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Case report

Air where it shouldn't be! Incidental diagnosis of emphysematous cholecystitis

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Abstract
Emphysematous cholecystitis (EC) is a rare, potentially fatal variant of acute cholecystitis, caused by gas-forming organisms in the gallbladder wall. It most commonly affects elderly, diabetic, or immunocompromised patients, and can progress rapidly to perforation, sepsis, or death if not recognized early. A 71-year-old male was referred to our pulmonology department for exacerbation of chronic lung disease. Laboratory workup showed elevated C-reactive protein levels. A non-enhanced and contrast-enhanced multidetector computed tomography (MDCT) scan of the thorax revealed no acute pulmonary pathology, but proximal abdominal cuts incidentally demonstrated air inclusions within the gallbladder wall, highly suggestive of EC. The finding prompted further evaluation for anaerobic infection and consideration of urgent management. EC is typically associated with gallstones, vascular compromise, or systemic conditions such as diabetes, but may also occur in their absence. This case highlights the role of cross-sectional imaging in detecting unsuspected abdominal pathology and underlines the importance of carefully reviewing all structures visible on a scan, even when outside the primary area of interest Incidental recognition of EC can be life-saving, as timely diagnosis allows for early intervention and reduced risk of complications. For medical residents and junior clinicians, awareness of its radiologic appearance and risk factors is essential to ensure prompt, effective management.

Keywords: *acute cholecystitis, emphysematous cholecystitis, MDCT scan, anaerobic infection, abdominal pathology.*

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Introduction
Emphysematous cholecystitis (EC) is a rare but life-threatening complication of acute cholecystitis, characterized by the presence of gas-forming organisms in the gallbladder wall. Typically affecting individuals with diabetes or other immunocompromising conditions, it is an infection that requires prompt recognition and intervention to prevent severe outcomes such as gallbladder perforation or sepsis. For medical residents, especially those in their early professional years, developing a keen awareness of EC is essential. Its clinical presentation can often mimic more common conditions, which may lead to delays in diagnosis. This underscores the importance of understanding EC early in one's training. The study discussed in this editorial highlights the significance of early recognition and seeks to empower residents with the knowledge and skills necessary to address this critical condition effectively and ultimately reduce morbidity and mortality rates.

Case Report
We report an incidental finding of an emphysematous cholecystitis on a MDCT scan of thorax. This paper will discuss its case report, and pathophysiology of this medical entity.
A 71 year old male patient was referred to our clinic to the department of pulmonology for an underlying chronic lung disease and its exacerbation. On admission we were informed that the patient has elevated inflammatory markers (elevated CRP)
As its initial diagnosis J98 ICD we performed an nonenhanced and contast- enhanced CT scan of the thorax.
The MDCT scan showed no signs of acute parenchymal consolidation or nodular lesions. No signs of enlarged mediastinal lymph nodes. A 13 mm bullous formation was noted peripherally. Additionally, air inclusions were observed in the left neck region, potentially from a prior intervention. The thyroid had multiple hyperdense nodules with contrast enhancement.

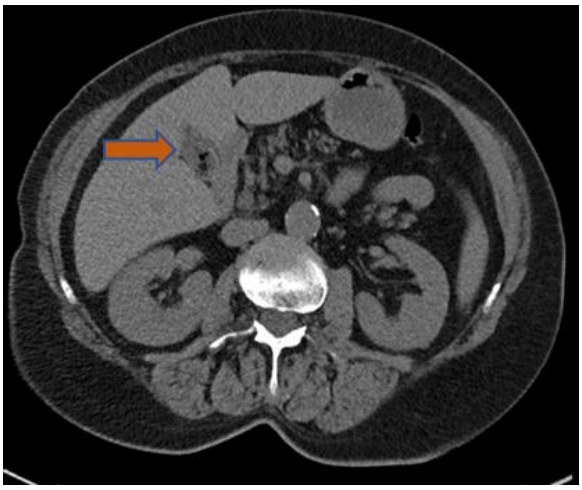

Figure 1: NECT scan axial view of proximal parts of abdomen-CT findings shows gas bubbles in the gallbladder lumen, supporting the diagnosis of emphysematous cholecystitis. (orange arrow)

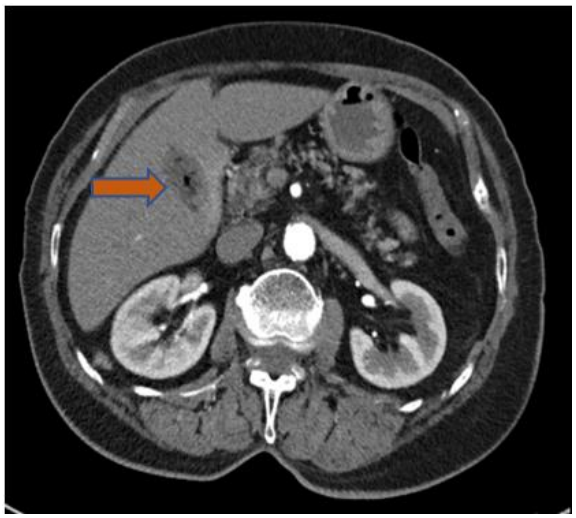

Figure 2: CECT axial scan of proximal parts of abdomen

Figure 3: CECT coronal scan demonstrates the presence of air within the gallbladder lumen, consistent with emphysematous cholecystitis.(orange arrows)

On the proximal scans of the abdomen an incidental finding was noted - Air inclusions were seen in the gallbladder suggesting anaerobic infection with differential diagnosis suggestive of emphysematous cholecystitis.

Figure 2 and Figure 3 demonstrates the presence of air within the gallbladder lumen, consistent with emphysematous cholecystitis (orange arrows).

After the initial differential diagnosis was established our radiology department refferd the case to the attending physician and the patient was brought back in for re-examination.

Discussion

Emphysematous cholecystitis (EC) is a severe form of gallbladder inflammation characterized by the presence of gas-forming bacteria, and several key pathogenetic factors contribute to its development. [1]

Vascular Compromise of the Gallbladder:

The cystic artery is often the primary blood supply to the gallbladder, and its obstruction or narrowing leads to ischemia. This ischemia makes the gallbladder more susceptible to infection and gas production by bacteria. Commonly, arteriosclerosis or embolic events can cause this vascular compromise, and it has been observed following hepatic artery embolization or gallbladder torsion. [2] This lack of blood flow allows for bacterial growth in low-oxygen environments. [3]

Cholelithiasis (Gallstones):

Gallstones are found in 40-80% of EC cases. Stones, particularly those impeding the cystic duct, can cause gallbladder wall edema, worsening vascular compromise. However, EC can also occur in the absence of gallstones (acalculous cholecystitis), suggesting that stones are not always central to the condition's pathogenesis. [4]

Acalculous cholecystitis is more frequent in immunosuppressed and diabetic patients. It often involves gangrene and necrosis, suggesting ischemia plays a role.

Biliary system contamination can occur through:

- Ascending infection from the duodenum into the bile ducts.
- Hematogenous or lymphatic spread via portal venous bacteremia or lymphatics.
- Primary intestinal disease–related spread through arterial and portal venous bacteremia, especially causing acute cholecystitis.
- Continuous bile flow from the narrow lumen usually prevents microorganisms from persisting.
- Although most cases of EC occur in the presence of gallstones, it has also been documented following endoscopic retrograde cholangiopancreatography (ERCP) in stone-free patients, suggesting that factors such as instrumentation, altered biliary dynamics, or secondary infection may play a role. [7]

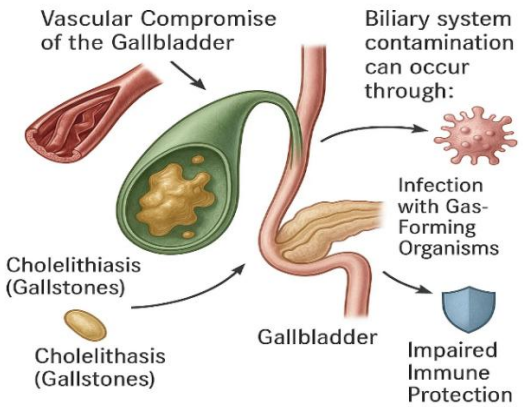

Figure 4: Basic causes of EC
Source: Image created using Sora

Impaired Immune Protection:
Many EC patients, especially those between 50-70 years of age, are diabetic. Hyperglycemia in diabetes impairs immune function, particularly macrophage activity, which reduces the body's ability to fight infections. This weakened immune response, along with older age, heightens the risk of infections, including EC. [5]
Diabetes increases susceptibility due to poor circulation, reduced gallbladder motility, impaired emptying, and a favorable low-oxygen environment for bacterial growth. Vascular and neuropathic complications from hyperglycemia, along with immune weakness, contribute to higher infection rates. [5]

Infection with Gas-Forming Organisms:
Gas-forming bacteria like Clostridium species, E. coli, and Klebsiella are frequently isolated in EC cases. While these organisms are often considered secondary invaders, they proliferate in the devascularized, oxygen-deprived gallbladder, causing significant tissue damage. Notably, Clostridium welchii is the most common clostridial species found, and its toxins, especially lecithinase-C, are highly lethal, causing tissue necrosis, shock, and systemic complications. [1]
The incidence of clostridial infections in EC is much higher than in typical acute cholecystitis, further highlighting the distinct nature of this condition. Although the precise sequence of infection remains unclear, these pathogens play a key role in the progression and severity of EC. [6] [8]

Table 1: Most common etiologic agent for emphysematous cholecystitis

Microorganism	Gram Stain / Morphology	Notes
Clostridium perfringens	Gram-positive anaerobic bacillus	Most commonly reported cause; gas production via anaerobic metabolism
Escherichia coli	Gram-negative facultative anaerobic bacillus	Common enteric pathogen; often isolated in mixed infections
Klebsiella pneumoniae	Gram-negative encapsulated bacillus	Gas-forming capacity; more frequent in diabetics
Proteus species	Gram-negative motile bacillus	Urease-positive; produces gas in tissues
Pseudomonas aeruginosa	Gram-negative aerobic bacillus	Less common; usually in immunocompromised hosts
Streptococcus pyogenes	Gram-positive cocci in chains	Can cause fulminant infection; less frequent
Staphylococcus aureus	Gram-positive cocci in clusters	Rare; more common in postoperative or immunocompromised patients

Source: [6]

Conclusion
Emphysematous cholecystitis remains a diagnostic challenge due to its nonspecific clinical presentation and rapid progression toward serious complications. This case illustrates how incidental findings on imaging performed for unrelated indications can reveal critical pathology. Vigilance in image interpretation, awareness of EC risk factors, and prompt recognition of radiologic signs are essential. Early diagnosis enables timely surgical or medical intervention, which is pivotal in reducing morbidity and mortality, especially in high-risk patient populations.

Acknowledgement
This case would not have been possible without the invaluable guidance and mentorship of my attendings, whose expertise and support were instrumental in diagnosing the case of emphysematous cholecystitis. Their willingness to engage in detailed discussions and provide insights has significantly contributed to my growth as a clinician. It is through their patient guidance that we have come to appreciate the importance of early recognition and intervention in such complex cases, a lesson we will carry forward in my practice

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