopy allows exclusion of peritoneal damage in cases where clinical examination is equivocal, avoid futile laparotomies and prevents the risk of leaving undiagnosed visceral lesions.

Regarding therapeutic laparoscopy, it was originally reserved for repair of small diaphragmatic injuries, hemostasis of minor liver or spleen injuries and blood collection for autotransfusion [47]. Gradually,
technological progress and accumulation of experience have allowed the use of therapeutic laparoscopy in abdominal trauma in hemodynamically stable patients, with an expanding range of surgical procedures, including those for injuries of the mesentery, gastoraphy, enteroraphy, coloraphy, splenectomy, hepatorahy, distal pancreatectomy, but especially small diaphragmatic injuries.

Although laparoscopy is gaining more credibility as a method of diagnosis and treatment in abdominal trauma, it must be signaled, on the one hand, its logistic boundaries (properly equipped operating room + service + trained staff + advanced imaging investigation available 24 hours a day) and legal implications related to informed consent. On the other hand, laparoscopic approach of abdominal trauma is encumbered by a number of specific complications for this type of surgery, which may influence the postoperative course: compressive pneumothorax induced by pneumoperitoneum in patients with diaphragmatic injuries, gas embolism in patients with venous lesions especially of the liver, visceral dilacerations for laparoscopy without gas insufflation, transperitoneal absorption of CO₂, which causes hemodynamic and metabolic changes: acidosis, heart failure, subcutaneous emphysema, increased intracranial pressure and subcutaneous or retroperitoneal dissection induced by pneumoperitoneum.

The study group included 113 closed abdominal trauma (75 cases = 66.37%) and open (38 cases = 37.63%), of which 72 (63.71%) patients (37 = 49.33% 35 closed trauma = 92.1% open trauma) were operated laparoscopically or classically, for the rest (41 cases=36.29%) we chose the nonoperative management.
Regarding the option for laparoscopic surgery (24 cases = 33.4%), it was used in closed abdominal trauma at hemodynamically stable patients with unclear abdomen, and in open abdominal trauma (wounds) where the penetrating character of the wound and visceral lesions was uncertain.

In the cases we have studied, laparoscopy had primarily a diagnostic role in all cases. It was limited to exploratory laparoscopy in 16 cases where the penetrating wounds was confirmed in 14 cases, and found integrity of the abdominal viscera or minor visceral injuries not requiring surgical correction, the operation ending with lavage and drainage of the peritoneal cavity and suture of the parietal penetrating wound. Where exploration showed visceral lesions, the attitude towards them was differentiated according to the type of lesion and the patient's condition. Three small wounds of the jejunum and ileonum and a rupture of 1 cm of the diaphragm were sutured laparoscopically, while in other 4 cases, the laparoscopy revealed rupture of the spleen and splenectomy was performed after conversion.

Summarizing, laparoscopy was purely diagnostic in 20 cases and for only 4 cases had both diagnostic and therapeutic role.
Conclusions

1. The introduction of laparoscopy, with its well known advantages, in diagnostic and therapeutic treatment arsenal of acute surgical abdomen is justified by the difficulties in the diagnosis of emergency abdominal lesion in spite of modern high-performance imaging and its benefits of extending range of laparoscopic surgical procedures.

2. In the surgical acute abdomen, laparoscopy is always primarily diagnostic and therapeutic procedures may proceed by laparoscopic or classical approach, depending on the lesions detected intraoperatively.

3. Timing of surgical intervention, criteria underlying the option for open or laparoscopic surgery, surgical technical and tactical pitfalls are different for each of the major syndromes or acute abdominal conditions.

4. Laparoscopic appendectomy for acute appendicitis, although may appear attractive for every case, has well established, standardised, indications: uncertain clinical picture, women of reproductive or premenopausal age where gynecologic diseases may mimic acute appendicitis, obese patients or those carrying heavy physical activity.

5. Therapeutic approach of associated lesions to acute appendicitis, found intraoperatively (mainly female genital pathology), is different depending on the type of the lesion, pathological form of appendicitis, peritonitis existence and type, age and general condition of the patient.
6. Concomitant genital lesions revealed laparoscopically along with cvasinormal or minor changes of the vermiform appendix at the female patients preoperatively diagnosed as acute appendicitis has two treatment options: laparoscopic appendectomy or leaving the appendix in place; the first is recommended.

7. Laparoscopic cholecystectomy is now the intervention of choice in acute cholecystitis, the only indication problem referring to time of surgery: early surgery (within 3 days after onset) or "delayed emergency" (4-7 days); the first option is the preferable therapeutic attitude.

8. For perforated duodenal ulcer, major objectives (closing perforation and peritonitis treatment) of surgical treatment, still the main treatment option, can be successfully achieved by laparoscopic approach; therapy for interception of pathophysiological mechanisms of the ulcer disease to definitively cure it and prevent relapses remains for gastroenterologist.

9. Laparoscopic approach is a reasonable alternative for most cases of acute abdomen because of gynecological etiology, laparoscopy having a diagnosis role firstly; pelvic pain of unspecified cause with or without peritonitis or occlusive syndrome is the main indication for laparoscopy, and type of the morphological lesion and haemodynamic status of the patient are main criteria for choosing the type of intervention.

10. Recent generalized peritonitis (first 12-24 hours) without significant deterioration of general condition is not a contraindication for laparoscopic approach of acute surgical abdomen.

11. Drainage of the peritoneal cavity in peritonitis is the option of choice, although any residual intraperitoneal collections can now be managed by
modern imaging, invasive radiology (ultrasound- / CT guided puncture) and / or their laparoscopic approach.

12. Conversion, with a rate that varies with the type of causal lesion and experience of surgical team (5.69% in acute appendicitis, 4.06% in acute cholecystitis, 16.13% in perforated duodenal ulcer and 9.37% in gynecologic causes of acute abdomen, in our study), should not be seen as a kind of failure, but a sign of consciousness and maturity of the surgical team.

13. The place and role of laparoscopy in abdominal trauma is still a topic of debate and there is no consensus in this filed, seen as "the last diagnostic but the first treatment tool".

14. In closed abdominal trauma, diagnostic laparoscopy is indicated in hemodynamically stable patients with parenchymatous visceral lesions and slowly, progressively growing haemoperitoneum, in patients with suspected injuries of the hollow viscus and those with "unclear abdomen" - discrepancy between imaging data and clinical aspect which deteriorates under proper supportive care.

15. In open abdominal trauma, diagnostic laparoscopy is indicated in hemodynamically stable patients with stab wounds, penetrating thoraco-abdominal wounds, tangential wounds by firearms, where the laparoscopy allows exclusion of peritoneal lesion in cases with equivocal clinical examination, avoid futile laparotomies and prevents risk of undiagnosed visceral lesions.
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“Perforation of the peptic ulcer – still an actual emergency” – oral presentation at Annual Meeting of Serbian medical Society Surgical Chapter and Romanian Surgeons at Vršac, Serbia, 29 November 2013
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3rd Multidisciplinary Conference with International Participation „Severin Medical Days”, 5-7 April 2012, Drobeta-Turnu Severin, Romania
2nd Multidisciplinary Conference with International Participation „Severin Medical Days”, 15-17 April 2010, Drobeta-Turnu Severin, Romania
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