



Radiodiagnosis

EVALUATION OF USE OF COMPUTED TOMOGRAPHY IMAGING TO ASSESS THE ACCURACY IN THE DETECTION OF SPREAD AND STAGING OF GALLBLADDER CARCINOMA

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ABSTRACT

Aims & objectives:- 1) To evaluate the use of computed tomography imaging to assess the accuracy in the detection of spread and staging of gallbladder carcinoma.

2) To evaluate if CT findings influenced the management and treatment planning in patients with ca gall bladder.

Materials and Methods:- This is a prospective conducted at Tertiary care centre, from July 2017 to November 2018 involving 40 patients, in whom mass lesion is seen USG & FNAC/ Biopsy proves it to be a case of carcinoma Gall bladder. Equipment used during study was-Siemens Dual slice Helical Somatom Emotion Duo CT scanner using multidetector CT with two slice spiral CT scanner, Somatom, Siemens (Germany)

Result :-

- 1) The CT imaging is fairly accurate in the detection of spread and staging of gallbladder carcinoma .can evaluate the loco regional spread in a case of gall bladder malignancies with the use of spiral CT
- 2) CT imaging can help in determining respectability and in planning the treatment, especially in advanced-stage gallbladder carcinoma, because of a high positive predictive value.

KEYWORDS : Gall bladder carcinoma, Hepatic invasion.

Introduction

Gallbladder carcinoma is the fifth most common gastrointestinal malignancy and the most common biliary tract malignancy. Typically patient has advanced stage of the cancer at the time of presentation, leading to poor prognosis. This is because of absence of a sub mucosal layer in the gallbladder, so carcinoma can more easily invade the muscular layer and the structures beyond. Clinical detection at early stages of gallbladder carcinoma is not possible due to vague clinical presentation. Preoperative imaging for tumor detection and staging is essential to triage patients to appropriate care. Recent technologic developments in sonography and CT have increased the chances of detecting smaller lesions. In recent years, radical procedure with en bloc dissection is done, so an accurate preoperative assessment of the extent of disease is essential.

This study tries to evaluate preoperatively the extent of tumor spread and a staging accuracy of CT imaging. Advanced gallbladder carcinoma is managed with curative resection, which includes resection of segments IVb and V or even an extended right hepatectomy. For confined gallbladder carcinoma, simple cholecystectomy / extended cholecystectomy (wedge resection of the gallbladder fossa including a 3- to 5-cm margin of a normal liver and a cystic,pericholedochal, gastro hepatic, pancreatico duodenal,and paraaortic lymphadenectomy) to be a curative resection . The 5-year survival rate after a curative resection is more than 50% compared with only 5% after a non curative resection.

Aim & objectives:

- 1) To evaluate the use of computed tomography imaging to assess the accuracy in the detection of spread and staging of gallbladder carcinoma.
- 2) To evaluate if CT findings influenced the management and treatment planning in patients with ca gall bladder.

Material and Methods:

This prospective Hospital based study of evaluation of gall bladder mass using multidetector CT was carried out in the department of Radio diagnosis in a tertiary care institute. The study included 40 patients. In all these patients, some abnormality of the gallbladder was initially found on sonography, Equipment used during study was-Siemens Dual slice Helical Somatom Emotion Duo CT scanner. All included patients were evaluated with detailed clinical history, physical examination and laboratory investigations where needed. All patients went through CT scanner with proper scanning technique and post processing image analysis. Oral contrast used was negative contrast like water or diluted mannitol. The axial and volume-rendered

images were prospectively evaluated on workstation with the consensus of two radiologists. The morphology of the tumor, vascularity, loco-regional spread, and distant spread were studied. The respectability of the tumor was also determined. Involvement of main portal vein or hepatic artery; involvement of the portal vein or hepatic artery branches of both lobes of the liver; simultaneous involvement of the ipsilateral hepatic artery and contralateral portal vein; simultaneous invasion in both lobes of the liver at the level of confluence of segmental bile ducts to form the hepatic ducts; contiguous involvement of more than two segments each in both lobes of the liver; contiguous extensive infiltration of the colon, duodenum, or pancreas; the presence of hepatic metastases; and the presence of peritoneal metastases was considered as the criteria for non respectability. Regional lymph node metastasis was not a criterion for non respectability. The criterion for vascular invasion was irregularity of the vessel wall or the presence of a tumor on both sides of the vessel. Loss of fat planes between adjacent organs such as the duodenum, colon, pancreas, and bile ducts was considered a sign of infiltration of these organs by the tumor. A meticulous follow up of all patients kept during study period. Histopathological confirmation was done where needed with all data entry into pre designed proforma.

For tumor staging, the TNM classification developed by American Joint Committee of Cancer in 2010 was used. T1 means the tumour has started to grow into the wall of the gallbladder. T2 means the cancer is still contained in the gallbladder but has grown through the main muscle layer of the wall into the connective tissue underneath. T3 means the invasion of liver or one other nearby organ such as the stomach, bowel or pancreas. T4 means the cancer has grown into one of the main blood vessels into the liver (the hepatic portal vein or hepatic artery). Or, it's grown into 2 or more organs outside of the liver. N0 means there are no lymph node involvement. The lymph nodes in the hepato-duodenal ligament were classified as N1; the retroportal pancreatico-duodenal, common hepatic, celiac, and superior mesenteric lymph nodes & all distant lymph nodes were classified as N2 in this series. Presence of Together the T, N and M stages give a complete description of the stage of your cancer.

Table 1 TNM staging

AJCC Stage	Stage grouping	Stage description
0	Tis, N0, M0	Involvement of epithelium only. (Tis) It has not spread to nearby lymph nodes (N0) or to distant sites (M0).
I	T1, N0, M0	The tumor has grown into the lamina propria or the muscle layer (muscularis) (T1).

IIA	T2a, N0, M0	The tumor has grown through the muscle layer into the fibrous tissue on the side of the peritoneum (T2a).
IIB	T2b, N0, M0	The tumor has grown through the muscle layer into the fibrous tissue on the side of liver, but has not invaded the liver (T2b). Nearby lymph nodes (N0) or to distant sites (M0) are not involved.
IIIA	T3, N0, M0	The cancer has grown through the serosa with involvement of liver and/or one nearby structure like the stomach, duodenum colon, pancreas, or bile ducts outside the liver (T3). It has not spread to nearby lymph nodes (N0) or to distant sites (M0).
IIIB	T1-3 N1 M0	The cancer may or may not have grown outside of the gallbladder. It has spread to no more than 3 nearby lymph nodes (N1). It has not spread to distant sites (M0).
IVA	T4 N0 or N1 M0	The tumor has grown into one of the main blood vessels leading into the liver (portal vein or hepatic artery) or it has grown into 2 or more structures outside of the liver (T4). It may or may not have spread to no more than 3 nearby lymph nodes (N0 or N1). It has not spread to distant sites (M0).
IVB	Any T N2 M0	The primary tumor may or may not have grown outside the gallbladder. The cancer has spread to 4 or more nearby lymph nodes (N2). It has not spread to distant sites (M0), OR It has spread to distant sites such as the liver, peritoneum or the lungs (M1).

Result:

The age of patients ranged from 29 to 76 years with a mean age of 59 years for females and 56 years for males. There was definite female preponderance.

Table 2 . Age and sex distribution

Age Group	Female	Male	Total	Percentage
Less than 30	—	1	1	2.5
31-40	3	2	5	12.5
41-50	7	4	11	27.5
51-60	8	3	11	27.5
61-70	6	3	9	22.5
More than 70	2	1	3	7.5
Total	26	14	40	100

Imaging Findings

1. Morphology— There were three patterns of findings seen in carcinoma GB

A. Mass Occupying or Replacing the Gallbladder Lumen, -

On, CT, the presence of a large gallbladder mass that nearly fills or replaces the lumen, often directly. The differentials includes malignancies located centrally in the liver that have invaded the gallbladder fossa, such as HCC, cholangio carcinoma, and metastatic disease.



Fig.1 Mass replacing GB fossa

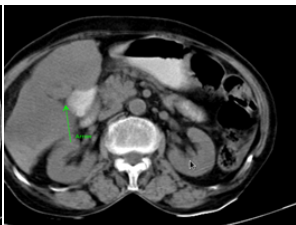


Fig. 2. Mass in GB fossa (Another case)

B. Focal mass



Fig.3 Focal mass in fundus



Fig 4 Focal mass in neck

c. Focal or Diffuse Asymmetric Wall Thickening -

Dfferential diagnosis, including acute and chronic cholecystitis , xanthogranulomatous cholecystitis and adenomyomatosis as well as diffuse hepatic or systemic diseases such as acute hepatitis, portal hypertension, and congestive heart failure.

Loco-regional spread—Contiguous hepatic infiltration was found in 15 patients. The hepatic infiltration was less than 2 cm in six patients and more than 2 cm in nine patients (fig. 5) . Infiltration of the duodenum was seen in seven patients and hepatic flexure was seen in two patients. Bile duct invasion was seen in ten patients (Fig 7 & 8) along with intra hepatic biliary radical dilatation leading to obstructive jaundice.

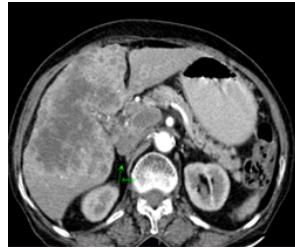


Fig.5 Hepatic infiltration



Fig 6 Peri-portal node



Fig.7 Bile duct invasion



Fig 8 Dilated IHBR

3. Lymphadenopathy -- The lymph nodes were involved in 24 (60 %) patients. The lymph nodes around the celiac axis and at the porta hepatis (N1 stage) were involved in 16 and retroperitoneal nodal involvement (N2 stage) was seen in the remaining 8 patients

2. Vascular invasion —Vascular invasion was seen in seven patients, in the form of left portal vein involvement, main portal vein involvement, right portal vein and right hepatic artery involvement, (two patient each, respectively) and right hepatic artery involvement (one patient)

Table 3 . Distribution of morphological pattern

Findings	TNM stage at diagnosis of cases				Number of cases	Percentage of cases
	T1	T2	T3	T4		
Mass replacing GB in the GB fossa	0	2	5	15	22	55
Focal mass	1	3	2	0	6	15
Wall thickening	4	3	5	0	12	30
Total	5	8	12	15	40	100

5. Distant metastases—Peritoneal deposits were seen in one patient. In another patient distant hepatic metastases and lung metastases were seen. Four patients had para-aortic lymphadenopathy.

6. Resectability—16 (40 %) patients were found to be resectable and 24 patients were unresectable as per imaging. The reasons for non-resectability were duodenal infiltration colonic infiltration main portal vein involvement and paraaortic lymph nodes .

Surgical Findings

There was 100% correlation in the diagnosis of hepatic, colonic, and bile duct infiltration by the tumor. Out of total seven cases showing duodenal infiltration on CT, two patients were labeled as unresectable. But on surgery, no involvement of duodenum could be seen & were actually resectable. Nine patients had peripancreatic, periduodenal, periportal, celiac or superior mesenteric lymph nodes (N2 level nodes) at surgery. CT detected lymph nodes in eight of these patients. In one patient, peripancreatic lymph nodes was not detected on CT. The resectability of the tumors was not affected in any of these cases as

regional lymph node metastases was not a criterion for non-resectability. Para-aortic lymph nodes were seen in all four patients who had these nodes on CT. Peritoneal metastases were found in three patients on laparotomy, however CT can detect peritoneal metastasis in only one patient. Vascular invasion was confirmed on surgery in all seven patients. Of the 40 patients with gallbladder carcinoma 18 (45 %) were found to be resectable on surgery as against 16 (40 %) found on CT.

Histopathologic Findings

One of the case was poorly differentiated carcinoma with focal squamoid differentiation. All other tumors were adenocarcinomas

TABLE 4: Comparison of CT and Surgical and Histopathological Findings

Finding	Radiological	Surgery & Histopathology
Hepatic infiltration	15	15
Liver Infiltration		
Duodenal infiltration	7	5
Colonic infiltration	2	2
Bile duct invasion	10	10
Lymph nodes N1	16	16
Lymph nodes N2	8	9
Para-aortic lymph nodes M	4	4
Peritoneal metastases	1	3
Vascular infiltration	7	7

Discussion :

The curative treatment of choice for gallbladder carcinoma is surgical resection, but precise preoperative diagnosis & accurate evaluation of the segmental anatomy and development of a road map of the arterial and the venous structures are essential prerequisites for planning. The diagnosis of hepatic, colonic, and bile duct infiltration by the tumor using a CT has a sensitivity of 85–93%. CT could not detect peritoneal deposits in two of three patients. Laparoscopy still remains a reliable method for the evaluation of peritoneal disease. In the present study, however, this did not affect the management because the tumor was un-resectable in these two patients due to the presence of extensive duodenal infiltration in one and the presence of para aortic lymph nodes in the other. Gallbladder carcinoma in the neck region frequently involves the common bile duct by intra ductal extension through the cystic duct or by external invasion of the hepatoduodenal ligament. In the present study, common bile duct infiltration was found in 10 patients on MDCT. The same findings were subsequently found in all of these patients on laparotomy.

The incidence of histological proven nodal involvement was 62 % (25 patients) and the most common spread of gallbladder carcinoma. The sensitivities in CT detection of N1 and N2 nodal involvement were 94 % and 88 %, respectively; positive predictive values were 94% and 72%, respectively. The sensitivities in the CT detection of direct spread to the liver, duodenal infiltration, colonic infiltration and bile duct invasion were 88%, 83%, 100%, and 84 %, respectively; positive predictive values were 100 %, 71%, 100%, and 100%, respectively.

The diagnostic accuracy of CT scan in staging of the disease and determining resectability has been reported in various studies. Yoshimitsu et al [3], reported an accuracy of 83-86% in diagnosing the local extent of carcinoma GB, but reported poor sensitivity for T1 lesions. Kim et al [8], have reported an overall accuracy of 71% in staging the T-factor of the TNM staging in their study of 100 consecutive cases, with accuracies varying from 79% for T1 & T2 , 46% for T3 and 73% for T4. The accuracy was lowest for thickened GB wall at 54% and highest for GB mass at 89%. Kumaran et al [4], in their study of 32 patients have reported 93.3% accuracy in predicting non-resectability using a set criteria. The criteria applied were patients with distant metastases (liver, peritoneum, distant lymph nodes), extensive contiguous local organ spread (duodenum, pancreas, colon), involvement of the secondary biliary confluence and tumoral invasion of the main portal vein or proper hepatic artery or simultaneous invasion of one side hepatic artery and other side portal vein. In the present study Stage IV patients were considered inoperable which accounted for 58% of our patients. The inoperable patients included those with obstructive jaundice, extensive local spread to duodenum, pancreas and omentum and with overlap of findings of these two groups. Ohtani et al [9], found that the sensitivity of CT in detecting the

direct spread to the liver of less than 2 cm, more than 2 cm, the extra hepatic bile duct, gastrointestinal tract and pancreas was 65, 100, 50 and 57% respectively while the positive predictive values (PPV) were 77, 100, 90, 100% respectively. The PPV was 100% and 86 % for detection of liver metastasis and involvement of inter aortocaval nodes. They concluded that CT can help in determining resectability and treatment in advanced stages because of high PPV.

In this study a changing gender distribution as well as a shift of the mean age at diagnosis into the sixth decade of life was observed. Contrast enhanced helical CT was effective in identifying the criteria for resectability of the tumor and in disease staging.

A limitation of our study was the small study group. Successful surgery in 18 (45%) of 40 patients seems to reflect a high rate of resection in gallbladder carcinoma. Larger prospective studies are needed to determine the actual resectability rate of gallbladder carcinoma. We found, use of CT significantly correct for the staging with more accuracy.

Conflicts of Interest None identified

Conclusion:

- 1) The CT imaging is fairly accurate in the detection of spread and staging of gallbladder carcinoma. We can evaluate the loco regional spread in a case of gall bladder malignancies with the use of CT
- 2) CT imaging can help in determining resectability and in planning the treatment, especially in advanced-stage gallbladder carcinoma, because of a high positive predictive value.
- 3) The ability of CT to predict the hepatic infiltration, colonic infiltration and bile duct invasion have nearly 100 % positive predictive value.
- 4) Duodenal involvement was over emphasized and peritoneal involvement was underestimated on CT.

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