

CASE REPORT

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Streptococcus pneumoniae primary peritonitis mimicking acute appendicitis in an immunocompetent patient: a case report and review of the literature

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Abstract

Introduction: Primary peritonitis without an identifiable intra-abdominal source is extremely rare in healthy individuals; it is commonly seen in cases of nephrotic syndrome, cirrhosis and end-stage liver disease, ascites, immunosuppression, and inflamed peritoneum due to pre-existing autoimmune and oncological conditions.

Case presentation: We present the case of a 68-year-old Caucasian woman operated on due to acute abdomen with a provisional diagnosis of acute appendicitis. During the operation a small amount of free intra-abdominal fluid was found. Her uterus, ovaries, and fallopian tubes were macroscopically normal. Therefore, with the suspicion of appendicitis, appendectomy was performed. Her blood cultures were negative while peritoneal fluid was positive for capsulated form of *Streptococcus pneumoniae*. A 30-day follow-up was performed and she was asymptomatic without any sign of infection.

Discussion: *Streptococcus pneumoniae* commonly causes upper respiratory tract infection and cutaneous infections. It very rarely causes gastrointestinal infection and it is very rarely responsible for primary peritonitis and septic shock syndrome.

Conclusion: Pneumococcal peritonitis has a rare occurrence and represents a clinical challenge because of its subtle and non-specific clinical findings. The interest in our case lays in the relatively rare diagnosis of primary peritonitis mimicking acute appendicitis.

Keywords: Primary peritonitis, *Streptococcus pneumoniae*, Acute abdomen

Introduction

Primary peritonitis (PP) is a diffuse infective inflammation of the peritoneal cavity in the absence of a localized source [1–3]. PP is extremely rare (2%) in healthy individuals; it usually occurs in patients with nephrotic syndrome, cirrhosis, end-stage liver disease, ascites, immunosuppressive status, or inflamed peritoneum due to pre-existing autoimmune and/or oncological conditions [4–7]. The pathophysiology of PP is not completely understood, but increased translocation of intestinal bacteria, retrograde

diffusion from the genitourinary tract in females, or hematogenous infectious pathways have been discussed. Historically, PP has been related to Gram-negative bacteria, while Gram-positive bacteria, excluding *Enterococcus* species, are rarely involved [8–10] and, therefore, PP was seldom misdiagnosed. We present the case of a 68-year-old Caucasian woman operated on due to acute abdomen with a provisional diagnosis of acute appendicitis.

Case presentation

A 68-year-old Caucasian woman presented to our emergency department complaining of acute onset of severe abdominal pain in the right lower quadrant that began

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approximately 48 hours earlier; she had a temperature of 39.1 °C and heart rate of 98/minute. She denied any recent fever, chills, hemoptysis, hematochezia, or change in bowel habits. She had no history of trauma or surgery; she did not take any regular medication; she did not use an intrauterine device (IUD) or other local contraceptive. She had normal sex activity with the same partner (last sexual relationship 20 days before surgery). No relevant history of infection in her family was reported. On her presentation to our emergency room, a physical examination revealed a localized peritonism in the right lower quadrant. At rectal examination, a normal sphincter tone was found with no palpable masses and normal stool. Other features were unremarkable. Laboratory values on admission showed an hemoglobin of 13.3 g/dL, 36.4% hematocrit, with $19.00 \times 10^3/\mu\text{L}$ white blood cells (WBC). C-reactive protein (CRP) value was 5 mg/dl (normal value <0.5). A computed tomography (CT) scan (Fig. 1) revealed no pathognomonic signs of appendicitis. Due to the diagnosis of acute abdomen, with provisional clinical diagnosis of acute appendicitis and secondary peritonitis, antibiotic treatment with amoxicillin-clavulanate 2.2 g three times a day was initiated and she was taken to our operating room. During the operation, a small amount of free intra-abdominal fluid was found with uterus, ovaries, and fallopian tubes being macroscopically normal. Appendicitis was therefore suspected and appendectomy was performed. Ascitic fluid culture was sent to the Microbiology Laboratory in suitable means of transport. The sample was processed with the classic method by sowing on culture-enriched media, searching for aerobic and anaerobic bacteria [11]. *Streptococcus pneumoniae* was isolated after 24 hours of incubation in CO_2 . The organism was identified as *S. pneumoniae* 99.9% with matrix-assisted

laser desorption/ionization time-of-flight (MALDI-TOF) mass spectrometry (bioMérieux Clinical Diagnostics). An antibiotic susceptibility test was performed using E-test method and interpreted using European Committee on Antimicrobial Susceptibility Testing (EUCAST) guidelines 2017 [12]. The organism was susceptible to antibiotics tested with minimum inhibitory concentrations (MICs) of benzylpenicillin 0.01 $\mu\text{g}/\text{ml}$, ampicillin 0.02 $\mu\text{g}/\text{ml}$, linezolid 1 $\mu\text{g}/\text{ml}$, ceftriaxone 0.01 $\mu\text{g}/\text{ml}$, meropenem 0.50 $\mu\text{g}/\text{ml}$, levofloxacin 0.5 $\mu\text{g}/\text{ml}$, clindamycin 0.02 $\mu\text{g}/\text{ml}$, trimethoprim/sulfamethoxazole 0.5 $\mu\text{g}/\text{ml}$, and vancomycin 0.1 $\mu\text{g}/\text{ml}$ while blood cultures were negative. Our patient's postoperative course was unremarkable and the antibiotic therapy was stopped after 4 days. She was discharged on the fifth postoperative day asymptomatic with a good performance status. In order to understand the source of this rare form of peritonitis we performed an evaluation of serum oncological markers and immunological status (procalcitonin, interleukin 5, interleukin 10), which were all negative. We also tested markers for HIV and hepatitis C virus (HCV) that gave negative results. A chest CT scan was also performed without any evidence of an active source of infection. Furthermore, histological examination of her appendix did not show signs of appendicitis but revealed a form of peritonitis (Figs. 2 and 3). A 30-day follow-up was performed. At day 10 an evaluation of our patient's immunological status was performed and the results were negative; at day 20 a chest CT was done and results were negative for any source of infection.

Discussion

S. pneumoniae is the most common cause of community-acquired pneumonia and the second most common cause of purulent meningitis, while intra-abdominal pneumococcal infection is rarely found [13–18].

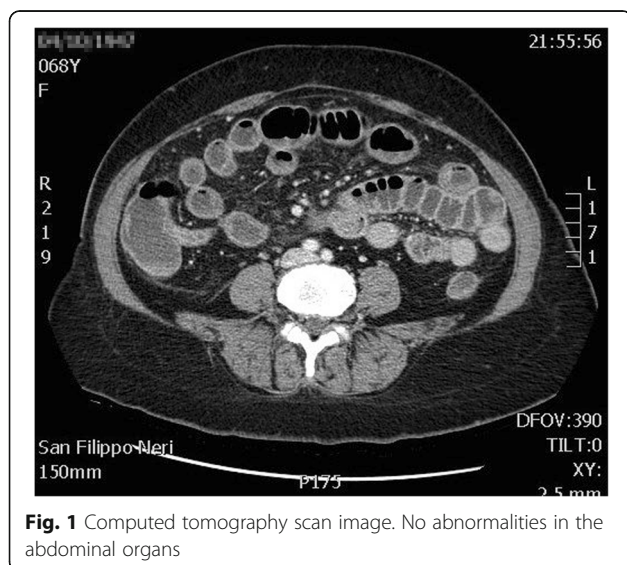


Fig. 1 Computed tomography scan image. No abnormalities in the abdominal organs

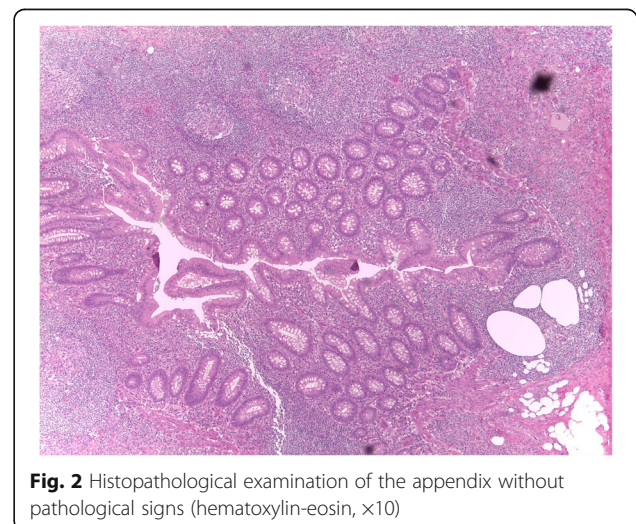
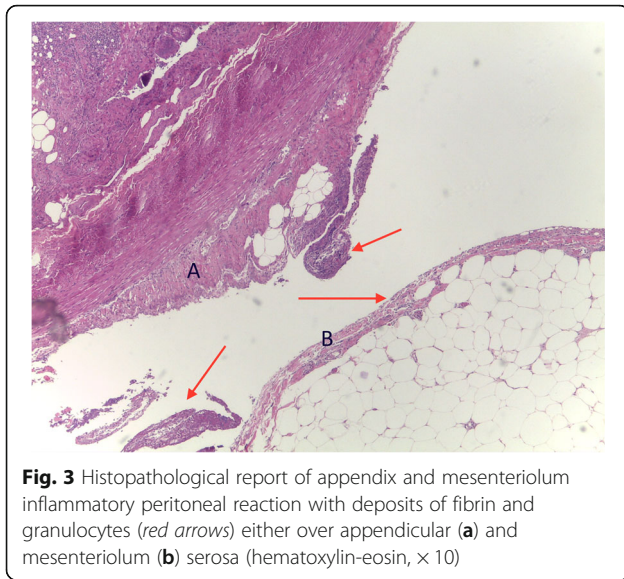


Fig. 2 Histopathological examination of the appendix without pathological signs (hematoxylin-eosin, $\times 10$)



We conducted a review of the literature by searching the PubMed database for all published series and case reports of PP due to *S. pneumoniae* in the worldwide literature up to 9 September 2017. We analyzed all cases reported in the literature [18–60]. Pediatric cases [19–21], secondary peritonitis [21, 22], and cases arising in patients with ongoing predisposing conditions [23–25] were excluded. All other papers were reviewed in order to evaluate real cases of PP (Table 1) [26, 31, 32, 34–40, 44–51, 53, 54, 56–60]. While pneumococcal peritonitis in children has been recognized for almost 100 years, our review shows, according with the findings of Dugi *et al.* [13], that primary pneumococcal peritonitis without pre-existing peritoneal disease is uncommon in healthy adults [61–64]. Without predisposing conditions, the virulence of some pneumococcus serotypes may contribute to the onset of this rare infection [44, 54]. The physiopathology of primary pneumococcal peritonitis remains controversial. Pneumococci may gain entry to the peritoneal cavity via the genital tract, the gastrointestinal tract, or by hematogenous spread from the respiratory tract [57]. Hemsley and Eykyn [40] reported an increased prevalence in female adults, with the genital tract being the most common source of pneumococcus. In fact, occasionally, vaginal commensals can presumably cause ascending infection also without predisposing factors such as the presence of an IUD or history of recent delivery. However, all the cases reported in their paper have evidence of a presumptive sepsis focus and therefore are not definable as PP.

Of interest, a peculiarity of this condition is the absence of mixed organisms. In fact, no case reported an association of multiple infective agents.

There is no definite clinical pattern or features which might help in the diagnosis. Usually the clinical picture closely resembles that of appendicitis or secondary peritonitis with or without sepsis which, in most cases, is the presumptive diagnosis [58–60].

Management of this condition is strictly linked to the diagnosis. While PP can be suspected in patients with comorbidities in the presence of a negative radiologic investigation, it is hardly recognizable in young and immunocompetent patients with no risk factors, like in our case. This confirms the fact that, based on an erroneous diagnosis, most of these patients are operated on despite negative results from imaging.

The best diagnostic algorithm is, in our opinion, Westwood and Roberts' [63]. Antibiotic therapy remains the first step in treatment of PP in patients with active comorbidities. The real clinical challenge arises with young, healthy, and immunocompetent patients. How can we suspect PP in those cases? In our opinion, with a negative CT scan, antibiotic therapy seems to be the first approach for 36–48 hours, despite several studies underlining that there seems to be little consensus regarding the antibiotic treatment for pneumococcal peritonitis and only little information has been published about the antibiotic regimens chosen for the treatment [65]. For patients infected by penicillin-susceptible organisms, penicillin remains the preferred treatment, while in areas where the prevalence of resistant pneumococci is high, cefotaxime or ceftriaxone is the empirical therapy of choice, as antibiotic-resistant strains of *S. pneumoniae* have been identified worldwide, and the prevalence of these resistant strains is as high as 57% in some countries [61, 64]. In *non-responders* and in patients with sepsis, exploratory laparotomy is a well-accepted treatment [65, 66]. The laparoscopic approach is pivotal, related to its low invasiveness and high diagnostic specificity and sensitivity, with peritoneal lavage or drainage being the diagnostic tool of choice [67]. It remains unclear, however, whether surgical exploration and lavage of the abdominal cavity with or without appendectomy is beneficial or detrimental for patients with primary pneumococcal peritonitis. One could assume that removal of infectious ascites and reduction of intra-abdominal bacterial load would support the healing process, while, in patients with cirrhosis with spontaneous bacterial peritonitis, surgery does not improve the course of the disease [68]. Laparotomy with abdominal debridement and visceral resection is a rare choice selected for advanced cases with complex peritoneal involvement [69, 70]. Based on all these findings it can be assumed that the management of pneumococcal peritonitis involves timely surgical intervention and treatment with antibiotics.

Table 1 Review of the literature

Reference (year)	Author	Age/Gender	Presumed source	Computed tomography	Laparotomy	Peritoneal fluid culture	Blood cultures
[26]/1970	Friedland and Harris	20/F	Unidentified	No	Yes	+	+
[31]/1989	Bukovsky <i>et al.</i>	33/F	Unidentified	No	No	–	+
[32]/1989	Davis <i>et al.</i>	21/F	Unidentified	No	Yes	+	ND
[34]/1990	Christen <i>et al.</i>	50/F	Unidentified	No	Yes	+	+
[34]/1990	Christen <i>et al.</i>	58/F	Unidentified	No	Yes	+	ND
[35]/1990	Casadevall <i>et al.</i>	87/F	Unidentified	No	Yes	+	+
[35]/1990	Casadevall <i>et al.</i>	42/F	Unidentified	Yes	No	+	ND
[36]/1992	Tariq and Joseph	27/F	Unidentified	Yes	No	–	+
[37]/1992	Kunkler <i>et al.</i>	36/F	Unidentified	No	Yes	+	–
[37]/1992	Kunkler <i>et al.</i>	38/F	Unidentified	No	No	ND	+
[38]/1993	Bruyn	35/F	Unidentified	No	Yes	+	+
[39]/1995	Graham <i>et al.</i>	39/F	Unidentified	No	Yes	+	–
[40]/1998	Hemsley and Eykyn	36/F	Unidentified	No	Yes	+	–
[35]/2001	Fox <i>et al.</i>	39/F	Unidentified	Yes	Yes	+	ND
[36]/2001	Ueyama <i>et al.</i>	52/F	Unidentified	Yes	Yes	+	–
[37]/2001	Sanchez and Lancaster	34/M	Unidentified	Yes	Laparoscopy	+	+
[38]/2004	Okumura <i>et al.</i>	29/F	Unidentified	Yes	Yes	+	–
[39]/2004	Kanetake <i>et al.</i>	40/M	Unidentified	Yes	Yes	+	–
[40]/2005	Brivet <i>et al.</i>	54/F	Unidentified	Yes	Laparoscopy	ND	+
[41]/2005	Brivet <i>et al.</i>	82/F	Unidentified	Yes	No	ND	+
[41]/2006	Jarvis <i>et al.</i>	38/F	Unidentified	Yes	Yes	+	ND
[42]/2006	Saha <i>et al.</i>	23/F	Unidentified	Yes	Yes	ND	+
[44]/2008	Doloy <i>et al.</i>	35/F	Unidentified	No	Laparoscopy	+	ND
[45]/2009	Thomas <i>et al.</i>	36/M	Unidentified	Yes	Yes	+	+
[47]/2010	Haap <i>et al.</i>	27/F	Unidentified	Yes	Yes	ND	+
[48]/2010	Tilanus <i>et al.</i>	39/F	Unidentified	Yes	Yes	ND	+
[49]/2010	Monneuse <i>et al.</i>	35 (23–43)	Unidentified (4 patients)	Yes	Yes	+	+
[50]/2011	Legras <i>et al.</i>	23/F	Unidentified	Yes	Laparoscopy	+	ND
[51]/2013	Malota <i>et al.</i>	–	Unidentified (3 patients)	Yes	Yes	+	ND

F female, M male, ND no data

Conclusion

Primary pneumococcal peritonitis without pre-existing peritoneal disease is rare and represents a cultural and clinical challenge, especially for surgeons, because of its subtle and non-specific clinical findings. The interest in our case lays in the rare diagnosis of PP mimicking acute appendicitis in a healthy woman, without history of recent acute pneumonia or pelvic inflammatory disease (PID) and the isolation of pneumococcus in its capsulated form. This case report reinforces the need for an appropriate clinical algorithm in those patients without medical history and active comorbidities when the diagnosis of acute appendicitis is not clear at the time of operation, especially for female patients. No

direct diagnosis is possible. The treatment of choice is the fast initiation of antibiotic therapy. Although surgical therapy is generally not required for the treatment of primary pneumococcal peritonitis, it may be necessary to exclude secondary peritonitis or in non-responders.

Abbreviations

CRP: C-reactive protein; CT: Computed tomography; EUCAST: European Committee on Antimicrobial Susceptibility Testing; HCV: Hepatitis C virus; IUD: Intrauterine device; MALDI-TOF: Matrix-assisted laser desorption/ionization time-of-flight; MICs: Minimum inhibitory concentrations; PID: Pelvic inflammatory disease; PP: Primary peritonitis; WBC: White blood cells

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Availability of data and materials

Data sharing was not applicable to this article, as no datasets were generated or analyzed during the current study.

Authors' contributions

PF and FC made substantial contributions to the study conception and design and were responsible for acquisition of data, analysis, and interpretation of data. PF and MB were involved in drafting the manuscript. GS and AG critically revised the manuscript for important intellectual content. GS and RM gave final approval of the version to be published. All authors read and approved the final manuscript.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing interests

The authors declare that they have no competing interests.

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