

ACUTE APPENDICITIS IN PREGNANT WOMEN

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Abstract. *Difficulties in diagnosing acute appendicitis during pregnancy are associated with impaired microcirculation, stagnation in the appendix due to stretching of the anterior abdominal wall and pressure of the enlarged uterus on the intestinal walls. This article covers modern issues of diagnosis and treatment of acute appendicitis in pregnant women, the difficulties of diagnosing this pathology in the first, second and third trimester of pregnancy, management of patients in the postoperative period, prolongation of pregnancy and discusses issues of delivery after appendectomy.*

An analysis of the case histories of 70 patients with acute appendicitis during pregnancy was carried out. appendectomy at various stages of pregnancy. The information value of ultrasound examination and diagnostic laparoscopy for acute appendicitis in pregnant women is assessed. Ultrasound and laparoscopic signs of acute appendicitis are described. A scheme of treatment and diagnostic algorithm for acute appendicitis in pregnant women has been developed.

Keywords: *pregnancy, acute appendicitis, ultrasound, laparoscopy, diagnosis, treatment.*

Acute appendicitis is the most common surgical disease in pregnant women, threatening the life of the mother and fetus, occurring in 0.03-5.2% of cases [2, 3, 9, 12, 13]. Most often, acute appendicitis occurs in the first (19-32%) and second trimesters (44-66%) of pregnancy, less often in the third trimester (15-16%) and the postpartum period (6-8%) [8-10]. Mortality in acute appendicitis in pregnant women is 10 or more times higher than outside pregnancy, and amounts to 2.5-3.0%, and in complicated appendicitis it reaches 16.7% [1, 9, 10, 16, 18]. Even if produced on time appendectomy does not always avoid obstetric and surgical complications, which occur in 17% of cases [5, 12-15]. The frequency of diagnostic errors in acute appendicitis in pregnant women ranges from 11.9-44.0%, and under- and overdiagnosis are equally acceptable, the frequency ratio of which is, respectively, 25 and 31% [1, 4]. According to available data, 20-25% of pregnant women with acute appendicitis are admitted to surgical hospitals 48 hours after the onset of the disease, which is 2-2.5 times higher than the corresponding indicators. Therefore, in pregnant women, especially in the later stages, destructive forms of appendicitis occur 5-6 times more often than in non-pregnant women [7, 8, 10, 13]. In the postoperative period, there is a significant number of cases of premature termination of pregnancy, which reaches 14-28% [9, 12, 13]. The development of appendicitis in pregnant women significantly worsens the prognosis for the mother and fetus. [5]. With uncomplicated appendicitis, perinatal losses range from 2-17% and increase to 19.4-50% with complicated appendicitis [2, 7, 8, 11]. In a study by G.A. Mondor (1986) found that there is an increased risk of premature termination of pregnancy during the first week after appendectomy, therefore all operated patients are at risk for miscarriage. After appendectomy during pregnancy, obstetric complications are: abruption of a normally located placenta, intrauterine infection of the fetus, chorioamnionitis [6, 8, 9]. Therefore, the role of early diagnosis of acute appendicitis in pregnant women before the onset of perinatal complications is especially great, which ultimately determines the prognosis for the mother and fetus [6, 7]. The clinical picture of acute appendicitis in the first three months does not have any features compared to that

in non-pregnant women, and diagnostic difficulties increase only in the second half of pregnancy [10, 11]. The most difficult diagnosis of acute appendicitis is in the last weeks of pregnancy, when the fundus of the enlarged uterus reaches the level of the hypochondrium and closes most of the abdomen for examination and examination. The abdominal wall during this period is peculiarly rigid due to the tension of its enlarged pregnant uterus. An enlarged uterus makes the appendix inaccessible to palpation and reduces the intensity of pain, making it difficult to identify symptoms of pain (appendiceal symptoms), which are based on palpation and displacement of the inflamed appendix. [2, 3, 8-10].

Diagnosis of acute appendicitis during pregnancy, as well as outside pregnancy, is based on the assessment of clinical, paraclinical symptoms and laboratory parameters. A characteristic symptom is the suddenness of the disease, pain arising in the epigastrium (Kocher's symptom), which gradually moves to the right iliac region. When assessing pain, the time of pain onset, its location, intensity, duration and irradiation are of great importance. In the clinical diagnosis of acute appendicitis, great importance is attached to identifying symptoms of pain - the so-called appendicular symptoms. More than 20 symptoms of pain in acute appendicitis are known, but none of them are pathognomonic for acute appendicitis. All of them are based on the appearance of pain upon direct palpation through the abdominal wall or displacement of the inflamed appendix.

Table 1.

In research patients painful characters manifestation to be according to distribution

Painful sign name	Non-flammable	catarrhal		destructive	
		Primary (n=32)	Comparative (n=12)	Primary (n=32)	Comparative (n=12)
Kocher-Volkovich	2 (6.3 %)	18 (56.3 %)	6 (50 %)	5 (15.6 %)	3 (25 %)
Shyotkin-Blumberg	-	11 (34.4 %)	6 (50 %)	7 (21.9 %)	3 (25 %)
Sitkovsky	-	16 (50 %)	6 (50 %)	7 (21.9 %)	3 (25 %)
Bartome-Michelson	-	16 (50 %)	6 (50 %)	7 (21.9 %)	3 (25 %)
Gregory	-	10 (31.3 %)	4 (33.3 %)	4 (12.5 %)	2 (16.7 %)
Cheremsky	2 (6.3 %)	15 (46.9 %)	7 (58.3 %)	7 (21.9 %)	3 (25 %)
Baradulin	2 (6.3 %)	16 (50 %)	6 (50 %)	4 (12.5 %)	2 (16.7 %)
Larosh	-	17 (53.1 %)	4 (33.3 %)	5 (15.6 %)	2 (16.7 %)
Rovsing	-	18 (56.3 %)	7 (58.3 %)	7 (21.9 %)	3 (25 %)
Razdolsky	-	18 (56.3 %)	7 (58.3 %)	7 (21.9 %)	3 (25 %)

Brando	-	15 (46.9 %)	5 (41.7 %)	5 (15.6 %)	1 (8.3 %)
Rizvan	-	14 (43.8 %)	5 (41.7 %)	4 (12.5 %)	1 (8.3 %)
When walking pain increase	-	7 (21.9 %)	3 (25 %)	5 (15.6 %)	2 (16.6 %)

During pregnancy, the identification of these symptoms is achieved by compression or displacement of the inflamed appendix by the pregnant uterus: increased pain in the right iliac region in a position on the right side - Barthomier -Michelson's symptom, the appearance of pain in the right iliac region when pushing along the left rib of the uterus - Gregory's symptom, severe pain when palpation in the position on the left side - Sitkovsky's symptom, increased pain when bringing the right lower limb to the stomach - Laroche's symptom, Cheremsky's cough symptom - the appearance of pain in the right iliac region when coughing. As the pregnant uterus enlarges, palpation access to the inflamed appendix is limited and symptoms of pain by the end of pregnancy are detected less frequently - from 49 to 53% of cases.

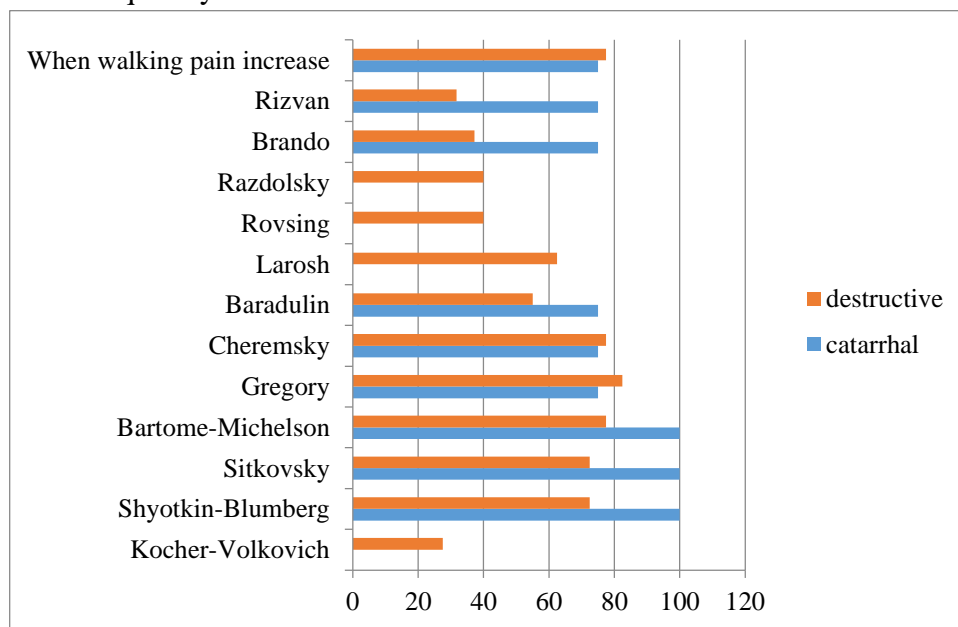


Fig. 1. Painful characters manifestation to be according to distribution.

One of the important clinical symptoms in the diagnosis of acute appendicitis outside pregnancy is protective tension in the muscles of the anterior abdominal wall. In destructive forms of acute appendicitis, this symptom is detected in 80 to 91.1% of cases. During pregnancy, especially in the second and third trimesters, this symptom is detected less frequently and is less pronounced. This is due to stretching of the muscles of the anterior abdominal wall by the enlarged pregnant uterus. In the second half of pregnancy, palpation the detection rate of this symptom does not exceed 47.8%. The development of the classic picture of acute appendicitis is usually a consequence of the involvement of the parietal peritoneum in the process, the appearance of effusion. Therefore, it is impossible to wait for the classic symptoms of acute appendicitis to appear in pregnant women, since they rather indicate the onset of complications [3, 12-15]. When assessing laboratory parameters, it is necessary to remember that increased leukocytosis in pregnant women is a physiological phenomenon. This indicator should be given importance when the number of leukocytes exceeds more than 10,000 ml³.

Table 2.

Laboratory indicators patients in the study

Laboratory indicator	Not ignites	catarrhal		destructive	
		Primary (n=32)	Comparative (n- 12)	Primary (n=32)	Comparative (n-12)
Leukocytosis					
10.0-12.0x10 ⁹ /l	2 (100%)	14 (60.8%)	8 (88.8%)	3 (42.8%)	-
>12.0 x 10 ⁹ /l	-	9(39.1%) *	1 (11.1%)	4(57.1%) *	3 (100%) ***
I AM LEE			-		
0.5-1.5	2 (100%)	6 (26%)		2 (28.5%)	
>1.5	-	17(73.9%) **		5 (71.4%) **	
NJI			-		
6.0-6.2	2 (100%)	8 (34.7%)		2 (28.5%)	
>6.2	-	15 (65.2%) ***		5 (71.4%) ***	

* $p = 0.4$; ** $r = 0.2$; *** $r = 0.3$;

It is not so much the leukocytosis itself that matters, but its change in dynamics. Leukocytosis, neutrophil shift to the left in the leukocyte formula, lymphocytopenia indicate appendicitis [7, 9]. Based on the severity of leukocytosis, one can judge the depth of morphological changes in the appendix [9, 10].

Acute appendicitis in pregnant women often has to be differentiated from pyelitis of pregnant women, threat of miscarriage, and in later stages - from acute cholecystitis. If a threat of miscarriage is suspected, the patient should be consulted by an obstetrician-gynecologist, and further tactics should be determined jointly. Differential diagnosis, in addition to clinical and laboratory data, is based on instrumental research methods. Ultrasound and laparoscopy are more informative [3, 7-9, 15]. Based on clinical, paraclinical and laboratory data, it is possible to diagnose acute appendicitis during pregnancy in 57 to 83.5% of cases [8-10]. During the period from 1999 to 2010, 70 patients were operated on in our clinic for acute appendicitis due to pregnancy. Of these, 32 (33.6%) were pregnant in the first, 26 (27.3%) in the second and 12 (12.6%) in the third trimester of pregnancy. According to our data, protective muscle tension in the muscles of the anterior abdominal wall in the first trimester was observed only in 66.6% of patients, in the second - in 41.6%, and in the third - in 25%. In the first trimester of pregnancy, pain began in epigastrium in 78.1%, in II - in 65.3% and in III - in 25% of cases. Various symptoms of pain in the third trimester were detected only in 25-41.6% of cases.

Paraclinical symptoms, such as increased heart rate, nausea, vomiting, increased body temperature, according to various authors, occur in 66.6 to 85% of cases [7-9, 11, 13, 15]. In our observations, paraclinical symptoms in pregnant women with acute appendicitis were detected in the first trimester - in 80.1%, in the second - in 76.9% and in the third - in 83.3% of patients. When assessing paraclinical symptoms, it is necessary to take into account that nausea and vomiting are companions of normal pregnancy, especially in the first half.

Of the instrumental research methods for suspected acute appendicitis, the simplest and safest method is ultrasound. Every pregnant woman with suspected acute appendicitis should

undergo an ultrasound of the abdominal cavity and pelvis. In this case, the condition of the uterus, its tone, fetal mobility, placenta previa, the presence of free fluid in the abdominal cavity and pelvis, its quantity, the condition of the intestinal loops, wall thickness, the condition of the ovaries, fallopian tubes and other echo structural formations are necessarily assessed.

Table 3.

In patients basic groups were observed absolute and relative signs of USR.

US symbol	Catarrhal	Destructive
Diameter vermiform tumors		
> 6 mm*	2 (28.5%)	3 (60%)
< 6 mm	5 (71.4%)	2 (40%)
Thickness walls vermiform tumors		
> 2 mm**	5 (71.4%)	5 (100%)
< 2 mm	2 (28.5%)	-
Thickening walls thin guts	2 (28.5%)	-
Availability fluids in the intestines	4(57.1%)	5 (100%)
Atony intestines	4(57.1%)	5 (100%)

There are no contraindications to ultrasound examination. A necessary condition for the study is a full bladder, which, by displacing the loops of the small intestine from the small pelvis, creates a kind of “acoustic window” that allows you to clearly visualize the internal genital organs. In addition, the bladder is used as a reference for cystic formation in the abdominal cavity and pelvis [2, 4, 8, 15]. An echo graphic differential diagnosis of acute appendicitis in pregnant women, especially in the first and second trimester, is based on a comparison of the acoustic structures of the bladder and the formation under study (the appendix). The examination begins with a survey echography of the abdominal cavity using a standard technique, performed with the patient lying on her back, which allows us to assess the condition of the abdominal organs and retroperitoneal space. Then the area of greatest pain, the so-called zone of interest, is studied in detail. When interpreting information, the main landmarks are assessed, which are the ilium and iliac vessels. The latter are visualized as anechoic parallel tubular structures located medial to the iliopsoas muscle.

To increase the information content of the study, moderate compression by the sensor can be used. In this case, the latter is brought closer to the object under study, the momentum and loops of the small intestine are displaced, or their lumen is compressed, which makes it possible to displace the gas contained in the intestine from the examination area. It is practically impossible to identify a normal appendix with ultrasound; morphological changes are not reflected in the ultrasound picture due to its small thickness, the presence of a narrow lumen, the elasticity of easily compressible walls and pronounced mobility of the organ. In destructive forms of acute appendicitis, due to inflammatory infiltration and thickening of the walls of the appendix, fluid retention in the lumen, it becomes possible to visualize it with ultrasound.

Many authors are guided by reliable and indirect signs of acute appendicitis. Reliable ultrasound signs include: wall thickness of the appendix >2 mm and diameter of the appendix >6 mm, but it must be taken into account that the dimensions of the appendix are individual. Indirect

ultrasound signs include: thickening of the walls of the small intestine, intestinal atony, the presence of fluid levels in the intestinal lumen. The use of ultrasound in the presence of pathological changes in the appendix allows one to visualize and establish the correct diagnosis in 85.5% of cases [1, 2, 12]. According to our data, it was possible to visualize the appendix in 26 patients (37.1%) out of 70. The use of ultrasound in combination with clinical, paraclinical and laboratory methods made it possible to increase the diagnostic efficiency by 11%. Thus, in the first trimester, diagnostic efficiency increased from 58.7 to 68.7%, in the second - from 62.6 to 73%, and in the third - from 66.6 to 77%.

The most informative of the instrumental research methods in the diagnosis of acute appendicitis in pregnant women is laparoscopy. Indications for diagnostic laparoscopy are cases when it is not possible to exclude acute appendicitis using clinical, laboratory and ultrasound methods within 2-4 hours. Many years of experience of surgeons and obstetricians-gynecologists suggests that the laparoscopic method should be decisive in the diagnosis of acute appendicitis in pregnant women. Traditionally, pregnancy was considered an absolute contraindication for laparoscopy, but in the last decade it has prevailed in the treatment of gynecological and non-gynecological pathologies associated with pregnancy. The most common laparoscopic surgery during pregnancy is cholecystectomy (45-48% of procedures), interventions on the uterine appendages (28-34%) and appendectomy (15-16%). Each of them gives good results in experienced hands [15].

The previously existing opinion about the danger of laparoscopy in comparison with laparotomy for the life of the fetus has not been confirmed by numerous experiences in recent years. In a large Swedish retrospective study of 2181 laparoscopies and 1522 laparotomies performed during pregnancies over two decades, there were no differences in weight, gestation length, congenital defects, stillbirths or neonatal deaths [11]. Two retrospective studies conducted in Israel confirmed the same. Laparoscopic diagnosis allows visualization of the appendix in almost any clinical location in the first and second trimesters of pregnancy, and pregnancy itself is not a contraindication to laparoscopy. [3, 6, 10, 11, 13, 14]. Laparoscopically, you can not only examine the abdominal cavity, but also determine the extent of the inflammatory process, and also, if necessary, install drainage tubes in any parts of the abdominal cavity and pelvis. In addition, laparoscopy allows, especially in complicated appendicitis, to choose an adequate surgical approach and, if conditions exist, to perform laparoscopic surgery. appendectomy [5-8, 14, 15].

Laparoscopic technique Appendectomy during pregnancy does not differ from the technique of this operation outside pregnancy, however, there are features and conditions for its implementation. One of the main conditions for performing diagnostic laparoscopy in pregnant women with suspected acute appendicitis is the choice of laparoscopic surgical approaches. During pregnancy from the 5th to the 14th week, the first trocar is inserted at the classic Olim point 2 cm below the navel in the midline. An average pneumoperitoneum is imposed - 8-10 mm Hg. Art. During pregnancy from the 14th to the 22nd week, the first trocar is inserted along the midline 3-4 cm above the height of the fundus of the pregnant uterus and through an incision under visual control, and not by puncture. The left upper quadrant of the abdominal wall can be used. Pneumoperitoneum must be applied to a minimum level of 4-6 mmHg. Art. An obligatory step in the revision of the abdominal cavity, in addition to visualizing the appendix, should be an examination of the pregnant uterus: color, consistency, tone, condition of the appendages, ovaries, fallopian tubes [3, 7, 8, 15]. Having confirmed the diagnosis of acute appendicitis before

proceeding with laparoscopic appendectomy, it is necessary to soberly assess the possibility of performing a laparoscopic operation, based on the nature of the changes in the appendix and the presence of its complications, as well as the level of training and technical capabilities of the surgeon. Often it is the latter factor that determines the resolution of the method [8].

Having decided to perform the operation laparoscopically, 3 more trocars are introduced into the abdominal cavity: in the right hypochondrium - a 10 mm trocar for working with a Babcock clamp; in the left iliac region - a 5 mm trocar for a bipolar clamp, scissors; in the right iliac region - a 5 mm trocar for auxiliary work with clamps, less often - with scissors or a coagulator. When performing laparoscopic appendectomy according to the method of K. Semm [31], it is necessary to adhere to a number of conditions and rules that allow for correct technical execution appendectomy. They are as follows: - applying a clamp should not lead to tissue cutting; — working with a monopolar coagulator on the mesentery of the appendix is extremely undesirable, since it not only does not provide reliable hemostasis, but is also much more dangerous in terms of thermal damage to organs; — in the area of the base of the vermiform appendix, parietally with the cecum, the first clip or endoloop according to Raeder is applied to the place pressed out with a clamp (with the ligature method), the second clip or endoloop is 1-2 mm higher. When using clips, if the first one does not completely block the lumen of the process, then the second one is applied towards the first, due to the rotation of the process. The third clip or endoloop is applied at a distance of 3-5 mm from the second and the process is intersected between them, and its stump (distal and proximal) is carefully electrocoagulated and treated with iodine solution;

- regardless of the method of processing the stump, the severed appendix is held with a clamp in the free abdominal cavity in a suspended state, and is removed in a special or adapted container to prevent its contact with the tissues of the wound canal at the location of the port; — upon completion of the intervention, inspection of the surgical area to check the reliability of hemostasis and the quality of treatment of the process stump. When performing laparoscopy during pregnancy, there are dangers, which primarily include the possibility of damage to the pregnant uterus by the first trocar or Veress needle. The likelihood of this complication depends on the size of the uterus. Cases of pneumoamnion with fetal loss in the second trimester of gestation have been described [10].

We used laparoscopic examination in 17 patients (24.2%) with suspected acute appendicitis: 10 patients were in the first trimester and 7 in the second trimester of pregnancy. Pregnancy periods ranged from 5 to 21 weeks. Of these, in 4 patients the diagnosis of acute appendicitis was excluded. In 5 cases, after confirmation of the diagnosis, laparoscopic appendectomy, and in 6 - classic open appendectomy. In 2 cases, laparoscopy revealed widespread peritonitis and indications for lower-middle laparotomy were established. The use of modern instrumental research methods (ultrasound, laparoscopy) in the diagnosis of acute appendicitis in pregnant women allowed us to develop a diagnostic and treatment algorithm. Treatment of acute appendicitis at any stage of pregnancy is only surgical. In the first trimester of pregnancy, surgical access for uncomplicated appendicitis is performed according to Volkovich-Dyakonov under local anesthesia. In the second and third trimesters, surgical access for uncomplicated forms of acute appendicitis is performed at the point of greatest pain (it is usually higher) or with the classic Volkovich-Dyakonov incision under general anesthesia. Indications for a midline incision are

acute destructive appendicitis, complicated by widespread peritonitis, as well as obstetric pathology requiring immediate delivery.

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