

## ORIGINAL ARTICLE

**Diagnostic Accuracy of Contrast-Enhanced Computed Tomography (CECT) and Ultrasonography (USG) in Diagnosing Carcinoma Gallbladder keeping Histopathology the Gold Standard**

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**ABSTRACT**

**Objective:** To evaluate the comparative role of ultrasonography and contrast-enhanced computed tomography in diagnosis of carcinoma gallbladder. Early experience at a hepatobiliary unit in a tertiary care hospital

**Study Design:** Cross sectional study.

**Place and Duration of Study:** The study was carried out at the Hepatobiliary Unit of the Pak Emirates Military Hospital, Rawalpindi from July 2021 to June 2022.

**Materials and Methods:** USG and CECT scans were used to assess the diagnostic accuracy of Carcinoma Gallbladder. 30 patients, with an average age of 54 years, were part of this study. Patients were included in the study based on radiological findings pertinent to gallbladder cancer which include gallbladder fossa mass replacing gallbladder, focal/intraluminal/polypoidal gallbladder growth and asymmetrical/diffuse thickness of gallbladder. All resected specimens were sent for histological investigation after the operation, histopathology serving as the Gold standard.

**Results:** On USG and CECT examination, 13.3% of the gallbladders were contracted and reduced in size, while 70% were large and distended. CECT has a sensitivity and specificity of 96% and 80%, respectively, in identifying GB carcinoma. USG scan had a sensitivity and specificity of 92% and 60%. There was a test of agreement is excellent (Kappa value 0.819) between the two techniques, indicating that the two diagnostic modalities are nearly equivalent in terms of diagnosing carcinoma Gallbladder.

**Conclusion:** The study findings indicate that both USG and CECT scans are ideal, non-invasive, safe imaging modalities for diagnosing gallbladder carcinoma. CECT scan has an additional advantage in defining the extension of the disease and involvement of surrounding structures including lymph nodes and hepato-duodenal ligament.

**Keywords:** Contrast Enhanced Computed Tomography (CECT), Carcinoma Gallbladder, Ultrasonography (USG), Diagnostic Accuracy.

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**Introduction**

Carcinoma gallbladder is a debilitating disease due to late diagnosis and high mortality. It is the commonest carcinoma of the biliary tree<sup>1,2</sup> and stands on the 5th

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position in commonly reported malignancies of the gastrointestinal tract. It occurs most commonly in the 6th decade of life having female predominance of 4 to 5 times than male.<sup>2,3</sup> Gallbladder malignancy presents vague symptoms such as abdominal pain, jaundice, pruritus, anorexia, and weight loss. This leads to the role of ultrasonography and contrast-enhanced computed tomography in pointing towards the gross pathology of gallbladder carcinoma. It includes mass in gallbladder fossa replacing gallbladder, focal/intraluminal/polypoid gallbladder growth and asymmetrical/diffuse thickness of gallbladder. Although percutaneous ultrasonography is the first diagnostic modality

advised, contrast-enhanced computed tomography has some advantages in evaluation of direct extension to contiguous structures e.g. liver, duodenum, hepatic flexure of the colon; regional adenomegalies and distant metastases giving resection outline for the malignancy. In this study, the findings of percutaneous ultrasonography and contrast-enhanced computed tomography were followed up by postoperative histopathological evidence of carcinoma gallbladder.

**Operational Definition**

Carcinoma Gallbladder: Histopathological evidence of a malignant tumor of the epithelial lining of gallbladder.

**Materials and Methods**

**Demographic, symptoms and histopathological analysis**

Radiological findings including gallbladder fossa mass replacing gallbladder, focal/intraluminal/polypoidal gallbladder growth and asymmetrical/diffuse thickness of gallbladder on percutaneous ultrasonography and contrast enhanced computed tomography, then diagnosed on histopathology as carcinoma gallbladder or cholecystitis.

Radiological findings not consistent with gallbladder fossa mass replacing gallbladder, focal/intraluminal/polypoidal gallbladder growth and asymmetrical/diffuse thickness of gallbladder on percutaneous ultrasonography and contrast enhanced computed tomography.

Over the course of 1 year from July 2021 till Jun 2022, this cross-sectional comparative study was undertaken in the Hepatobiliary Unit of the Pak Emirates Military Hospital, Rawalpindi. Because this is an uncommon condition, convenient non-randomized sampling was used. Based on suspicion of carcinoma gallbladder as picked by ultrasonography and CECT scan, a total of 30 patients consisting of 53.3% of male and 46.7% female with mean age 54.9±12.9 were included. These 30 patients had atleast one of the radiological imaging finding or both on CECT scan and USG, as they underwent both radiological modalities. Moreover, these two radiological modalities are used to evaluate carcinoma extension, and operability. Upon histopathology analysis 25 cases were confirmed as gallbladder carcinoma and 5 cases were diagnosed

as cholecystitis. Statistical analysis was carried out using the SPSS (Statistical Package for Social Sciences) version 26 software.

**Results**

Most of the patients were in their fifth to sixth decades of life, with an average age of 54. Males made up 53.3 percent of the study participants, while females made up 46.9%. (16 males and 14 females). (See Table 1) Pain was the most common complaint (83.3%), followed by anorexia (63.3%), and finally jaundice (30%). (Table 1). On histopathology analysis five patients (16.7 %) had well differentiated adenocarcinoma, 17 had moderately differentiated adenocarcinoma (56.7%), three had poorly differentiated adenocarcinoma (10 %), and five (16.7 %) had chronic cholecystitis. The most prevalent symptom among the patients was pain (both upper and lower abdomen pain).

**Table 1: Distribution of patients by Demographic, symptoms and histopathological characteristics (n=30)**

<b>Demography</b>	
Age (Mean ± SD )	54.9 ± 12.96
Male	53.3 % (16)
Gender % (n)Female	46.7 % (14)
<b>Symptoms % (n)</b>	
Pain abdomen	83.3% (25)
Jaundice	30 % (9)
Anorexia	63.3% (19)
<b>Histopathological Diagnosis % (n)</b>	
Well differentiated adenocarcinoma GB	16.7% (5)
Moderately differentiated adenocarcinoma GB	56.7% (17)
Poorly differentiated adenocarcinoma GB	10% (3)
Chronic cholecystitis	16.7% (5)

**Radiological profile of gallbladder using Ultrasound and CECT scan**

On USG, gallstones were found in 50% of the cases. According to the contrast enhanced computed Tomography (CECT) scan, 13.3% of the gallbladder scanned were contracted and reduced in size, while 70% were large and distended. Involvement of the hepatic parenchyma was seen in 50% as direct invasion and in 20% as metastases. In 36.7% of cases enlarged lymph nodes were seen. In CECT the margin of the gallbladder was found to be well delineated in 50% of cases and poorly delineated in 25% of cases. (Table 2).

**Table 2: Assessment of hepatobiliary system by CECT scan (n=30)**

Radiological Profile of Gall Bladder on CECT Scan	
<b>Gall bladder size</b>	<b>% (n)</b>
Normal	16.7 % (5)
Contracted	13.3 % (4)
Large	70 % (21)
<b>Bile ducts</b>	<b>% (n)</b>
Dilated	46.7 % (14)
Not dilated	53.3 % (16)
<b>Extent of Disease</b>	<b>% (n)</b>
Direct invasion of hepatic parenchyma	50% (15)
Hepatic parenchyma not involved	50% (15)
Metastasis	20 % (6)
Presence of enlarged lymph nodes	36.7 % (11)
<b>Margin of gallbladder</b>	<b>% (n)</b>
Well delineated	50 % (12)
Poorly delineated	25 % (6)
Not delineated	25 % (6)

**Comparison of gallbladder findings between CECT and USG**

When diagnosed with USG, gallbladder fossa mass replacing gallbladder was detected 46.7% of the time, and in CECT it was diagnosed 43.3% of the time. Polypoidal gall bladder growth was discovered by USG in 26.7% of cases and by CECT in 16.7% of cases. USG revealed a diffuse wall thickness in 26.7% cases, while CECT detected diffuse wall thickness in 40%. (Table 3).

**Table 3: Comparative findings of Gallbladder at USG and CECT Scan (n=30)**

	Comparison of Gall Bladder Findings	
	USG% (n)	CECT % (n)
Gallbladder fossa mass replacing gallbladder	46.7% (14)	43.3% (13)
Focal/intraluminal/polypoidal gallbladder growth	26.7% (8)	16.7% (5)
Asymmetrical/diffuse thickness of gallbladder	26.7% (8)	40% (12)

**Accuracy of USG and CECT scan in the diagnosis of carcinoma gallbladder**

The accuracy of both radiological investigations in correctly diagnosing carcinoma gallbladder was carried out using SPSS 26. The sensitivity of the CECT scan in distinguishing gallbladder carcinoma from inflammatory lesions was 24/25×100=96%, while the test's specificity in accurately distinguishing individuals who did not have the disease was

4/5×100=80%. The test has 96% positive predictive value and 80% negative predictive value, with a positive result being carcinoma and a negative result being cholecystitis. Similarly, USG had a sensitivity of 92% in distinguishing gallbladder cancer from an inflammatory lesion, and a specificity of 60% in ruling out individuals who did not have the disease. The test has a positive predictive value of 92% and a negative predictive value of 83.3%, respectively. The study demonstrated an excellent agreement between the two techniques owing to Kappa value of 0.819 in correctly diagnosing carcinoma gallbladder, implying that the two diagnostic modalities are almost equal in terms of effectiveness. (Table 4).

**Table 4: Accuracy of abdominal USG and CECT in diagnosing carcinoma Gallbladder**

		Histopathology	
		Carcinoma (n= 25)	Cholecystitis (n = 5)
CT Scan	Positive Report	24 (TP) a	1 (FP) b
	Carcinoma (25)		
	Negative Report	1 (FN) c	4 (TN) d
	Cholecystitis (5)		
CT Scan Sensitivity = 24/25 x 100 = 96 %			
CT Scan Specificity = 4/5 x 100 = 80%			
USG	Positive Report	23 (TP) a	2 (FP) b
	Carcinoma (25)		
	Negative Report	2 (FN) c	3 (TN) d
	Cholecystitis (5)		
USG Sensitivity = 23/25 x 100 = 92%			
USG Specificity = 3/5 x 100 = 60%			
TP = True Poitive, TN = True Negative			
FP = False Positive, FN = False Negative			

**Discussion**

Gallbladder cancer was once thought to be a rare disease. However, reports in the last few decades have revealed that it is not as uncommon as previously stated, instead it is the most common malignant tumor in the biliary tract. Because there are no distinct signs and symptoms of carcinoma gallbladder, early detection is difficult. With recent advancements in hepatobiliary imaging modalities, effective preoperative identification, and evaluation of the extent of gallbladder carcinoma has become increasingly promising. Because the clinical features are so perplexing, these contemporary imaging methods can be very helpful in determining the disease's diagnosis.

The majority of the actualized outcomes in this study were comparable to other studies. The patients in this study were on average 54 years old. In both genders, the incidence is either equal or close. There

are 16 males and 14 female in this group of study.<sup>4,5</sup> The polypoid lesions being one of the presentation of CA gallbladder, it can affect people of any age, they are more common in people over the age of 40 as documented by Hietz et al.<sup>5</sup> Pain was the most common presenting symptom among the patients in this study (83.3%), followed by anorexia (63.3%) and jaundice (63.3%). Jha V et al<sup>6</sup> and Z.Zhang et al<sup>7</sup> found comparable presentations, with upper abdominal pain being the most prevalent symptom, followed by jaundice and weight loss. Similarly, Singh et al<sup>8</sup> found upper abdominal pain (81%). Tairo et al<sup>9</sup> explored pain (96.7%), followed by nausea (87.5%) and vomiting (65.0%) whereas Paktar et al<sup>10</sup> studied abdominal pain (80.7%), jaundice (8.1%), and non-specific symptoms (5.5%) including dyspepsia, weight loss, loss of appetite, and fever.

Gallbladder polyps are described differently depending on their histology. 16.7% were highly differentiated, 56% were moderately differentiated, and 10% were poorly differentiated. For carcinoma Gallbladder, the WHO has established a three-stage grading system (well, moderately, and poorly differentiated), which takes into account architectural and cytological alterations.<sup>11,12</sup> Well-differentiated carcinomas are papillary carcinomas that might be difficult to tell apart from gallbladder polyps.

In terms of gallbladder mass echotexture, Levy et colleagues discovered a heterogeneous echotexture of gallbladder mass reflecting various degrees of tumor necrosis. Coexisting gallstones may be linked to echogenic foci and acoustic shadowing associated with the tumor.<sup>13</sup>

On CECT scans, hepatic parenchyma invasion was found to be 50% in the current study. This is in line with Ramchandaran et al<sup>14</sup> which indicated hepatic parenchyma involvement in 65% of patients. Ultrasonography is reliable in the identification of primary gallbladder mass, according to Bach et al.<sup>15</sup> However, sonographic findings do not accurately reflect the whole amount of disease, and ultrasonography has limitation in the diagnosis of liver, lymph node, and peritoneal invasion. The tumor's slight spread beyond the gallbladder's wall and into the surrounding tissues and lymph nodes is more easily seen on a CECT scan.

According to Courtney & Townsend<sup>16</sup>, the sensitivity

of ultrasonography in detecting gallbladder cancer ranges from 50 to 100 percent. The diagnostic accuracy of CECT as a diagnostic modality in the evaluation of gallbladder carcinoma was found to be 95%, which compares favorably to Kumaran et al<sup>17</sup> who found CECT to be 93.3% accurate in the diagnosis of gallbladder carcinoma. Previous studies<sup>18,19</sup> however, indicated a poor sensitivity of CECT scan in the diagnosis of gallbladder carcinoma (ranging from 69% to 80%), suggesting that previous CECT technologies were less sensitive to diagnose gallbladder carcinoma than current ones. Infact, CECT scans is of greater value in the evaluation of extent of involvement of surrounding structures and thus determining its respectability. However, as the study was carried out in limited time period, a larger study spanning over years is needed to confirm the findings of the current study.

## Conclusion

Both USG and CECT scan are helpful imaging modalities for identification of carcinoma gallbladder as supported by histological evidence. CECT scan has some specific advantages over USG in terms of detecting tumor extension and involvement of nearby tissues like lymph nodes and the hepatoduodenal ligament as well as determining resectability.

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