Pyogenic liver abscess caused by *Fusobacterium* in a 21-year-old immunocompetent male

Zohair Ahmed, Saurabh K Bansal, Sonu Dhillon

Computed tomography imaging revealed hepatic abscesses, the largest measuring 9.5 cm. Empiric antibiotics were started and percutaneous drains were placed in the abscesses. Anaerobic cultures from the abscesses grew *Fusobacterium nucleatum*. This is a gram negative anaerobic bacteria; a normal flora of the oral cavity. Fusobacterium is most commonly seen in Lemiere’s disease, which is translocation of oral bacteria to the internal jugular vein causing a thrombophlebitis and subsequent spread of abscesses. Our patient did not have Lemiere’s, and is the first case described of fusobacterium pyogenic liver abscess in a young immunocompetent male with good oral hygiene. This case was complicated by sepsis, empyema, and subsequent abscesses located outside the liver. These abscesses’ have the propensity to flare abruptly and can be fatal. This case not only illustrates fusobacterium as a rare entity for pyogenic liver abscess, but also the need for urgent diagnosis and treatment. It is incumbent on physicians to diagnose and drain any suspicious hepatic lesions. While uncommon, such infections may develop without any overt source and can progress rapidly. Prompt drainage with antibiotic therapy remains the cornerstone of therapy.

**Key words:** Hepatic abscess; Pyogenic; Fusobacterium; Liver; Immunocompetent

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**Core tip:** Pyogenic liver abscesses have the propensity to cause devastating effects; immediate drainage and antibiotics are the mainstay of treatment. Herein we report the first case of a pyogenic liver abscess from fusobacterium in a young, otherwise healthy immunocompetent individual.

Ahmed Z, Bansal SK, Dhillon S. Pyogenic liver abscess caused by *Fusobacterium* in a 21-year-old immunocompetent male.
INTRODUCTION

Pyogenic liver abscesses (PLA) are uncommon entities which require urgent diagnosis and treatment. If untreated they carry a high mortality. Hepatic abscess due to fusobacterium (gram negative anaerobic bacteria) is rare, but when reported they are associated with Lemierre's disease, an infectious thrombophlebitis of the internal jugular vein. Such infections are typically seen in the setting of instrumentation, dental work, and incidental oral flora translocation. Herein, we present the first case of de novo hepatic abscesses due to fusobacterium in an otherwise healthy 20-year-old Caucasian male with no identifiable source of infection. His course was further complicated by development of multiple intra-abdominal abscesses with subsequent direct seeding into the right pleural cavity causing empyema.

CASE REPORT

A 20-year-old Caucasian male was admitted with two weeks of progressive right upper quadrant abdominal pain, approximately 10 pound weight loss, fevers/chills, fatigue, and diarrhea. His social history was not significant for any IVDA, high risk sexual behavior, recent travel, exposure to contaminated water, or pet exposure. He was a college student and played baseball on the school team. On presentation his vital signs were stable and was afebrile. Examination revealed mild RUQ tenderness, but was otherwise unremarkable. His laboratory work revealed: leukocytosis with wbc count of 16.3 k/uL and anemia with Hgb of 7.6 gm/dL. Liver function tests revealed normal: AST (29 U/L)/ALT (44 U/L), total bilirubin (0.7 mg/dL); and mild elevation of alkaline phosphatase (158 U/L). Serologic workup was negative for human immunodeficiency virus, hepatitis B virus and hepatitis C virus. Computed tomography (CT) imaging of abdomen/pelvis revealed multiple hepatic abscesses, the largest in the right lobe measuring 8.9 cm × 9.4 cm × 9.5 cm (Figure 1A). Aerobic and anaerobic blood cultures were collected and empiric antibiotic treatment was initiated with Vancomycin and Piperacillin/Tazobactam. Two percutaneous drains were placed in the largest hepatic abscesses. The hepatic abscesses’ anaerobic culture grew heavy Fusobacterium nucleatum (F. nucleatum). The patient denied any neck pain or recent dental infection, but did report recent routine dental cleaning. Neck imaging revealed patent jugular veins without tenderness or palpable cords. An ERCP was done to rule out a biliary source, and revealed normal hepatic, biliary, and pancreatic ducts.

One week after initiating treatment the patient developed respiratory distress and was found to have a large right sided multiloculated pleural effusion for which a chest tube was placed and pleural fluid analysis revealed empyema, likely due to direct extension of the pyogenic liver abscesses. The chest tube did not resolve the pleural effusion and the patient subsequently developed a trapped lung. He underwent evacuation of the pleural fluid and partial decortication with a VATS procedure. He developed 2 more abdominal abscesses, and one pelvic abscess, all required percutaneous drain drainage with resolution. A 2D trans-thoracic echocardiogram was unremarkable, apart from a mild pericardial effusion. The patient was placed on IV Ertapenem for 8 wk and discharged home in stable condition. Repeat imaging during out-patient follow-up showed complete resolution of his abscesses after 9 wk of treatment (Figure 1B).

DISCUSSION

Liver

The two most common types of liver abscesses are: PLA and amebic abscess. PLA is defined as an encapsulated mass containing purulent material\(^1\)\(^-\)\(^3\). Incidence varies with geographical location; PLA are more common in developed countries whereas amebic abscess are more common in developing countries.
For PLA the reported incidence in the United States is 3.6 out of 100000 people\textsuperscript{4,5}. The right hepatic lobe is the most common site of involvement, due to its larger size and having greater blood supply when compared to the left and caudate hepatic lobes\textsuperscript{6}. PLA are more commonly polymicrobial rather than monomicrobial. Meddings \textit{et al}\textsuperscript{5}, evaluated close to 18000 patients with PLA in the United States; and found the most commonly recorded bacterial infections were: Streptococcus species (29.5\%) and \textit{Escherichia coli} (18.1\%). Of note, Taiwan had the highest reported incidence at 17.6 out to 10000 people, with Klebsiella being the most prominent bacterial organism being found. Anaerobic species are also not uncommon in such patients, with Bacteroides being most commonly isolated. Anaerobes are probably under-reported because of difficulty associated with culturing them. There are only a few case reports, which report fusobacterium as the causative organism. Of the two large PLA studies done by Meddings \textit{et al}\textsuperscript{5} and Chuang \textit{et al}\textsuperscript{7}, none of them were reported to have been caused by Fusobacterium.

Liver abscess can occur from three mechanisms: (1) dissemination via the portal venous system is most common cause of pyogenic liver abscess. Intra-abdominal infections in portal bed region organes, result in septic thrombophlebitis causing micro-abscess formation in the liver. These micro-abscesses later coalesce to form larger single or multiple abscesses; (2) biliary tract disease such as biliary duct stone, stricture or malignancy, results in direct extension of infection through biliary channels to liver; and (3) hematogenous spread from systemic bacteremia can result from endocarditis, septic thrombophlebitis (Lemierre's syndrome) or periodontal infections\textsuperscript{8,9}.

Notable risk factors for PLA include: diabetes mellitus, liver transplantation, intra-abdominal malignancy, biliary tract procedures, and immune system suppression\textsuperscript{9,10}. Several recent studies from Taiwan mention an association between Klebsiella pneumoniae and colorectal cancer. Their studies show patients diagnosed with PLA had a fourfold increase in gastrointestinal malignancy, of which colorectal cancer was the most common\textsuperscript{10-15}.

Treatment of PLA includes prompt initiation of intravenous antibiotics and drainage of purulent material. The preferred method is via percutaneous drainage, with needle aspiration being an inferior choice due to requirement of repeated aspirations. Surgical intervention is recommended for: abscesses > 5 cm, gas forming organism, or biliary fistulization. Empirc broad spectrum intravenous antibiotics should include one of the following: ampicillin/sulbactam, ceftriaxone plus metronidazole, or meropenem. Definitive therapy is based on speciation of isolated organism. Recommended duration of antibiotics varies, usually ranging from 2-6 wk; depending on clinical improvement and resolution of abscess seen on CT imaging\textsuperscript{3}.

\textbf{Fusobacterium}

The genus Fusobacterium currently includes 13 species and belongs to family bacteroidaceae\textsuperscript{16,17}. Most common species of Fusobacterium responsible for human infections are \textit{Fusobacterium necrophorum} (\textit{F. necrophorum}) and \textit{F. nucleatum}. Fusobacterium is a nonsporeforming, nonmotile, gram negative small spindle-shaped rod\textsuperscript{17,18}. \textit{F. nucleatum} is part of normal oral flora\textsuperscript{18,19}. Fusobacterium species possesses outer membrane proteins like other gram-negative bacteria\textsuperscript{17}. The Lipopolysaccharides in the outer membrane proteins can act as endotoxins and provide other antigenic properties such as adhesion and co-aggregation which helps in invasion of the tissue and contribute towards virulence\textsuperscript{17}.

In 1936, Dr. Lemierre was the first to describe a periodontal source leading to septicemia from Fusobacterium. \textit{F. necrophorum} is associated with younger healthy population while \textit{nucleatum} is mostly associated with older patients with chronic medical conditions\textsuperscript{20}. \textit{F. nucleatum} had been associated with infections such as tropical skin ulcers, peritonsillar abscesses, pyomyositis, septic arthritis, bacteremia, intrauterine infections, bacterial vaginosis, urinary tract infections, pericarditis, endocarditis, myocarditis, and pulmonary infections\textsuperscript{17,21}. \textit{F. Nucleatum} has also recently been implicated as causative agent in chorioamnionitis and idiopathic preterm labor\textsuperscript{16}. Association of \textit{F. Nucleatum} infections with GI tract malignancies is attributed to the breach in mucosal lining resulting in invasive infections\textsuperscript{18}.

Annual incidence of Fusobacterium infections is between 0.6-3.5 cases per 1000000 people\textsuperscript{20}. Su \textit{et al}\textsuperscript{22} pointed out that most Fusobacterium blood stream infections were from \textit{nucleatum} species. Community acquired \textit{F. nucleatum} infections tend to be more polymicrobial as compared to nosocomial which are almost always monomicrobial\textsuperscript{23,24}. Risk factors for poor prognosis were presence of comorbid conditions such as diabetes mellitus, renal failure, dialysis and malignancy\textsuperscript{18,20}. Nosocomial bacteremia was a significant mortality predictor with rates as high as 84\% in one study\textsuperscript{18}. \textit{F. nucleatum} bacteremia without identifiable source is not uncommon. In such cases, a GI tract malignancy is often found\textsuperscript{18}.

The fusobacteria species are broadly susceptible to commonly used antibiotics, but reports of increasing resistance to: vancomycin, neomycin, erythromycin, amoxicillin, ampicillin, and penoxymethylpenicillin; have emerged\textsuperscript{17}. Recently some resistant patterns to quinolones had been identified with fusobacteria isolated from oral flora of dogs and cats\textsuperscript{18,19}. An accurate identification of fusobacterium species is critical not only for taxonomic reasons but also for appropriate treatment of infection, since the susceptibility of different Fusobacterium species to antibiotics varies.
Pyogenic liver abscess is a rare and serious condition characterized by infection in the liver. It can occur due to various factors, including bacteria, fungi, and parasites. The abscess is typically diagnosed through imaging techniques such as ultrasound or computed tomography (CT) scans. Treatment usually involves antibiotics and drainage of the abscess to prevent complications and improve outcomes.

**Experience and lessons**

This case report illustrates the importance of recognizing pyogenic liver abscesses as a possible entity in otherwise healthy individuals and the need for prompt diagnosis and treatment. It highlights the importance of maintaining a high index of suspicion in patients with unexplained abdominal pain and fever, especially in the absence of clear risk factors.

**Peer-review**

The authors discuss the importance of prompt diagnosis and treatment, emphasizing the need for a high index of suspicion in otherwise healthy individuals. They also stress the importance of close monitoring and follow-up in such cases. The report encourages readers to keep in mind the potential for delayed diagnosis and treatment, and the subsequent risks to patient outcomes.

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