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Case report

# Pneumococcal perihepatitis due to hematogeneous dissemination

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ABSTRACT

Perihepatitis is mainly caused by a direct extension of pelvic inflammatory disease, in which the causative pathogen is typically *Neisseria gonorrhoeae* or *Chlamydia trachomatis*. We herein discuss the case of a 61-year-old female patient who presented with a fever and right upper quadrant pain. Perihepatitis was diagnosed by contrast-enhanced computed tomography. She had no previous history of sexual activity, genital symptoms, remarkable physical findings or examination results indicative of pelvic inflammatory disease or other diseases. A blood culture detected *Streptococcus pneumoniae*, leading to the suspicion of hematogeneous dissemination. The patient was therefore treated with the appropriate antimicrobials. While invasive pneumococcal disease mainly results in bacteremic pneumonia, meningitis or endocarditis, the present case showed that it can also lead to perihepatitis; a blood culture is therefore useful for clarifying the infection route and pathogens in perihepatitis if the patient has no past history of sexual activity, genital symptoms or physical or other findings indicative of pelvic inflammatory disease.


## Introduction

Although perihepatitis can occasionally be non-infectious, it is mainly infectious [1–4]. Infectious perihepatitis is chiefly caused by a direct extension of pelvic inflammatory disease (PID), in which the causative pathogen is typically *N. gonorrhoeae* or *C. trachomatis*, both of which are transmitted sexually. Other infection routes consist of the hematogeneous or lymphatic dissemination of pathogens [1]; however, no previous studies have reported the hematogeneous dissemination of *Streptococcus pneumoniae* as a cause of perihepatitis. We herein report a case of perihepatitis due to the hematogeneous dissemination of *Streptococcus pneumoniae,* which was diagnosed on the basis of blood culture findings.

## Case report

A 61-year-old female patient presented with a three-day history of fever and gradually increasing right upper quadrant pain. She had a past history of hepatitis C, which was cured with sofosbuvir-ribavirin, and a sustained virological response of 11 years' duration. She had no history of splenic disorder, immunodeficiency, abnormal vaginal discharge, genital hemorrhage or dysuria, was sexually inactive for 20 years, and had never contracted a sexually transmitted disease. On physical examination, her temperature was 39.7 ℃, her blood pressure 112/59 mmHg, her pulse rate 103 bpm, and her respiration rate 16 breaths per minute. She generally appeared to be in good health. The sclerae were not icteric, her heart sounds were normal, and no cardiac murmur was noted. Auscultation revealed clear bilateral lung sounds and no rales. The abdomen was soft, and the bowel sounds were normal. Right upper quadrant tenderness was present without rigidity. There was no acute cervical motion or uterine or adnexal tenderness on bimanual pelvic examination. The rest of the physical examination was unremarkable.

Laboratory tests showed a white blood cell count of 17,200 /μL with 96 % neutrophils and C-reactive protein 42.87 mg/dL. Although the total bilirubin was 1.5 mg/dL, the other liver enzyme levels were normal. Transvaginal ultrasonography found no thickened, fluid-filled fallopian tubes or free pelvic fluid. A chest radiography denied infiltration shadows and pleural effusion. Contrast-enhanced computed tomography (CT) of the abdomen revealed no findings indicative of liver parenchymal, biliary tract, pancreatic, spleen, urinary or gynecological disorders but demonstrated linear enhancement of the hepatic capsule along both hepatic lobes (Fig. 1). Based on the CT findings, perihepatitis was diagnosed. Despite the absence of symptoms or findings indicative of PID, ceftriaxone and azithromycin were empirically administered because perihepatitis is the chief extrapelvic manifestation of PID due to the direct extension of *N. gonorrhoeae* and *C. trachomatis* infection to the liver capsule.

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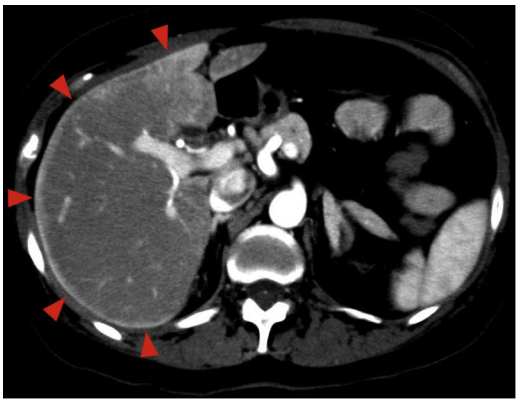

**Fig. 1.** Contrast-enhanced computed tomography of the abdomen demonstrated linear enhancement of the hepatic capsule (arrowheads).

A blood culture on the day of admission was positive for *Streptococcus pneumoniae* on hospital day two, but a vaginal swab was negative for *N. gonorrhoeae* and *C. trachomatis*, and a vaginal secretion culture detected only an α-hemolytic streptococcus and a coagulase-negative staphylococcus. Based on these findings, invasive pneumococcal disease was diagnosed, and perihepatitis via hematogeneous dissemination of *Streptococcus pneumoniae* was suspected. Although the causative pathogen was identified as *Streptococcus pneumoniae*, neither the physical findings nor chest radiograph taken on admission revealed pneumonia. The patient also denied symptoms of meningitis. Treatment was continued after switching the antimicrobials to penicillin G. The patient's condition improved, and treatment was terminated after two weeks. She had no further symptoms thereafter.

## Discussion

The present case demonstrates two, significant, clinical issues. First, perihepatitis can occur via hematogeneous dissemination of *Streptococcus pneumoniae.* Second, a blood culture is useful for clarifying the infection route and pathogens in perihepatitis if the patient has none of the usual findings indicative of PID.

First, perihepatitis can occur via hematogeneous dissemination of *Streptococcus pneumoniae,* a condition known as invasive pneumococcal disease. Although Behcet's disease [2], systemic lupus erythematosus [3], and adverse drug reactions [4] have been reported as non-infectious causes of perihepatitis, most cases are infectious and are thought to have three possible infection routes: direct extension, lymphatic spread, and hematogeneous dissemination [1].

Direct extension is the most common infection route in perihepatitis. Many cases occur as a result of PID known as Fitz-Hugh-Curtis syndrome [1]. The causative pathogens may be respiratory or enteric organisms, but more than 85 % of infections are due to sexually transmitted cervical pathogens, notably *N. gonorrhoeae*, *C. trachomatis* or bacterial vaginosis-related microbes [5]. Other possible causes of direct extension include liver abscesses [6], cholecystitis [6], peritonitis [7], urinary tract infections [8], and device infection [9]. Lymphatic dissemination is a possibility in patients with PID whose infection route cannot be explained by a direct extension or hematogeneous dissemination, which occurs when an infection spreads via the bloodstream and reaches the liver capsule [1].

While some cases of perihepatitis are due to the hematogeneous dissemination of the sexually transmitted pathogens, *N. gonorrhoeae* and *C. trachomatis* [10–13], other, non-sexually transmitted pathogens, such as *Mycobacterium tuberculosis* in miliary tuberculosis [14], may also be implicated.

A blood culture positive for *Streptococcus pneumoniae* is definitive evidence of true bacteremia [15]. In the present case, a blood culture detected *Streptococcus pneumoniae*, supporting the hypothesis of hematogeneous dissemination. Although the patient had right upper quadrant pain, a bimanual pelvic examination, transvaginal ultrasonography, and CT produced no findings indicative of PID. A vaginal culture detected only an α-hemolytic streptococcus and a coagulase-negative staphylococcus, ruling out the possibility that the perihepatitis was a direct extension of PID caused by *Streptococcus pneumoniae*. The physical findings, laboratory examination, and imaging study also denied the possibility of a disease other than perihepatitis; this and the fact that only *Streptococcus pneumoniae* was detected from the blood culture led to the conclusion that the pathogen was spread by hematogeneous dissemination. Although invasive pneumococcal disease due to *Streptococcus pneumoniae* sometimes includes peritonitis or appendicitis [16–18], no previous cases of perihepatitis due to the hematogeneous dissemination of *Streptococcus pneumoniae* have been reported.

Second, a blood culture can be useful for clarifying the infection route and pathogens in perihepatitis if the patient has no history of sexual activity, genital symptoms, physical findings or other examination results indicative of PID. Perihepatitis can be definitively diagnosed only by directly visualizing the liver via laparoscopy or laparotomy [1], but these procedures are invasive. Therefore, diagnosis based on CT, which was used in the present case to visualize capsular enhancement along the surface of the liver, is preferable not only for its non-invasiveness but also its accuracy and sensitivity [19,20]. To detect the pathogen, a vaginal swab and secretion culture are useful in perihepatitis with associated PID [1]. However, when PID is not suspected as in this case, hematogeneous dissemination rather than direct extension is more likely, making a blood culture more useful for identifying the infection route and pathogen. In the present case, the blood culture was instrumental in detecting the presence of *Streptococcus pneumoniae*, thus enabling the choice of an appropriate antimicrobial.

In conclusion, perihepatitis can occur via the hematogeneous dissemination of *Streptococcus pneumoniae*. Hence, a blood culture is useful for identifying the infection route and pathogens in perihepatitis when the possibility of PID can be ruled out.

## CRediT authorship contribution statement

**Koichiro Okumura:** Writing - original draft. **Yu Sato:** Writing - original draft. **Hiroaki Yonekura:** Writing - review & editing. **Noriyoshi Toki:** Writing - review & editing. **Takaie Kuki:** Writing - review & editing. **Satoshi Watanuki:** Writing - review & editing. **Kenji Nishida:** Writing - review & editing, Supervision.

## Declaration of Competing Interest

The authors declare no conflicts of interest associated with this manuscript

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