Original Review Article

Gallbladder wall thickening at ultrasonography - A review»

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Abstract

The aim of the present review was providing help for the assessment of the correct interpretation of gallbladder wall thickening and differential diagnosis at ultrasonography. Gallbladder wall thickening is a frequent son graphic finding and has been subject of great interest for being considered as a hallmark feature of acute cholecystitis, despite the fact that such a finding is observed in a number of other medical conditions. An appropriate characterization and interpretation of ultrasonography finding are of great importance, considering that the correct diagnosis has a direct impact on the treatment that in some cases includes surgery. In this article, describe a set of son graphic finding that is an association with the clinical and laboratory findings can reduce the number of diagnostic hypotheses allowing a more accurate establishment of the cause for gallbladder wall thickening through a rational data evaluation. Sonography is used as the initial imaging technique for evaluating patients with suspected acute calculus cholecystitis because of its high sensitivity at the detection of GB stones, real-time character, speed, and portability. Cholescintigraphy has the highest sensitivity and specificity in the patients who are suspected of having acute cholecystitis. The use of cholescintigraphy is limited in clinical practice Due to a combination of reasons including logistic drawbacks, broad imaging capability, and clinician referral pattern. CT is particularly useful for evaluating the many complicated cases of acute calculous cholecystitis. Relatively high cost of MRI and lack of widespread availability the MRI is prohibits its primary use in the patients with acute calculous cholecystitis The US are currently considered the preferred initial imaging technique for patients who are clinically suspected of having acute calculous cholecystitis.

Key words

Gallbladder, Ultrasonography, Inflammation, Neoplasm.

Introduction

For a long time finding of the thickening of gallbladder wall is a controversial topic for the sonographers being frequently found and for having been considered, this concept has been undergoing to change nowadays, this is happened due to involvement of professionals experience in the field of imaging diagnosis and the development of technologies of ultrasonography (US) apparatuses [1].

Background

Acute inflammation of the gallbladder wall is called acute cholecystitis. The underlying etiology is an obstruction in the cystic duct in many of the cases, due to an impacted stone in either the cystic duct or neck of the gallbladder (acute calculous cholecystitis). Acute cholecystitis can also develop without association with the cholelithiasis (acute acalculous cholecystitis). It is very uncommon that patients without a history of biliary symptoms, such as colic pain, develop an acute cholecystitis [2].

The different diseases that cause gallbladder walls thickening are beside acute pyelonephritis, cholecystitis, pancreatitis, diverticulitis, heart failure, and hepatitis can be mentioned [3]. Ultrasonography is the initial imaging method for the diagnostic approach and evaluation of the biliary system, as it is widely available, non-expensive, and safe [4, 5, 6].

Ultrasound may be utilized as a safe and effective method to avoid intraoperative endoscopic retrograde cholangiopancreatography (IERC) in Pre-operative (24 to 48 hours) prior to surgery [7]. Imaging provides valuable information for the following reasons:- (1) To ensure the final diagnosis, as up to 20% of patients clinically classified as having acute cholecystitis or have another disease that does not require surgery (2) To detect complications which may urge the surgical treatment and (3) To prevent the patient from complications in case of delayed diagnosis (2) we can evaluate the accuracy of ultrasonography in this paper for the diagnosis of acute calculous cholecystitis in comparison with other imaging modalities through a literature search.

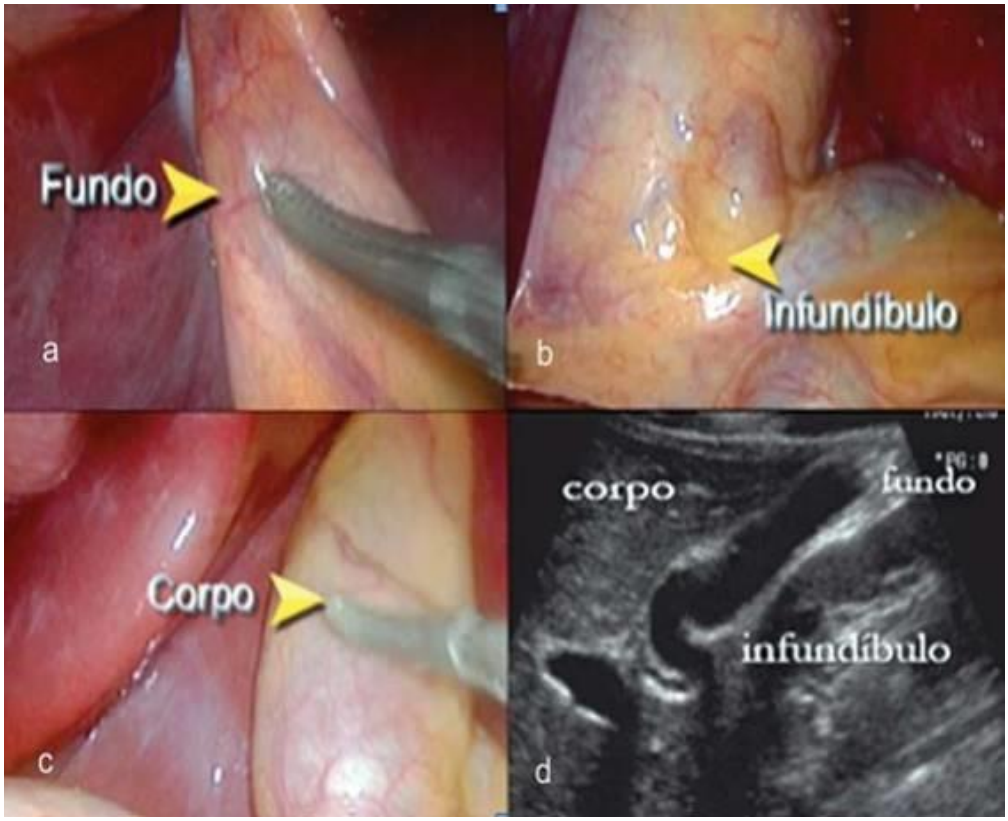
Anatomy and sonographic technique

The gallbladder is a hollow pear-shaped viscera which have thin and regular walls, located in between the IV and V segments of the liver, in the gallbladder fossa this area is devoid of the visceral peritoneum [8]. The part of the gallbladder is divided into the fundus, body, and infundibulum and its walls formed by four layers: a first layer mucosa formed by a basal lamina and simple columnar epithelium; a second layer comprising irregular muscular tissue; a third layer formed by loose connective tissue; and fourth layer formed by the serosa [9, 10, 11] function of gallbladder is to store the bile and 30 to 50 ml bile is presents in the gallbladder [6].

Gallbladder ultrasonography is routinely performed with a convex transducer. A systematic scanning should be carried out with cross-sectional views and longitudinal views of the organ, evaluating its shape, wall thickness, dimensions, regularity and texture pattern of its walls and contents, besides loco-regional and Doppler velocimetric alterations in order to acquire appropriate images [9]. Sonographic images provide a faithful representation of the gallbladder anatomical structure can be correlated with these images (**Figure – 1**). The ultrasonography is possible to identify three layers: mucosa is corresponding to the innermost, presents a regular surface, linear and echogenic, muscular layer corresponding to the second one, is thin and slightly hypoechoic, and serosa is the outermost layer corresponding to the organs, that is regular, linear and echogenic [1, 10].

According to several authors [1, 3] the upper limit of normal gallbladder wall thickness is 3 mm. the parietal thickness may exceed in patients under inappropriate fasting, such a limit because of the organs smooth muscle contraction [9]. The functional changes of the organ are the main differential diagnosis of parietal thickening, even at a re-evaluation after extended fasting one observes a persistently withered gallbladder [10].

Figure - 1: Laparoscopic anatomy (a, b, c) compared with sonographic anatomy (d) demonstrating gallbladder infundibulum, body and fundus.



The important differential diagnosis is the functional change of the gallbladder [11, 12]. The following signs can be mentioned to identify pseudo thickening, the presence of a static gallstone, increased gallbladder transverse diameter, biliary tract dilation, perivesicular fluid, perivesicular fat, hilar lymph node enlargement, heterogeneity as inflammatory, neoplastic and systemic, and their differentiation is the disease that causes gallbladder wall thickening they may be obtained by means of a combined evaluation of clinical and imaging findings.

Inflammatory causes

Acute calculous cholecystitis

This is the most common inflammatory complication that affects the gallbladder and is related to choledocholithiasis in 90– 95% of the cases. This is the fourth most common cause of acute abdomen requiring hospitalization [4]. In 95% of cases, this is caused by persistent obstruction of stones in the infundibulum or in the cystic duct. In spite of not being pathognomonic, at ultrasonography in acute calculous cholecystitis is the main cause of gallbladder wall thickening. In general, less than 7 mm thickness of the gallbladder wall, presenting trilaminar appearance and regular contour [4, 10, 12]. The echotextural appearance of the gallbladder walls may change in cases of emphysematous cholecystitis [13] (**Figure - 2**).

The sensitivity of ultrasonography ranges between 80% and 100%, and specificity ranges between 60% and 100%. The positive predictive

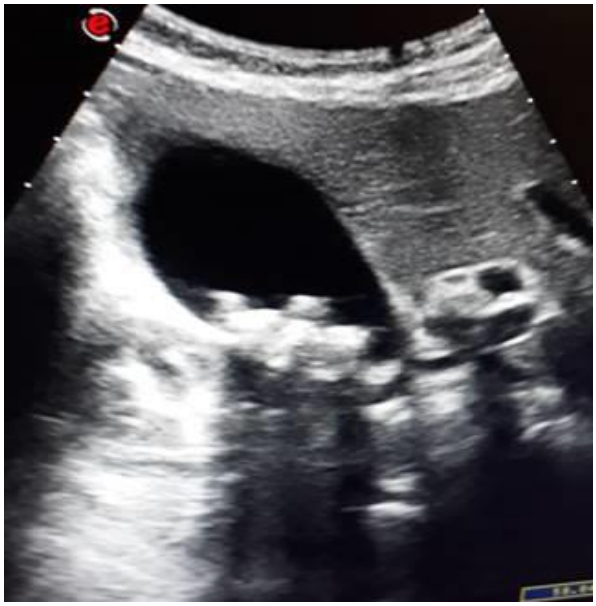
value for the identification of calculi is 88%, increasing to 92% as associated with sonographic Murphy's sign (**Figure – 3**). Gallbladder wall thickening associated with the positive Murphy's sign has a predictive value of up to 94% [12, 13]. Another rare condition that determines gallbladder wall thickening associated with Mirizzi syndrome. In this situation, an impacted gallstone located in the gallbladder neck or in the cystic duct causes dilatation of the biliary tract and causing secondary inflammation, compression of the common hepatic duct or, fibrosis on the duct wall or producing edema [12] (**Figure - 4**).

Figure - 2: Emphysematous cholecystitis. Observe echogenic parietal images of the gallbladder, with reverberation compatible with gas.

Chronic calculous cholecystitis

This is an inflammatory process of the gallbladder and causing inflammation, fibrosis and originated from a transitory gallbladder obstruction [12, 13]. Porcelain gallbladder is the rare presentation of chronic cholecystitis, the risk factor for gallbladder carcinoma represents an inflammatory process, and even an accidental finding in asymptomatic patients submitted to routine ultrasonography examinations [1, 4, 14] (**Figure - 3**).

Figure - 3: A 45-year-old Female patient with severe abdominal pain in the right hypochondrium, radiating to the scapular region. Positive sonographic Murphy's sign. Figures demonstrate tense gallbladder with thickened walls and presence of gallstones.



Acalculous cholecystitis

The affecting diabetes patients associated with poor general conditions. It is more common in hospitalized patients those undergoing mechanical ventilation and hyperalimentation therapy and in extensive burn patients, trauma victims, with a high mortality rate. Such a condition was described in 1970, in the seriously wounded soldiers during the Vietnam War [15, 16] (**Figure - 5**).

As some sonographers, acalculous cholecystitis is frequently misdiagnosed equivocally attribute to chronic acalculous cholecystitis, the secondary thickening determined by the systemic pathologies such as pyelonephritis [17] (**Figure - 6**).

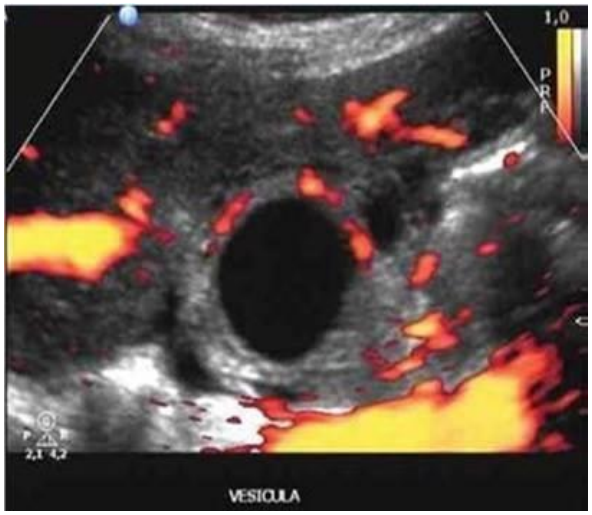
Xanthogranulomatous cholecystitis

This is an uncommon pathology, described in the early 1980's as a pseudotumor presentation of chronic calculous cholecystitis, it is secondary to bile extravasations through the gallbladder walls, and frequently they are associated with adenocarcinoma [18, 19]. At macroscopic

examination, observes a nodular thickening of the walls in association with the presence of possible locoregional infiltration and calculi. Enlarge Lymph nodes and coexistence with gallbladder cancer may also be found [4, 18, 19]. Clinically it is manifested in a clinical picture of cholecystitis in women aged from 60 to 70 years.

Figure - 4: Mirizzi syndrome. a: Oblique coronal T2-weighted sequence. b: MRI cholangiography with volume rendering. In this case, the presence of impacted gallstone in the cystic duct, causing dilatation of the biliary tract and compression of the common hepatic duct.

Figure - 5: Acalculous cholecystitis. Observe diffuse gallbladder wall thickening, with flow at color Doppler and a minor, adjacent fluid collection. All these findings are frequently observed in cholecystitis and in the present case is not associated with the presence of gallstones.



Adenomyomatosis of the gallbladder

It is characterized by excessive proliferation of the surface epithelium towards the Rokitansky-Aschoff sinuses the determination of gallbladder wall thickening that may be segmental, focal, or diffuse. It is a benign non-inflammatory condition of the gallbladder that is found in 8.7% of the cholecystectomies.[6] This is manifested with persistent pain in the right hypochondrium, and most commonly found in women and association with gallstones in 90% of the cases.

Cholesterol polyp

Focal and nodular thickening of gallbladder wall represent approximately 50% of a malignant potential all polypoid lesions and most of the times do not present [1]. The main differential diagnoses include adenoma and adenocarcinoma [1, 20]. The two-dimensional ultrasonography is not capable of differentiating small neoplastic polypoid lesions from non-neoplastic ones (**Figure - 7**). In such cases, MRI may be very useful to differentiation [21].

Porcelain gallbladder

The term porcelain is utilized because of its consistency and appearance, extensive

calcification of the gallbladder walls is an uncommon chronic cholecystitis variation characterized by affected partially or completely. Its prevalence in cholecystectomies is 0.06% to 0.8%. In 95% of cases, associated with cholelithiasis is found. This is five times more common in women than in men and is most frequently found in the fifth and sixth decades of life [8, 13]. In the porcelain gallbladder demonstrating a low incidence of coexistence of neoplasia [21, 22].

Figure - 6: Diffuse and unilateral pyelonephritis. Upper abdominal US (a) did not identify gallstones or increase in gallbladder's diameter, however the walls were thickened. At contrast-enhanced abdominal CT (b), heterogeneous nephrogram and increased volume of the right kidney are observed, leading to gallbladder wall thickening (arrow).

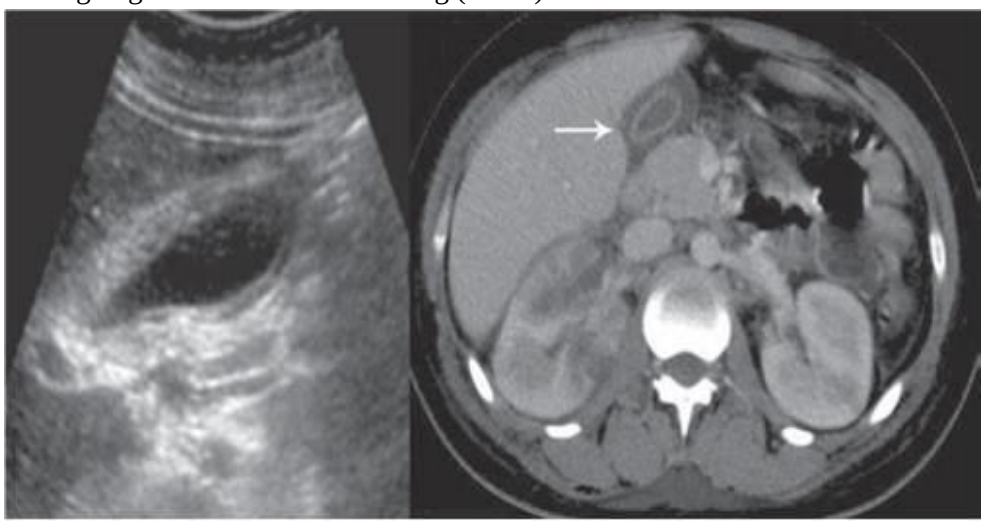
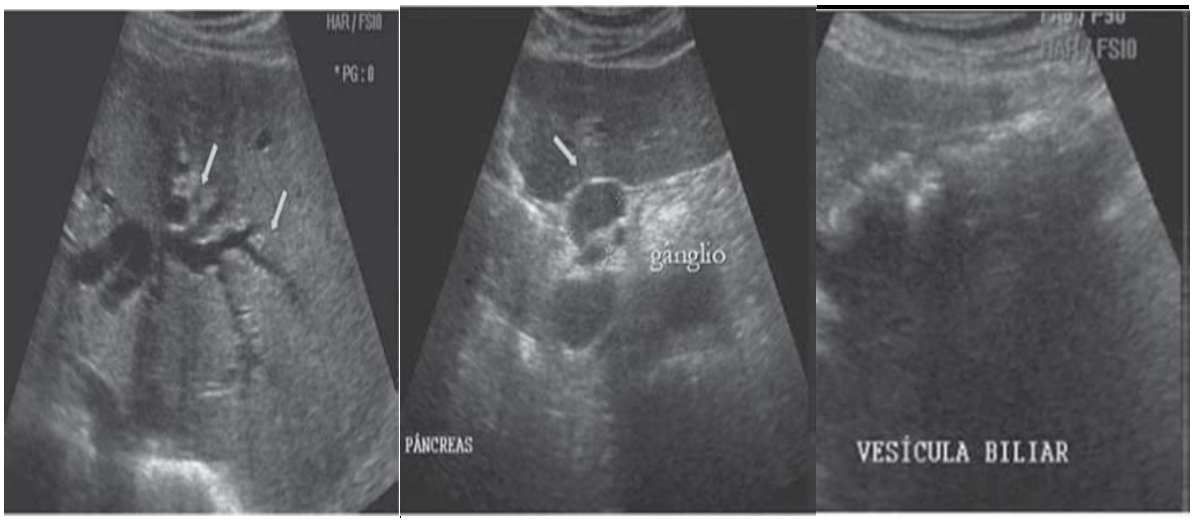


Figure - 7: Gallbladder carcinoma associated with lithiasis. Observe dilatation of intrahepatic biliary ducts (a arrows), lymph node enlargement in the hepatic hilum (b arrow) and ill-defined lesion associated with gallstones (c).



Neoplastic causes

Carcinoma of the gallbladder is the most common neoplasia of the biliary system, with 2.5 new cases per 100,000 inhabitants per year. The diagnosis in most of the times achieved at advanced stages of the disease. It has a high mortality rate, because of the scarcity of symptoms. The main differential diagnoses include complicated acute cholecystitis, metastasis to the gallbladder fossa, hepatocellular

carcinoma. Adenocarcinoma is the malignant histological type of tumor that most frequently affects the gallbladder, occurring in 90% of cases. Three image patterns generally present in the tumor: a) the mass occupying and obscuring the gallbladder bed; b) polypoid parietal lesion projecting towards its lumen c) focal or diffuse parietal thickening. Its most frequent presentation is a large solid lesion in the gallbladder fossa is associated with calculi and extending to the liver and adjacent organs (**Figure - 7**). When the focal or asymmetric wall thickening > 10 mm is found, the possibility of neoplasia is high. Computed tomography (CT) presents a characteristic enhancement pattern that is typical of lesions suspicious for malignancy [23, 24].

Metastasis to the gallbladder

Some tumors, such as carcinoid tumor, breast carcinoma, lymphoma, and sarcomas metastasis to the gallbladder; these are the possible cause of gallbladder wall thickening. Among them, the most common cause of gallbladder wall thickening is the melanoma, representing approximately 50% of cases [25].

Systemic causes

Inflammation present in the right hypochondrium that does not originate only from the gallbladder and systemic disorders it may have acute cholecystitis, this determining symmetrical and diffuse wall thickening. These changes are present by the extension of the inflammation or by the increase in the portal venous pressure associated with the decrease in the intravascular osmotic pressure, causing parietal edema. Results of clinical and laboratory tests, signs of pneumoperitoneum, inflammation of the appendix with the upper location, inflamed diverticula in the right/transverse colon, pyelonephritis signs of all these allow the definition of the anatomical diagnosis [5, 7, 24]. Based on this physiopathological examination any inflammatory process located in the right hypochondrium, such as perforated duodenal ulcer, appendicitis, pyelonephritis and acute diverticulitis, can determine gallbladder wall thickening [4, 5, 10, 11, 21, 26] (**Figure - 7**).

In the cases of viral hepatitis, gallbladder wall thickening is observed regular and diffuse [3, 18]. In the cases of acquired immune deficiency syndrome (AIDS), dengue and malaria transmitted by hepatitis induced diseases [18]. Hepatic dysfunctions such as cirrhosis, ascites, and malnutrition, cause parietal thickening secondary to hypoalbuminemia to deter in ascites [8]. In some reports suggest that gallbladder wall thickening is more frequently found in the benign diseases, while in the malignant conditions do not cause gallbladder wall thickening. The cardiac liver is a clinical condition present in the individuals presenting with right heart failure. The mechanism of the gallbladder wall thickening is physiopathologically related to increasing the intrahepatic pressure, determining edema in the second layer of the gallbladder wall associated with preservation of the hyperechogenic appearance of the mucosa [7].

Conclusion

For the study of the gallbladder, ultrasonography is one of the methods of choice, gallbladder wall thickening detection with a high sensitivity. Finding the gallbladder wall is not synonymous with acute cholecystitis. In order to avoid unnecessary cholecystectomies, the correlation with other sonographic, laboratory, epidemiological and clinical findings is of utmost importance. For patients who are clinically suspected of having acute calculous cholecystitis ultrasonography is currently considered the preferred initial imaging technique. Because of the lower costs, the majority of radiologists is preferred to the ultrasonography, its accuracy for cholecystitis for better availability after hours, and more evidence is present. Now-a-days CT is being used in the emergency setting, increasingly especially in elderly patients when they are suspected of having acute cholecystitis and abdominal pain.

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