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Diagnostic Performance and Prognostic Relevance of Computed Tomography for Patients with Cholangiocarcinoma

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Abstract:Background: Background: Cholangiocarcinoma is the second most frequent type of liver cancer after hepatocellular carcinoma. It is a moderately common liver cancer. The multidetector CT (MDCT) is a noninvasive imaging modality of choice, which is used to evaluate patients in order to determine the location of the obstruction, identify distant metastases, and determine mass lesions.

Aim of the study: The purpose of this research is to determine how the MDCT scan contributes to the visualization of cholangiocarcinoma imaging findings, their classifications, and the preoperative assessment that is crucial for the disease's diagnosis and staging.

Patients and Methods: Our present study included 50 patients with biliary obstruction and previously radiological or laboratory diagnosed cases of cholangiocainoma after obtaining written informed consent, meeting the inclusion and exclusion requirements.

Results: They had a mean age of 63.1± 10.2 years. Males outnumbered females and accounted for 56% versus 44% of females. In correlation to histopathological findings, MDCT was 96% sensitive in detection of cholangiocarcinoma. A statistically significant correlation was observed between the site, type, and TNM staging. As CBD and hilar cholangiocarcinoma were mostly early stages (II, and III), while peripheral type was associated with advanced staging mainly stage IV, followed by stage II and stage III with p value 0.001. High significant association was detected between site, type and vascular invasion, as CBD and hilar cholangiocarcinoma were not associated with vascular invasion, while peripheral type was associated with invasion of portal vein mainly, followed by hepatic artery and finally hepatic vein with p value 0.012.

Conclusion: Multidetector computed tomography MDCT can be considered a noninvasive , fast and high sensitivity imaging tool in the assessment of patients with cholangiocarcinoma for accurate staging and preoperative assessment of the tumor extent..

Keywords:*Cholangiocarcinoma; Multi-Detector Computed Tomography*

List of Abbreviations:
MDCT: Multidetector computed tomography.
CBD: Common bile duct.
CCA : Chronic cumulative amyloidosis .
ERCP : Endoscopic retrograde cholangiopancreatography.
HCC: Hepatocellular carcinoma.

Introduction

Cholangiocarcinoma is an adenocarcinoma develops from the epithelium lining the bile ducts, either within or outside of the liver. It ranks second in incidence of liver cancer, behind only hepatocellular carcinoma, and is therefore a rather frequent malignancy (1). From the peribiliary glands to the ampulla of Vater and the terminal ductules (canals of Hering), cholangiocarcinoma may develop at any point along the bile duct epithelium. (2).According to its origin, cholangiocarcinoma may be classified as either an intrahepatic tumor, a peri-hilar tumor, or a distal extrahepatic tumor of the bile ducts. Originally, the term cholangiocarcinoma was used only to describe cancers of the intrahepatic bile ducts, but currently it is used more broadly. (3). Figure(1).

In cholangiocarcinoma, growth is gradual, the tumor invades duct walls, and it slowly spreads along tissue planes (2).

The typical symptoms include jaundice, discomfort, anorexia, weight loss and fatigue between the sixth and seventh decades of life with males predominance(4,5).

The cause of most CCAs is unknown. Nevertheless, there are a number of known risk factors that might make young patients more likely to develop CCA. The main risk factor is the presence of chronic inflammation inside the bile duct. Patients diagnosed with primary sclerosing cholangitis are 10% to 20% more likely to develop chronic cumulative amyloidosis (CCA).Other risk factors, such as congenital bile duct abnormalities, have been reported, especially Caroli's disease and choledocal cysts. The latter increase the risk for CCA after the second decade of life (10-15%). Other factors have also been reported, such as hepatolithiasis, biliary papillomatosis, infections with parasites such as Clonorchis sinensis and Opisthorchis viverrini, exposure to toxics such as thorium dioxide, as well as liver cirrhosis caused by Hepatititis B and C virus, fatty liver and metabolic syndrome(4).

Diagnosis is built on both invasive and non-invasive diagnostic techniques. Ultrasound, CT scans, and MRIs are examples of noninvasive imaging techniques utilized while invasive technique as endoscopic retrograde cholangiopancreatography (ERCP)can be used (6).

Imaging plays a role in the noninvasive diagnosis since it may characterize cholangiocarcinoma, confirm the diagnosis, stage the patient before therapy, determine respectability, and screen high-risk individuals for early identification.When diagnosing cholangiocarcinoma, computed tomography (CT) scans are crucial. CT has replaced other noninvasive diagnostic tests for cholangiocarcinoma staging and analysis. A straightforward assessment of the tumor's connection with arteries and surrounding organs may reveal intraductal tissue, tumor bulk, bile duct wall thickening, bile duct dilatation, and polypoid cholangiocarcinoma(7).

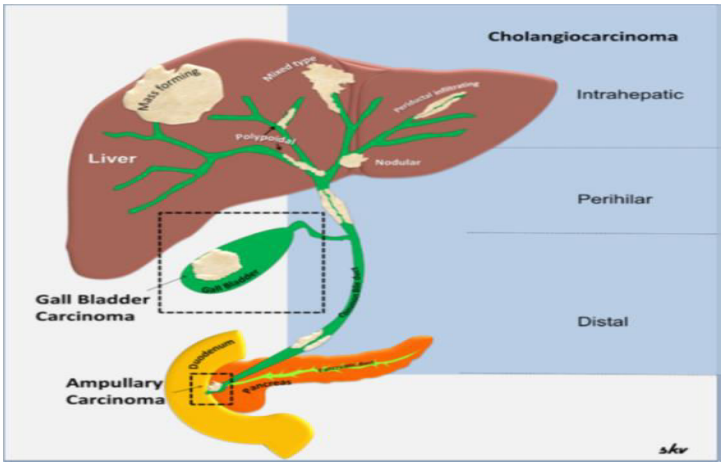


Figure 1 Malignancies of the biliary tract. Diagram showing the biliary tract and the various malignancies arising from the tract. The cholangiocarcinomas are shown in accordance with the current categorization into several subtypes based on anatomy and morphology. (8).

Aim of the WORK

The purpose of this research was to identify the function of multidetector computed tomography (MDCT) scans in cholangiocarcinoma imaging, classification, and preoperative evaluation—all of which are crucial in the disease's diagnosis and staging.

PATIENTS AND Methods

Our present study included 50 patients with biliary obstruction and clinically suspected cholangiocarcinoma.

The diagnosis of cholangiocarcinoma was supported by clinical, laboratory, and imaging investigations (elevated tumor markers), as well as postoperative pathology testing. Imaging studies included US and triphasic CT. In order to verify the extent of blockage, they were sent for a magnetic resonance cholangiopancreatography (MDCT) examination of the biliary tract.

tumor staging.

Inclusion criteria: Patient with progressive obstructive jaundice and previous radiological or laboratory diagnosed patients of cholangiocarcinoma.

Exclusion criteria Patient with infections, calcular and other inflammatory causes of jaundice, pregnant Patients and patients with chronic renal diseases.

Patients were thoroughly informed about the clinical reasons to perform the investigations. Radiation exposure and the dangers of contrast agents, such as allergic responses, are minimal. After going over the potential advantages and dangers of the experiment, all patients were asked to provide their informed permission**.**

Here is what all patients went through**:**

- Clinical evaluation: identification data: age, sex, and weight
- Complete assessment of history.
- Serum bilirubin, liver enzymes (aspartate transaminase and alanine transaminase), prothrombin time, prothrombin concentration, alkaline phosphatase, γ-glutamyl transferase, and renal profiles with blood urea and serum creatinine level, carbohydrate antigen 19–9, and carcinoembryonic antigen were measured through laboratory and serological examinations.
- Imaging investigations: US with colored Doppler and triphasic MDCT of the abdomen and pelvis.

Approval was asked from Theodor Bilharz institutional review board (IRB) and written consents were taken from patients included in the study.

Patient scan

Triphasic contrast-enhanced CT scans of the abdomen, which included the liver and biliary system, were used to examine the patients. CT investigations were carried out using non-ionic contrast material utilizing a multi-detector, 16-channel row CT scanner (Alexion; Toshiba Medical Systems), and post-processing was completed. After having an empty stomach for at least six hours, patients had an abdominal contrast enhanced CT scan with informed consent about potential contrast response. From the level of the lung bases to the ischial tuberosity, axial images were obtained. An IV dynamic contrast scan with an injection of omnipaque (300 mg iodine/ml) contrast material was then performed.Sections were obtained from the superior border to the inferior border of the liver in the craniocaudal direction in the non-contrast phase, hepatic arterial phase (HAP-10s), portal venous phase (PVP-40-50s), and delayed phase (3-5mins).

Post processing

Sagittal and coronal reconstructions as well as more recent methods in multi-slice CT, such as 3D volume rendering, may be used to process post-contrast reconstructions.

Image analysis

Double vision was made in interpretation of the image data from CT by two experienced radiologists and were correlated with histopathological findings. The imaging features of the lesions were assessed regarding size, site, pattern of enhancement, stage and effect.With MDCT, Tumor features were recorded on imaging, and the Liver Cancer Study Group of Japan criteria were used to classify the tumor's morphology and stage it using the TNM classification.

Statistical analysis

We used SPSS 27th version for our statistical study. We used the count and percentage formats for categorical data, and we used the Chi-square test for our comparisons. The mean, standard deviation, minimum, and maximum values were used to display the continuous variables. We regarded any p value less than 0.05 to be significant.

Results

We enrolled 50 patients diagnosed with suspected cholangiocarcinoma and confirmed by histopathology. They had a mean age of 63.1± 10.2 years, with a range of 36-85 years. Males outnumbered females and accounted for 56% versus 44% of females.

Histopathology was confirmed all patients as cholangiocarcinoma, and two patients had synchronous HCC. In correlation to histopathological findings, MDCT was 96% sensitive in detection of cholangiocarcinoma.

Number of lesions detected were solitary in 22 (44%) patients, multiple in 14 (28%) patients, and few lesions in 10 (20%) patients. The mean size of the largest lesion was 7.4± 3.1 cm, and a range of 1.7-13.8 cm. site within liver was CBD in 14%, hilar in 8%, left lobe in 46%, and right lobe in 28% of the included patients.

Classification of site showed that 6 patients had lesions in CBD, 2 patients in distal CBD, hilar in 6 patients and the majority had peripheral lesions accounting for 72% of the included patients.

Multi detector CT scan showed that 24 (48%) patients revealed ill-defined masses, 12 (24%) patients had well defined masses, and 8 (16%) patients had mural thickness.

Liver morphological changes were mainly satellites in 20 (40%) patients, enlarged liver was found in 12 (24%) patients, perfusion changes were reported in 8 (16%) patients, and two (4%) patients showed HCC lesions.

Intrahepatic biliary radicals dilatation was found in 36 (72%) patients, it was minimal in 4 patients, differential in 10 patients, upstream in 18 patients.Dilated CBD was found in 10 patients, metastasis was reported in 6 patients affecting peritoneum in 6 patients, pulmonary nodules in 4 patients and bone Mets in 2 patients. Pyogenic cholangitis was found in 2 patients in the form of abscess.

Cholangiogram using ERCP was performed in 14 (28%) patients. Dynamic MRI was performed for 10 (20%) patients, MRCP was performed in 4 (8%) patients, PET CT is performed in 2 (4%) patients. Tumor markers was elevated in two patients.

Follow up CT scan was performed in 8 patients, 2 of them showed disease progression, another two showed stationary disease, and 4 were unknown status.

Assessment of risk factors for cholangiocarcinoma showed that only 8 patients had chronic calculus cholecystitis, elevated liver functions in 20 (40%) patients, and 32 (64%) patients presented with obstructive jaundice.

TNM staging of assessed patients showed that majority were of stage IV disease (60%), followed by stage III (28%), and least as stage II (12%) of study population.

After radiological assessment of resectability, only 6 patients had resectable disease, and 44 (88%) patients had irresectable disease. However, only two patients underwent surgical intervention, and 48 (96%) patients were treated on palliative settings.

Regarding lines of treatments, only two patients underwent left lobectomy, while 60% received palliative Chemotherapy, 24% underwent ERCP stenting, and 12% underwent PTD stenting.

Table 1 Baseline demographic, clinical, pathological, radiological and management characteristics among studied patients.

		Mean ±SD	Min-Max
Age		63.1± 10.2	36-85
		Count	%
Sex	Female	22	44%
	Male	28	56%
Number of lesions	Few	10	20%
	Multiple	14	28%
	One	22	44%
	No	4	8%
Size of largest FL		7.4± 3.1	1.7-13.8
Site within liver	Distal CBD	5	10%
	Proximal CBD	2	4%
	Hilar	4	8%
	Left Lobe	23	46%
	Right lobe	14	28%
	No	2	4%
Segment	NA	17	34%
	II/III	4	8%
	III	2	4%
	IV	5	10%
	IV, I, VIII	2	4%
	IV, III, V	2	4%
	IV/II/III	2	4%
	IV/VIII/V	2	4%
	V/VI/VII	2	4%
	V/VIII	2	4%
	VI/IVb	2	4%
	VI/VI, VIII	2	4%
	VI/VII	4	8%
	VI/VIII	2	4%
Site Type	CBD	6	12%
	Distal CBD	2	4%
	Hilar	6	12%
	Peripheral	36	72%
Shape	Circum. Mural thickening	2	4%
	Ill-defined infiltrative exophytic mass	2	4%
	Ill-defined infiltrative mass	10	20%
	Ill-defined mass	10	20%
	Ill-defined exophytic mass	2	4%
	Infiltrative mass	2	4%
	Exophytic mass	2	4%
	Mass forming	4	8%
	Mural Thickening	6	12%
	Soft tissue Thickening	6	12%
	Well-defined infiltrative mass	2	4%
	Well-defined mass	2	4%
Liver Morphologic changes	Normal	10	20%
	Enlarged	10	20%
	Enlarged Satellites	2	4%

	HCC	2	4%
	Perfusion changes	8	16%
	Retraction Satellites	4	8%
	Satellites	14	28%
IHBRD	Minimal differential	4	8%
	Differential	4	8%
	Mild bilateral	8	16%
	Mild upstream	14	28%
	Mild Differential	2	4%
	Moderate upstream (CHD infiltration)	4	8%
	No IHBRD	14	28%
Dilated CBD	No	40	80%
	Yes	10	20%
Metastasis	No	44	88%
	Peritoneal deposits	2	4%
	Peritoneal, pulmonary nodules	2	4%
	Peritoneal, pulmonary, vertebra (bone)	2	4%
Pyogenic Cholangitis	No	48	96%
	Yes	2	4%
Histopathology	Cholangiocarcinoma	48	96%
	Combined HCC/ Cholangiocarcinoma	2	4%
Cholangiogram	No	36	72%
	Yes	14	28%
Dynamic MRI	No	40	80%
	Yes	10	20%
MRCP	No	46	92%
	Yes	4	8%
PET CT	No	48	96%
	Yes	2	4%
Tumor Markers	Elevated	2	4%
	No	48	96%
Follow up CT	Progressive disease	2	4%
	Stationary disease	2	4%
	Yes	4	8%
	No	42	84%
Risk Factors	None	42	84%
	Calcular	8	16%
Liver Function tests	Elevated	20	40%
	Normal	30	60%
Obstructive jaundice	No	18	36%
	Yes	32	64%
TNM staging	II	6	12%
	III	14	28%
	IV	30	60%
Radiological resectability	Not resectable	44	88%
	resectable	6	12%
Outcome	Operated	2	4%
	Palliative	48	96%
Management	Chemotherapy	30	60%
	ERCP stenting	12	24%
	LT. lobectomy	2	4%
	PTD stenting	6	12%

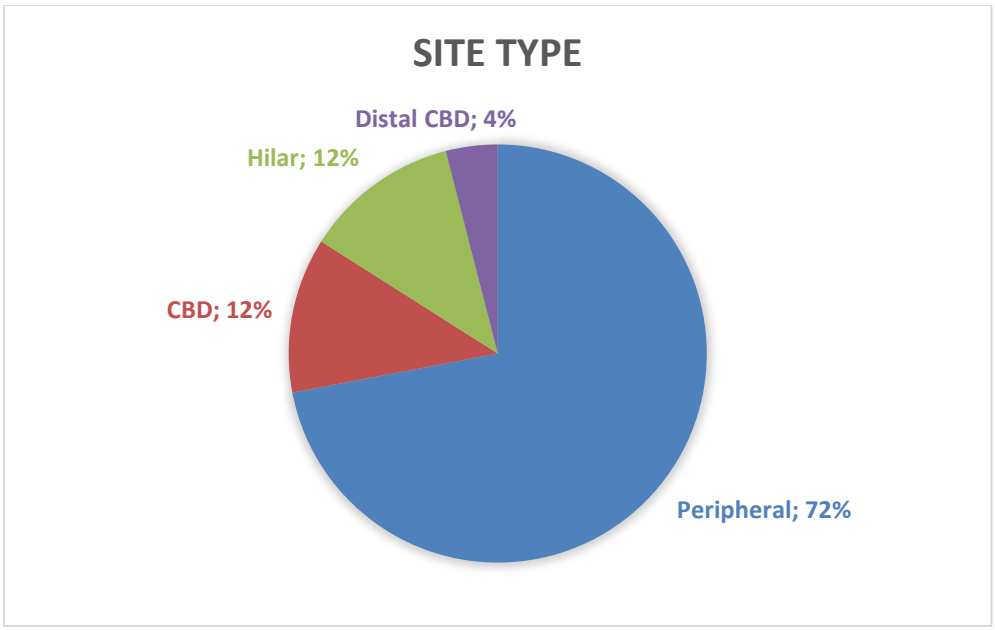


Figure 2 Pie chart showing site type of the included patients.

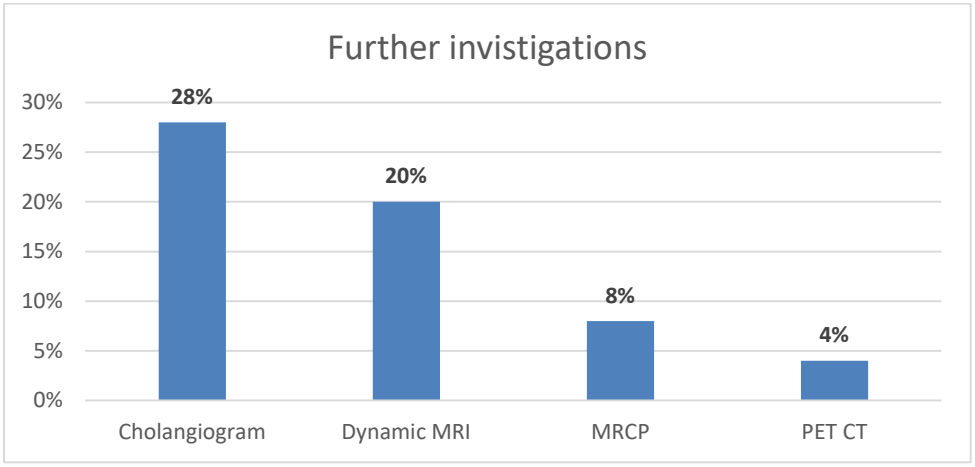


Figure 3 Bar chart showing further investigation for diagnosis of tumor.

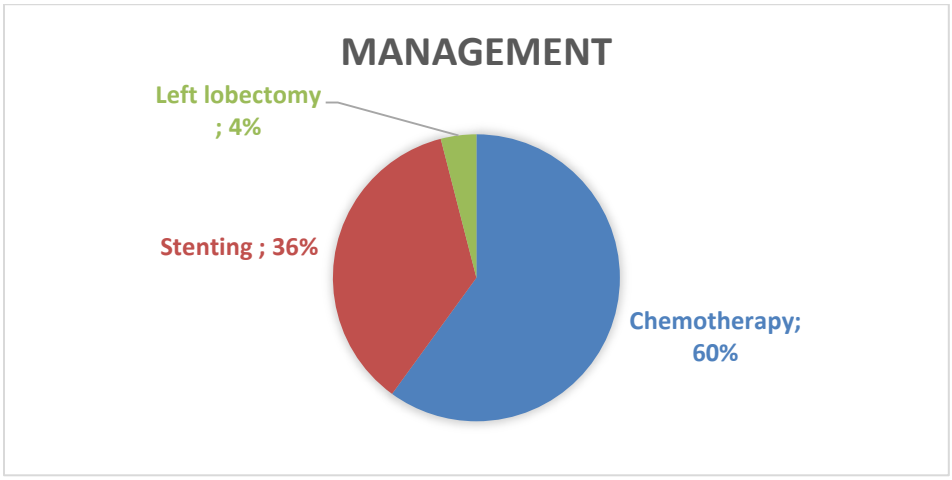


Figure 4 Pie chart showing management of the included patients.

Ill defined masses were found in the majority of patients accounting for 64%, followed by mural thickening in 28%, and least well defined masses in 8% of the included patients.CT Arterial and porto-venous phase enhancement showed that marginal enhancement was found in 20 (40%) patients, followed by faint marginal enhancement in 10 (20%) patients, heterogeneous enhancement was found in 6 (12%) patients.CT delayed phase showed that progressive filling in central non enhancing in majority of patients accounting for 28 (56%) patients, while Delayed enhancement, Heterogenous washout& heterogenous filling, Delayed enhancement, and Progressive filling in Heterogenous washout were found in two patients each among study cohort.Intrahepatic biliary radicals dilatation was found in 36 (72%) patients, it was minimal in 4 patients, differential in 10 patients, upstream in 18 patients. Common bile duct was found dilated in 10 (20%) patients.

Table 2 CT enhancement findings and biliary changes among the included patients.

		N	%
Shape	Ill-defined mass	32	64%
	Well defined mass	4	8%
	Mural thickening	14	28%
CT Arterial and porto-venous phase enhancement	Faint marginal enhancement	10	20%
	Heterogenous enhancement	6	12%
	Marginal enhancement	20	40%
	Marginal enhancement Heterogenous	2	4%
	Mild enhancement	4	8%
	NA	8	16%
CT Delayed phase	Delayed enhancement, Heterogenous washout& heterogenous filling int	2	4%
	Delayed enhancement	2	4%
	Progressive filling in central non enhancing	28	56%
	Progressive filling in Heterogenous washout	2	4%
	NA	16	32%
IHBRD	Minimal differential	4	8%
	Differential	4	8%
	Mild Bilateral	8	16%
	Mild Differential Lt.	2	4%
	Mild Upstream	14	28%
	Moderate upstream (CHD infiltration)	4	8%
	No	14	28%
CBD dilatation	Yes	10	20%
	No	40	80%

Among patients who had CBD cholangiocarcinoma 100% were found as mural thickening, or circumferential mural thickening, hilar cholangiocarcinoma was found as soft tissue thickening in 100% of cases, while peripheral were ill-defined masses in 66.7%, and well defined masses in 33.3% of the included patients.

Table 3 description of MDCT findings according to site type among the included patients.

Site Type	MDCT findings	Count	%
CBD	Mural Thickening	6	100.0%
Distal CBD	Circum. Mural thickening	2	100.0%
Hilar	Soft tissue thickening	6	100.0%
Peripheral	Ill-defined infiltrative exophytic mass	2	5.6%
	Ill-defined infiltrative mass	10	27.8%
	Ill-defined mass	8	22.2%
	Ill-defined mass forming	2	5.6%
	Ill-defined exophytic mass	2	5.6%
	Infiltrative mass	2	5.6%
	Mass (exophytic)	2	5.6%
	Mass forming	4	11.1%
	Well defined infiltrative mass	2	5.6%
	Well defined mass	2	5.6%

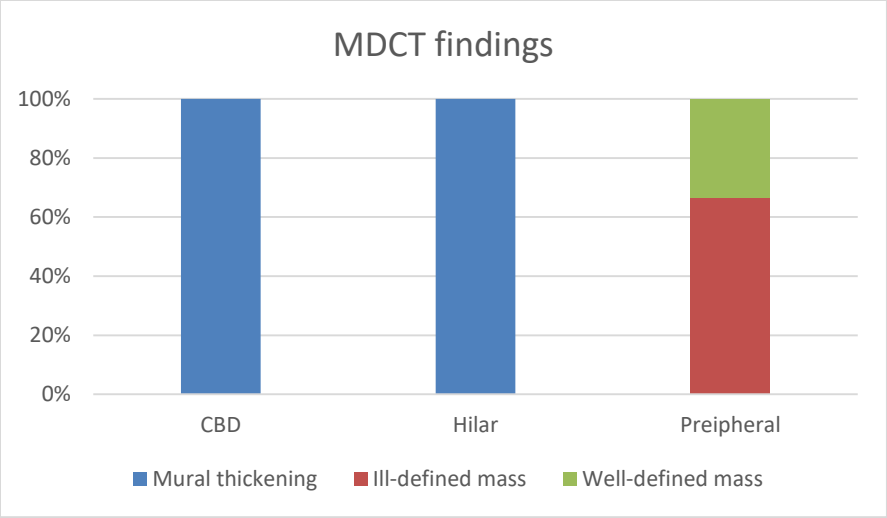


Figure 5 Bar chart showing MDCT findings according to site type. There was a statistically significant association between site, type and vascular invasion, as CBD and hilar cholangiocarcinoma were not associated with vascular invasion, while peripheral type was associated with invasion of portal vein mainly, followed by hepatic artery and finally hepatic vein with p value 0.012.

Table 4 showing vascular invasion according to site type among studied patients.

	Site Type				
	CBD	Distal CBD	Hilar	Peripheral	
Vascular invasion	N (%)	N (%)	N (%)	N (%)	P value
Hepatic artery	0 (0%)	0 (0%)	0 (0%)	6 (16.7%)	0.012
Hepatic vein	0 (0%)	0 (0%)	0 (0%)	2 (5.6%0	
Portal vein	0 (0%)	0 (0%)	0 (0%)	18 (50%)	
No	6 (100%)	2 (100%)	6 (100%)	10 (27.8%)	

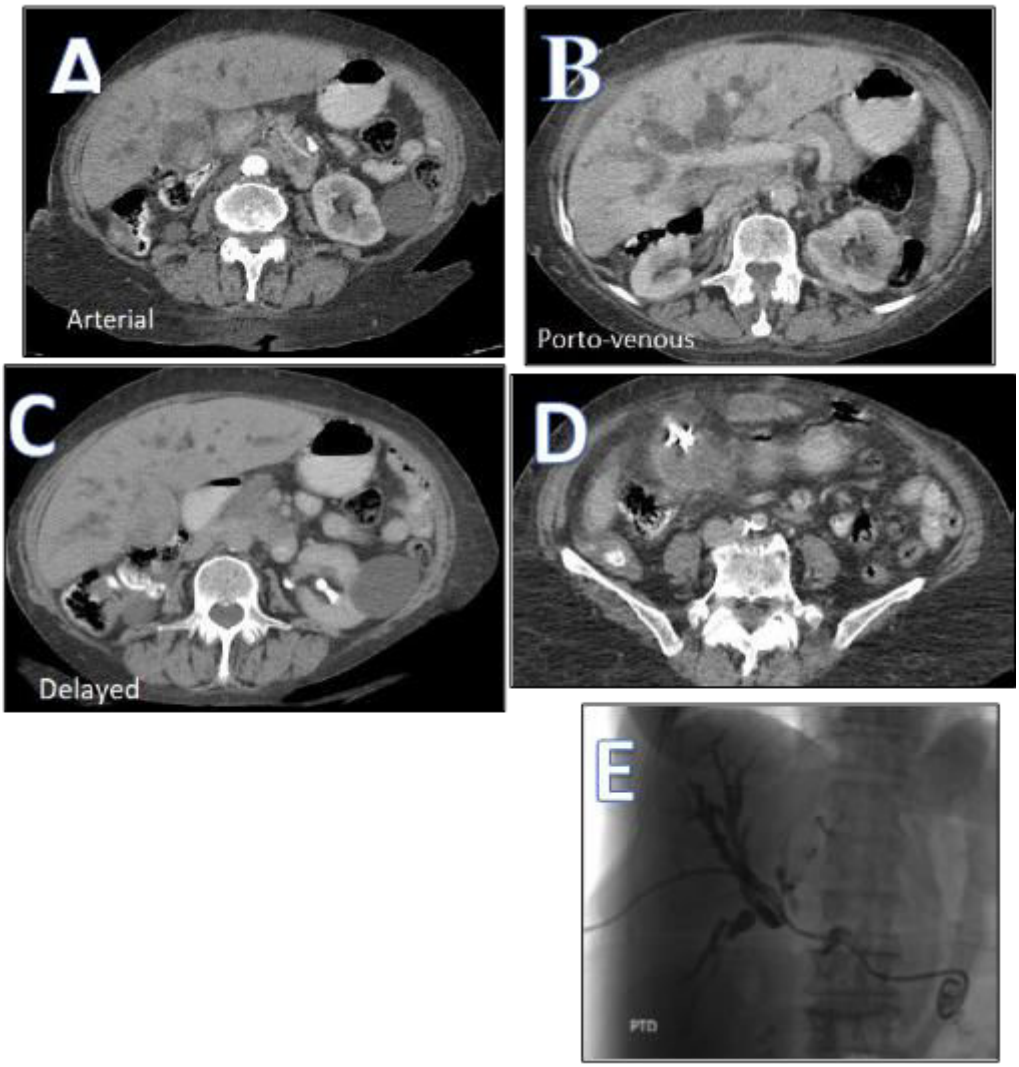
There was a statistically significant association between site type and TNM staging, as CBD and hilar cholangiocarcinoma were mostly early stages (II, and III), while peripheral type was associated with advanced staging mainly stage IV, followed by stage II and stage III with p value 0.001.

Table 5 showing TNM staging according to site type among studied patients.

		Site Type				
		CBD	Distal CBD	Hilar	Peripheral	
		N (%)	N (%)	N (%)	N (%)	P value
TNM Staging	II	0 (0%)	2 (100%)	0 (0%)	4 (11.1%)	<0.001
	III	6 (100%)	0 (0%)	6 (100%)	2 (5.6%)	
	IV	0 (0%)	0 (0%)	0 (0%)	30 (83.3%)	

Case 1

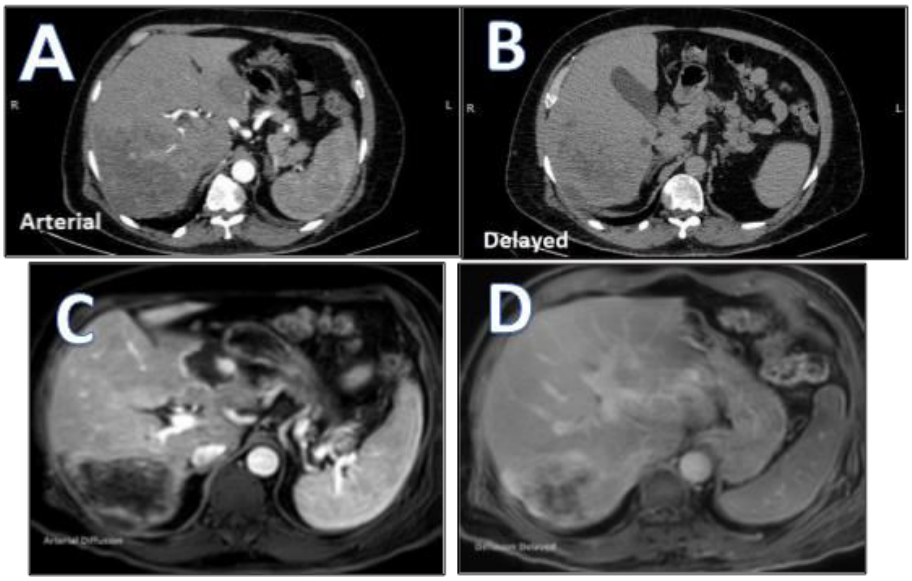
Female patient 76 years old with obstructive jaundice histopathologically proven Klatskintumour underwent percutaneous trans hepatic dilatation (PTD), the figures below are of the pre-interventional. Triphasic CT and the cholangiogram just after applying the biliary stent showing upstream biliary radicles dilatation.



(A&B): Hilar soft tissue mass lesion with heterogenous arterial enhancement and progressive filling in the delayed phase **(C)** Associated calcular gall bladder. **(D&E):** Moderate upstream biliary radicles dilatation.

Case 2

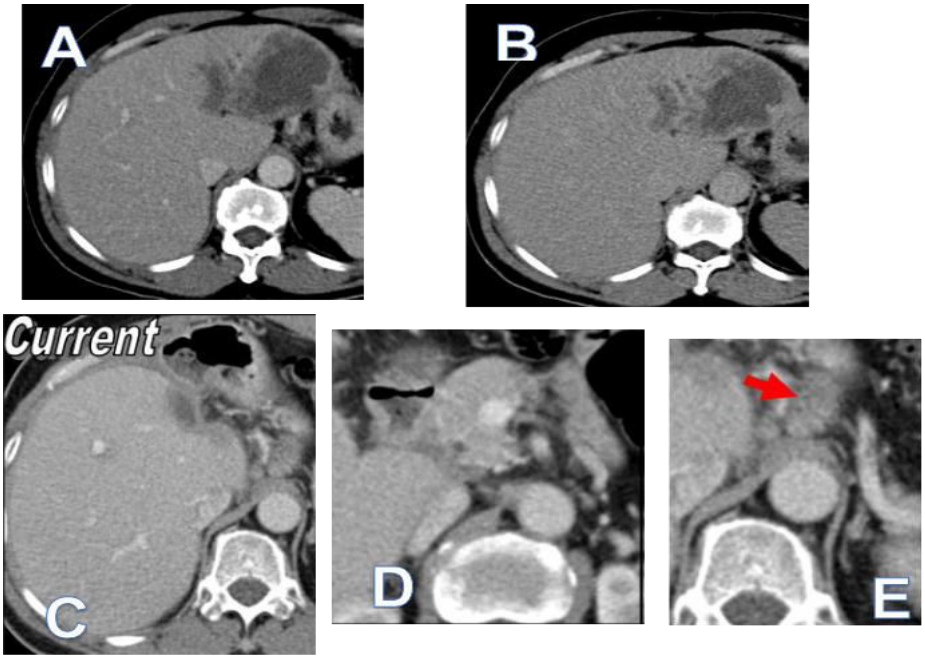
The images below are of Triphasic CT study and Dynamic MRI of Male patient 66 years old revealed right hepatic lobe segment VI/VII with enhancement pattern keeping with cholangiocarcinoma which was in agreement with the histopathology.



Figures A&B Right hepatic lobe exophytic mass lesion shows heterogeneous arterial enhancement with progressive filling in the delayed phase with non-enhancing internal areas of both CT andMRI.**Figures C&D** it is seen engulfing right posterior branch of the portal vein.

Case 3

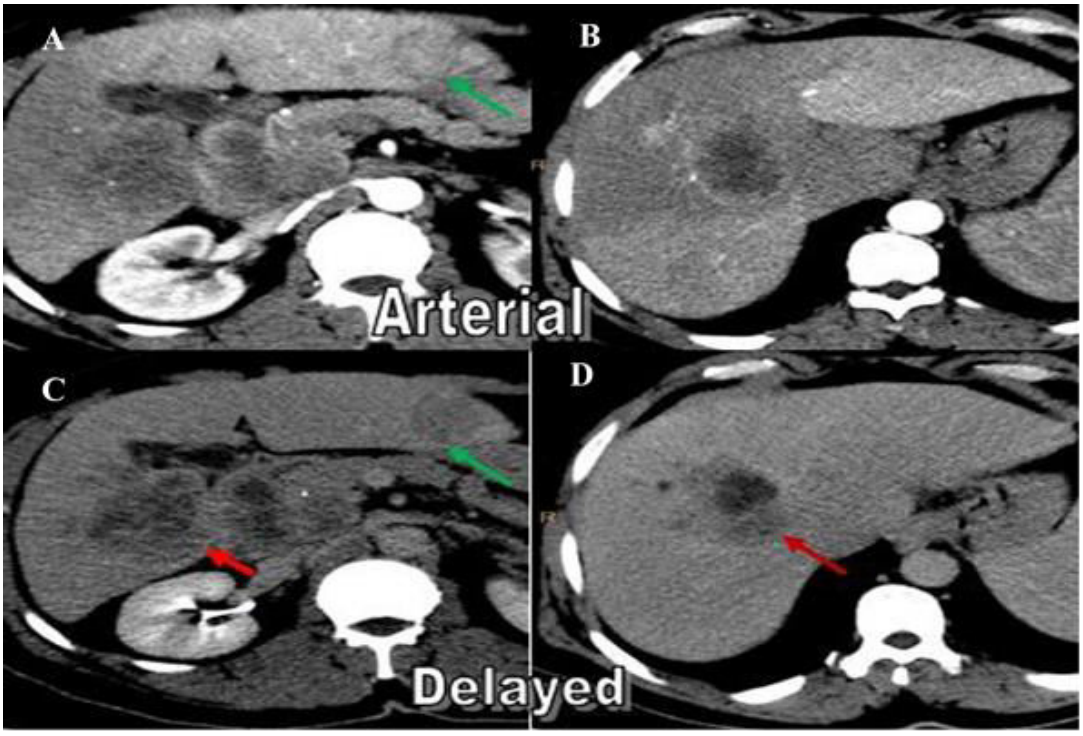
Male patient 58 years old, known case of cholangiocarcinoma underwent left lobectomy, the figures below show the pre operative triphasic CT study illustrating the site and extension of the lesion and post operative triphasic CT study after complete excision of the lesion

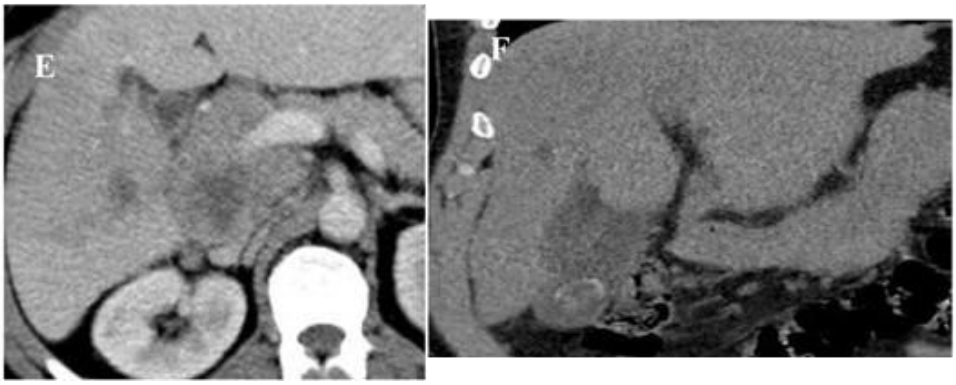


A&B: Left hepatic lobe infiltrative focal lesion showing faint arterio-portal marginal enhancement with progressive filling in the consecutive porto-venous and delayed phases with central non-enhancing core. **C&D:** Postoperative bed lesion inseparable from the caudate lobe and operative bed and hepatic subcapsular encysted collections.**E:** Mild progression of the left gastric /peri-gastric lymph nodes(red arrow).

Case 4

Triphasic CT study of a male patient 59 years old with liver cirrhosis showed combined hepatocellular cholangiocarcinoma, in agreement with the results of the histopathology.





A&C (green arrow): segment III hepatic focal lesion with arterial phase hyper enhancement and rapid washout in the delayed phase. **B,C& D:** segment VI/VIII show areas of faint arterial and arterio-portal enhancement with contrast washout in delayed phase merged with intralesional areas of progressive contrast filling(red arrow). E: Enlarged porta-hepatis lymphnode along its maximum axial dimensions with central necrotic areas seen attenuating main portal vein. **F:**Calcular gall bladder

Discussion

Examining the function of MDCT scan in cholangiocarcinoma assessment according to type, origin, and blockage degree was the primary goal of the present investigation.

We enrolled 50 patients, all were investigated by triphasic contrast-enhanced CT and confirmed by biopsy.

The average age of the participants in this research was 63.1±10.2 years old, which is in agreement with ***Samy et al. (2019)*** who discovered that the 60-70 year old age group was the most impacted. The majority of the cases in the age category of 41-60 years were reported by ***Mathew et al. (2016)***.

Regarding ***the gender*** distribution in our study, we found slight ***male predominance (***56%) in agreement with many studies as ***Samy et al. (2019)*** and ***Narayanaswamy et al.,(2015)***. However, ***Mathew et al. (2016)*** showed equal male to female affection.

The main complaint of the patients in the present study; was obstructive jaundice among 64% of casesin harmony with ***Samy et al. (2019)*** series.

In this study, Histopathology was confirmed all patients as cholangiocarcinoma, and two patients had synchronous HCC.

To the contrary, with ***Narayanaswamy et al. (2015)***, we found that MDCT correctly identified 40 patients (66.6% of the total) as having biliary tract obstruction due to malignancy in 16 cases. Among these cases, cholangiocarcinoma accounted for 40% (16 patients), pancreatic head carcinoma for 15% (6 patients), periampullary carcinoma for 10% (4 patients), gall bladder carcinoma for 7.5% (3 patients), hepatocellular carcinoma for 5% (2 patients), and duodenal malignancy for 2.5% (1 patient). One case that was first diagnosed as extrahepatic cholangiocarcinoma diagnosed on MDCT turned out to be carcinoma head of pancreas on final diagnosis**.**

Mohamed et al. (2016) study includes eight cases of intrahepatic malignant tumors **.**One case was misdiagnosed as benign stricture but was later shown to be metastasis from non-Hodgkin lymphoma.

Thirteen patients, or 20.3% of the total cases, were found to have cholangiocarcinoma in the research conducted by ***Samy et al. (2019).*** Extra value was added to MinIP images by improvements in stenosis definition in the CBD bifurcation area and by accurate assessment of hilar cholangiocarcinoma expansion **.**

By MDCT in the current study, Ill-defined masses were found in the majority of patients accounting for 64%, followed by mural thickening in 28%, and least well defined masses in 8% of the included patients. CT Arterial and porto-venous phase enhancement showed that marginal enhancement was found in 20 (40%) patients, followed by faint marginal enhancement in 10 (20%) patients, heterogeneous enhancement was found in 6 (12%) patients.CT delayed phase showed that progressive filling in central non enhancing in majority of patients accounting for 28 (56%) patients, while Delayed enhancement, Heterogenous washout& heterogenous filling, Delayed enhancement, and Progressive filling in Heterogenous washout were found in two patients each among study cohort.

Intrahepatic biliary radicals' dilatation was found in 36 (72%) patients, it was minimal in 4 patients, differential in 10 patients, upstream in 18 patients. Common bile duct was found dilated in 10 (20%) patients.

Similarly, ***Narayanaswamy et al. (2015)*** found that two patients (12.5%) with cholangiocarcinoma at the pancreatic level, including the periampullary area, had delayed and prolonged contrast enhancement. Of the individuals they examined, eight (20%) had blockage at the supra-pancreatic level. The diagnosis of cholangiocarcinoma was made in four patients (50%) because to localized and asymmetrical thickening of the common bile duct wall, as well as at the level of the porta hepatis. Twelve patients (30%) had obstruction Six patients (50%) of them manifested with low-attenuation mass lesions, with five (83.3%) due to cholangiocarcinoma, which was seen with delayed and sustained enhancement of contrast and one (16.7%) was hepatocellular carcinoma which showed neovascularity and early wash out of contrast**.**

For all cases of intrahepatic and proximal common hepatic duct blockage caused by infiltrating neoplasms, MDCT demonstrated a high degree of sensitivity (100%) in the study by ***Narayanaswamy et al. (2015).*** These lesions typically manifest by irregular regions of low attenuation surrounding the intrahepatic ducts, and are clearly accentuated by the excellent enhancement of surrounding hepatic parenchyma

In ***Elsayed et al. (2017)*** study, aimed to describe the role of MDCT in the staging of cholangiocarcinoma using surgery as the reference standard among 50 patients with cholangiocarcinoma. The extrahepatic (distal) cholangiocarcinoma was detected in one (2%) patient, observed on MDCT as dilated CBD with mural wall thickening and enhancement, which was associated with mild intrahepatic biliary radicals dilatation.

In the present study; by correlation to histopathological findings, MDCT was ***96% sensitive*** in detection of cholangiocarcinoma.

In agreement with many studies showing high sensitivity and accuracy as ***Samy et al. (2019)*** study, MDCT identified the level of biliary obstruction with 100% accuracy, they reported that The SN, SP, PPV, NPV, and ACC of MDCT cholangiography in detection of malignant stricture were 94.4%, 93.94, 94.44%, 93.93% and 94.2% respectively, in the same line ***Mohamed et al. (2016)*** whose results was 96.8%, 94.9, 98.2%, 96.7% and 95.6% respectively.

Similarly, ***Elsayed et al. (2017)*** study; found that MDCT cholangiography correctly diagnosed all patients with hilar obstruction that had occurred at the porta hepatis in 27 patients.

In the present study There was a statistically significant association between site type and TNM staging, as CBD and hilar cholangiocarcinoma were mostly early stages (II, and III), while peripheral type was associated with advanced staging mainly stage IV, followed by stage II and stage III with p value 0.001.

Elsayed et al. (2017) found that MDCT and its reformatted images (MinIP and MPR) were adequate for cholangiocarcinoma staging and accurate preoperative evaluation of tumor size in relation to surgical procedures and results.

In addition, research by ***Hashemzadeh et al. (2018)*** shown that periampullary cancers may be accurately and sensitively identified by MDCT.

The arterial and venous post-contrast phase, the suspected lesion's location, inflammatory changes may be identified as well as the enhancement's criteria. In addition, delayed phases (usually 3-5 min after contrast medium injection) are helpful for the differential diagnosis of intrahepatic CC, which shows delayed enhancement due to its abundant fibrous stroma ***(Joo et al. 2018)***.

Ruys et al., 2012 meta-analysis found that when it came to detecting portal vein and hepatic artery involvement in perihilar CC, MDCT had a pooled sensitivity of 89% and specificity of 92%.

Rizzo et al., 2020 reported that due to an overestimate of the tumor's proximal extent, MDCT has a diagnosis accuracy of 60%-88% for resectability and 75%-92% for the longitudinal tumor extent of perihilar CC. Recently, a substitute for MRCP in BS evaluation using CT cholangiography images acquired with multiplanar reconstruction and minimum intensity projections was suggested, particularly for patients who are not MRI candidates.

Conclusion

Multidetector computed tomography MDCT can be considered a noninvasive , fast and high sensitivity imaging tool in the assessment of patients with cholangiocarcinoma for accurate staging and preoperative assessment of the tumor extent.

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