What the thickening of the gallbladder wall hides: findings in imaging studies and etiology

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Learning objectives

Knowing the pathologies that cause wall thickening of the gallbladder and its radiographic features.
Identifying the signs in the imaging studies that indicate gallbladder wall thickening.
Addressing the differential diagnosis of the wall thickening of the gallbladder based on the findings in imaging studies.
Background

It is considered that the gallbladder wall is thickened when it measures more than 3 mm. Ultrasound, CT and MRI allow direct visualization of the gallbladder wall. Ultrasound has traditionally been the initial test to assess the gallbladder wall due to its easy availability and high sensitivity to detect biliary pathology such as lithiasis. In ultrasound, the thickening of the gallbladder wall is detected as several lines of different echogenicity. In some cases, CT is the test of choice to find parietal thickening of the gallbladder, that it is sometimes seen as hypodense layer of subserosal edema, or it is used as a complementary study to ultrasound. MRI plays a little role because of its lower availability. It is important to make a good differential diagnosis because the management can vary considerably, from a benign process like adenomyomatosis to requiring surgical treatment in the case of cholecystitis.
Findings and procedure details

The thickening of the vesicular wall can occur in both primary and secondary diseases. The first group includes cholecystitis (acute, chronic, acalculous and xanthogranulomatous), carcinoma of the gallbladder and adenomyomatoses, while in the second pathologies such as liver cirrhosis, hepatitis, right heart failure, renal failure and pancreatitis among others.

Physiological thickening of the vesicular wall should not be confused with a pathological finding in patients who gallbladder is not distended. For this reason, in order to correctly assess the parietal thickening of the gallbladder it is important that the patient is fasted to distend de gallbladder.

There are numerous pathologies that can cause parietal thickening (Table 1), so it is necessary to make a differential diagnosis between them.

Primary diseases

**Acute cholecystitis** (Figures 1 and 2)

It is the first diagnosis to take into account if parietal thickening of the gallbladder wall is seen because of its high incidence. Although parietal thickening is suggestive of cholecystitis, it is important to detect other signs to support the diagnosis since it is not pathognomonic of cholecystitis. Among the signs suggestive of acute cholecystitis are:

- Obstructive biliary lithiasis.
- Gallbladder hydrops (marked distension).
- Sign of positive "Murphy ultrasound" (pain at pressure on the location of the gallbladder).
- Inflammation of the fat or presence of perivesicular fluid.
- Hyperemia of the vesicular wall seen in Doppler mode.

**Acalculous cholecystitis**

Acute acalculous cholecystitis occurs mainly in very sick patients due to an increase in the viscosity of the bile as a consequence of fasting and medication, which leads to a state of cholestasis. Ultrasonography findings are similar to those of acute gallstone cholecystitis but, as the name suggests, stones are not seen in acalculous cholecystitis, although gallbladder sludge is frequently present.
Chronic cholecystitis (Figure 3)

It is called chronic cholecystitis to mild inflammation of the gallbladder with fibrosis due to transient obstruction by a stone. The imaging findings, which are slight parietal thickening and cholelithiasis, must be accompanied by a compatible clinical history.

Xanthogranulomatous cholecystitis

Xanthogranulomatous cholecystitis is a rare variant of chronic cholecystitis characterized by an inflammatory process with lipid deposition that is comparable to xanthogranulomatous pyelonephritis. Imaging findings are a marked thickening of the gallbladder wall, which sometimes contains hypoechoic intramural nodules in ultrasound that are hypodense in CT. These nodules represent abscesses or foci of xanthogranulomatous inflammation. Occasionally, the imaging findings of this pathology are indistinguishable from gallbladder carcinoma.

Porcelain gallbladder

A porcelain gallbladder is a rare entity caused by a mural calcification due to chronic cholecystitis. In these patients, prophylactic cholecystectomy is important because of its association with gallbladder carcinoma, although this complication seems to be infrequent.

Gallbladder carcinoma

Vesicular carcinoma is the fifth most frequent cause of cancer of the gastrointestinal tract. Sometimes it is detected in advanced stages of the disease as a consequence of the lack of early and specific symptoms. In imaging tests, it can be seen from intraluminal polypoid lesions to an infiltrating mass that completely replaces the gallbladder. In addition, it can also present as a diffuse parietal thickening.

Other findings, such as the invasion of adjacent structures, secondary dilatation of the biliary ducts and hepatic metastases or metastatic adenopathies, can help in the differential diagnosis with other pathologies such as acute or xanthogranulomatous cholecystitis. In the absence of these findings, it is possible that carcinoma can not be distinguished.

Adenomyomatosis (Figure 4)

Adenomyomatosis of the gallbladder is characterized by epithelial proliferation, muscle hypertrophy and intramural diverticula, which can affect the wall of the gallbladder in a segmental or diffuse manner. It is a benign pathology that does not require specific treatment, being a relatively frequent incidental finding.
In ultrasound, cholesterol crystals present reverberating artifacts that make the diagnosis compatible when parietal thickening is present. Air causes similar artifacts, so differential diagnosis with emphysematous cholecystitis must be included (Figure 5); however, patients with emphysematous cholecystitis are quite ill and patients with adenomyomatosis are asymptomatic.

Secondary diseases

Systemic diseases such as liver cirrhosis (Figure 6), hepatitis (Figures 7 and 8), heart failure, pancreatitis or renal failure may cause parietal thickening of the gallbladder. The pathophysiological mechanism by which this occurs is unknown, but it is likely due to various factors such as portal hypertension, increased central venous pressure or decreased intravascular osmotic pressure. Other factors, such as hypoproteinemia, have also been proposed although with little scientific evidence. In liver cirrhosis, thickening of the vesicular wall is thought to be due to portal hypertension and to the decrease in intravascular osmotic pressure. In pancreatitis, parietal thickening of the gallbladder may be secondary to the direct extension of the inflammation or due to an immunological reaction.

Other entities such as hepatitis and pyelonephritis can also cause an increase in the thickness of the gallbladder wall by the same mechanism. Other causes of parietal thickening, such as infectious mononucleosis or HIV, have also been described, the latter due to the appearance of opportunistic infections or secondary neoplastic infiltration.
Table 1: Causes of thickening of the gallbladder wall.

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**Fig. 1:** Gallbladder hydrops with parietal thickening and biliary sludge and cholelithiasis.

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Fig. 2: Gallbladder hydrops with increased of parietal thickness up to 8 mm, double-walled pattern and perivesicular fluid but without cholelithiasis.

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Fig. 3: Gallbladder with cholelithiasis and slightly thickening of the wall but without increased of Doppler signal nor perivesicular inflammatory changes.

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Fig. 4: Gallbladder with several small echogenic foci in its wall that present "comet tail" artifact due to adenomyomatosis.

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Fig. 5: Distended gallbladder with thickening of the wall and intraluminal air bubble suggestive of acute emphysematous cholecystitis.

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**Fig. 6**: Gallbladder wall thickening in a patient with liver cirrhosis.

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Fig. 7: Gallbladder with intramural and perivesicular edema in a patient with hepatitis.

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Fig. 8: Parietal thickening of the gallbladder seen on CT in a patient with hepatitis B.

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Conclusion

The thickening of the gallbladder wall can be caused by numerous pathologies, including primary diseases of the gallbladder, as well as secondary pathologies usually caused by systemic diseases. The differential diagnosis is important because in some pathologies such as cholecystitis the treatment is surgical. However, the findings in imaging studies are not pathognomonic and in many cases these findings must be correlated with clinical data.
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