

ACUTE APPENDICITIS IN POSTPARTUM PERIOD: A DIAGNOSTIC CHALLENGE

Nataša Janković^{1,2}, Miloš Janković³, Aleksandar Lilić⁴, Vladan Djurov¹,
Vladan Djordjević⁴

Acute appendicitis in pregnancy and the puerperium is the most common non-obstetric condition requiring urgent surgery. Unlike appendicitis during pregnancy, reports of appendicitis occurring during delivery and the early puerperium are rare. The most common puerperal infections include puerperal endometritis, urinary tract infections, adnexal torsion, tubo-ovarian abscess, ovarian vein thrombosis, sepsis, pelvic thrombophlebitis, pyelonephritis, pneumonia, and cholecystitis. Diagnosing acute appendicitis in pregnancy and the puerperium is challenging due to atypical or diminished symptoms caused by abdominal wall distension, displacement of abdominal organs, and reduced tissue response to inflammation. The primary symptoms of appendicitis during pregnancy include vomiting, anorexia, nausea, fever, and pain in the lower right abdomen or flank. Appendicitis can lead to refractory postpartum sepsis and should be considered in postpartum patients with sepsis of unknown origin, necessitating a multidisciplinary approach involving both obstetricians and surgeons.

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¹Pirot General Hospital, Department of Gynecology and Obstetrics, Pirot, Serbia

²Community Health Centre Pirot, Department of Gynecology and Obstetrics, Pirot, Serbia

³Pirot General Hospital, Department of Internal Medicine, Pirot, Serbia

⁴Pirot General Hospital, Department of General Surgery, Pirot, Serbia

Contact: Nataša Janković
7/25 Ustanička St., 18300 Pirot, Serbia
E-mail: natasa.jankovic1984@gmail.com

Introduction

Acute appendicitis in pregnancy and the puerperium is the most common non-obstetric condition requiring urgent surgery (1). Appendix perforation is more frequent during pregnancy, with an incidence of 55%, compared to 4–19% in the general population, where it is most commonly observed in children and the elderly, regardless of gender (1, 2). Appendicitis is less common in the early puerperium than during pregnancy. The most common puerperal infections include puerperal endometritis, urinary tract infections, adnexal torsion, tubo-ovarian abscess, ovarian vein thrombosis, sepsis, pelvic thrombophlebitis, pyelonephritis, pneumonia, and cholecystitis (3). Appendicitis during pregnancy may follow a fulminant course for several reasons. Increased

pelvic vascularization and appendix displacement can accelerate strangulation, while enhanced local lymphatic drainage and reduced omental mobility—due to the enlarged uterus—may facilitate the systemic spread of inflammation. In some cases, signs and symptoms of appendicitis may be absent, as anatomical changes can mask the classical clinical presentation, reducing the likelihood of an accurate diagnosis (4). Diagnosing acute appendicitis during pregnancy is challenging due to diminished signs and symptoms caused by abdominal wall distension, displacement of abdominal organs, reduced tissue response to inflammation, and appendix displacement. Nausea, vomiting, and abdominal pain are common in normal pregnancy, particularly during the first trimester (5). The primary symptoms of appendicitis in pregnancy include vomiting, anorexia, nausea, fever, tachycardia, and pain in the lower right quadrant or flank (6, 7). Appendicitis during pregnancy increases the risk of miscarriage, preterm birth, small-for-gestational-age newborns, and neonatal mortality within the first seven days after birth (8). Laparoscopic appendectomy is the preferred treatment (7).

Case report

The first patient was a 30-year-old woman in her first pregnancy, admitted to the Obstetrics Department of the General Hospital in Pirot at 40 weeks of gestation due to lower abdominal pain and lower limb edema, more pronounced in the

right leg. Her pregnancy had been uneventful until admission. She underwent clinical, ultrasound, and cardiotocographic examinations. Blood test results were normal, while a urine sample revealed proteinuria (0.15 g/L), 10–15 erythrocytes, 50–60 leukocytes, numerous squamous epithelial cells, and a high bacterial presence. A urine culture was requested, and treatment with Cefuroxime 1.5 g every 8 hours was initiated. Labor was stimulated with Syntocinon during the expulsion phase and completed vaginally. At the end of the fourth stage of delivery, the patient reported dizziness, weakness, and headache. She was hypotensive (60/40 mmHg) with a thready pulse. She received 1L of crystalloids through two intravenous lines. Bimanual and ultrasound examinations were normal. There was no apparent bleeding, and the uterus was contracted, with the fundus at the umbilical level. Her condition initially improved, but thirty minutes later, she again reported dizziness and headache. An urgent blood count was performed, revealing the following: Erythrocytes $2.92 \times 10^{12}/\text{uL}$, haemoglobin 86g/L, hematocrit 25.25%, leucocytes $27.9 \times 10^9/\text{uL}$, platelets $247 \times 10^{12}/\text{uL}$, protein 51g/L, albumin 28g/L. The patient was stabilized, with a blood pressure of 115/70 mmHg and a pulse of 90 bpm. Two units of blood and 50 mL of 20% albumin were ordered. Specialists in internal medicine, neurology, and infectious diseases were consulted. A repeat blood sample was obtained, a urinary catheter was placed, and diuresis was monitored. Procalcitonin was 0.54 ng/ml, D-dimer 6000 ng/ml, leucocytes $23.14 \times 10^9/\text{uL}$, erythrocytes $3.05 \times 10^{12}/\text{uL}$, haemoglobin 85g/L, hematocrit 28.3%, platelets $227 \times 10^{12}/\text{uL}$. An infectious disease specialist was consulted due to persistently elevated procalcitonin levels (0.53 ng/ml). The abdominal surgeon found no significant clinical findings on the abdomen, and a Doppler ultrasound of the lower limbs was also normal. Urine cultures from both samples were sterile. On the third day, procalcitonin levels remained largely unchanged (0.49 ng/ml), leading to the addition of Ciprofloxacin (500 mg twice daily). The general urine examination was now normal. On the fourth postpartum day, the patient reported a sudden onset of abdominal pain in the lower right quadrant. She was nauseous without vomiting and had a fever of 37.5°C. An internal medicine specialist and a general surgeon were consulted. An ultrasound of the abdomen and ileocecal region revealed a blind-ended tubular structure measuring 11 mm in diameter and 5.5 cm in length, with subserosal edema—findings consistent with acute appendicitis. Additionally, enlarged mesenteric lymph nodes measuring 11×16 mm were observed. Follow-up laboratory tests showed leukocytosis with $21.3 \times 10^9/\text{uL}$ leukocytes, neutrophilia of 87.2%, and a procalcitonin level of 0.26 ng/ml. The patient was transferred to the general surgery department, and surgery was performed on the same day. Intraoperatively, an altered appendix was

observed, along with mesenteric lymphadenopathy and a small amount of ascitic fluid in the Douglas recess. An antegrade appendectomy was performed, followed by hemostasis and suturing. The excised tissue was sent for pathological examination. Two antibiotics, analgesics, thromboprophylaxis, and rehydration therapy were administered. The postoperative course was uneventful. Follow-up laboratory tests, gynecological evaluation, and ultrasound examinations were all normal. The patient was discharged in good general condition. Pathohistological examination confirmed purulent phlegmonous-gangrenous appendicitis.

The second case involves a 21-year-old primiparous woman who was admitted for a post term pregnancy. An urgent cesarean section was performed due to imminent fetal asphyxia and posterior occipital presentation. She was discharged in good condition. Fourteen days after delivery, she reported upper abdominal pain that gradually spread to the entire abdomen. She experienced nausea, anorexia, fever of 38.5°C, and diarrhea. Initially, she was examined by a surgeon and a gynecologist and was discharged home. However, eight days later, she presented to the emergency department of General Hospital Pirot, appearing pale and adynamic, with an axillary temperature of 37.7°C and a rectal temperature of 38.5°C. Blood pressure was 120/70 mmHg, heart rate of 100/min. All clinical signs of appendicitis were negative. Following blood tests were performed: Leu- $16,06 \times 10^9/\text{uL}$, Er- $3,39 \times 10^{12}$, Hgb-98 g/L, HCT-29,3%, Tr-368x $10^9/\text{L}$, PCT-0,07 ng/ml, D-dimer 6783,33 ng/ml, CRP 215,9 mg/L. Abdominal ultrasound revealed interintestinal ascites in the right iliac region and the Douglas pouch, along with meteorism. Computed tomography of the abdomen and pelvis showed an irregular hypodense structure in the lower right quadrant, encompassing the cecum and terminal ileum en bloc, with a possible intraluminal hemorrhage. Fluid accumulation was noted around the structure. Additionally, a large number of enlarged lymph nodes were observed in the right retroperitoneum and along the branches of the superior mesenteric artery. Ascites was also present in Morison's pouch and the right paracolic gutter. Surgery was performed the same day. An en bloc abscess, approximately the size of two male fists, was found in the right inguinal fossa, containing the ileum, terminal ileum, and cecum. After careful dissection, around 200 mL of pus was drained from the abscess cavity and sent for microbiological analysis. The small intestines were irrigated, and the cecal base was examined, revealing only the tip of the appendix and a coprolite—the appendix itself was absent. The base of the appendix was sutured, and drainage was placed in the Douglas pouch and the retrocecal space. The patient received antibiotics, antisecretory drugs, analgesics, and crystalloids. She was discharged on the seventh postoperative day in stable condition and was feeling well at her scheduled follow-up appointment.

Discussion

There is insufficient evidence to suggest that pregnancy increases the incidence of appendicitis. The incidence of appendicitis during pregnancy ranges from 1 in 1,200 to 1 in 1,500 pregnancies, with the highest occurrence typically in the second trimester (9). Early puerperal appendicitis is less common, with regional variations and a decreasing trend in incidence (3). In contrast to appendicitis during pregnancy, there is very limited data on appendicitis around the time of delivery and in the early puerperium. A large cohort study conducted in England in 2015 showed that the incidence of appendicitis in the postpartum period is similar to that of the general population, with an incidence rate ratio (IRR) of 1.01 (95% CI, 0.81–1.26) in women aged 15 to 34. However, the incidence is slightly higher in women over 34 years old, with an IRR of 1.84 (95% CI, 1.18–2.86) (10). According to the most widely accepted theory, appendicitis is caused by a mechanical obstruction of the appendix lumen, which may result from stagnant feces, lymphoid hyperplasia, or a parasitic infection of the appendix wall (11). Diagnosing appendicitis during pregnancy is challenging, particularly in the second half of pregnancy, during labor, and in the first few days postpartum (4). This is due to the anatomical and physiological changes that occur during pregnancy and the puerperium, which must be considered when interpreting anamnestic data and clinical examination results. During pregnancy, the uterus enlarges twentyfold, stretching ligaments and muscles, and exerting pressure on abdominal structures and the layers of the abdominal wall, which reduces its tone, even several weeks postpartum (12). Typical features of acute surgical conditions, such as abdominal tenderness and stiffness, are often absent or diminished in the early postpartum period. Additionally, the high levels of circulating estradiol, progesterone, estriol, and glucocorticoids during this time diminish the tissue's response to inflammation, masking early signs of infection and its localization (13). Constant abdominal pain is the most common symptom, with pain in the lower right quadrant being the most reliable indicator, present in 84% of patients (14). The main symptoms of appendicitis during pregnancy include vomiting, anorexia, nausea, fever, tachycardia, and pain in the lower right quadrant and flank (9). Nausea is particularly noteworthy, as early pregnancy nausea and vomiting are typically self-limiting and confined to the first trimester. The appendix typically returns to its original position at McBurney's point ten days after delivery (7). Classical migration of pain strongly suggests

appendicitis and is present in 50% of patients (4). While some of the classical signs of appendicitis, such as Rowsing's, Alder's sign, obturator sign and psoas sign may not be highly sensitive, they are considered specific (15). The mid-axillary temperature for proven appendicitis ranges between 37.2°C and 37.8°C (present in 50% of cases), but can rise to as high as 39°C in cases of perforation and diffuse peritonitis (16). An increased heart rate has a similar positive predictive value, though it is not a sensitive sign (9). Average leucocyte count after delivery is 13.39×10^9 uL, with significant differences regarding the modality of delivery (vaginal birth, vaginal assisted delivery or cesarean section) (17). White blood cell count of over 16×10^9 uL should raise suspicion. C-reactive protein (CRP) levels are elevated during pregnancy, although the mechanism behind this increase is unknown. The levels remain elevated until after delivery, peaking on the second day postpartum (18). We monitored procalcitonin levels. A cohort study conducted in Geneva in 2009 concluded that a procalcitonin level of 0.25 µg/l should be used as a threshold during the third trimester and delivery (19). As a non-invasive test, abdominal ultrasound is the diagnostic tool of choice. It provides high precision during the first and second trimesters, although its accuracy decreases in the third trimester. A non-compressible, dead-ended tubular structure in the lower right quadrant with a diameter greater than 6 mm is considered diagnostic (20). Sensitivity ranges from 75% to 100%, but specificity is only between 40% and 50% (14). Perforated appendicitis is a known cause of preterm delivery and may have contributed to the onset of labor in our case, despite the patient not reporting any abdominal pain. There is anecdotal evidence supporting conservative antibiotic treatment for perforated appendicitis during pregnancy. It is possible that the symptoms of appendicitis were masked due to the use of antibiotics.

Conclusion

Appendicitis can lead to refractory sepsis in the postpartum period and should be considered when no obvious cause of sepsis is found. Due to physiological changes during pregnancy and early puerperium, diagnosing appendicitis is challenging and should be considered whenever abdominal pain occurs. Delayed or missed diagnosis and treatment can result in serious complications for the mother, highlighting the importance of a collaborative approach between surgeons and obstetricians.

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**AKUTNI APENDICITIS U POSTPARTALNOM PERIODU:
DIJAGNOSTIČKI IZAZOV**

*Nataša Janković^{1,2}, Miloš Janković³, Aleksandar Lilić⁴, Vladan Đurov¹,
Vladan Đorđević⁴*

¹Opšta bolnica Pirot, Služba za ginekologiju i akušerstvo, Pirot, Srbija

²Dom zdravlja Pirot, Služba za zdravstvenu zaštitu žena, Pirot, Srbija

³Opšta bolnica Pirot, Odeljenje interne medicine, Pirot, Srbija

⁴Opšta bolnica Pirot, Odeljenje hirurgije, Pirot, Srbija

Kontakt: Nataša Janković

Ustanička 7/25, 18300 Pirot, Srbija

E-mail: natasa.jankovic1984@gmail.com

Apendicitis u trudnoći i puerperijumu najčešći je uzrok neginekološkog oboljenja koje zahteva hitnu hiruršku intervenciju. Za razliku od apendicitisa u trudnoći, mali broj radova bavi se apendicitisom koji nastaje u toku porođaja i u ranom puerperijumu. Najčešće infekcije u puerperijumu su puerperalni endometritis, infekcije urinarnog trakta, adneksalna torzija, tubo-ovarijski apscesi, tromboza ovarijumskih vena, sepsa, pelvični tromboflebitis, pijelonefritis, pneumonija i holecistitis. Do poteškoća prilikom dijagnostikovanja akutnog apendicitisa u trudnoći i puerperijumu dolazi zbog oslabljenih simptoma i znakova usled distenzije trbušnog zida, dislokacije intraabdominalnih organa i smanjenog odgovora tkiva na upalu. Glavni simptomi apendicitisa u trudnoći uključuju povraćanje, anoreksiju, mučninu, povišenu telesnu temperaturu, tahikardiju i bol u donjem desnom kvadrantu ili boku. Budući da apendicitis može biti uzrok neprepoznate refraktorne sepsa u postpartalnom periodu, kod pacijentkinja posle porođaja, osim na sepsu, treba obratiti pažnju na upalu slepog creva. Stoga, neophodan je timski rad ginekologa i hirurga.

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Ključne reči: *apendicitis, trudnoća, puerperijum*

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