

Accuracy of Conventional CT in Predicting Resectability of Cholangiocarcinoma: A Retrospective Review

Suwannee Surattanasophon, M.D.*, Apinya Chareonsuk, M.D.*, Ranista Suchato, M.D.*, Yongyut Sirivatanauksorn, M.D.**

*Department of Diagnostic Radiology, **Department of Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand.

Siriraj Hosp Gaz 2002;55:527-533.

INTRODUCTION

Cholangiocarcinoma is the most common tumor of the bile ducts and the second most common tumor of the hepatobiliary system in Thailand. It can be frequently found in the Northeastern part of the country, because of wide infestation of *Opisthorchis viverrini*. The patients always present with an abdominal mass jaundice due to the tumor type and invasion.

Cholangiocarcinoma can be cured by resection, depending on the staging of the disease. Thus, preoperative examination has shown to play an important role in determining whether or not such a tumor can be resected. Moreover, there is potential for use of percutaneous and endoscopic palliative techniques for biliary drainage.

In our study, we evaluated the use of conventional computed tomography [CT] in predicting the resectability of this tumor because it is more available in the rural areas than spiral or multidetector CT.

Our study was designed to determine the value of conventional CT scan for the detection and classification of cholangiocarcinoma and for determining its resectability.

MATERIALS AND METHODS

From January 2002 to December 2002, a search from the ICD 10 (International Statistical Classification of Diseases and Related Health Problems: 10th Revision) of patients diagnosed with cholangiocarcinoma at Siriraj Hospital. 60 patients were diagnosed with cholangiocarcinoma, but 37 patients were excluded from the study because no further surgery was performed, there was no available CT scans or there was loss of OPD cards. 23 patients were included in this study. The study group consisted of 18 men of 5 women who were 38-72 years old (mean age, 56.17 ± 11.19 years old).

Proof of diagnosis was established by surgical resection. 9 patients underwent hepatic resection, palliative surgical technique for biliary drainage was performed in 1 patient and diagnostic laparotomy with biopsy was done in the remaining 13 patients. All CT scans were obtained within 1-76 days before surgery (mean, 25.78 ± 19.85 days).

CT image were interpreted by two gastrointestinal radiologists with consensus. We reviewed surgical findings from operative notes and pathological data.

Tumor Classification and Resectability

The appearance of cholangiocarcinoma is classified into two types: intrahepatic and extrahepatic type.

Scan interpretation was performed to preoperatively assess tumor resectability. Patients were judged to have unresectable cholangiocarcinoma if any of the following features were found on CT scans:

- Distant metastasis
- Involvement of the main trunk of the portal vein or bilateral involvement of hepatic artery or portal vein structures by tumor
- Bilateral ductal extension of tumor beyond second-order bile ducts
- Intrahepatic metastases
- Adenopathy of lymph nodes outside hepatoduodenal ligament

A soft-tissue mass in the node-bearing regions with a diameter greater than 1cm or a low-attenuation center was considered to be malignant. Nodular masses in the greater omentum or peritoneum or sheetlike areas of soft-tissue attenuation that were diffusely thickening an upper abdominal ligament indicated that peritoneal spread was present.

Positive predictive value was defined as the total number of respectable tumors in the study population with were correctly classified as respectable using CT.

Negative predictive value was defined as the number of unresectable tumors diagnosed using CT that actually were unresectable (Table 1).

RESULTS

The study group consisted of 18 men and 5 women, ranging from 38 to 72 years (mean age, 56.17 ± 11.19 years old). 1 patient was diagnosed opisthorchiasis and another one patient was diagnosed with ascending cholangitis.

The distribution of the disease was 18% from the Northeastern part, 30% from the central part, 9% in both Eastern and Northern part and 4% from the Southern part of Thailand.

17 patients were diagnosed with intrahepatic cholangiocarcinoma (16 mass forming type, 1 intraductal type) and six patients were diagnosed with extrahepatic cholangiocarcinoma (5 mass forming type, 1 infiltrative type).

We evaluated each of the following criteria in all patients:

1. Lymph node metastasis (Table 2).

Conventional CT failed to detect N1 group node in 1 patient (hilar node 1.5 cm) and failed to detect lymph node metastasis outside hepatoduodenal ligament in 3 patients (N2 group) (Figure 1).

2. Distant metastasis: peritoneal seeding (Table 3).

11 patients without peritoneal seeding were correctly diagnosed by CT imaging. Four metastatic tumors were unable to be diagnosed by CT imaging (Figure 2).

Visceral metastasis was diagnosed in 1 patient (adrenal gland metastasis, which was compatible with pathological result).

3. Vascular invasion (Table 4).

We could evaluate vascular invasion in only 9 patients who underwent hepatic resection. CT imaging could not detect vascular invasion in 1 patient (microvascular invasion in pathological result). False positive was found in 1 patient.

4. Bile duct involvement.

As an evaluation of vascular invasion, bile duct involvement was able to be assessed in only 9 patients who underwent hepatic resection.

CT scan indicated no hepatic involvement up to secondary biliary radicles, bilaterally. These results were consistent with the surgical results.

5. Bilateral liver parenchymal involvement.

No patient was diagnosed with bilateral liver parenchymal involvement from either both CT scan or surgery.

Of the 23 patients who underwent surgery, 19 patients (82.6%) had unresectable cholangiocarcinoma at surgery had from pathology reports. CT enabled correct diagnosis of resectable tumor in 4 of these 7 patients (PPV 57%, NPV 100%) (Table 1). Of 3 patients who were considered to have resectable tumors on CT but found to have unresectable tumors at surgery, 2 patients had carcinomatosis peritonei, and 1 patient had microvascular invasion.

DISCUSSION

A number of articles were published on the accuracy of conventional CT for the detection and diagnosis of cholangiocarcinoma. Accuracy was reported to be from 40% to 63%. Recently, there were the studies designed to predict respectability of hilar cholangiocarcinoma by using helical CT.¹¹⁻¹² Tillich et al.¹ reported accuracy 60%, PPV 100%, NPV 20% and Feydy et al.² reported that helical CT was useful for assessment of parenchymal, biliary intrahepatic, and portal involvement but that it was not in the assessment of biliary extrahepatic, arterial, and lymph node involvement.

Lymph Node Metastasis

We failed to detect the lymph node in N1 and N2 groups in 4 patients, which may have been due to the poor resolution and thick slice of some studies. In the future, multidetector thin-slice CT help to reduce these problems.

Distant Metastasis

We found that the patients who had ascites, also had peritoneal seeding detected by surgery. Thus, the presence of very minimal ascetic fluid might be missed, and this is indicative of peritoneal seeding. Also, in this study, CT failed to detect distant metastasis in 4 patients.

Vascular invasion

Vascular assessment is a crucial aspect of the staging of cholangiocarcinomas because vascular involvement represents the most frequent criteria of unresectability. According to previous studies, portal vein involvement is rarely detected by CT. But our study showed CT is useful for detection of vascular invasion. Moreover, if helical CT was used, it could perform the arterial, portal and delayed phase and make the diagnosis of vascular invasion much easier and more accurate. However, helical CT still gives false-negative and false-positive findings.

We failed to detect vascular invasion in 1 patient, who had microvascular invasion from pathological results. There was a false-positive in 1 patient.

Bile Duct Involvement

The proximal extent of bile duct tumor spread is important for assessing respectability.¹⁰ In the study of Choi et al.⁸, dynamic CT scans showed a nonunion of right and left intrahepatic ducts in 33(94%) of 35 patients. Tumors spread to the secondary confluence were not evaluated. According to Triller et al.¹³, intraluminal tumor extension was correctly shown with dynamic CT in 9 (50%) of 18 patients. A study by Takayasu et al.⁹ of a series of six patients indicated the extent of tumor spread into the hepatic ducts was underestimated by CT in all patients. Our data suggested that conventional CT is reliable in detecting and depicting intrahepatic bile duct dilatation.

Bilateral liver parenchymal involvement

Conventional CT could reliably detect the tumor mass in our study. However, some masses could not be differentiated as to whether they were metastasis, hepatocellular carcinoma or cholangiocarcinoma. Dynamic CT and eliminate these problems by using the phases appropriate for each tumor.

Time lag between CT and surgery varied from 1-76 days in this study; which we used Mann-Whitney U test to evaluate the correlation of this time lag and respectability. P-value was 0.480 (> 0.05) indicating no significant correlation of time lag between Ct and surgical results.

In our study population, the overall accuracy of CT for predicting respectability was 87%. No tumor was overstaged using conventional CT, which was helpful because overstaging could prevent patients from undergoing potentially beneficial surgery (negative predictive value, 100%). However, only 4 of 7 patients in whom potentially respectable disease were diagnosed on conventional CT were found to actually have respectable disease at surgery (positive predictive value, 57%). Hence, our findings obtained with conventional CT were not ideal.

Several limitations of this study were noted:

1. It was a retrospective study
2. There were small numbers of patients
3. A variety of CT protocols was used
4. There was too much time elapsed between CT and surgery

All cholangiocarcinoma in our study were hypodense to the liver parenchyma on nonenhanced phase scans. These findings were similar to those reported for hilar and peripheral cholangiocarcinoma.⁵⁻⁶ These masses often appear similar to metastases, and can easily be misdiagnosed as adenocarcinoma metastases of unknown primary origin. Takayasu et al.⁹ and Lacomis et al.⁴ reported that the delayed contrast-enhanced CT scans can increase confidence in the diagnosis, which showed hyperattenuating lesion, especially those tumors with a predominantly fibrous content. The optimal time for delayed scan should be 6 to 20 minutes.⁷ This delayed enhancement can be bright enough to simulate hemangioma and other blood pool collections. The dynamic phases do not show lesion enhancement matching blood pool attenuation, however, which will prevent the mistaken diagnosis of hemangioma. This delayed retention can be helpful in differentiating cholangiocarcinoma from metastases. It can also be used to detect small tumors in patients at high risk cholangiocarcinoma (such as sclerosing cholangitis, Caroli's disease), or to detect tumors when intrahepatic dilatation is seen focally without an observed initial cause.

In the surgical study by Callery MP et al.³, it was found that laparoscopy with laparoscopic ultrasonography has a role in staging the tumor in the operative room; which the authors detected radiological occult metastases in 30% of the patients.

CONCLUSION

Conventional CT can be used to detect and classify cholangiocarcinoma but was found to underestimate the respectability of cholangiocarcinoma.

Further progress in preoperative staging of cholangiocarcinoma might be achieved using multidetector thin-slice CT scans with delayed contrast-enhanced scans. MR cholangiography can provide the additional benefit of demonstrating both the intraluminal and extraluminal extent of disease.

References

1. Tillech M, Mischinger HJ, Preisegger KH, Rabl H, Szolar DH. Multiphasic helical CT in diagnosis and staging of hilar cholangiocarcinoma. *AJR* 1998;171:651-58.
2. Feydy A, Vilgrain V, Denys A, et al. Helical CT assessment in hilar cholangiocarcinoma: Correlation with surgical and pathological findings. *AJR* 1999;172:73-77.
3. Callery MP, Strasberg SM, Doherty GM, Soper NJ, Norton JA. Staging laparoscopy with laparoscopic ultrasonograph: Optimizing respectability in hepatobiliary and pancreatic malignancy. *J Am Col Surg* 1997;185:34-41.
4. Lacomis JM, Baron RL, Oliver JH III, Nalesnik MA, Federle MP. Cholangiocarcinoma: Delayed CT contrast enhancement patterns. *Radiology* 1997;203:98-104.
5. Han JK, Choi BI, Kim TK, et al. Cholangiocarcinoma: Pictorial essay of CT and cholangiographic findings. *Radio Graphics* 2002;22:173-83.
6. Lee WJ, Lim HK, Jang KM, et al. Radiologic spectrum of cholangiocarcinoma: Emphasis on unusual manifestations and differential diagnoses. *Radio Graphics* 2001;21:97-116.
7. Baron RL, Tublin ME, Peterson MS. Imaging the spectrum of biliary tract disease. *Radiol Clin N Am* 2002;40:1325-54.
8. Choi BI, Lee JH, Han MC, Kim SH, Yi JG, Kim CW. Hilar cholangiocarcinoma: Comparative study with sonography and CT. *Radiology* 1989;172:689-92.
9. Takayasu K, Ikeya S, Mukai K, Muramatsu Y, Makuuchi M, Hasegawa H. CT of hilar cholangiocarcinoma: Late contrast enhancement in six patients. *AJR* 1990;154:1203-206.
10. Gibson RN, Yeung E, Thompson JN, et al. Bile duct obstruction: Radiologic evaluation of level, cause, and tumor respectability. *Radiology* 1986;160:43-47.
11. Soyer P, Bluemke DA, Reichle R, et al. Imaging of intrahepatic cholangiocarcinoma: 1. Peripheral cholangiocarcinoma. *AJR* 1995;165:1427-31.
12. Soyer P, Blumke DA, Reichle R, et al. Imaging of intrahepatic cholangiocarcinoma: 2. Hilar cholangiocarcinoma. *AJR* 1995;165:1443-36.
13. Triller J, Looser C, Baer HU, Blumgart LH III, Nalesnik MA, Federle MP. Hilar cholangiocarcinoma: Radiological assessment of respectability. *Eur Radiol* 1994;4:9-17.

Table 1. The formula of calculating PPV, NPV & accuracy rate.

		Surgery	
		Resectable	Unresectable
CT	Resectable	a (4)	b (3)
	Unresectable	c (0)	d (16)

PPV = $a/a+b$, NPV = $d/c+d$, Accuracy = $a+d/a+b+c+d$

Table 2. Lymph node metastasis.

		Surgery and pathology		
Findings		N0	N1	N2
CT	N0	11	1	3
	N1	0	1	0
	N2	0	0	7

: Accuracy 82.6%

N0 - No regional lymph node metastasis. N1 - metastasis to lymph node within the hepatoduodenal ligament (cystic duct, pericholedochal and/or hilar lymph node). N2 - metastasis to peripancreatic, periduodenal, periportal, celiac, superior mesenteric and/or posterior pancreaticoduodenal lymph nodes.

Table 3. Distant metastasis : peritoneal seeding.

		Surgery and pathology	
		Peritoneal seeding	
		Yes	No
CT	Yes	8	0
	No	4	11

: Accuracy 82.6%

Table 4. Vascular invasion.

Surgery and pathology			
Vascular invasion		Yes	No
CT	Yes	2	1
	No	1	5

Accuracy 70.8%

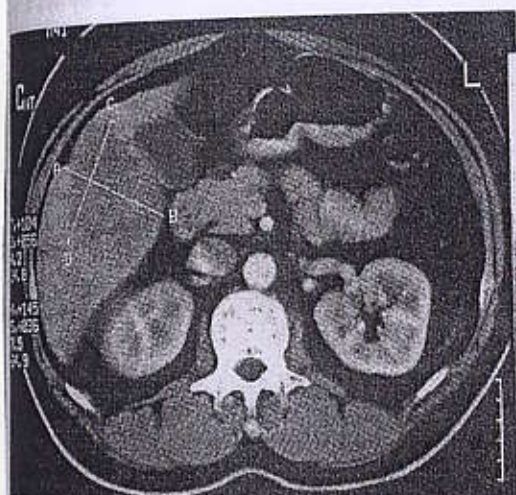


Figure 1. 41-year-old with cholangiocarcinoma with CT failed to detect hepatoduodenal, portal, duodenal and renal lymph nodes.

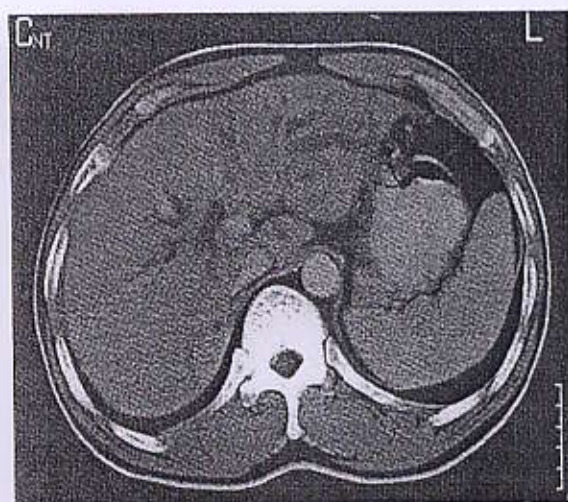


Figure 2. 60-year-old man with hilar cholangiocarcinoma with CT failed to detect peritoneal seeding and ascites (they were found in operation).

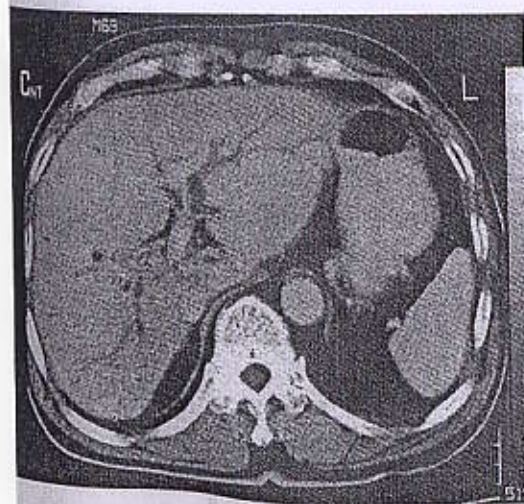


Figure 3. 69-year-old man with cholangiocarcinoma with CT detected right portal vein invasion, but the surgical and pathological found no invasion (false positive).