

## Computed tomography of cholangiocarcinoma

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### Objective

*Cholangiocarcinoma is a common primary cancer of the bile duct especially in the northeastern part of Thailand. The purpose of this study was to analyze the computed tomographic (CT) findings in pathologically proven cholangiocarcinoma.*

### Material and methods

*The CT findings of 13 histologically proved cholangiocarcinoma were retrospectively reviewed (9 males and 4 females; 37 - 68 years old; average age 53 years)*

### Results

*There were 15 lesions found in 13 patients and they were classified into 4 types.*

*Type A. Intrahepatic mass with or without bile duct dilatation.*

*Type B. Ill-defined mass with nonunion bile duct dilatation.  
(Hilar cholangiocarcinoma)*

*Type C. Generalized bile duct dilatation without identified mass.*

*Type D. Intraductal mass*

*The most common pattern was type A. (8 in 15 lesions) and the second most common was type B (4 in 15 lesions). Two of 15 lesions were type C and only 1 of was type D. The associated findings were hepatomegaly, tumor calcification and regional lymphadenopathy. Three cases had abdominal wall invasion.*

**Conclusion**

*The most common CT findings in the studied cases was an intrahepatic mass with or without bile duct dilatation. Most of the masses were hypodense with minimal or no contrast enhancement. Although it is nonspecific, the additional findings of tumor calcification, lobar atrophy, history and clinical findings may be helpful for diagnosis.*

**Key words :** *Cholangiocarcinoma, CT of cholangiocarcinoma.*

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#### วัตถุประสงค์

มะเร็งของท่อน้ำดีเป็นมะเร็งปฐมภูมิที่พบได้บ่อย โดยเฉพาะในภาคตะวันออกเฉียงเหนือของประเทศไทย การศึกษานี้มีวัตถุประสงค์เพื่อวิเคราะห์ภาพเอกซเรย์คอมพิวเตอร์ที่พบในผู้ป่วยมะเร็งท่อน้ำดี ซึ่งได้รับการตรวจยืนยันทางพยาธิวิทยา

#### วัสดุและวิธีการ

ผู้ศึกษาได้ทำการศึกษาย้อนหลังภาพเอกซเรย์คอมพิวเตอร์ของผู้ป่วยมะเร็งท่อน้ำดี 13 คน ประกอบด้วย ผู้ป่วยชาย 9 คน ผู้ป่วยหญิง 4 คน อายุระหว่าง 37-68 ปี อายุเฉลี่ย 53 ปี

#### ผลการศึกษา

ภาพเอกซเรย์คอมพิวเตอร์พบรอยโรค 15 ตำแหน่ง ในผู้ป่วย 13 คน ซึ่งแบ่งรอยโรคที่พบออกเป็น 4 ชนิด

- ชนิด A. ก้อนเนื้องอกในตับ ซึ่งพบหรือไม่พบการขยายตัวของท่อน้ำดี พบมากที่สุด (8 ใน 15 รอยโรค)
- ชนิด B. ก้อนเนื้องอกขอบเขตไม่ชัดเจนบริเวณขั้วตับ ร่วมกับการขยายตัวของท่อน้ำดีซึ่งไม่สม่ำเสมอ พบรองลงมา (4 ใน 15 รอยโรค)
- ชนิด C. ท่อน้ำดีขยายตัวอย่างสม่ำเสมอโดยไม่พบเนื้องอก (พบ 2 ใน 15 รอยโรค)
- ชนิด D. ก้อนเนื้องอกในท่อน้ำดี (พบ 1 ใน 15 รอยโรค)

สิ่งที่พบร่วมกับรอยโรคได้แก่ภาวะตับโตแคลเซียมในก้อนเนื้องอก, ต่อม้ำเหลืองข้างเคียงโต และมีผู้ป่วย 3 รายที่พบก้อนเนื้องอกลูกกลมมายังผนังหน้าท้อง

#### สรุป

พบลักษณะทางรังสีจากภาพเอกซเรย์คอมพิวเตอร์ในผู้ป่วยมะเร็งท่อน้ำดี 4 แบบต่าง ๆ กัน โดยแบบที่มีลักษณะก้อนเนื้องอกในตับ ซึ่งอาจพบ หรือไม่พบการขยายตัวของท่อน้ำดีร่วมด้วยพบมากที่สุด

Cholangiocarcinoma is a primary cancer of biliary ductal epithelium. It can originate in a small intrahepatic bile duct, including the hepatic hilum or extrahepatic bile duct. The gross appearance, as well as the clinical picture, is different according to the site of origin or subtype of the disease.<sup>(1)</sup> The optimal management of patients with cholangiocarcinoma requires accurate preoperative diagnosis and evaluation of the tumor extent.<sup>(2-4)</sup> Currently, cholangiography is the definitive method for tumor detection and assessing the ductal extent. However, it is insensitive in detecting extrabiliary tumor spread.<sup>(5-6)</sup> The ultrasonography was first used in investigation of patients with jaundice, and it is widely accepted as a highly effective screening method for detection of cholangio-carcinoma.<sup>(2-4,7)</sup> Computed tomography was subsequently found to be useful in the diagnosis of this disease owing to its noninvasiveness and because it provides accurate anatomic detail and tumor extent. Some CT patterns are quite characteristic, while others are nonspecific.<sup>(6-10)</sup> The purpose of this study was to review the CT features of cholangiocarcinoma cases found in Chulalongkorn Hospital. Eighty patients with pathologically proven cholangiocarcinoma were admitted to Chulalongkorn Hospital during the period October, 1991 to October, 1994. Only 13 CT scans of these patients were available for evaluation.

### Material and Method

Eighty patients with pathologically proven cholangiocarcinoma were admitted to Chulalongkorn Hospital during the period October, 1991 to October, 1994. Only 13 CT scans of these

patients were available for evaluation. Of these patients; there were 9 males and 4 females and ages ranged from 37-68 years with an average of 53. Most of the patients were from the northeastern part of Thailand. All the CT scans were performed prior to surgery or percutaneous transhepatic biliary drainage (PTBD). All except 2 were examined by the General Electric Sytec 4000 CT machine. The scans were obtained at 10 mm. interval and 10 mm. section thickness with a scan time of 4 seconds. The scans were obtained before and after intravenous injection of 100 ml. of 60% Urovideo. The clinical, laboratory and computed tomographic findings of all of the patients were retrospective reviewed by us.

### Result

There were 15 lesions found in 13 patients. The patterns of lesions found in CT scans were summarized in Table 1.

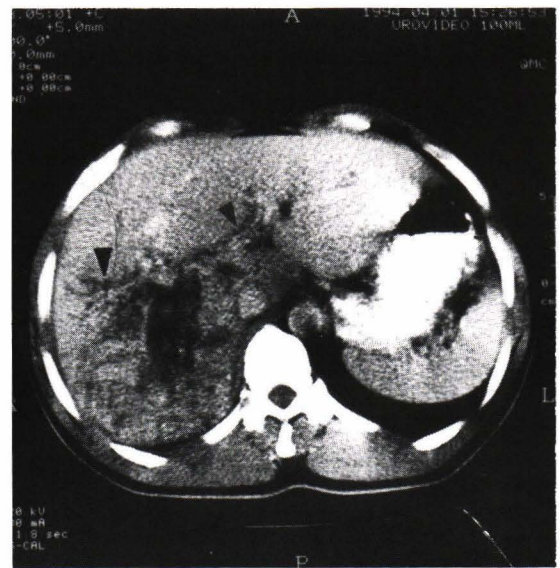
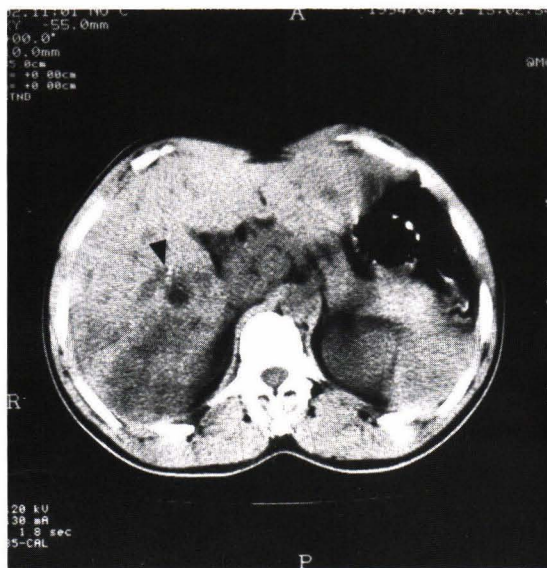
**Table 1.** Pattern of CT findings.

Patterns of CT findings	No. of lesion
A. Intrahepatic mass	
A.1 with bile duct dilatation	6 *
A.2 without bile duct dilatation	2
B. Ill defined mass with nonunion bile duct dilatation (Hilar cholangiocarcinoma)	4 *
C. Generalized bile duct dilatation without mass	2
D. Intraductal mass	1

\*Two patients had both type A and B

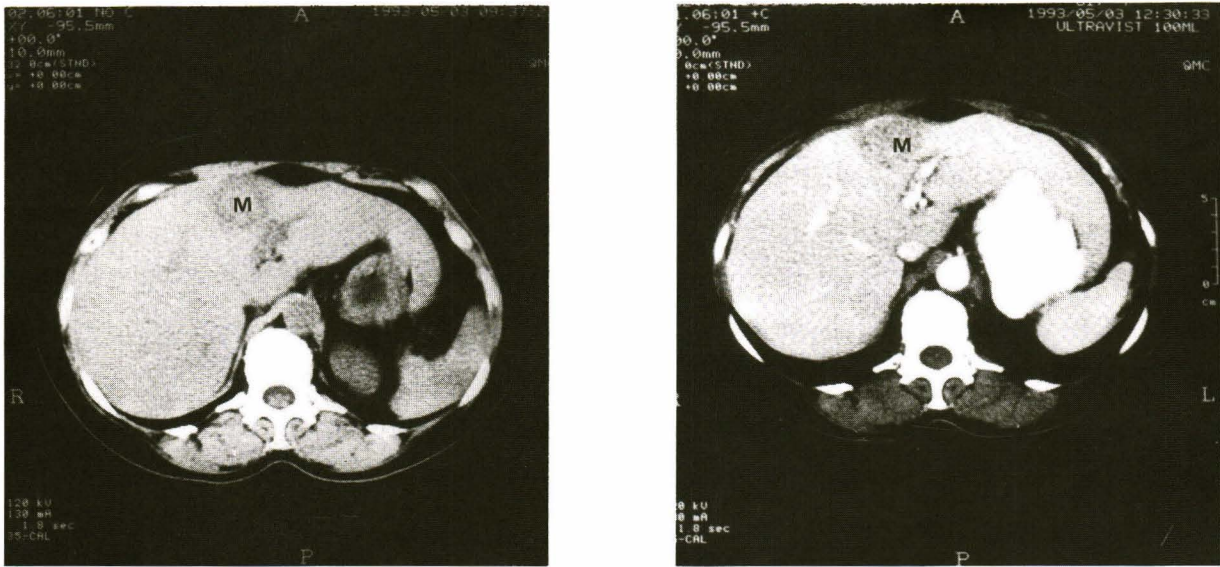
The most common pattern was type A (intrahepatic mass). Four lesions were found in the right lobe and four in the left. Of these 8 mass lesions, 6 lesions were associated with mild to moderate dilatation of the adjacent intrahepatic bile duct (Fig.1-3) There was one patient presented with a large mass at the anterior abdominal wall which originated from the left lobe with adjacent mild dilatation of the bile duct (Fig.4). The latter case was initially diagnosed as liver metastases but the biopsy result was

cholangiocarcinoma. All of the masses were hypodense compared to the normal liver and most showed no significant contrast enhancement. There was only one lesion with minimal enhancement, the same patient as described in Figure 4. Rims enhancement was observed in one patient who also had fever on admission. Needle aspiration was performed and the result was infected material with cholangiocarcinoma. (Fig.5) Calcifications were noted in 3 masses. (Fig.1,5).

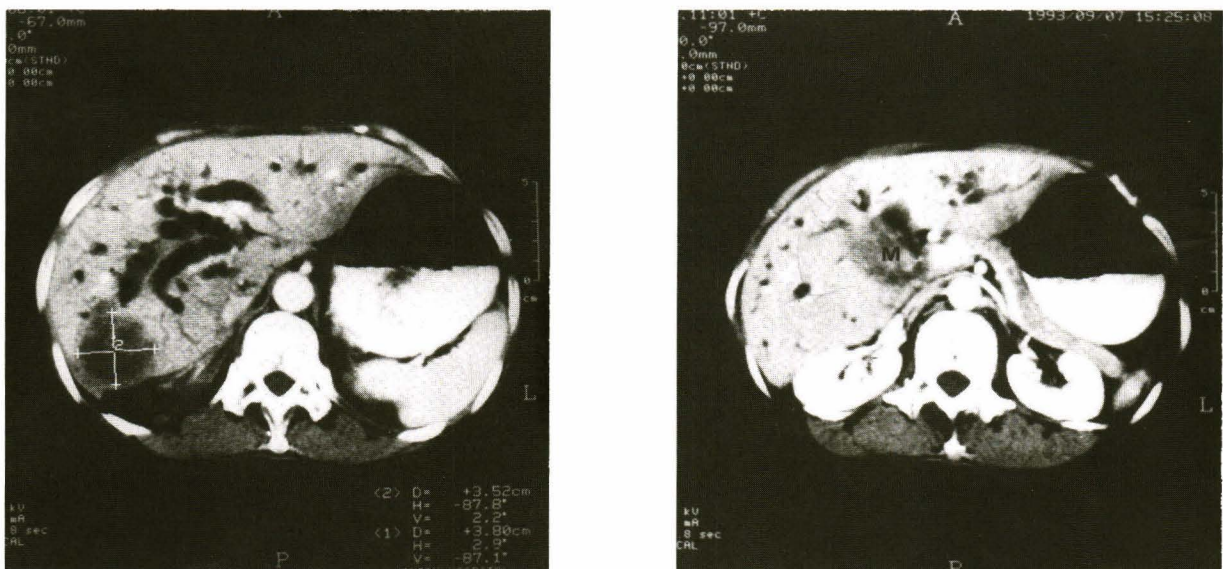


**Figure 1.** Type A. Cholangiocarcinoma

- A. Unenhanced CT scans showed ill defined inhomogeneous low density mass with strippl calcifications (arrow head) in the right lobe.
- B. Postcontrast CT scans at level above A. showed no significant enhancement of the inhomogeneous hypodense mass with dilatation of the intrahepatic bile duct. (arrow head)

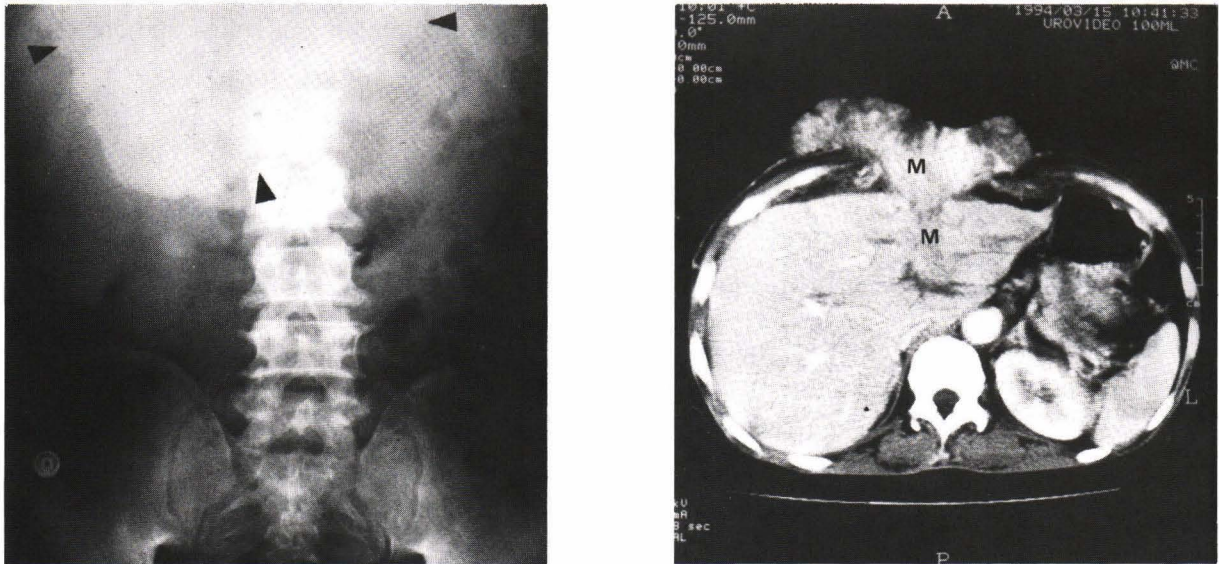


**Figure 2.** Type A. Cholangiocarcinoma manifest as a hypodense mass in medial segment of the left lobe. There was no dilatation of the bile duct. A. Precontrast CT scans and B. Postcontrast CT scans showed a well defined hypodense mass (M) without definite enhancement of the mass.



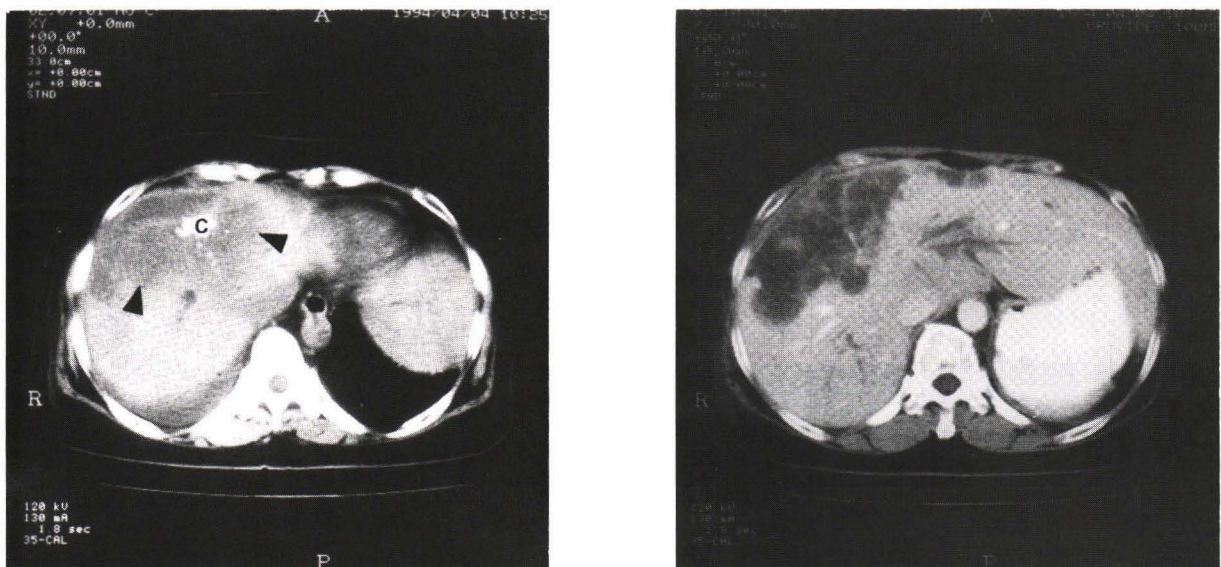
**Figure 3.** Type A+B. Cholangiocarcinoma.

- A. Contrast CT scans of the liver showed infiltrative mass (M) at porta hepatis causing intrahepatic bile duct dilatation.
- B. Contrast CT scans of the liver at the level above A. revealed A 3.5x3.8 cm. hypodense mass (+...+) in the right lobe.



**Figure 4.** Cholangiocarcinoma presented as large mass at anterior abdominal wall.

- A. Plain abdomen revealed large soft tissue mass (arrow heads) superimposed mid upper abdomen.
- B. Postcontrast CT scans showed the mass (M) originating from the left hepatic lobe. Minimal bile duct dilatation was noted.

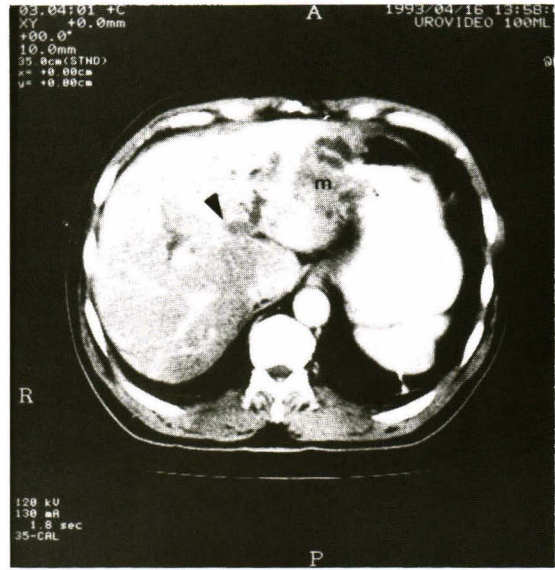
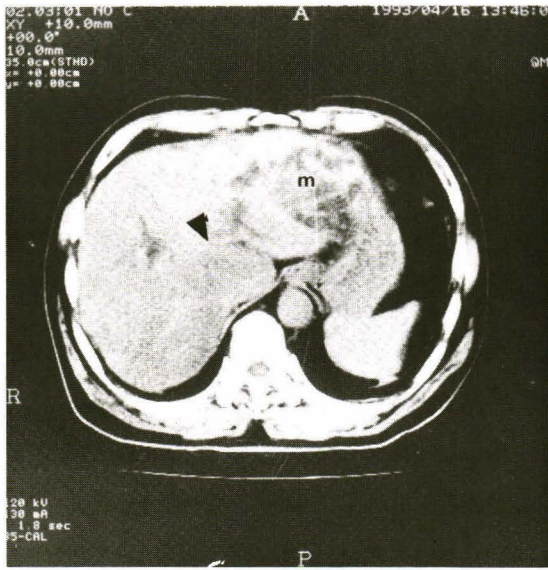


**Figure 5.** Rims enhancing cholangiocarcinoma with superimposed infection

- A. Precontrast CT scan showed poorly defined low density mass (arrow heads) with calcifications (C) in the right lobe. Right pleural effusion was also noted.
- B. Postcontrast CT scan at level slightly below A. showed rims enhancing appearance. Mild dilatation of the intrahepatic bile duct was also noted. Needle aspiration was performed and the result was cholangiocarcinoma with infected material.

An ill-defined mass with nonunion bile duct dilatation (type B) was the second most common feature (Fig 6.). Four lesions in four

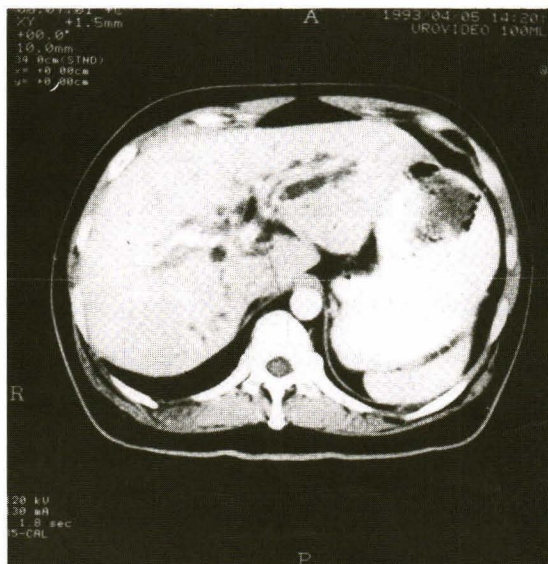
patients were noted in our study, and one of these showed evidence of calcification.



**Figure 6.** Cholangiocarcinoma Type B. Hilar cholangiocarcinoma A. precontrast and B. postcontrast CT scans revealed infiltrative mass (arrow heads) at porta hepatis with nonunion intrahepatic bile duct dilatation. There was a hypodense mass (m) with mild enhancement in the left lobe which could be another peripheral type of cholangiocarcinoma.

Type C, generalized dilatation of the intrahepatic bile duct without identified mass, was noted in 2 patients (Fig 7). One had an operative

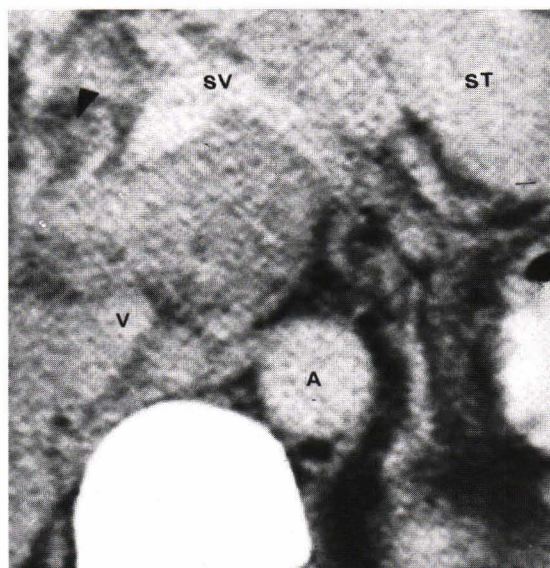
finding of a tumor at the proximal common bile duct. Another had a tumor at the common hepatic bile duct.



**Figure 7.** Cholangiocarcinoma Type C. Contrast CT scans of the liver showed generalized dilatation of the intrahepatic bile duct without mass.

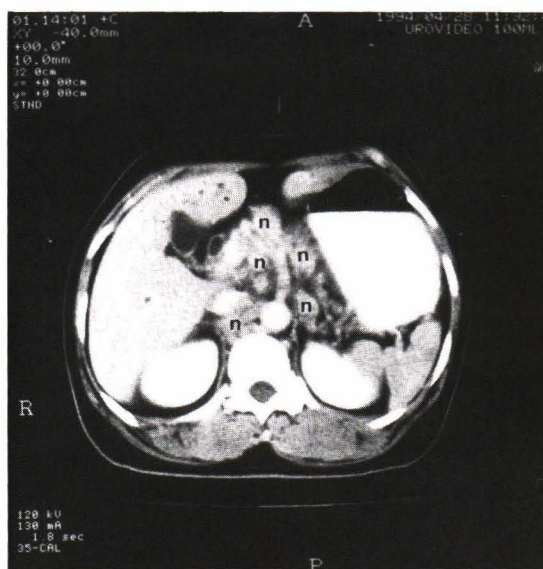


Intraductal mass(type D) was seen in one patient. The operative findings was a tumor in the proximal third of the common bile duct (Fig.8).



**Figure 8.** Type D. Intraductal mass. Postcontrast CT scan showed small soft tissue mass (arrow head) in the common bile duct. Enlarged celiac lymph nodes (n) were noted. (SV = Splenic vein, A = aorta, V = IVC., ST = stomach)

The other associated findings in the 13 patients were hepatomegaly, distended gallbladder, regional lymphadenopathy (Fig.9), obliteration of the portal vein, intrahepatic duct stones, and abdominal wall invasion. These findings are summarized in Table 2.



**Figure 9.** Contrast CT scans showed multiple celiac and retrocaval lymphadenopathy (n) in the patient with type A. cholangiocarcinoma.

**Table 2.** Associated findings.

Associated findings	No. of lesion
Hepatomegaly	8
Tumor calcification	4
Distended gallbladder	4
Regional lymphadenopathy	3
Obliteration of the portal vein	2
Intrahepatic duct stone	1
Abdominal wall invasion	3

The most common presentation was abdominal pain which was found in 10 patients. The others were jaundice in 7 patients, dyspnea in 1, fever in 3, and an abdominal wall mass in 1 patient. Elevation of serum alkaline phosphatase was seen in 9 patients and the value varied from 545-3055. Serum bilirubin was elevated in 10 patients. Normal values of Alfa-fetoprotein were seen in 4 patients. There was no report of Alfa-fetoprotein levels in the other patients.

## Discussion

Cholangiocarcinoma continues to be an important diagnostic entity. Early detection and accurate evaluation of its extent are necessary for proper management. CT provides useful information, especially the anatomic detail and the extrahepatic extension which are helpful for potentially resectable tumors.

The CT findings in the 13 patients of our study can be divided into 4 types; intrahepatic mass, with or without bile duct dilatation (type A); ill defined mass with nonunion dilatation of the intrahepatic bile duct (type B); generalized dilatation of the intrahepatic bile duct without identified mass (type C); and intraductal mass (type D).

The most common type found in our limited study was type A.1 (intrahepatic mass with or without bile duct dilatation). This type was similar to bulky exophytic tumors as described by Nesbit et al<sup>(13)</sup> and Choi et al<sup>(7)</sup> They found that this type of tumor was the second most common while we found that this type was our most common. Most of these masses were quite large at presentation but they caused only partial ob-

struction of the biliary system. This was probably due to the tumors in the liver obstructing only a portion of the biliary system and thus remaining clinically silent and allowing longer subclinical growth.<sup>(9)</sup> This may responsible for late presentation of the patient as in one case in our study with abdominal wall invasion. The invasive nature of cholangiocarcinoma is well known. Ros et al had reported one case of intrahepatic cholangiocarcinoma of the left lobe with invasion of the gastric wall.<sup>(11)</sup> There were no reports of abdominal wall invasion by cholangiocarcinoma as in our cases. The CT was found to be better than the ultrasonography in detecting the mass, especially isoechogenic liver mass. Most of the masses found in CT scans showed hypodensity with minimal or no contrast enhancement. These findings are nonspecific and other liver mass lesions such as hepatocellular carcinoma or metastases should be included in the differential diagnosis.<sup>(8,10-11)</sup> However, the presence of calcification secondary to mucous secretion, which is uncommon in untreated typical hepatocellular carcinoma or an uncommon invasion of the portal veins and clinically the presence of a normal level of Alfa-fetoprotein, may be useful in ruling out typical hepatocellular carcinoma. In cases of metastatic tumors, the clinical history and a thorough evaluation of organs that frequently have primary adenocarcinomas will be helpful for differentiation.<sup>(11)</sup>

The second most common type was type B (ill-defined mass with nonunion bile duct dilatation). This is synonymous with "klatskin tumor" or hilar cholangiocarcinoma or infiltrating type.<sup>(7,9)</sup> This type was the most common finding

in other reported study.<sup>(7,9)</sup> The tumor involves the bile duct wall and occludes the lumen, characteristically being manifested as a focal biliary stricture. The CT features were intrahepatic duct dilatation that may be asymmetrical in degree, a soft tissue mass in the porta hepatis that may or may not be enhanced, and a mass of low attenuation within the liver parenchyma. CT was found to be more sensitive than ultrasonography in detecting mass in this region.<sup>(7,9)</sup> This findings were also nonspecific.<sup>(8)</sup> Other possible diseases are localized sclerosing cholangitis, inflammatory or postsurgical stricture, gall bladder carcinoma, primary hepato-cellular carcinoma and metastases. However, cholangiocarcinoma was highly suggested if there was an associated finding of lobar atrophy.<sup>(8,13)</sup> We did not find lobar atrophy in our study. However, cholangiocarcinoma was diagnosed in the patient from the northeastern part of Thailand who had CT findings of this type because liver flukes are endemic in that part of Thailand. As we know, liver flukes are the predisposing factor of cholangiocarcinoma.

Type C (generalized bile duct dilatation without identified mass) is not specific for cholangiocarcinoma. Other diseases causing obstruction of the bile duct such as stones, biliary papilloma or other tumors obstructing the bile duct, may result in bile duct dilatation. Ultrasonography was found to be more sensitive than CT in detecting mass in the extrahepatic bile duct distal to the bifurcation<sup>(9)</sup> owing to the advantage of ultrasonography in performing sagittal imaging of the common bile duct, and the entire common bile duct can be examined. The CT can display only axial images so that small lesions may not be

detected if a continuous thin slice was not performed.

Type D (intraductal mass) was the least common finding. The most common site of the tumor in the major biliary ductal system was the distal common bile duct. Common bile duct stones, especially cholesterol stones, were considered to be the differential diagnosis.<sup>(10)</sup> Again, the ultrasonography was found to be more sensitive than CT in identifying tumors in this region owing to the problem of volume averaging, small lesions and the oblique course of the extrahepatic bile duct.

The associated findings of the cholangiocarcinoma in our study were tumor calcification, biliary stones and regional lymphadenopathy.

In conclusion, the most common CT feature of cholangiocarcinoma found in our limited study was a focal mass with or without adjacent bile duct dilatation. The second most common finding was nonunion dilatation of the right and left hepatic bile duct with ill-defined mass at the porta hepatis. The most nonspecific finding was generalized dilatation of the intrahepatic bile duct, which was found in 2 of 13 patients. There was calcification in 3 cholangiocarcinomas. We did not find any lobar atrophy in our study. We had three patients with invasive tumors extended to the abdominal wall and one of these came with an abdominal wall mass.

## References

1. Itai Y, Araki T, Furui S, Yashiro N, Ohtomo K, Iio M. Computed tomography of primary intra-hepatic biliary malignancy. *Radiology* 1983 May ; 147(2): 485-90

2. Voyles CR, Bowley NJ, Allison DJ, Benjamin IS, Blumgart LH. Carcinoma of the proximal extrahepatic biliary tree; radiologic assessment and therapeutic alternative. *Ann Surg* 1983; 197 : 188-94
3. Ferrucci JT Jr, Adson MA, Mueller PR, Stanley RJ, Stewart ET. Advances in the radiology of jaundice : a symposium and review. *AJR* 1983 Jul; 141(1): 1-20
4. Berk RN, Cooperberg PL, Gold RP, Rohrmann CA Jr, Ferrucci JT Jr. Radiology of the bile ducts : a symposium on the use of new modalities for diagnosis and treatment. *Radiology* 1982 Oct; 145(1) : 1-9
5. Nichols DA, Mac Carty RL, Gaffey TA. Cholangiographic evaluation of bile duct carcinoma. *AJR* 1983 Dec; 141(6) :1291-4
6. Broughton NS, Evenson A, Osnes M. Endoscopic retrograde cholangiography in primary biliary tract carcinoma. *Clin. Radiol* 1978 Nov; 29(6) : 647-9
7. Choi BI, Lee JH, Wan MC, Kim SH, Yi JG, Kim CW. Hilar cholangiocarcinoma : comparative study with sonography and CT. *Radiology* 1989 Sep; 172(3): 689-692
8. Carr DH, Hadjis NS, Banks LM, Hemingway AP, Blamgart LH. Computed tomography of hilar cholangiocarcinoma. A new sign, *AJR* 1985; 145 : 53-56
9. Nesbit GM, Johnson CD, James EM, Mac Carty RL, Nagorney DM, Bender CE. Cholangiocarcinoma : Diagnosis and Evaluation of Resectability by CT and sonography as Procedures complementary to cholangiography. *AJR* 1985 Nov;151(5): 933-8
10. Thorsen MK, Quiroz F, Lawson TL, Smith DF, Foley WD, Stewart ET. Primary biliary carcinoma. CT evaluation. *Radiology* 1984 Aug; 152(2): 479-83
11. Ros PR, Buck JL, Goodman ZD, Ros AM, Olmsed WW. Intrahepatic Cholangiocarcinoma: Radiologic-Pathologic Correlation *Radiology* 1988 Jun; 167(3): 689-93
12. Pickering SP, Haaga JR. The biliary system. In : Haaga JR, A Ifidi RJ, eds. *Computed tomography of the whole body* second edition. The C.V. Mofby Company 1988. 870-904
13. Vazquez JL, Thorsen MK, Dodds WJ, Foley WD, Lawson TL. Atrophy of the left hepatic lobe caused by a cholangiocarcinoma. *AJR* 1985 Mar; 144(3): 547-8