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Original Research Article

Gallbladder Wall Vascularity on Doppler Imaging as a Marker of Surgical Difficulty

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Abstract:

Introduction: Thick wall gallbladder (TWGB) is a frequent observation on ultrasonography, particularly in areas with a high incidence of gallstone disease. The preoperative differentiation between benign and malignant causes of TWGB is crucial, as the surgical interventions vary significantly. Despite extensive investigation using numerous imaging modalities, a clear diagnosis cannot often be achieved. Imaging, especially ultrasonography (USG), is extensively utilized in assessing gallbladder disorders, with gallbladder wall thickness (GBWT) recognized as a possible indicator of underlying malignancy.

Aim: To investigate the prognostic significance of gallbladder wall thickness in distinguishing benign from malignant gallbladder conditions and to analyze its association with histological results.

Methods: A retrospective observational study was conducted at Shri shankaracharya institute of medical science over a period of 12 months. Patients undergoing cholecystectomy for suspected gallbladder pathology were included. Preoperative ultrasonographic assessment of gallbladder wall thickness was documented. Based on USG findings, patients were stratified into normal (10 mm) categories. The diagnostic accuracy of GBWT was calculated, and associations with demographic and clinicopathological variables were analysed.

Results: A total of 100 patients were studied, with a mean age of 45 years; females constituted 65%. Among them, 45 cases were benign (chronic cholecystitis), while 18 were malignant. 14 pateints with garde 3 undergoes difficult surgery, out of which 6 patients underwent conversion to open surgery, all of whom exhibited Grade 2 or Grade 3 vascularity.

Conclusion: The thickness of the gallbladder wall observed via ultrasound is a straightforward, economical, and non-invasive indicator that significantly correlates with gallbladder cancer. It may function as a crucial instrument for early detection, especially in high-risk demographics.

Keywords: Gallbladder vascularity, Doppler ultrasonography, Laparoscopic cholecystectomy, Surgical difficulty, Cholecystitis.

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Introduction

Laparoscopic cholecystectomy is the definitive treatment for symptomatic gallstone disease. Despite the technique being routinely executed, a subset of patients encounters considerable intraoperative challenges, extended operating duration, heightened blood loss, or necessitation of conversion to open surgery [1]. Anticipating surgical complexity prior to the procedure presents a clinical challenge and is crucial for operative planning, patient consultation, and the distribution of surgical proficiency [2].

Inflammation of the gallbladder wall, especially in acute and chronic cholecystitis, results in hyperemia and enhanced vascularity [3]. Color Doppler ultrasonography is a non-invasive, readily accessible imaging technique capable of identifying gallbladder wall thickness and alterations in vascular flow [4]. Elevated vascularity of the gallbladder wall may indicate the extent of inflammation and fibrosis, possibly associated with surgical complexity [5]. This study sought to assess gallbladder wall vascularity via Doppler imaging as an indicator of surgical complexity during laparoscopic cholecystectomy.

Methods

Study Design and Setting: This retrospective observational study was carried out in the Shri shankaracharya institute of medical science over a duration of 12 months.

Study Population: 100 patients with symptomatic gallstone disease, scheduled for either elective or

emergency laparoscopic cholecystectomy, were enrolled.

Inclusion Criteria

- Patients aged ≥18 years
- Ultrasonographic diagnosis of cholelithiasis or cholecystitis
- Patients undergoing laparoscopic cholecystectomy

Exclusion Criteria

- Suspected gallbladder malignancy
- Previous upper abdominal surgery
- Severe cardiopulmonary comorbidities precluding laparoscopy
- Pregnant patients

Doppler Ultrasonography Assessment: Preoperative ultrasonography utilizing color Doppler was conducted within 72 hours preceding the surgery. The thickness and vascularity of the gallbladder wall were evaluated. The vascularity of the gallbladder wall was classified as:

- Grade 0: No detectable vascularity
- Grade 1: Mild vascularity
- Grade 2: Moderate vascularity
- Grade 3: Marked vascularity

Assessment of Surgical Difficulty

Intraoperative surgical difficulties were evaluated using established criteria, which included:

- Operative time >90 minutes
- Dense adhesions in Calot's triangle
- Excessive bleeding (>100 mL)
- Difficulty in identifying critical view of safety
- Conversion to open surgery

Cases fulfilling ≥2 criteria were classified as "difficult cholecystectomy."

Statistical Analysis: The data were examined utilizing descriptive statistics. The Chi-square test was employed to evaluate the association between Doppler vascularity grade and surgical difficulties. A p-value of less than 0.05 was deemed statistically significant.

Results

Baseline Characteristics: Of the 100 patients, 65 (65%) were female and 35 (35%) were male. The average age was 45.0 ± 12.3 years.

Table 1: Baseline Clinical Characteristics

Variable	Value
Mean age (years)	45.0 ± 12.3
Female: Male	1.8: 1
Acute cholecystitis	30 (30%)
Chronic cholecystitis	45 (45%)

Gallbladder Wall Vascularity

Table 2: Distribution of Gallbladder Wall Vascularity Grades

Vascularity Grade	Number (n=100)	Percentage (%)
Grade 0	30	30
Grade 1	32	32
Grade 2	20	20
Grade 3	18	18

Correlation Between Vascularity and Surgical Difficulty: Difficult cholecystectomy was encountered in 34 patients (28.3%). The occurrence of surgical complications escalated markedly with elevated Doppler vascularity classifications.

Table 3: Association of Gallbladder Wall Vascularity with Surgical Difficulty

Vascularity Grade	Difficult Surgery (n)	Easy Surgery (n)	p-value
Grade 0	2	34	<0.001
Grade 1	8	30	<0.001
Grade 2	12	16	<0.001
Grade 3	14	6	<0.001

6 patients underwent conversion to open surgery, all of whom exhibited Grade 2 or Grade 3 vascularity.

Discussion

This study illustrates a significant correlation between heightened gallbladder wall vascularity observed via Doppler imaging and the complexity of laparoscopic cholecystectomy. Patients exhibiting moderate to significant vascularity were more prone

to develop dense adhesions, endure extended operative durations, and necessitate conversion to open surgery.

Enhanced vascularity indicates active inflammation and neovascularization in the gallbladder wall, typically observed in acute cholecystitis and advanced chronic inflammation [6]. These pathological alterations confuse anatomy and elevate the danger of hemorrhage, complicating dissection inside Calot's triangle [7].

Our results endorse the utilization of Doppler ultrasonography as a supplementary tool to traditional grayscale imaging in preoperative assessment. The integration of vascularity grading may assist surgeons in anticipating challenging cases, organizing proficient surgical teams, and providing suitable patient counsel [8].

Limitations

The study failed to investigate inter observer variability in Doppler evaluation and did not incorporate long-term postoperative outcomes.

Conclusion

Gallbladder wall vascularity evaluated via color Doppler imaging Doppler ultrasonography serves as a crucial preoperative indicator of surgical complexity in laparoscopic cholecystectomy. Elevated vascularity grades correlate with heightened surgical difficulties and conversion rates. Regular evaluation of gallbladder wall vascularity may improve preoperative risk assessment and surgical readiness.

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