

Original Research Article

Special Issue: Radiology

A Clinical Audit on Sonological Differential Diagnosis in Gall Bladder Wall Thickening

Dr. Sajji Mathai¹, Dr. Aji Rajan² & Dr. Naveen Sukumaran Nair³¹MD (Physician) MDRD Specialist, Department of Radiology, Al Adan Hospital, Kuwait²MBBS MD Associate Professor, Department of Radiodiagnosis, Mount Zion Medical College, Adoor, Pathanamthitta, Kerala³MBBS MD Professor, Department of Community Medicine, Mount Zion medical College, Adoor, Pathanamthitta, Kerala

HIGHLIGHTS

1. Evaluating sonographic pattern in gall bladder thickening.
2. Audit on diagnostic accuracy for gallbladder thickening.
3. Sonological findings in gallbladder wall diseases.
4. Comparing differential diagnoses in gallbladder thickening.
5. Clinical audit on gallbladder sonology interpretations.

ARTICLE INFO

Handling Editor: Dr. S. K. Singh

Key words:

Gall Bladder thickening
Cholecystitis
Pain Per Abdomen
USG, Carcinoma
BMI

ABSTRACT

Gallbladder wall thickening is a controversial topic among radiologists for being frequently found and for having been considered, for a long time, a sign highly suggestive of acute cholecystitis. Such a concept has been undergoing changes as a result of a greater experience of the professionals involved in imaging diagnosis and the considerable technological development of ultrasonography (US) apparatuses.¹ Ultrasonography is the initial imaging method for diagnostic approach and evaluation of the biliary system, as it is widely available, safe, innocuous and non-expensive.² This method allows the detailed realtime study of the gallbladder, besides the evaluation of other findings that contribute to the final diagnosis, thus avoiding unnecessary cholecystectomies and their complications [3-5] **Objective:** To enumerate the various clinical entities that may cause diffuse thickening of the gallbladder wall on Ultrasonography. **Methods:** A prospective study was conducted among 50 patients of all age and sex with right upper abdominal pain who were advised ultrasound imaging, selected through Simple Random Sampling. A predesigned, pretested, validated checklist was used to collect the required data from medical records of patients during the period of June 2011–November 2013. Association between variables were estimated with McNemar's test. **Results:** Cholecystitis was found to be the most common cause of GB wall thickening followed by Dengue Viral Infection. The maximum GB wall thickness was found to be 11mm with maximum incidence noted at 5 mm. The incidence of GB wall thickening peaked in two age groups: 40–49 and 60–69 years. **Conclusion:** As the results of the study suggest, secondary causes including type of food, BMI status of the patients, medications for other co-morbidities etc were statistically associated with mild thickening (4–7mm.) of gallbladder wall. However, primary causes like Cholecystitis, Carcinoma of the Gall bladder etc. were significantly associated with marked thickening of the gall bladder (> 7mm.), and with few causes of gall bladder growth showing (11 mm) of wall thickness. Ultrasonography is the method of choice for the study of the gallbladder, with a high sensitivity in the detection of gallbladder wall thickening.

* Corresponding author.

Dr. Sajji Mathai, MD (Physician) MDRD Specialist, Department of Radiology, Al Adan Hospital, Kuwait
Received 07 August 2024; Received in revised form 28 August 2024; Accepted 02 September 2024

© The Author(s) 2024. Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format.

INTRODUCTION

Gallbladder wall thickening is a controversial topic among radiologist for being frequently found and for having been considered, for a long time, a sign highly suggestive acute cholecystitis. Such a concept has been undergoing changes as a result of a greater experience of the professionals involved in imaging diagnosis and the considerable technological development of ultrasonography (US) apparatuses[1]. Ultrasonography is the initial imaging method for diagnostic approach and evaluation of the biliary system, as it is widely available, safe, innocuous and non-expensive[2]. This method allows the detailed realtime study of the gallbladder, besides the evaluation of other findings that contribute to the final diagnosis, thus avoiding unnecessary cholecystectomies and their complications[3-5]. Hence this study was undertaken to analyse the various clinical conditions that may be significantly associated with various stages of gall bladder thickening.

METHODS AND MATERIAL

A prospective study was conducted among 50 patients of all age and sex with right upper abdominal pain who were advised ultrasound imaging, selected through Simple Random Sampling. Patients who had complaints of Pain Per Abdomen were assessed by a Clinical surgeon and referred to the Radiology Department. Patients were ten screened for gall bladder wall thickening. According to several authors, the upper limit for normality of the gallbladder wall thickness is 3 mm[1,2]. However, in patients under inappropriate fasting, the parietal thickness may exceed such a limit because of the organ's smooth muscle contraction[8]. So, 8-hour fasting before the examination was recommended. Normal size of the gallbladder on ultrasonography is approximately 10 cm in length and 4 cm in width (depending on the amount of bile). Gallbladder wall thickening is classified as mild (between 4 and 7 mm), marked (> 7 mm), and in focal or diffuse. A predesi-

gned, pretested, validated checklist was used to collect the required data from medical records of patients during the period of June 2011 – November 2013. Patients with metabolic disorders were excluded from the study. Sample size was calculated using Cochran's formula based on a study conducted by Pandey M, Sood BP et al published in the Journal of Clinical ultrasound in the year 2000[4]. Simple Random Sampling was done to identify the participants from a total of 139 patients. Informed written consent was taken from the study participants. Cross verification of the data done from the participants through phone and email done whenever deemed necessary.

ETHICS

The Institutional Ethical Committee has reviewed and approved this study at each stage.

STATISTICS

All the data was entered into, coded and decoded in MS EXCEL. It was analyzed using SPSS versio 19.0 in which statistical significance was determined with Mc Nemar's test. A p value less than 0.05 was taken as statistically significant.

RESULTS

In total, details of 50 patients were collected. Among these, majority patients (18 in number) belonged to the age group 60-69 years and 40-49 years. 6 participants were aged less than 18 years. The mean age of peatients taken for this study is 33.05. 67.5% of the study subjects were Males and the remaining were Females. In 54% of the patients, there were no primary causes that lead to Gall Bladder wall thickening. It was only a secondary finding. However, in the remaining 46% cases, there was an identified primary cause that leads to gallbladder wall thickening. The most common causes of gallbladder thickening were Cholecystitis (30% cases), Dengue Viral Fever (16% cases) Cirrhosis of the Liver and Pancreatitis (12% cases each) etc. The mean duration of hospital stay of the patients was 10.19 days.

Table 1: Association between Category of GB wall thickening with Primary and Secondary Causes

Category	With Primary Cause		Secondary Cause	
Mild	08 (66.7%)	07 (77.8%)	20 (86.9%)	03 (50.0%)
Moderate	04 (33.3%)	02 (22.2%)	03 (13.1%)	03 (50.0%)
Total	12 (100.0%)	09 (100.0%)	23 (100.0%)	06 (100.0%)
p-value 0.001				

The maximum GB wall thickness was found to be 11mm with maximum incidence noted at 5 mm. The incidence of GB wall thickening peaked in two age groups : 40-49 and 60-69 years. Most of the gallbladder wall thicknesses measured were greater

in men (72%) than in women (28%). Most of the patients presented with symptoms of vomiting , right upper quadrant abdominal pain or non specific pain and fever. However some of the cases were asymptomatic.

Table 2: Gall Bladder Wall Thickening Associated with Age & Gender

Category	Age(years)		Gender	
	<18	>18	Female	Male
Mild	02 (33.3%)	36 (81.8%)	24 (70.6%)	14 (87.5%)
Moderate	04 (66.7%%)	08 (18.2)%	10 (29.4%)	02 (12.5%)
Total	06 (100.0%)	44 (100.0%)	34 (100.0%)	16 (100.0%)
Age p-value 0.001 <0.05 Sex value =.0331				

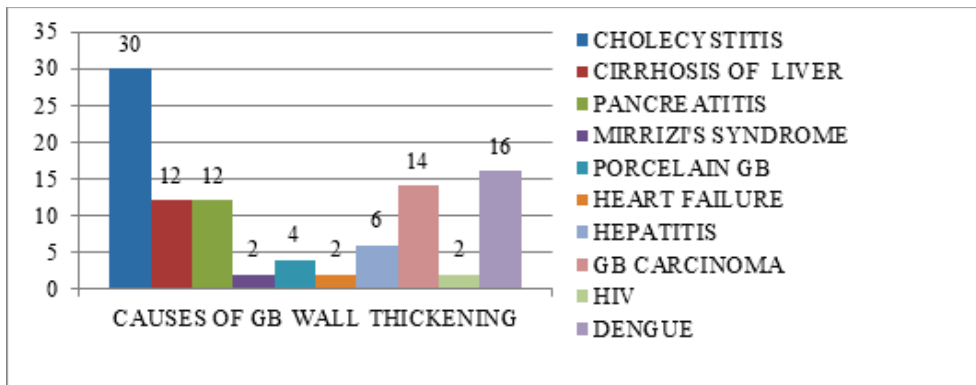


Figure 1: % Incidence of Various Causes of Gallbladder Wall Thickening (Multiple Responses Recorded)

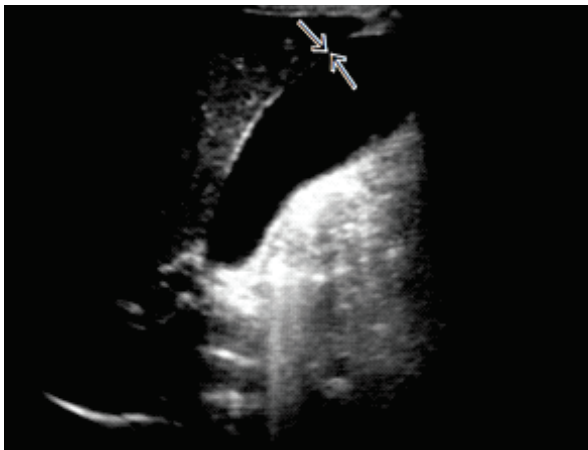


Figure 2: Longitudinal USI mage Showing Site of Measurement of Gallbladder wall Thickness (Arrows)

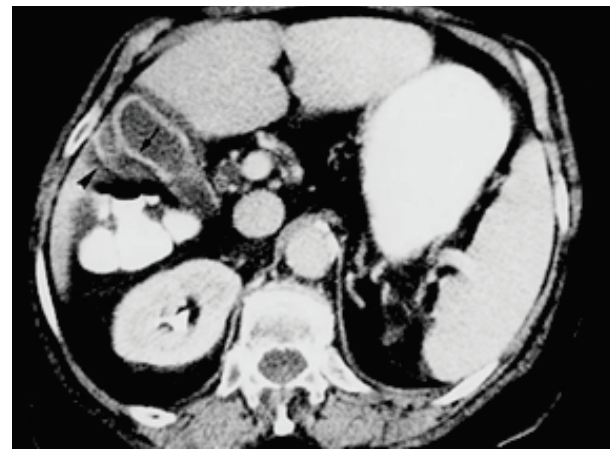


Figure 3: Contrast enhanced CT Shows a "Sandwich-Like" Thickening of the Gallbladder Wall,

DISCUSSION

In this study, age of the study subjects ranged from 10-89years. The age group of 40-49 years and 60-69 years had the maximum representation (36%) and the age group of 10-19 and 80-89 years had the least representation (10%). It was observed that in this study that 36 (72%) of patients were males and 14 (28%) of patients were females. In this study, it was observed that in the current clinical setting of a patient with nonspecific abdominal complaints or symptoms of biliary obstruction, the discovery of a gallbladder or bile duct polyp or mass, gallbladder wall thickening, or biliary stricture is most often indicative of malignancy (14% cases). Pandey M, Sood BP et al J Clin ultrasound 2000;28:227-32 did a study in an attempt to define the sonographic characteristics of gallbladder cancer, their retrospectively analyzed the sonographic findings in 203

cases of gallbladder cancer confirmed by cytology or histopathology. The results of the study was that a mass in the gallbladder and gallbladder wall thickening (> 12 mm) were cardinal sonographic findings of carcinoma. Ching BH, Yeh BM et al AJR Am J Roentgenol 2007;189:62-6 conducted a study on CT differentiation of adenomyomatosis and gallbladder cancer. The results of this study where that Reviewer 1 detected a morphologic gallbladder abnormality in 17 patients and correctly characterized the abnormality in 14 (82%) of the patients (eight with adenomyomatosis and six with gallbladder cancer). Reviewer 2 detected an abnormality in 18 patients and was correct for 13 (72%) of the patients (eight with adenomyomatosis and five with gallbladder cancer). In our study, the most common causes of gall Bladder thickening were Cholecystitis (30% cases), Dengue Viral Fever (16% cases)

Cirrhosis of the Liver and Pancreatitis (12% cases each) etc.

A study was conducted Mirvis S E, Vainright J R the results of which revealed that when several imaging procedures were performed over a 6-year period on 56 patients with clinically suspected acute acalculous cholecystitis were evaluated retrospectively, Sonography and CT were both found to be highly sensitive (92% and 100%, respectively) and specific (96% and 100%, respectively). A study was conducted by Parra JA, Acinas O et al to evaluate the sonographic and CT features of Xanthogranulomatous cholecystitis, correlating the pathologic and surgical findings. Xanthogranulomatous cholecystitis was pathologically diagnosed in 26 patients from January 1996 to August 1998.

Approximately 64% of the patients presenting with pancreatitis evolve with gallbladder wall thickening secondary to extension of the inflammatory process towards locoregional structures [3-5]. Cases of transinfection by hepatitis include diseases such as acquired immune deficiency syndrome (AIDS), dengue and malaria. In patients with AIDS, such finding may be secondary to the utilization of antiretroviral drugs, worsened nutritional status and opportunistic infections of the biliary tract [41].

CONCLUSION

- The most common causes of gall Bladder thickening were Cholecystitis, Dengue Viral Fever, Cirrhosis of the Liver and Pancreatitis.
- Ultrasonography is the method of choice for the study of the gallbladder, with a high sensitivity in the detection of gallbladder wall thickening.

ACKNOWLEDGEMENTS

The authors acknowledge the efforts of all health care providers of A. J. Institute of Medical Sciences and the study participants in the successful completion of this study. We also submit that this study has not received any funds or aids from any external agencies or individuals.

SOURCES OF FUNDING – Nil

REFERENCES

1. Levy AD, Murakata LA, Abbott RM, et al. From the archives of the AFIP: Benign tumors and tumorlike lesions of the gallbladder and extrahepatic bile ducts: radiologic-pathologic correlation. *Radiographics*. 2002;22:387–413.
2. Wibbenmeyer LA, Sharafuddin MJ, Wolverson MK, et al. Sonographic diagnosis of unsuspected gallbladder cancer: imaging findings in comparison with benign gallbladder conditions. *AJR Am J Roentgenol*. 1995;165:1169–74.
3. Spence SC, Teichgraaber D, Chandrasekhar C. Emergent right upper quadrant sonography. *J Ultrasound Med*. 2009;28:479–96.
4. Patriquin HB, Di Pietro M, Barber FE, et al. Sonography of thickened gallbladder wall: causes in children. *AJR Am J Roentgenol*. 1983;141:57–60.
5. Rosenthal SJ, Cox GG, Wetzel LH, et al. Pitfalls and differential diagnosis in biliary sonography. *Radiographics*. 1990;10:285–311.
6. Watanabe Y, Nagayama M, Okumura A, et al. MR imaging of acute biliary disorders. *Radiographics*. 2007;27:477–95.
7. Van Breda Vriesman AC, Engelbrecht MR, Smithuis RH, et al. Diffuse gallbladder wall thickening: differential diagnosis. *AJR Am J Roentgenol*. 2007;188:495–501.
8. AIUM practice guideline for the performance of an ultrasound examination of the abdomen and/ or retroperitoneum. *J Ultrasound Med*. 2008;27:319–26.
9. Hong HS, Han JK, Kim TK, et al. Ultrasonographic evaluation of the gallbladder: comparison of fundamental, tissue harmonic, and pulse inversion harmonic imaging. *J Ultrasound Med*. 2001;20:35–41.
10. Feldman MK, Katyal S, Blackwood MS. US artifacts. *Radiographics*. 2009;29:1179–89.
11. Herbener TE. The gallbladder and biliary tract. In: Haaga JR, Lanzieri CF, Sartoris DJ, Zerhouni EA, editors. *Computed Tomography and Magnetic Resonance Imaging of Whole Body*, Edn 3, Vol. 2. St Louis, MO: Mosby, 1994:978–1036.
12. Onofrio A, Catalano, Dushyant V, Sahant et al : MR imaging of the gall bladder.
13. Teefey SA, Baron RL, Bigler SA. Sonography of the gallbladder: significance of striated (layered) thickening of the gallbladder wall. *AJR Am J Roentgenol* 1991;156:945–7.
14. Kalloo AN, Kantsevov SV. Gallstones and biliary disease. *Prim Care* 2001;28:591606.
15. Bree RL. Further observations on the usefulness of the sonographic Murphy sign in the evaluation of suspected acute cholecystitis. *J Clin Ultrasound* 1995;23:169–72.
16. Park MS, Yu JS, Kim YH, et al. Acute cholecystitis: comparison of MR cholangiography and US. *Radiology* 1998;209:781–785.
17. Regan F, Schaefer DC, Smith DP, Petronis JD, Bohlman ME, Magnuson TH. The diagnostic utility of HASTE MRI in the evaluation of acute cholecystitis. Half-Fourier acquisition single-shot turbo SE. *J Comput Assist Tomogr* 1998;22:638–642.
18. Ward EM, Fulcher AS, Pereles FS, Gore RM. Neoplasms of the gallbladder and biliary tract. In: Gore RM, Levine MS, editors. *Textbook of gastrointestinal radiology*. 2nd edition. Philadelphia: WB Saunders; 2000. p. 1360–74.
19. Orth K, Berger HG. Gallbladder carcinoma and surgical treatment. *Arch Surg* 2000;385:501–8.
20. Pandey M, Sood BP, Shukla RC, et al. Carcinoma of the gallbladder: role of sonography in diagnosis and staging. *J Clin Ultrasound* 2000;28:227–32.
21. Soyer P, Gouhiri M, Boudiaf M, et al. Carcinoma of the gallbladder: imaging features with surgical correlation. *AJR Am J Roentgenol* 1997;169:781–5.
22. Memel DS, Balfe DS, Semelka RC. The biliary tract. In: Lee JKT, Sagel SS, Stanley RJ, Heiken JP, editors. *Computed body tomography with MRI correlation*. 3rd edition. Philadelphia: Lippincott; 1998. p. 779–803.
23. Onoyama H, Yamamoto M, Takada M, et al. Diagnostic imaging of early gallbladder cancers: retrospective study of

- 53 cases. *World J Surg* 1999;23:708–12.
24. Levy AD, Murakata LA, Rohrmawm CA. Gallbladder carcinoma: radiologic-pathologic correlation. *Radiographics* 2001;21:295–314.
 25. Yamashita K, Jin MJ, Hirose Y, et al. CT finding of transient focal increased attenuation of the liver adja- R.M. Gore et al / *Radiol Clin N Am* 40 (2002) 1307–1323 1321 cent to the gallbladder in acute cholecystitis. *AJR Am J Roentgen* 1995;164:341–6.
 26. Yoshimitsu K, Honda H, Jimi M, et al. MR diagnosis of adenomyomatosis of the gallbladder and differentiation from gallbladder carcinoma: importance of showing Rokitansky-Aschoff sinuses. *AJR Am J Roentgenol* 1999; 172:1535–40.
 27. Fidler J, Paulson EK, Layfield L. CT evaluation of acute cholecystitis: findings and usefulness in diagnosis. *AJR Am J Roentgen* 1996;166:1085–8.
 28. Wilbur AC, Sagireddy PB, Aizenstein RI. Carcinoma of the gallbladder: color Doppler ultrasound and CT findings. *Abdom Imaging* 1997;22:187–9.
 29. Mainprize KS, Gould SW, Gilbert JM. Surgical management of polypoid lesions of the gallbladder. *Br J Surg* 2000;87:414–7.
 30. Veno N, Tomiyama T, Tano S, et al. Diagnosis of gallbladder carcinoma with color Doppler ultrasonography. *Am J Gastroenterol* 1996;91:1647–9.
 31. Yamada K, Yamada H. Gallbladder wall thickening in mononucleosis syndromes. *J Clin Ultrasound* 2001; 29:322–325.
 32. Regan F, Schaefer DC, Smith DP, et al. The diagnostic utility of HASTE MRI in the evaluation of acute cholecystitis. Half-Fourier acquisition single-shot turbo SE. *J Comput Assist Tomogr* 1998;22:638–42.
 33. Haradome H, Ichikawa T, Sou H et-al. The pearl necklace sign: an imaging sign of adenomyomatosis of the gallbladder at MR cholangiopancreatography. *Radiology*. 2003;227(1): 80-8
 34. JC Balaguera et al “ISPUB - Diffuse Adenomyomatosis Of The Gallbladder: An Infrequent Disease With Difficult Preoperative Diagnosis
 35. Ching BH, Yeh BM, Westphalen AC et-al. CT differentiation of adenomyomatosis and g allbladder cancer. *AJR Am J Roentgenol*. 2007;189(1): 62-6.
 36. Boscak AR, Al-hawary M, Ramsburgh SR. Best cases from the AFIP: Adenomyomatosis of the gallbladder. *Radiographics*. 26(3): 941-6.
 37. Zissin R, Osadchy A, Shapiro-Feinberg M, et al. CT of a thickened-wall gall bladder. *Br J Radiol*. 2003;76:137–43.
 38. Yun EJ, Cho SG, Park S, et al. Gallbladder carcinoma and chronic cholecystitis: differentiation with two-phase spiral CT. *Abdom Imaging*. 2004;29:102–8.
 39. Martel JP, McLean CA, Rankin RN. Melanoma of the gallbladder. *Radiographics*. 2009;29:291–6.
 40. Hanbidge AE, Buckler PM, O'Malley ME, et al. From the RSNA refresher courses: imaging evaluation for acute pain in the right upper quadrant. *Radiographics*. 2004;24:1117–35.
 41. Parra JA, Acinas O, Bueno J, et al. Xanthogranulomatous cholecystitis: clinical, sonographic, and CT findings in 26 patients. *AJR Am J Roentgenol*. 2000;174:979–83.
 42. Langman's Medical Embryology-Twelfth edition.
 43. Gray's Anatomy 40th edition.
 44. Smith EA, Dillman JR, Elsayes KM, et al. Cross-sectional imaging of acute and chronic gallbladder inflammatory disease. *AJR Am J Roentgenol*. 2009;192:188–96.
 45. Paulson EK. Acute cholecystitis: CT findings. *Semin Ultrasound CT MR* 2000;21:56–6
 46. Fidler J, Paulson EK, Layfield L. CT evaluation of acute cholecystitis: findings and usefulness in diagnosis. *AJR Am J Roentgen* 1996;166:1085–8.
 47. Alterman DD, Hochszstein JG. Computed tomography in acute cholecystitis. *Emer Radiol* 1996;26:25–9.
 48. Mirvis SE, Vainright JR, Nelson AW, et al. The diagnosis of acute acalculous cholecystitis: a comparison of sonography, scintigraphy, and CT. *AJR Am J Roentgen* 1986;147:1171–5.
 49. Hakansson K, Leander P, Ekberg O, et al. MR imaging in clinically suspected acute cholecystitis. A comparison with ultrasonography. *Acta Radiol* 2000;44:32–8.
 50. Regan F, Schaefer DC, Smith DP, et al. The diagnostic utility of HASTE MRI in the evaluation of acute cholecystitis. Half-Fourier acquisition single-shot turbo SE. *J Comput Assist Tomogr* 1998;22:638–42.
 51. Sudhamshu KC Kathmandu University Medical Journal (2006), Vol. 4, No. 4, Issue 16, 415-418
 52. Keng-Liang Wu, MD, Chi-Sin Changchien, MD, Chung-Huang Kuo, MD, Kaohsiung Chang Gung Memorial Hospital, 123, Ta-Pei Road, Niao Sung Hsiang, Kaohsiung Hsien, Taiwan .