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CORRESPONDING AUTHOR:

Bhupendra Charan Shrestha
Lecturer,
Department of General Surgery
Birat Medical College Teaching Hospital, Nepal.
Email: bcshrestha2016@gmail.com
ORCID: https://orcid.org/0000-0002-0400-0636

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Laparoscopic Cholecystectomy in Patients with Wall-Echo-Shadow (WES) Complex in Ultrasonography: A Prospective Cross-sectional Study

Bhupendra Charan Shrestha[1], Milan Adhikari[2], Aliza Timsina[2], Sanjay Kumar Yadav[3], Narendra Pandit[4]

[1] Lecturer, Department of General Surgery
[2] Medical Officer, Department of Anaesthesiology and Critical care
[3] Assistant Professor, Department of General Surgery
[4] Professor, Department of Surgical Gastroenterology

ABSTRACT

Introduction: Cholelithiasis, a common gastrointestinal disorder, significantly impacts healthcare and quality of life. Laparoscopic cholecystectomy (LC) is the preferred treatment, but the significance of WES Complex on gallbladder ultrasound remains unclear.

Objective: To study surgical outcomes, intraoperative details, and complications in LC patients with WES complex.

Methodology: A hospital based prospective cross-sectional study was conducted in the Department of Surgery at Birat Medical College Teaching Hospital between March 2023 to November 2023. All consecutive patients with WES complex on ultrasound and planned for laparoscopic cholecystectomy were included. Data was collected on patient demographics, duration of symptoms, intraoperative findings, state of gallbladder, ability of achieve critical view of safety, open conversion and postoperative complications. A non-WES complex group in the ratio of 1:2 was consecutively enrolled for the comparison of outcome using Nassar intraoperative difficulty score.

Results: Among 382 symptomatic gallstone diseases patients undergoing elective LC, 16 patients (4%) had wall echo complexes confirmed on ultrasonography. Eleven (68%) patients had contracted gallbladder intraoperatively. One patient (6%) required conversion to open cholecystectomy. One patient (6%) had major complications. Despite there being higher Nassar score grade III in non-WES group, it did not increase the conversion or complications. The histopathological reports in all patients were negative for malignancy and were consistent with chronic calculous Cholecystitis.

Conclusion: WES complex although being an uncommon entity suggestive of chronic gallbladder condition, does not possess difficulty in LC.

INTRODUCTION

Cholelithiasis is a common gastrointestinal disorder affecting millions of individuals worldwide, with a substantial impact on healthcare resources and quality of life.[1] LC has become the gold standard for the treatment of symptomatic gallstone disease due to its minimally invasive nature and favorable outcomes.[2] Ultrasonography is the cornerstone of gallstone diagnosis, enabling the visualization of gallstones and the assessment of gallbladder wall abnormalities. In routine clinical practice, ultrasonography often reveals a wide spectrum of gallbladder wall abnormalities, including the intriguing and enigmatic "Wall-Echo-Shadow" (WES) complex.[3] The WES complex (or double-arc shadow), characterized by its thickened gallbladder wall closely followed by a hyperechoic line and shadowing distal to it due to stones, has been the subject of importance in treating the patients. It is a rare finding observed in only 5% of cases.[4]

While it has been associated with various pathological conditions, such as chronic cholecystitis, Xanthogranulomatous cholecystitis (XGC), emphysematous cholecystitis and porcelain gallbladder its clinical significance in the context of LC remains

uncertain.[4,5]This uncertainty has led to varying clinical practices, with some surgeons proceeding with LC in the presence of WES complex, while others opting for alternative strategies, including open cholecystectomy.

Due to the limited research literature on this topic, there is no consensus on what the best possible practices could be, its surgical difficulty and consequences. Given the lack of consensus regarding the significance of WES in ultrasonography and its potential impact on the outcomes of LC, this study seeks to address this important knowledge gap. We aim to investigate the clinical outcomes, intraoperative findings and postoperative complications of patients with WES complex who underwent LC.

METHODOLOGY

A hospital based prospective cross-sectional study was conducted in the Department of General Surgery, Birat Medical College Teaching Hospital among all symptomatic gallstone patients admitted for elective LC during March 2023 to November 2023. Our center is a tertiary care referral center with department of general surgery performing all elective and emergency laparoscopic procedures.[6] Patients diagnosed with symptomatic cholelithiasis with confirmed WES complex on ultrasonography findings undergoing elective cholecystectomy were included for the study. Patients unfit for surgery (ASA III and above) and suspected for malignancy were excluded from the study. All patients during the study period were included through total enumeration sampling. The study was approved by the Institutional Review Committee (IRC-PA-253/2023) and informed consent was obtained from each patient. The ultrasonography was performed by the senior radiologists and was re-confirmed by a second radiologists. WES complex was defined by the presence of large gallstone/stones within the collapsed gallbladder wall; thin hypoechoic layer of bile and posterior acoustic shadow creating a double-arc appearance (Figure 1).

Fig 1: Transabdominal ultrasound showing wall, echo and distal shadow (arrow) due to stone.

The demographic data on patient's age, sex, diagnosis, body mass index (BMI), duration of symptoms, operative findings like-state of the gallbladder (distention or contracted), critical view of safety achieved or not, operating time, open conversion were recorded. The postoperative outcomes like morbidities, bile leak and gallbladder histopathology findings were also recorded.

All patients primarily underwent LC for WES complex conditions. It was performed by the experienced surgical team (performed > 500 cases) and executed by the standard 4-port technique. After creation of the pneumoperitoneum, the state of the gallbladder (normal distention, contracted) was observed. The calot's triangle was dissected to achieve a satisfactory (anterior and posterior) critical view of safety. Any difficulties leading to conversion to open cholecystectomy were recorded. The gallbladder specimens were sent for histopathology examination.

Any postoperative complications if occurred, were observed till 30-days postoperatively at follow-up visit. Patients were discharged on the second postoperative day with no complications.

We also conducted a comparative study by including a control group of patients without WES complex in the ratio of 1:2 to compare the intraoperative and postoperative outcomes. The Nassar intraoperative difficulty score was used to compare the intraoperative difficulty between the WES and non-WES complex groups.[7]

The Nassar difficulty grading scale was published in 1995 and graded operative findings from the gallbladder, cystic pedicle and associated adhesions.[7] The scale is as follows:

Grade 1:

Gallbladder—floppy, non-adherent

Cystic pedicle—thin and clear

Adhesions—Simple up to the neck/Hartmann's pouch

Grade 2:

Gallbladder—Mucocele, Packed with stones

Cystic pedicle—Fat laden

Adhesions—Simple up to the body

Grade 3:

Gallbladder— Acute cholecystitis, deep fossa, Contracted, Hartmans pouch adhered to CBD, Impaction, fibrosed

Cystic pedicle—Abnormal anatomy or cystic duct—short, dilated or obscured

Adhesions—Dense up to fundus; Involving duodenum or hepatic flexure

Grade 4:

Gallbladder—completely obscured, Empyema, Gangrene, Mass

Cystic pedicle—Impossible to clarify

Adhesions—Dense, fibrosis, gallbladder is wrapped up, hepatic

flexure or duodenum challenging to separate

The grading system is used for an overall summary of the intra-operative status found. The worst factor found in the individual aspect of either the 'gall bladder', 'cystic pedicle' or 'adhesions' should be used to find out the final grade.

The collected data was entered in a Microsoft excel sheet, checked for completeness and descriptive statistics (frequency, mean, median and percentage) where appropriate were used. SPSS 17.0 was used for the statistical analysis. To compare the two groups, we applied t-test or Mann-Whitney U test for continuous or categorical variables where appropriate P value less than 0.05 was considered significant.

RESULTS

A total of 382 consecutive symptomatic gallstone diseases patients underwent elective laparoscopic cholecystectomy during the study period, out of which 16 patients (4.18%) had WES complex. The mean age of the patients with WES complex was 49.5 years (range: 26 to 70 years). The study group comprised ten female (62.5%) and six (37.5%) male patients. The average Body Mass Index (BMI) of patients was 23.46 kg/m2 (range-17.5-30). The mean duration of symptoms in WES group was 16 months (range: 4-24 months). Abdominal pain was observed in 10 patients, while six patients had non-specific symptoms of fatty food intolerance. None had jaundice, concomitant bile duct stones or prior hospitalization of acute gallbladder conditions (Table 1). On comparison between the two groups, there were higher number of female patients, and the duration of symptoms was significantly shorter in the non-WES group. Similarly, there were higher number of patients with acute gallbladder disease requiring emergency cholecystectomy in the non-WES group as shown in Table 1.

Table 1: Clinical Characteristics of patients with and without WES complex

Parameters		WES group (n=16)	Non-WES group (n=32)	P value
Age in years (Mean ± SD)		49.5±18.7	38.2±20.2	0.06
Gender	Male, n (%)	10 (63%)	15 (46.87%)	0.03
	Female, n (%)	6 (37%)	17 (53.12%)	
Duration of Symptoms in months (Mean ± SD)		16±5.3	2.1±1.4	0.02
Body mass index (BMI) in kg/m^2 (Mean ± SD)		23.4±5.8	21.3±3.4	0.8
Abdominal pain, n (%)		10 (63%)	28 (87.5 %)	0.76
Acute Calculous Cholecystitis, n (%)		0	8 (25%)	0.01

Out of 16 patients, normal distention of the gallbladder was seen in five (31%) patients, while in 11 (69%) patients it was contracted as suggested by WES appearance on ultrasound. In a normal distention, one gallbladder was completely wrapped and suspended in a mesentery (Figure 2).

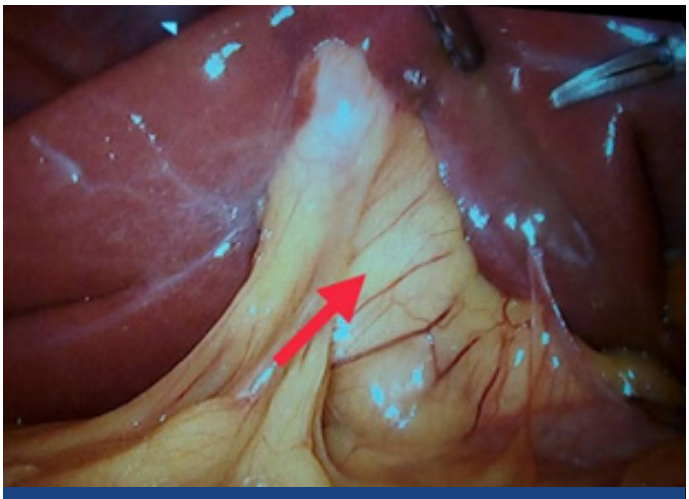

Fig 2: Laparoscopic view of WES complex gallbladder (arrow) wrapped in the thick mesentery.

The critical view of safety (CVS) was achieved in all, except one patient (Figure 3).

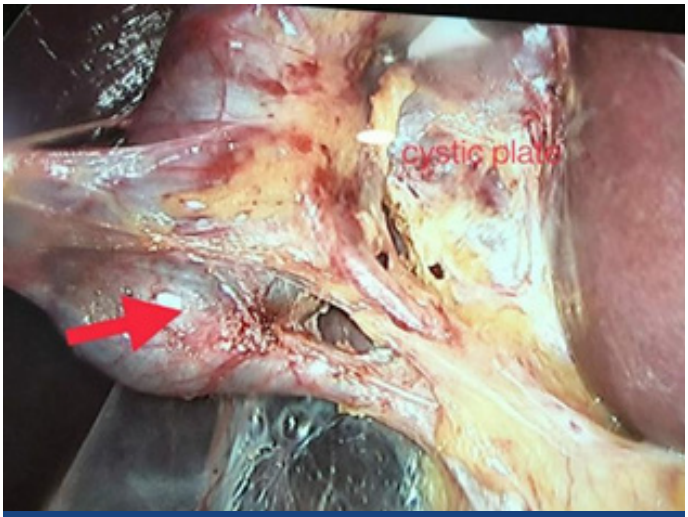

Fig 3: Exposed cystic duct and artery after dissection of the calot's triangle (arrow).

None of the patients had intraoperative bleeding. The mean operating time was 48 minutes (range- 36-90 minutes). Only one male patient (6%) required conversion to open cholecystectomy, as critical view of safety was not achieved due to the contracted gallbladder. The same patient underwent endoscopic retrograde cholangiopancreatography (ERCP) for bile duct stone prior to LC (Table 2).

Table 2: Intraoperative details of Operative difficulty based on Nassar score of the two groups.

Operative findings		WES group (n=16)	Non-WES group (n=32)	P value
Aspiration of gallbladder, n (%)		2 (12.5%)	6 (18.7%)	0.09
Gallbladder difficult to grasp, n (%)		3 (18.7%)	7 (21.8%)	0.06
Gallbladder difficult to grasp because of packed stones, n (%)		10 (62.5%)	5 (15.6%)	0.07
Calot's dissection	Frozen, n (%)	1 (6.25%)	2 (6.2%)	0.052
	Not difficult, n (%)	15 (93%)	25 (78%)	
Spillage of stones, n (%)		1 (6.25%)	14 (43.7%)	0.04
Abdominal drain, n (%)		2 (12.5%)	6 (18.7%)	0.4
Nassar operative Grade	I, n (%)	12 (75%)	20 (62.5%)	0.007
	II, n (%)	3 (18.7%)	4 (12.5%)	
	III, n (%)	1 (6.25%)	8 (25%)	
	IV, n (%)	0	0	
Conversion to open cholecystectomy, n (%)		1 (6.25%)	2 (6.2%)	0.07
Operative time in minutes (Mean ± SD)		48±16.2	42±19.1	0.8

The postoperative course in these patients were satisfactory and all patients were discharged on the second postoperative day. One female had retained cystic duct stone and choledocholithiasis at 30th postoperative day follow-up. She underwent ERCP, common bile duct stone extraction and stenting, and completion open cholecystectomy at seven weeks. Remaining all other patients had a normal postoperative period without any complications.

On comparison of the two groups based on the Nassar score, there were significantly more spillage of stones and higher operative grade in the non-WES complex group compared to the WES group. The remaining factors were comparable between the two groups as shown in Table 2. The histopathological reports of gallbladder in all patients were negative for malignancy and were consistent with chronic calculous cholecystitis. There was no intraoperative bleeding, bile leak/duct injury or operative mortality in the entire group.

DISCUSSION

The present study showed that 16 (4.18%) of our patients exhibited wall echo shadow complexes on ultrasonography and this finding did not increase the technical difficulty and postoperative complications following LC compared to the non-WES group as shown by the Nassar intraoperative difficulty score. Fifteen patients with WES complex undergoing elective LC had an uneventful and successful operative outcome in our study. One patient developed retained cystic duct stone and its consequences, which may be attributed due to WES complex, and is inherited in modern LC due to the current practice of avoiding identification of cystic duct and bile duct junction. Retained cystic duct stone is observed in 2-16% of cases following LC and is a mature decision thus avoiding major bile duct injury.[8] WES complex is formed because either the gallbladder is packed with multiple stones leaving no room for bile or a large stone.[9,10] The above patient had multiple packed stones in the gallbladder leading to retained stone in the cystic duct stump. We suggest careful milking and clipping of the cystic duct to avoid this late complication.

Contrary to our finding, a study done from New Delhi, India had significantly higher prevalence of WES triad, observed in 50 patients.[4] They also reported that the majority 20 (40%) had contracted gallbladder followed by adhesions 10 (20%), and a single large calculus in neck 8 (16%) as an intraoperative finding.[4] Compared to them, our patients had significantly more (68%) contracted gallbladder, with 31% normally distended. In our study, one patient (6%) required conversion from laparoscopic to open cholecystectomy, as critical view of safety was not achieved. This conversion was non-significant compared to the non-WES group. A similar percentage of conversion was observed in another similar study, which explained four (8%) patients had to undergo conversion to open cholecystectomy due to obscure anatomy in calot's triangle.[4] This suggests that the presence of WES does not necessarily translate into technically challenging or complicated surgeries. However, it is essential to acknowledge that some cases did require conversion, often due to unexpected intraoperative findings. These findings reinforce the importance of careful preoperative planning and informed consent discussions with patients regarding the potential for conversion. In LC, the current benchmark for open conversion is 5% depending upon the centers.[11]

Similar to our study, the histopathological report of gallbladder had no major findings and were consistent with previously identified findings.[4] The presence of WES on ultrasonography has raised concerns among surgeons due to the suspicion of underlying gallbladder pathology like malignancy, XGC or porcelain gallbladder.[5,10-12] Our study confirmed that a substantial proportion of these cases may not exhibit significant or worrisome pathology upon histopathological examination of gallbladder.[13]

CONCLUSION

The WES complex in ultrasonography is an uncommon entity observed in less than 5% of cases with symptomatic gallstone disease. Though most of the gallbladder is contracted, suggesting chronicity, safe LC with satisfactory achievement of

critical view of safety is possible, with no increased operating time, open conversion and morbidity. However, larger sample size and multi-institutional involvement is required to replicate the finding.

Recommendation: Laparoscopic surgery is feasible in symptomatic and chronic gallstone disease with WES complex.

LIMITATION OF STUDY

Sample size is limited, and this is single center observational study. Future prospective studies with larger cohorts and longer follow-up periods could provide more robust insights into the outcomes of LC in patients with WES complex.

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CONFLICTS OF INTEREST None.

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