



Pneumobilia: A Clinical Perspective on Interpretation and Management

Running Title: Pneumobilia in Clinical Practice

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Abstract

Pneumobilia, which is the presence of air within the bile ducts, is a radiological finding with varying clinical significance. Its interpretation should be tied to the specific clinical context. Following biliary procedures, this finding is usually benign and expected. However, it may also indicate serious underlying pathology requiring careful evaluation. Air may enter the biliary system through communication with the gastrointestinal tract, prior instrumentation, or infection with gas-forming organisms. A critical aspect of diagnostic evaluation involves differentiating pneumobilia from hepatic portal venous gas, given their varying clinical significance. Pneumobilia usually manifests centrally, adjacent to the hepatic hilum, while portal venous gas tends to be more peripheral, potentially extending towards the liver capsule. This distinction is clinically important because, in the right clinical setting, gas within the portal vein is often linked to serious abdominal pathology. In contrast, air in the bile ducts, when isolated, rarely requires immediate surgery. Ultimately, management is guided by clinical context. In stable, asymptomatic patients with clear iatrogenic causes, pneumobilia is usually expected. In contrast, unexplained findings or associated symptoms should prompt further evaluation. Recognizing these patterns helps clinicians determine when pneumobilia is benign and when it warrants closer attention.

Keywords: Pneumobilia

Introduction

Pneumobilia, or the presence of air within the biliary tree, is a radiologic finding whose significance can vary widely depending on the clinical setting. In many instances, especially after recent biliary procedures, it represents an expected and benign finding. That said, it can also reflect more serious underlying disease, so interpretation always needs to be grounded in the patient's overall presentation.¹

Air can be found in the biliary system via several mechanisms, most commonly through communication between the biliary tract and intestine, or less likely secondary to infection with gas-forming organisms. Common causes include prior biliary surgery or endoscopic interventions, spontaneous biliary enteric fistula, and sphincter of Oddi incompetence. While sphincter incompetence is most often related to prior instrumentation, rare cases have been described in association with ampullary tumors resulting in pneumobilia. In contrast, emphysematous infections or cholangitis are less frequently linked to this finding.^{1,2}

Pneumobilia must be differentiated from hepatic portal venous gas, as the two can be confused given that both present as air within the liver. These structures can be confused because the biliary tree and portal venous system run in parallel through the hepatic parenchyma. Pneumobilia usually appears centrally, with a concentration near the hepatic hilum; in contrast, portal venous gas is more peripheral, often extending towards the liver capsule in a branching pattern that can come within 2 cm of the margin.^{2,3} Computed tomography is the most sensitive imaging modality for detecting intrahepatic gas, characterizing its distribution, and distinguishing between these entities. Ultrasound with color doppler may also aid in differentiation by evaluating flow characteristics within the portal venous system, with portal venous gas moving with blood flow and pneumobilia remaining more centrally located and nonvascular. This distinction is clinically significant because portal venous gas is often linked to serious conditions such as mesenteric ischemia, particularly in the appropriate clinical context. In cases with visualized portal venous gas alongside clinical signs of mesenteric ischemia, immediate intervention may be required.²

The patient's overall presentation is what ultimately determines how concerning the finding is. In a patient who is otherwise stable and showing no symptoms after a recent biliary procedure, the presence of pneumobilia is usually expected and does not require further action. However, if there's no clear reason for the pneumobilia, or if the patient has systemic or abdominal symptoms, further evaluation is warranted.¹ Furthermore, in cases of pneumobilia where systemic symptoms or patient presentation raise concern for infection, immediate biliary drainage combined with broad spectrum antibiotic coverage (to include anaerobes) should be considered.

Consequently, management strategies should prioritize the presumed underlying etiology for pneumobilia over the imaging results in isolation. For patients who are stable and have a clearly identified cause of their condition, observation is appropriate. Conversely, unexplained pneumobilia or concurrent clinical instability necessitates further investigation, encompassing laboratory analyses and cross-sectional imaging modalities. Furthermore, when infection is a potential diagnosis, the prompt commencement of antibiotic therapy and the involvement of relevant specialists are crucial.¹ In this way, pneumobilia is best approached as a clinical sign rather than a diagnosis in itself. The significance of this information depends on how it integrates into the overall clinical picture.

Conflict of Interest

The authors declare no conflict of interest.

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