

CASE REPORTS

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Acute appendicitis coexisting with acute pyelonephritis causing diagnostic dilemma: a case report

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Abstract

Background: Acute appendicitis and acute pyelonephritis are the most common diseases admitted to emergency departments. Both conditions have common symptoms such as flank pain, abdominal pain, and fever. Patients' history, physical examination, laboratory evaluation, and imaging methods are used to differentiate these two conditions. Diverticulitis, colitis, gynecological pathologies, and ureteral stones that mimic acute appendicitis should be kept in mind as differential diagnoses. Cases of pyelonephritis mimicking acute appendicitis have been reported in the literature, but there has not been a reported case in which acute appendicitis occurs during management of acute pyelonephritis. In this article, a case report which can cause such a diagnostic dilemma has been presented.

Case presentation: A 42-year-old female patient presented with clinical features suggestive of acute appendicitis that developed after a diagnosis of acute pyelonephritis. She underwent laparoscopic appendectomy on account of acute appendicitis during medical treatment for acute pyelonephritis. Physical examination showed only right costovertebral tenderness without any rebound tenderness at McBurney's point at the first admission, but during treatment rebound tenderness at McBurney's point was also detected. The Alvarado score of the patient was 5 at the first admission and 7 when acute appendicitis was diagnosed. The patient fully recovered and was discharged after both diseases were completely treated.

Conclusions: As seen in this case, it should be remembered that both diseases can be seen together which causes a diagnostic dilemma. If clinical or biochemical progression is detected in a patient under treatment, imaging methods should be repeated and additional ones with higher resolutions should be used.

Keywords: Acute pyelonephritis, Acute appendicitis, Medical treatment, Appendectomy, Case report

1 Background

Renal colic and abdominal pain are the most common causes of emergency department applications [1]. Acute appendicitis is the most common diagnosis in patients presenting with right lower quadrant pain. Diverticulitis, colitis, gynecological pathologies, and ureteral stones that mimic acute appendicitis should be kept in mind as

differential diagnoses [1]. Renal colic is mostly related to ureteral stones, pyelonephritis with obstruction on the ureter, and rarely renal infarctions. The presence of dull flank pain or renal colic with fever suggests pyelonephritis or pyelonephritis secondary to accompanying ureteral stones. Symptoms such as anorexia, fever, nausea, and vomiting due to acute appendicitis may also be observed in acute pyelonephritis. Imaging methods such as ultrasonography (USG) and computed tomography (CT) are frequently used for diagnosis in patients presenting with abdominal pain or renal colic [2, 3]. The sensitivity and specificity of CT are 94% and 95%, respectively, in diagnosis of adults presenting with abdominal pain [1, 2].

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Diagnosing diseases incorrectly as appendicitis causes unnecessary surgeries, and delays in the diagnosis and treatment of acute pyelonephritis may lead to renal scarring and therefore hypertension and chronic renal failure. Untreated pyelonephritis poses a risk of life-threatening clinical conditions such as urosepsis and xanthogranulomatous pyelonephritis [4].

Cases of pyelonephritis mimicking acute appendicitis have been reported in the literature, but there has not been a reported case in which acute appendicitis occurs with an already existing acute pyelonephritis. In this article, a case of acute appendicitis coexisting with acute pyelonephritis has been presented.

2 Case presentation

A 42-year-old female was admitted to our emergency department with complaints of right flank pain, painful micturition, fever (39.0 C), chills, anorexia, and vomiting. Her medical history revealed recurrent urinary tract infections and frequent antibiotic usage. Also, we learned that she got married a month prior to admission. She had been using antibiotics and paracetamol for two days before admission. Physical examination showed only right costovertebral tenderness without any rebound tenderness at McBurney's point. Her urinalysis showed 8–10 leukocytes, 1–2 erythrocytes, and leukocyte esterase positivity. Laboratory examinations revealed some changes as follows: white blood leukocyte count (WBC) 14.660 (neutrophil ratio 83.2%, lymphocyte ratio 10.3%), C-reactive protein (CRP) 5.13 (normal range <0.5), and serum creatinine 0.81 mg/dl. The Alvarado score of the patient was calculated as 5 (low risk of appendicitis, but probable).

Abdominal USG showed mild edema in the right kidney. She was hospitalized with pre-diagnosis of acute pyelonephritis. Intravenous fluid, analgesic, and antipyretic were started with antibiotic (ciprofloxacin 2 × 400 mg/day intravenous). After 24 h of hospitalization, WBC was 25.370 (neutrophil rate 90.5%, lymphocyte ratio 6.4%), CRP was 21.9, and complete urinalysis was 7–8 leukocytes, 1–2 erythrocytes, and leukocyte esterase positivity. Her body temperature was 38.4 C, but she felt more comfortable and her pain was decreased. On the following day, WBC was 20.600 and CRP was 30.5 with no alteration in the clinical status of the patient. Leukopenia (WBC 3.700/ml) had developed on the fourth day of antibiotic therapy with ciprofloxacin, in addition to the following results: erythrocyte sedimentation rate 80 mm/h and CRP 35. On the same day, right lower abdominal quadrant pain with rebound tenderness at McBurney's point was detected in her physical examination. The Alvarado score was calculated as 7 (probable appendicitis). Abdominal USG was done again, and increased

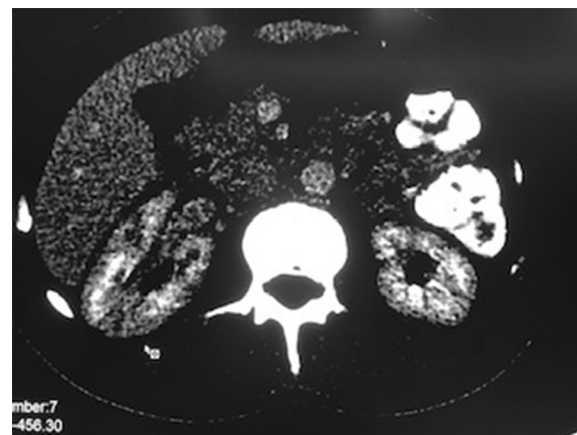


Fig. 1 Right kidney (white arrow) with axial tomography cross section compared to the left kidney, with contrast enhancement significantly reducing hypodense patchy lesion area

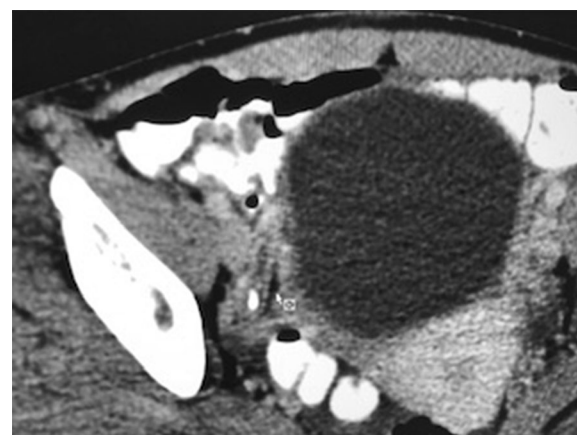


Fig. 2 In the axial section, hyperdense formations compatible with appendicolith are observed adjacent to the ovary in the right half of the minor pelvis thick-walled, lumen-free oral contrast agent, appended with cecum (appendicitis)

thickening and edema were detected in the distal appendix (acute appendicitis?). Ciprofloxacin treatment was replaced with meropenem 3 × 1000 mg/day immediately. Thereafter, oral and intravenous contrasted abdominal CT was done. CT findings were compatible with distal appendicitis and right pyelonephritis (Figs. 1, 2). Urine culture taken during the admission to the emergency department showed expanded spectrum b-lactamase (ESBL)-positive *Escherichia coli* (>100,000 cfu, resistant to ciprofloxacin). After the third day of meropenem treatment, laparoscopic appendectomy was done by general surgery. During the operation, the appendix was found to be in a normal location, swollen, and edematous, and it was inflamed in the meso. Histological examination

of the appendix vermiformis, 6 cm in length and 0.7 cm in diameter, was consistent with acute appendicitis and local peritonitis. The postoperative course of the patient was uneventful. Patient was discharged after completing her medical treatment for pyelonephritis. On the day of her discharge, laboratory examinations were found as follows: WBC 5.680, CRP 0.61, and erythrocyte sedimentation rate 20 mm/h. Control urinalysis was found to be normal with sterile urine culture. Ten days after discharge, control physical and laboratory examination was also found to be normal.

3 Discussion

Acute pyelonephritis is a kidney infection manifested by painful micturition, flank pain, chills, fever, nausea, and vomiting. The presence of leukocytes in urine is always seen. No classification is present to determine the degree of severity of acute pyelonephritis. Indications for hospitalization are generally ongoing vomiting, progression of the clinical picture, and suspicion of sepsis or urinary system obstruction [5]. Our case was hospitalized with high fever, flank pain, and mild dehydration due to vomiting.

Pyelonephritis caused by a typical pathogen is evaluated as an uncomplicated disease in a person who has normal renal anatomy and function [6]. Although the prevalence and incidence of pyelonephritis are not known worldwide, it is abundantly seen in the summer. The hospitalization rate due to the disease is five times higher in women [7]. Our female patient was admitted to emergency department in the summer.

Pyelonephritis is most often caused by bacteria in the bladder ascending through the ureter. The disease can develop after bacteremia in some cases. The most common isolated organism is *E. coli* (56–85%), while other common ones are *Enterococcus faecalis*, *Klebsiella pneumoniae*, and *Proteus mirabilis* [8]. People with structural and functional urinary system anomalies are more vulnerable to renal infections and also are resistant to oral therapy [5]. Risk factors for development of pyelonephritis in healthy women are sexual intercourse, spermicide use, urinary tract infections, diabetes mellitus, and urinary incontinence [8]. The most important risk factor for complicated urinary tract infections is the obstruction of the urinary system [9]. Our case had married one month prior, and recurrent episodes of urinary tract infection were found in her history. In addition, no obstruction was detected in her urinary tract.

The incidence of antibiotic-resistant microorganisms varies geographically. Hospital stays, history of antibiotic usage, immunosuppression, recurrent pyelonephritis, and nephrolithiasis are usually responsible for this resistance [10]. To us, the patient's recurrent urinary tract infections and frequent usage of antibiotics posed a risk

of ESBL-positive *E. coli* infection in our case. The complications of pyelonephritis are renal abscess, septic shock, and renal failure [5]. In our patient, acute appendicitis could be a complication of pyelonephritis.

Appendicitis is an inflammation of the vermiform appendix and is considered to be the most common cause of acute abdomen. Symptom diversity is high due to developmental anomalies and topographic variations [11]. The most common symptoms are lower right quadrant pain, vomiting, and fever. The proximity of the genitourinary system to the appendix may cause confusion during the diagnosis. The genitourinary simulations of appendicitis symptomatology also may be variable [11]. In some cases, anomalies of the genitourinary system may mask themselves as acute appendicitis. Obstruction or infections of abnormally located genitourinary organs may mimic appendicitis [12]. Appendicitis may also be accompanied by urological symptoms due to the topographic variations of the appendix and/or urogenital organs. The proximity of the appendix to the urinary system may cause hematuria, leukocyturia, proteinuria, and/or bacteriuria [13]. Urine retention has been reported due to the appendix, which is located close to the right ureter or bladder [14]. In such cases, it is important to evaluate these urological symptoms correctly in order not to delay the diagnosis of appendicitis. In some cases, the appendix may be located close to the kidney. Appendicitis can be confused with pyelonephritis, especially when the appendix is in the retrocecal position [15].

It is important to differentiate the diseases since both appendicitis and pyelonephritis manifest themselves with flank pain and abdominal pain. In the literature, there is a case report in which a patient with right lower quadrant pain was diagnosed with acute appendicitis, but on further examination, the clinical condition was found to be due to pyelonephritis of the ectopic kidney [1]. This patient recovered with antibiotic treatment without surgical intervention, and no surgery was performed [1]. Jones et al. also reported that retrocecal appendicitis had been detected in abdominal CT of a patient who had presented with abdominal pain and had been diagnosed with pyelonephritis [13]. However, in our patient, acute appendicitis developed after diagnosis of acute pyelonephritis. Perhaps, there was acute appendicitis as a co-infection, when the patient was diagnosed with acute pyelonephritis, or acute appendicitis resulted from pyelonephritis as a rare complication. In our research, we could not find a case of appendicitis developing after pyelonephritis. Our case had been admitted to the hospital with a pre-diagnosis of acute pyelonephritis, and all findings in the initial evaluation were compatible with the pre-diagnosis and were normal in terms of appendicitis. In our case, the patient's complaints at admission to

the hospital, the patient's clinical and physical examination findings, and the normal evaluation of the appendix vermiformis on radiological imaging and edematous appearance of the right kidney in favor of pyelonephritis in the same imaging, alone suggested pyelonephritis and ruled out acute appendicitis and other possible pathologies. Acute appendicitis was detected by ultrasonography on the fourth day of pyelonephritis treatment due to the clinical and laboratory changes in the patient. We believe that the continuing evidence of the accompanying pyelonephritis is important in terms of showing these two clinical conditions, which could be found or added together without imitating each other. In abdominal CT, both the appearance of pyelonephritis foci and confirmation of appendicitis development result in a rejection of the idea that we missed an appendicitis diagnosis when the patient first arrived. However, it must be remembered that appendicitis can still be missed at early phase when the clinical features are not established. We think that the proximity of the ureter, bladder, and appendix anatomically may cause this interaction, as well as lymphatic or hematogenous spread. In our case, the determination of the appendix vermiformis in its normal anatomical position during surgery suggests that this spread is through the hematogenous or lymphatic spread rather than the neighborhood route. Symptoms in the retrocecal appendix may mimic acute pyelonephritis, and it can be difficult to distinguish between these two conditions. The detection of ESBL-positive *Escherichia coli* in our case and the resistance to the antibiotic given due to the diagnosis of pyelonephritis suggests that the appendix vermiformis was affected by this situation in the following days and triggered the development of acute appendicitis under antibiotic treatment.

USG, CT, or magnetic resonance imaging is used as radiological procedures for the diagnosis of acute appendicitis. The specificity of abdominal USG is 94%, and its sensitivity is 88%. Abdominal CT is recommended for use in patients with the suspicion of atypical or perforated appendicitis, since its specificity and sensitivity are higher (95% and 94%, respectively) [16]. Diagnostic accuracy is increased with greater usage of CT scanning; however, CT confers risk and disadvantages such as cost, radiation exposure, and contrast-related complications. The Alvarado score for predicting acute appendicitis is a method that relies on a combination of factors derived from physical signs, symptoms, and laboratory tests and produces a numerical score used to rule in or rule out acute appendicitis. It is a well-established and widely used clinical decision tool that may help reduce CT usage [17]. However, we have to remember that symptoms may overlap with other disease; that is, higher scores are found in patients with non-appendiceal inflammatory

conditions such as diverticulitis, acute pelvic inflammatory disease, or pyelonephritis. So it is important to consider the whole clinical picture in making the diagnosis of appendicitis. When we applied the Alvarado scoring to our case, the score was calculated as 5 (low risk of appendicitis, but probable) at the first visit and then 7 (probable appendicitis) when the clinical status changed and when we diagnosed acute appendicitis. However, we think that clinical conditions such as pyelonephritis alone may cause high Alvarado scores and that the common findings of these two clinical conditions may also play a role in this.

Acute appendicitis can be treated with antibiotics or appendectomy (open or laparoscopic). However, surgery is the preferred method at the moment [18]. In our case, surgeons had chosen laparoscopic appendectomy as the treatment because appendicitis had developed in the course of parenteral antibiotic treatment for pyelonephritis. Here, it can be questioned whether the strain resistant to antibiotic treatment, initiated in the culture, had an additional contribution to the development of acute appendicitis. The patient was discharged from the hospital after completing 10 days of meropenem treatment for pyelonephritis with full recovery.

4 Conclusion

Acute pyelonephritis and acute appendicitis are clinical conditions that may have common findings in patients presenting to the emergency department. Developmental anomalies and topographic variations of the genitourinary system and the appendix may sometimes lead to confusion of these two conditions. However, as seen in this case, it should be remembered that acute appendicitis coexisting with acute pyelonephritis could also be observed. If clinical or biochemical progression is detected in a patient under treatment, imaging studies should be repeated and additional ones with higher resolutions must be done.

Abbreviations

USG: ultrasonography; CT: computed tomography; WBC: white blood leukocyte count; CRP: C-reactive protein; ESBL: extended-spectrum β -lactamase.

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Authors' contributions

BO contributed to the conception and design, drafted the manuscript, and reviewed the manuscript for relevant intellectual content. Patient was under care of UC, and UC reviewed the manuscript for relevant intellectual content. ERC revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

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Availability of data and materials

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Declarations**Ethics approval and consent to participate**

Ethical clearance (certificate number: 409-2020) was obtained from the Committee of the Bakirkoy Acibadem Hospital, following signed written consent from the patient for the use of the clinical history, radiological photographs, diagnosis, and treatment plan.

Consent for publication

Written informed consent was obtained from the patient for the use of the clinical history, radiological photographs, diagnosis, and treatment plan in this case report.

Competing interests

The authors have no conflict of interest to declare.

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