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Cryptogenic pyogenic liver abscess due to *Fusobacterium nucleatum*: A case report

Clinicians should consider the possibility of pyogenic liver abscess when patients present with fever, right upper quadrant pain, and shortness of breath.

ABSTRACT: Pyogenic liver abscesses are relatively uncommon but potentially life-threatening. Most infections that lead to an abscess are associated with underlying biliary disease, or are due to hematogenous spread from a variety of nonbiliary sites. Although most infections are polymicrobial, monomicrobial *Fusobacterium nucleatum* abscesses do occur. These exceedingly rare monomicrobial infections typically occur in immunocompromised individuals or in the presence of periodontal disease. A recent case involved a solitary pyogenic liver abscess due to *F. nucleatum* in an immunocompetent 44-year-old woman with no underlying risk factors. Despite the cryptogenic nature of the abscess, the patient was treated successfully with percutaneous drainage and antibiotics.

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Formation of a pyogenic liver abscess (PLA) is potentially life-threatening, with an estimated incidence rate of 2.3 cases per 100 000 patients.[1,2] Despite recent advances in the investigation and management of such abscesses, the mortality rate still ranges from 2% to 12%.[3,4] Amebic liver abscess is the most common form of liver abscess worldwide, whereas PLA is the most common form in North America,[5] and is usually the result of polymicrobial infection.[6] It is believed that the introduction of pyogenic bacteria to the liver most often occurs during an intra-abdominal infection, particularly one involving biliary tract pathology.[1,3] Less often, bacteria spread by way of the portal vein or hematogenously during systemic infection,[1] with periodontal disease being recognized increasingly as a source of pathogens in this setting.[7-9]

Although monomicrobial infections are rare, they do occur. A recent case involved *Fusobacterium nucleatum*, a nonmotile, gram-negative, anaerobic bacterium that normally inhabits the oropharynx and is a significant contributor to the formation of periodontal plaques.[10] Anaerobic bacteria have long been known to play a part in PLA formation, with one case series identifying anaerobes in up to 45% of cases.[11] Typically, systemic *F. nucleatum* infections occur in immunocompromised individuals or are of odontogenic origin.[7-9,12]

Case data

A 44-year-old woman presented to the emergency room with a 6-day history of fever, chills, rigor, vomiting, headache, and shortness of breath. She had diffuse abdominal pain that had become localized to the right upper quadrant, and had progressed to being sharp and steady in nature and worse with inspiration. Her surgical history included a total hysterectomy that had been complicated by an *Escherichia coli* bacteremia and sepsis secondary to a surgical site infection. Her medical history included chronic gastroesophageal reflux disease, which was controlled with esomeprazole. Her dental history was unremarkable.

After her 1991 hysterectomy and *E. coli* infection, the patient had suffered a second episode of bacteremia

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and sepsis in 2001 as a result of a foodborne gastroenteritis. This second bacteremic episode is believed to have been precipitated, in part, by a reduction in her immunity caused by an esomeprazole-related decrease in gastric acidity.

On presentation, the patient's vital signs were recorded as temperature 39.5°C, heart rate 116 beats per minute, blood pressure 92/62 mm Hg, oxygen saturation 98% on room air, and respiratory rate 18 breaths per minute. Physical examination revealed abdominal tenderness, worst in the right upper quadrant, with no signs of peritonitis. She exhibited decreased air entry to both lung bases, and crackles were heard from the lower left lobe. Abdominal and chest radiographs showed no abnormalities, ruling out a preliminary diagnosis of pneumonia. Results from initial laboratory tests indicated infection (**Table**). Subsequently, gram-negative anaerobic bacilli identified as *F. nucleatum* were found in 2 of 2 vials of blood culture, and an abdominal ultrasound revealed a solitary liver mass (**Figure 1**). A CT scan of the abdomen then confirmed the presence of a 5 x 4.4 x 3.2–cm multiloculated mass in the anterior right lobe of the liver (**Figure 2**). CT-guided percutaneous drainage was performed with direct aspiration of the abscess, which yielded thick purulent material. Laboratory examination of the aspirate fluid revealed polymorphonuclear leukocytes and erythrocytes, but gram-stain and culture results were negative.

Initially, the patient was empirically treated with imipenem (500 mg by IV every 6 hours) and metronidazole (500 mg by IV every 8 hours), but she was eventually switched to cefotaxime (2 g by IV every 8 hours) and metronidazole (500 mg by IV every 8 hours). The patient improved

Table. Results from initial laboratory tests.

Analyte	Reference range	Result
WBC	4.0–10.0 × 10^9/L	17.3 (neutrophils 15.7)
Hemoglobin	115–150 g/L	132 g/L
Platelets	160–380 × 10^9/L	226 × 10^9/L
Creatinine	45–84 umol/L	78 umol/L
Random glucose	3.6–6.1 mmol/L	5.4 mmol/L
Urea	2.0–8.2 mmol/L	7.4 mmol/L
AST (aspartate transaminase)	< 32 IU/L	56 IU/L
ALT (alanine transaminase)	10–36 IU/L	69 IU/L
GGT (gamma-glutamyl transferase)	5–36 IU/L	30 IU/L
ALP (alkaline phosphatase)	42–98 U/L	61 U/L
INR	0.9–1.2	1.4
PTT (partial thromboplastin time)	26.6–41.4 seconds	47.9 seconds
Bilirubin, direct–total	< 5 µmol/L – < 18 µmol/L	6 µmol/L – 14 µmol/L

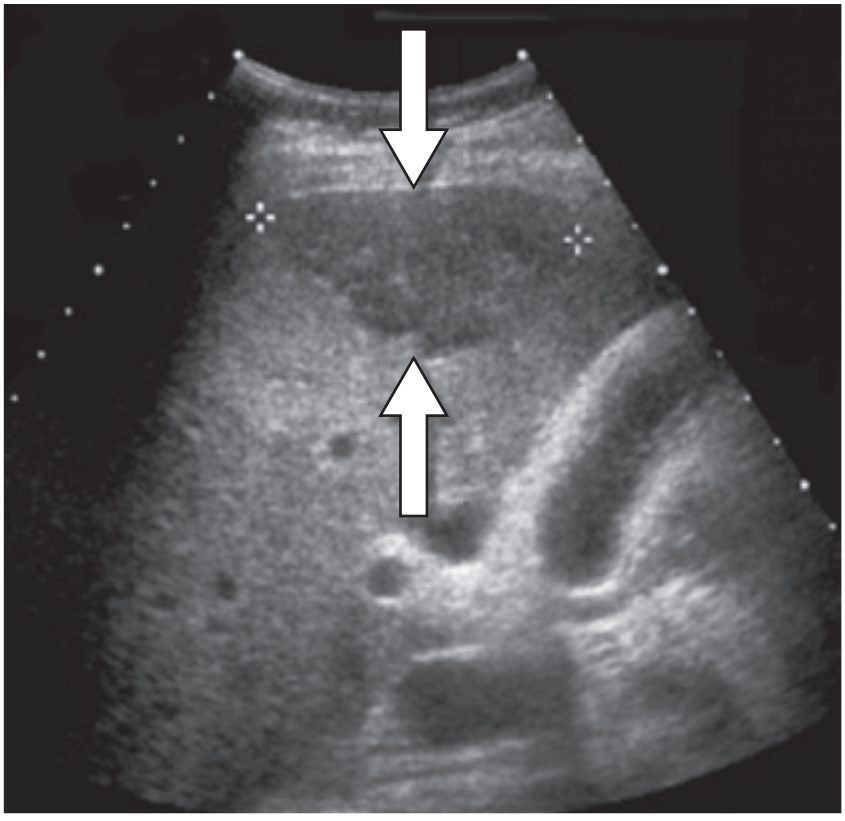

Figure 1. Ultrasound image of the liver showing solitary, largely hypoechoic mass (arrows).

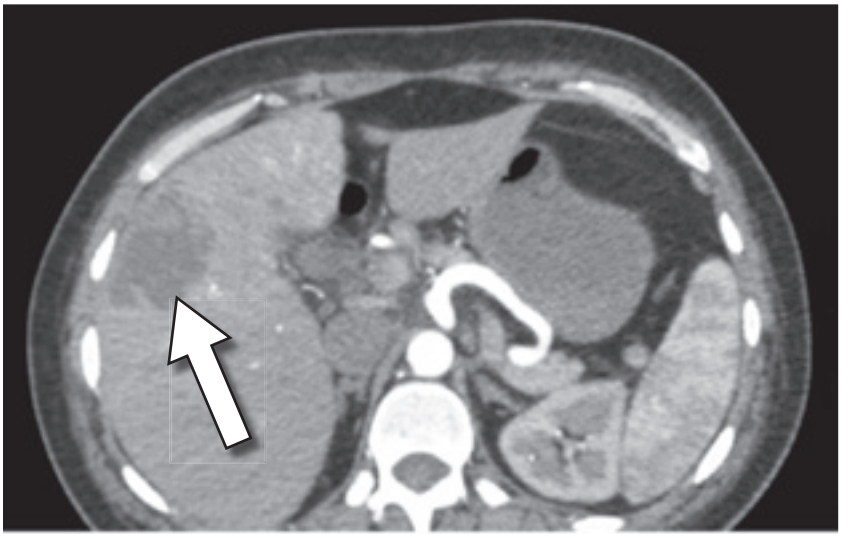

Figure 2. CT scan of abdomen showing large multiloculated mass in anterior right lobe of the liver (arrow).

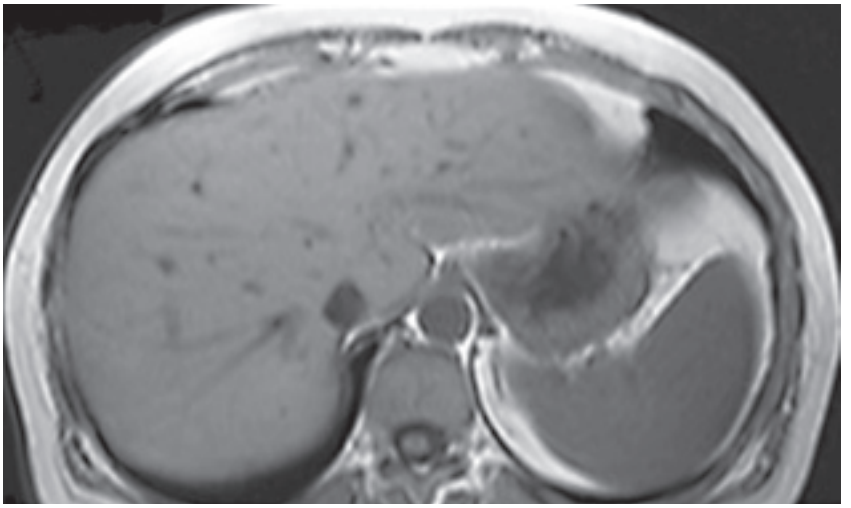

Figure 3. Follow-up MRI scan of abdomen following completion of antimicrobial therapy showing resolution of the abscess.

on this regimen and after 13 days she was discharged on ceftriaxone (2 g by IV once daily) and metronidazole (500 mg P.O. 3 times daily) for 5 weeks. Following completion of 6 weeks of antibiotic therapy the patient remained well and a follow-up MRI scan of the liver showed complete resolution of the hepatic abscess (**Figure 3**).

Discussion

The patient described here had no recognized immunodeficiency and no evidence of either dental or pharyngeal pathology. This apparent lack of risk factors raises questions about the true cause of the abscess.

There are several risk factors for developing pyogenic liver abscesses, including hepatobiliary disease, pancreatic disease, diverticular disease, immunocompromised status, diabetes mellitus, current malignancy, alcoholism, liver transplantation, and rheumatological disease such as rheumatoid arthritis and systemic lupus erythematosus.[2,9,12] Additionally, periodontal disease and recent dental manipulation have been recognized increasingly as risk factors for PLA.[7-9] Several pathogens may cause a pyogenic liver abscess, with *Klebsiella pneumoniae, E. coli,* and *Streptococcus* spp. being the most common in humans.[2,8] *F. nucleatum* is a relatively uncommon bacterium in this setting, and is typically found only in cases of periodontal disease.[13] A case review published in 2008 by Kajiya and colleagues identified 13 described cases of PLA due to *F. nucleatum*.[9] Since that time two more cases have been described.[8,14] Of these 15 total cases, only four patients had documented immunocompetence, and of these four only one patient had no history of dental disease, but did interestingly present with a tonsil infection.[15]

The most common site of PLA (72% of cases) is the anterior right lobe of the liver, likely because of the site's good vascular supply.[14,16] However, it is difficult to attribute a source from infection based on its location within the liver. It is known that abscesses from a hematogenous seeding mechanism typically result in multiple lesions rather than a solitary lesion.[16] Although it would be highly unlikely for a liver to have been seeded from remote bacteremic episodes, a history of multiple gram-negative bacteremic episodes may increase susceptibility to recurrent bacteremia. A case series in 1994 by Maslow and colleagues looking at recurrent *E. coli* bacteremia found that all the patients studied had "one or more identifiable defects in local or systemic host defense mechanisms."[17]

Currently, the results of history taking, physical examination, laboratory tests, and imaging studies are the mainstay for diagnosis of PLA. The clinical presentation of the patient described here is typical for pyogenic liver abscess. The main presenting symptoms and their reported frequencies are fever (73% to 100% of cases), chills (45%), right upper quadrant abdominal pain (38%), vomiting (20% to 37%), and shortness of breath (17%).[2,18] The most common laboratory abnormalities seen in PLA are elevated CRP (100%), hypoalbuminemia (96%), elevated alkaline phosphatase or gamma-glutamyl transferase (71% and 81%, respectively), and leukocytosis (69%).[2,19] Nonspecific elevations in alanine transaminase and aspartate transaminase are not uncommon,[19] even though in the case described here liver enzyme abnormalities were relatively minor. Patients typically fulfill criteria for the systemic inflammatory response syndrome at presentation in 26% of cases.[18] Although not an uncommon finding, the combination of sepsis and shortness of breath can present a diagnostic dilemma and lead to a delay in making the correct diagnosis of PLA.[2]

Blood cultures are positive in about 50% of cases, and aspirate cultures are positive in 71% of cases.[2,6,20] Negative cultures are typically the result of initiating antibiotic therapy before acquiring specimens.[6,20] In the case described here, blood was drawn for culture immediately on presentation and then antibiotics were started. Aspiration and culture of the abscess fluid, however, were not performed until the second day after presentation, likely explaining why the gram-stain and culture results were negative.

Given the nearly universally fatal clinical course of untreated PLA, prompt identification and treatment are essential.[6] Risk factors for mortality include an abscess greater than 5 cm in size, anaerobic infection, and the need for open surgical drainage.[21-23] Treatment consists of abscess drainage (via needle aspiration, percutaneous drainage, or open surgical drainage) as well as appropriately targeted antimicrobial therapy.[6] Collection of blood and other specimens before initiation of antibiotics is ideal. Extended use of antibiotics is typically required for a total treatment duration of at least 6 weeks.[24] In this case, we opted to treat with a combination of metronidazole, which is highly active against *Fusobacterium*, and a third-generation cephalosporin, which was needed because we could not rule out the possibility of a polymicrobial infection while waiting for the aspirate cultures.

Summary

To our knowledge, this is the first reported case of a cryptogenic pyogenic liver abscess due to *F. nucleatum* in an apparently immunocompetent patient with no underlying dental or oropharyngeal pathology. While the patient had no obvious quantitative deficits in immune function, further testing of her granulocyte, humoral, and complement function could be informative. Despite the cryptogenic nature of the abscess, we believe the *F. nucleatum* likely originated in the oropharyngeal cavity. But whatever the source of the bacterium, this case shows that clinicians should consider the possibility of pyogenic liver abscess when a patient presents with fever, right upper quadrant abdominal pain, and shortness of breath, particularly after more likely diagnoses have been ruled out. Once pyogenic liver abscess is diagnosed, appropriate infection source identification should include assessing for intra-abdominal infection, underlying biliary and bowel pathology, recent history of bacteremia, and periodontal health. Drainage of the abscess and appropriate antimicrobial therapy are the cornerstones of treatment, with coverage for anaerobes being an important consideration.

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Competing interests

None declared.

References

1. Huang CJ, Pitt HA, Lipsett PA, et al. Pyogenic hepatic abscess: Changing trends over 42 years. Ann Surg 1996;223:600.
2. Kaplan GG, Gregson DB, Laupland KB.

Treatment consists of abscess drainage (via needle aspiration, percutaneous drainage, or open surgical drainage) as well as appropriately targeted antimicrobial therapy.

Population-based study of the epidemiology of and the risk factors for pyogenic liver abscess. Clin Gastroentrol Hepatol 2004;2:1032.

3. Rahimian J, Wilson T, Oram V, et al. Pyogenic liver abscess: Recent trends in etiology and prognosis. Clin Infect Dis 2007; 44:1194-1201.
4. Mohsen AH, Green ST, Read RC, et al. Liver abscess in adults: Ten years experience in a UK centre. QJM 2002;95:797.
5. Wong WM, Wong BC, Hui CK, et al. Pyogenic liver abscess: Retrospective analysis of 80 cases over a 10-year period. J Gastroenterol Hepatol 2002;17:1001-1007.
6. Stroup JS, Depriest KL, Haraway GD. Fusobacterium pyogenic liver abscess. Infect Med 2007;24:79.
7. Crippin JS, Wang KK. An unrecognized etiology for pyogenic hepatic abscess in normal hosts: Dental disease. Am J Gastroenterol 1992;87:1740-1743.
8. Ohyama H, Nakasho K, Yamanegi K, et al. An unusual autopsy case of pyogenic liver abscess caused by periodontal bacteria. Jpn J Infect Dis 2009;62:381-383.
9. Kajiya T, Uemura T, Kajiya M, et al. Pyogenic liver abscess related to dental disease in an immunocompetent host. Intern Med 2008;47:675-678.
10. Bolstad AI, Jensen HB, Bakken V. Taxonomy, biology, and periodontal aspects of Fusobacterium nucleatum. Clin Microbiol Rev 1996;9:55-71.
11. Sabbaj J, Sutter VL, Finegold SM. Anaerobic pyogenic liver abscess. Ann Intern Med 1972;77:629-638.
12. Nozawa Y, Joshita S, Fukushima M, et al. A case of pyogenic liver abscess infected with Fusobacterium necrophorum depicted by microscopy and confirmed by tissue culture. Intern Med 2011;50:1815:1819.
13. Bennett KW, Eley A. Fusobacteria: New taxonomy and related diseases. J Med Microbiol 1993;39:246-254.
14. Maroun EN, Chakrabarti A, Baker M, et al. Pyogenic liver abscess due to Fusobacterium mimicking metastatic liver malignancy. Infect Dis Clin Pract 2012;20:359-361.
15. Memain N, Arvaniti K, Bruneel F, et al. Septic shock with liver abscess in an immunocompentence patient. Presentation of an unusual Fusobacterium nucleatum infection. Presse Med 2001;30:1777-1779.
16. Lei WY, Chang WH, Shih SC, et al. Pyogenic liver abscess with Prevotella species and Fusobacterium necrophorum as causative pathogens in an immunocompetent patient. J Formos Med Assoc 2009;108:253-257.
17. Maslow JN, Mulligan ME, Arbeit RD. Recurrent Escherichia coli bacteremia. J Clin Microbiol 1994;32:710.
18. Lopez-Cano Gomez M, Laguna Del Estal P, Garcia Montero P, et al. Pyogenic liver abscess: Clinical presentation and predictors of unfavorable outcome. Gastroenterol Hepatol 2012;35:229-235.
19. Pang TC, Fung T, Samra J, et al. Pyogenic liver abscess: An audit of 10 years' experience. World J Gastroenterol 2011;17: 1622-1630.
20. Chemaly RF, Hall GS, Keys TF, et al. Microbiology of liver abscesses and the predictive value of abscess gram stain and associated blood cultures. Diagn Microbiol Infect Dis 2003;46:245-248.
21. Yang CC, Yen CH, Ho MW, et al. Comparison of pyogenic liver abscess caused by non-Klebsiella pneumoniae and Klebsiella pneumoniae. J Microbiol Immunol Infect 2004;37:176-184.
22. Chen SC, Huang CC, Tsai SJ, et al. Severity of disease as main predictor for mortality in patients with pyogenic liver abscess. Am J Surg 2009;198:164-172.
23. Lok KH, Li KF, Li KK, et al. Pyogenic liver abscess: Clinical profile, microbiological characteristics, and management in a Hong Kong hospital. J Microbiol Immunol Infect 2008;41:483.
24. Donovan AJ, Yellin AE, Ralls PW. Hepatic abscess. World J Surg 1991;15:162-169.

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