Revista Română de Medicina Familiei
Romanian Journal of Family Medicine

Vol 4 / Nr 2 / Iunie 2021 https://www.revmedfam.ro

MEDICAL PRACTICE

UpToDate

Acute appendicitis in pregnancy - a review about diagnosis and management

Lecturer MD PhD Anca A Simionescu[1,2,4], Assistant professor MD PhD Scăunașu Razvan[1,3,5], Lecturer MD PhD Gabriel Cristian Bejan[1,4,6], Assoc. prof. MD PhD Ana Maria Alexandra Stănescu[1,4,6]

[1] "Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania, [2]Filantropia Clinical Hospital, Bucharest, Romania, [3]Coltea Hospital Hospital, Bucharest, Romania, [4]Obstetrics and Gynecology, [5]Surgery, [6]Family Medicine

Received: 15.05.2021 • Acceptated for publication: 27.05.2021

Abstract

Acute appendicitis is one of the most common causes of emergent abdominal surgery. About 1 in 1,000 pregnant women undergoes an appendectomy during pregnancy, of which only 1 in 1,500 confirms to be acute appendicitis. The main objective of this study is to present the clinical, imaging and preclinical diagnosis of acute appendicitis during pregnancy. The second objective was to review surgical and conservative treatment, mainly to present the particularity during pregnancy.

The diagnosis of appendicitis during pregnancy is challenging, in most cases unspecified. The clinical examination provides accurate data for the diagnosis of appendicitis and is more important than imaging and laboratory tests. Laparoscopy is safe and recommended for appendicitis diagnosed during pregnancy. A multidisciplinary team including the obstetrician, surgeon and anaesthetist is necessary for the management of this pathology during pregnancy.

Keywords: *pregnancy, appendicitis, surgery*

PRACTICA MEDICALĂ

UpToDate

Apendicita acută în timpul sarcinii - o recenzie despre diagnostic și management

Rezumat

Apendicita acută este una dintre cele mai frecvente cauze ale intervenției chirurgicale abdominale de urgență. Aproximativ 1 din 1.000 de femei gravide suferă o apendicectomie în timpul sarcinii, dintre care doar 1 din 1500 se confirmă a fi o apendicită acută. Obiectivul principal al acestui studiu este prezentarea diagnosticului clinic, imagistic și preclinic al apendicitei acute în timpul sarcinii. Al doilea obiectiv a fost revizuirea tratamentului chirurgical și conservator, în principal pentru a prezenta particularitatea în timpul sarcinii.

Diagnosticul apendicitei în timpul sarcinii este dificil, în majoritatea cazurilor nespecific. Examenul clinic oferă date mai exacte pentru diagnosticarea apendicitei și este mai important decât imagistica și testele de laborator. Laparoscopia este sigură și recomandată pentru apendicita diagnosticată în timpul sarcinii. Este necesară o echipă multidisciplinară, inclusiv medicul obstetrician, chirurg și anestezist pentru gestionarea acestei patologii în timpul sarcinii.

Cuvinte *cheie: sarcina, apendicita, chirurgie*

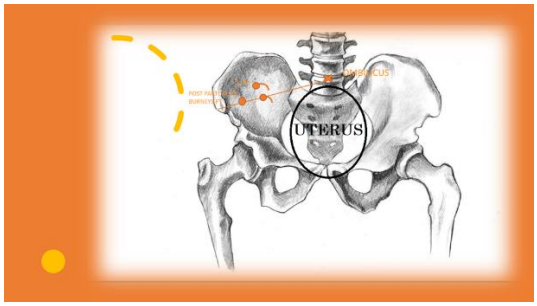
A century and a half ago, more precisely in 1849, the first case of appendicitis during pregnancy was published in Lancet (1). Acute appendicitis is defined as acute inflammation and infection of the vermiform appendix, most commonly referred to as the appendix. Acute appendicitis is one of the most common causes of emergent abdominal surgery. About 1 in 1,000 pregnant women undergoes an appendectomy during pregnancy, of which only 1 in 1,500 confirms to be acute appendicitis. The prevalence of appendectomy during pregnancy is estimated to be 0.1% of pregnancies (2-4), lower than the incidence of appendectomy in non-pregnant women of the same age. The diagnosis of appendicitis during pregnancy is challenging. Although unspecified, the clinical examination provides accurate data for the diagnosis of appendicitis and is more important than imaging and laboratory tests.

In this case, non-specific symptomatology combined with a non-contributive clinical examination due to the displacement of pain from McBurney's point can be misdiagnosed. Almost half of cases are diagnosed in the second trimester of pregnancy , but can be also diagnosed during pregnancy or in the postpartum period.

Our main objective is to present the clinical, imaging and preclinical diagnosis of acute appendicitis during pregnancy. The second objective was to review surgical and conservative management, mainly to present the particularity during pregnancy.

The position of the appendix changes with gestational age, as we can see in figure 1, due to the displacement of the appendix outside the abdominal wall occuring during pregnancy.

Figure 1. Displacement of the appendix with the time of gestation



Two theory that implies the occurrence of microbial infection after obstruction of the appendiceal lumen are founded :

- *Enterogenic theory.* The microbes come from the lumen of the appendix. Favouring factors of the infection narrow or obstruct the lumen of the appendix: cudts, flanges, mucosal edema, lymphoid hypertrophy, coprolites, foreign bodies, diverticula, excessive length of the appendix, Crohn's disease, carcinoid syndrome. Common microorganisms include *Escherichia coli, Peptostreptococcus, Bacteroides fragilis* and *Pseudomonas aeruginosa*.

- *Hematogenous theory.* Microbes reach the appendix from a nearby source of infection.

Symptoms and diagnosis in pregnant women with acute appendicitis

The most common symptoms in pregnant women with acute appendicitis are:

- Spontaneous abdominal pain (100% of cases) is most commonly located in the lower right quadrant but can also be located in the upper right quadrant, right flank, periumbilical and even diffuse. Anorexia, nausea and vomiting that accompany a normal pregnancy are also common symptoms of appendicitis.

- Uterine contractions, dysuria, diarrhoea and constipation, may also be present.

- One of characteristic for acute appendicitis is the exacerbation of abdominal pain on palpation. In the first trimester, the pain is located in the lower right quadrant. After the 4th month, due to the development of the uterus, the appendix and the cecum rise above the iliac crest. The clinician must be faced with abdominal distension, muscle defence and decreased intestinal noises.

The classic positive signs of acute appendicitis are found in varying proportions:

- Blumberg sign - pain in the lower abdomen after abrupt withdrawal;

- Psoas sign -pain in the lower abdomen (iliopsoas muscles) after stretching (by hyperextension at the hip) or contraction (by flexion of the hip) of the leg;

- Rovsing sign – pain felt in the right lower quadrant after the palpation of the left lower quadrant;

- Obturator sign - pain on passive internal rotation of the hip when the right knee is flexed.

During pregnancy, the muscular defence of the abdominal wall may be absent, and the perception of somatic pain may be decreased due to the distension of the abdominal muscles and to the increased distance of the anterior parietal peritoneum from the inflammatory process.

Laboratory tests are not helpful; leukocytosis founded during pregnancy must be wise interpreted.

Best Evidence Topic reports ((BETs) found that positive abdominal ultrasonography has valuable clinical utility in pregnant women with suspected appendicitis (5).

The use of high-frequency sonography with additional compression may found the signs associated with appendicitis: a non-compressible appendix, dilated appendicular transverse diameter> 6mm with dirty intraluminal fluid, a small amount of pericecal fluid, and periapendicular hyperemia.

Those patients with a negative scan should be further observed. In difficult cases, other imaging investigation may include magnetic resonance imaging (MRI) and even computed tomograph (CT). MRI has high sensitivity and specificity (91.8% and 97.9%, respectively) for the diagnosis of acute appendicitis in pregnant patients with clinically suspected appendicitis (6,7).

Maternal, obstetrical and fetal complications remain high once perforation and peritonitis has occurred.

The reported rate of peritonitis reported in pregnancy was 20% after nondiagnosed appendicitis (8,9).

This may justify the use of diagnostic laparoscopy when high suspicion of the diagnosis, even when inconclusive imaging (10).

Treatment

Surgical treatment is recommended after the diagnosis of acute appendicitis. Even if sometimes diagnostic errors, surgical exploration leads to the removal of a normal appendix (it is better to intervene than to delay the intervention until the development of generalized peritonitis). Delayed surgery is associated with 30% of perforation(10).

During pregnancy, the type of surgery is influenced by the knowledge and the available resources. In recent years, laparoscopy has become an acceptable surgical alternative to open surgery in pregnancy. In the first and second trimester of pregnancy laparoscopy is safe (3) . Many surgeons recommend Hasson technique instead of Veress technique for primary port placement to avoid perforation of the uterus, appendages or trauma of pelvic veins.

Laparoscopy involves several risks due to pneumoperitoneum and to physiologic changes during pregnancy:

- Increased intra-abdominal pressure and decreased uterine blood flow can trigger premature labor.
- The use of CO2 increases the risk of fetal acidosis, acidosis that can cause fetal hemodynamic changes: tachycardia, hypertension. Therefore it is necessary to monitor blood gases.
- Venous stasis in the lower extremities, to which is added the hypercoagulability induced by pregnancy, promotes thrombosis.

Laparoscopy during pregnancy was associated with miscarriage, premature birth and small for gestational age fetuses (11-13). Increased intra-abdominal pressure and decreased uterine blood flow during laparoscopy can trigger premature labor. Also, the risk of premature birth is higher in the situation of evolution towards perforation with peritonitis.

In our practice and medical reports, even available, laparotomy under general anaesthesia was performed for more than 50 % of appendicectomies during pregnancy. Surgical access incision depends on uterine size and gestational age, pain location, presence, or peritonitis. McBurney incision is preferred because it does not sacrifice the abdominal wall's muscles, innervation or vascularity. If perforation occurs or if an appendicular abscess is formed, the incision on the right median or paramedian line is preferred for emergency exploration in the presence of diffuse peritonitis.

In the situation of non-complication appendicitis with perforation and peritonitis, the surgery does not affect the evolution of the pregnancy (7).

One of the most extensive retrospective studies between 2003 to 2010, on 7114 women with appendicitis during pregnancy, has reported more laparotomy during pregnancy and more postoperative complications, including transfusion, pneumonia, bowel obstruction, infection. There were statistically significant increases reported in maternal morbidity, including peritonitis, septic shock and venous thromboembolism in the former group (7).

Also, many authors have reported a negative laparotomy rate of appendicitis of 25–50% in obstetric cases and 15–35% in general surgical cases (14-21).

In conclusion

The diagnosis of appendicitis during pregnancy is difficult; the practician should differentiate appendicitis from renal or other digestives pathologies. Nowadays, maternal mortality from appendicitis is close to zero and is in most cases associated with neglected cases when perforation and peritonitis occurred, consequences of delayed diagnosis and surgery.

Early surgery is the treatment of choice at any time of pregnancy. Fetal mortality remains minimal when surgery is performed early before appendix perforation occurs. Once acute appendicitis diagnosis is suspected in the pregnant woman, a close collaboration between the obstetrician, surgeon and anaesthetist is necessary.

Conflict of interst: none**/Conflict de interese:** nu există

Acknowledgments: All authors contributed equally to this article/ Toţi autorii au avut contribuţie egală la acest articol

References/Bibliografie

1. Hancock H. Disease of the appendix ceaci cured by operation. *Lancet* 1842;2:380-382.
2. Rasmussen AS, Christiansen CF, Uldbjerg N, Nørgaard M. Obstetric and non-obstetric surgery during pregnancy: A 20-year Danish population-based prevalence study. *BMJ Open* 2019 19;9(5):e028136. Available from: doi: 10.1136/bmjopen-2018-028136.
3. Ball, E et al. Evidence-Based Guideline on Laparoscopy in Pregnancy: Commissioned by the British Society for Gynaecological Endoscopy (BSGE) Endorsed by the Royal College of Obstetricians & Gynaecologists (RCOG). Facts, views & vision. *ObGyn* 2019;11(1):5-25.
4. Yuk JS, Kim YJ, Hur JY, Shin JH. Association between pregnancy and acute appendicitis in South Korea: a population-based, cross-sectional study. *J Korean Surg Soc.* 2013;85(2):75-79.
5. Williams R, Shaw J. Ultrasound scanning in the diagnosis of acute appendicitis in pregnancy. *Emerg Med J*. 2007;24(5):359-360. Available from: doi:10.1136/emj.2007.048488.
6. Smith MP, Katz DS, Lalani T, et al. ACR appropriateness Criteria® right lower quadrant pain--suspected appendicitis. *Ultrasound Q.* 2015;31(2):85–91.
7. Baron KT, Arleo EK, Robinson C, Sanelli PC. Comparing the diagnostic performance of MRI versus CT in the evaluation of acute nontraumatic abdominal pain during pregnancy. *Emerg Radiol.* 2012;19(6):519–525.
8. Abbasi N, Patenaude V, Abenhaim HA. Management and outcomes of acute appendicitis in pregnancy-population-based study of over 7000 cases. *BJOG.* 2014, 121(12):1509-14. Available from: doi: 10.1111/1471-0528.12736.
9. McGee TM. Acute appendicitis in pregnancy. *Aust N Z J Obstet Gynaecol* 1989;29:378–385.

10. Gurbuz AT, Peetz ME. The acute abdomen in the pregnant patient. Is there a role for laparoscopy? *Surg Endosc* 1997;11:98–102.
11. Papandria D, Goldstein SD, Rhee D, et al. Risk of perforation increases with delay in recognition and surgery for acute appendicitis. *J Surg Res.* 2013;184(2):723-729. Available from: doi:10.1016/j.jss.2012.12.008.
12. Wilasrusmee C, Sukrat B, McEvoy M, Attia J, Thakkinstian A. Systematic review and meta-analysis of safety of laparoscopic versus open appendicectomy for suspected appendicitis in pregnancy. *Br J Surg.* 2012;99(11):1470-1478.
13. Aylin P, Bennett P, Bottle A, et al. *Estimating the risk of adverse birth outcomes in pregnant women undergoing non-obstetric surgery using routinely collected NHS data: an observational study*. Health Services and Delivery Research:Southampton (UK); 2016.
14. Balinskaite V, Bottle A, Sodhi V, Rivers A, Bennett PR, Brett SJ, et al. The Risk of Adverse Pregnancy Outcomes Following Nonobstetric Surgery During Pregnancy: Estimates From a Retrospective Cohort Study of 6.5 Million Pregnancies. *Ann Surg.* 2017;266(2):260-266.
15. Kave M, Parooie F, Salarzaei M. Pregnancy and appendicitis: a systematic review and meta-analysis on the clinical use of MRI in diagnosis of appendicitis in pregnant women. *World J Emerg Surg* 2019;14(37). Available from: https://doi.org/10.1186/s13017-019-0254-1
16. Jung SE, Byun JY, Lee JM, Rha SE, Kim H, Choi BG, et al. MR imaging of maternal diseases in pregnancy. *Am J Roentgenol.* 2001;177(6):1293–1300.
17. Yilmaz HG, Akgun Y, Bac B, Celik Y. Acute appendicitis in pregnancy–risk factors associated with principal outcomes: a case control study. *Int J Surg.* 2007;5(3):192–197. Available from: doi: https://doi.org/10.1016/j.ijsu.2006.05.005.
18. McGory ML, Zingmond DS, Tillou A, Hiatt JR, Ko CY, Cryer HM. Negative appendectomy in pregnant women is associated with a substantial risk of fetal loss. *J Am Coll Surg.* 2007;205(4):534–540. Available from: doi:https://doi.org/10.1016/j.jamcollsurg.2007.05.025.
19. Ramalingam V, LeBedis C, Kelly JR, Uyeda J, Soto JA, Anderson SW. Evaluation of a sequential multi-modality imaging algorithm for the diagnosis of acute appendicitis in the pregnant female. *Emerg Radiol.* 2015;22(2):125–132.
20. Aggenbach L, Zeeman GG, Cantineau AE, Gordijn SJ, Hofker HS. Impact of appendicitis during pregnancy: no delay in accurate diagnosis and treatment. *Int J Surg.* 2015;15:84–89.
21. Thompson MM, Kudla AU, Chisholm CB. Appendicitis during pregnancy with a normal MRI. *West J Emerg Med.* 2014;15(6):652.

