Helical CT Assessment on Hilar Cholangiocarcinoma: Comparison Value of Arterial Phase and Portovenous Phase Correlation

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Objective: *To study the correlation between the findings of hilar cholangiocarcinoma in hepatic arterial phase and portal venous phase. Attention will focus on whether the arterial phase imaging shows more detail than portal phase imaging.*
Material and Method: *Descriptive study design with retrospective data collection in Srinagarind Hospital, Khon Kaen University. CT scans of the upper abdomen of 34 patients with pathologically proven hilar cholangiocarcinoma between 2002 and 2004 were reviewed for: 1) characteristic of the tumor, 2) adenopathy, 3) arterial involvement, 4) venous involvement, and 5) degree of biliary involvement on both the hepatic arterial and portal venous phases.*
Results: *The correlation was high for characteristics of the tumor, the tumor enhancement pattern, and detection of adenopathy, degree of biliary involvement, and arterial involvement, but low for portal venous involvement which the portal venous phase detected better than the hepatic arterial phase.*
Conclusion: *In hilar type cholangiocarcinoma, the portal venous phase yielded the best findings. Furthermore, it showed all findings that were seen in the hepatic arterial phase. According to the present study, the authors suggest doing a pre-contrast study then a portal venous phase imaging for evaluation and diagnosis of hilar type cholangiocarcinoma. There is no necessity to perform hepatic arterial phase in hilar cholangiocarcinoma.*

Keywords: *Hilar cholangiocarcinoma, Helical CT, Portovenous phase*

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The population of Northeast Thailand has one of the highest known rates of cholangiocarcinoma[1]. Currently, triple-phase helical computed tomography (CT) is done in-patients suspected with hilar cholangiocarcinoma. Routine triple-phase helical CT is also used for persons suspected of having a liver mass[2-3,7]. But in cholangiocarcinoma, it seems unnecessary for hepatic arterial phase (HAP) because the tumor is not a hypervascular tumor[4-8]. In the present study, the authors compared the findings from HAP and portal venous phase (PVP) by evidence characteristic of the tumor such as hilar mass, degree of biliary dilatation, adenopathy, arterial involvement, and venous involvement and concluded the correlation between the two phases of imaging. The authors wanted to determine whether HAP imaging shows some detail findings as PVP. If unnecessary, the authors could use two phase helical CT, pre-contrast and PVP, instead of the routine three-phase helical CT.

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Material and Method

Eighty-two patients with newly CT scan diagnosed hilar cholangiocarcinoma underwent imaging at Srinagarind Hospital between January 2002 and June 2004 using a uniform triple-phase helical CT technique.

Forty-eight patients were excluded from the present study for the following reasons such as patients do not have pathological proven no surgical resection had been performed or incomplete preoperative imaging. Thirty-four cases were retrospectively reviewed by two radiologists by consensus (26 men, 8 women; age range, 44-78 years; mean age, 58 years). All scans were obtained using a 4-slice MDCT scan (Siemens, Somatome Volume Zoom). First, the non-enhanced axial scans with 8-mm collimation were performed. Then, contrast material-enhanced helical CT of the entire liver was performed during a single breath held using an 8-mm collimation in craniocaudal direction. The scanning sequences were initiated 30 and 70 seconds after intravenous injection of 100 mL of nonionic contrast material at the rate of 2.5 mL/sec. This scanning protocol provided two sets of scans corresponding to the HAP (30 seconds) and PVP (70 seconds) of contrast enhancement.

The helical CT images were first grouped into two separate image sets (HAP and PVP) which were interpreted by two radiologists working in consensus and blinded to the results of interpretation of the other set of images, by using separate reading sessions, with an interval of 2 weeks between sessions. The observers were not blinded to the phase type, because there were obvious differences in the appearance between the two sets of helical CT imaging. The observers were asked to determine detectability or undetectablity of the mass, tumor enhancement pattern, adenopathy, arterial involvement, venous involvement and degree of biliary involvement.

Statistical analysis

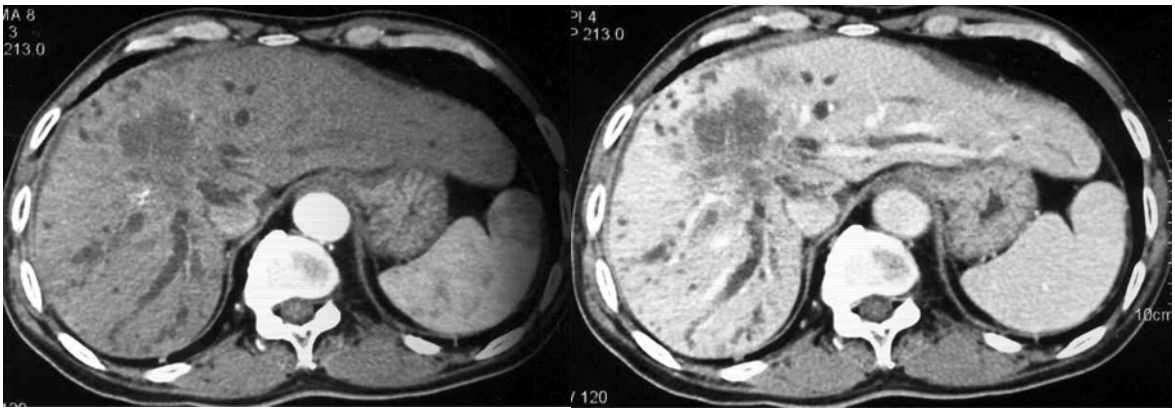
Correlations of detectability or undetectability of the hilar tumoral mass, tumor enhancement pattern, adenopathy, arterial involvement, venous involvement and degrees of biliary involvement between HAP and PVP imaging were evaluated using Kappa statistics.

Results

The present study results are presented in Table 1 and 2. The authors were able to detect hilar tumoral mass in all 23 patients by PVP, but only 18 by HAP (Fig. 1). The authors could detect adenopathy by HAP and PVP in seven and 14 patients, respectively (Fig. 2). Right hepatic artery only could be in one patient by HAP. In the present study, patient-using HAP could not detect portal venous involvement but 12 patients were detected with portal venous involvement by PVP (Fig. 3). The results of severity of biliary involvement were the same between HAP and PVP, mild intrahepatic bile duct dilatation in five cases, moderate intrahepatic bile duct dilatation in 21 cases, and severe intrahepatic bile duct dilatation in eight cases (Fig. 1-4).

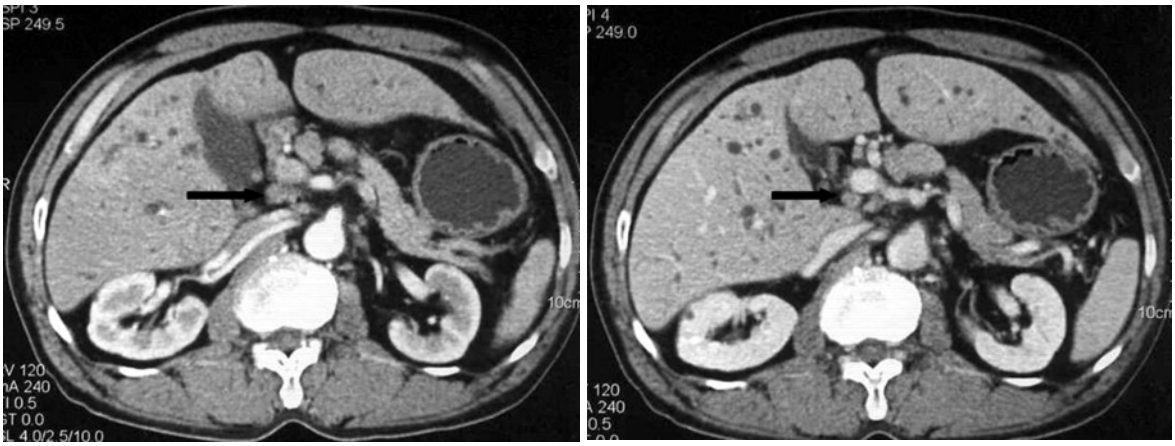
Discussion

The triple-phase helical CT scan upper abdomen is routinely performed in cases suspected of having a liver mass. This protocol is used to detect hypervascular tumors, which rapidly washes out before the portal phase and for detecting arterial involvement[7,9]. But in-patients with hilar cholangiocarcinoma, most of the important details required for evaluation and



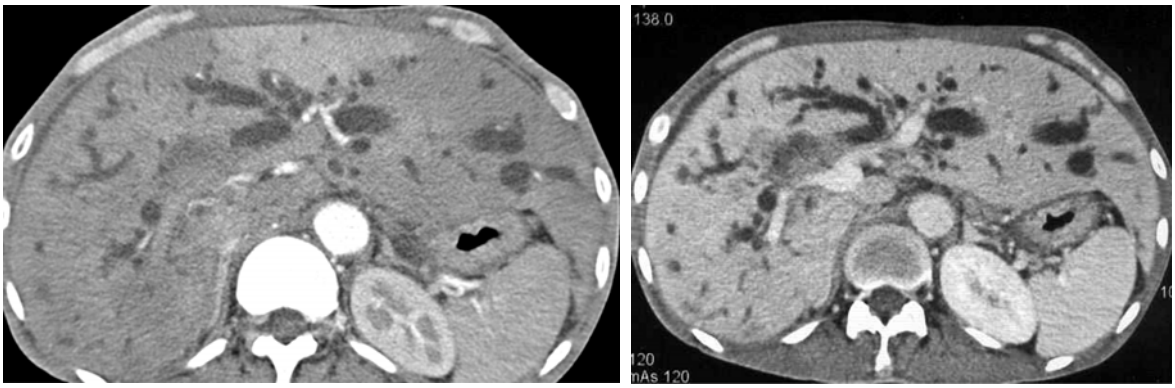
(a) (b)

Fig. 1 Hilar cholangiocarcinoma shows hilar tumoral mass in HAP imaging (a) and PVP imaging (b)



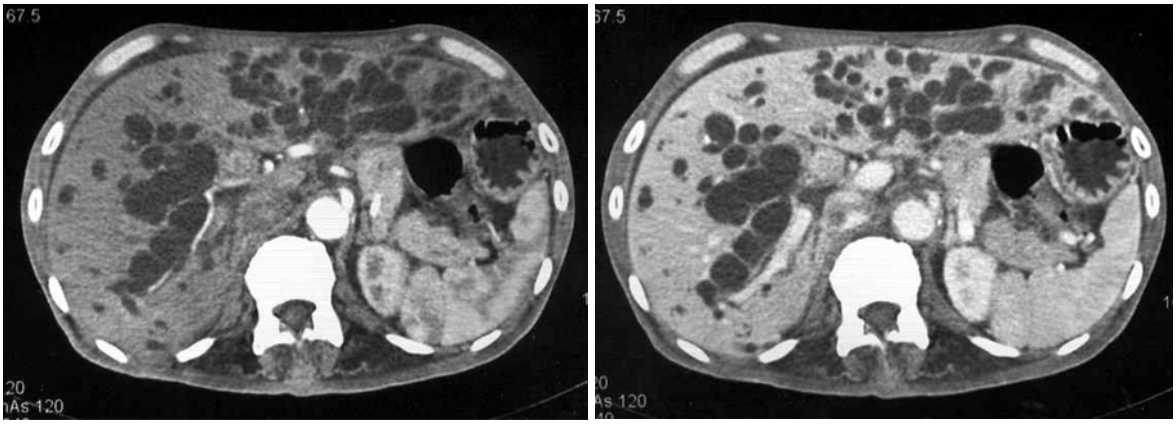
(a) (b)

Fig. 2 Hilar cholangiocarcinoma, mild to moderate IHD dilatation and portocaval lymphadenopathy (arrow) demonstrate in HAP imaging (a) and PVP imaging (b)



(a) (b)

Fig. 3 A 63-year-old man with hilar cholangiocarcinoma and right portal vein invasion. in HAP (a) imaging could not demonstrate right portal vein invasion which was seen in PVP imaging (b)



(a) (b)

Fig. 4 A 63-year-old man with hilar cholangiocarcinoma, in both HAP (a) and PVP (b) imaging shows marked dilatation of IHD

Table 1. Comparison of helical CT findings in HAP and PVP in 34 patients with hilar cholangiocarcinoma

Details	Hepatic arterial phase (HAP)	Portal venous phase (PVA)
Detection of hilar mass	18	23
Tumor enhancement pattern		
Hypodense	8	14
Isodense	9	8
Hyperdense	1	1
Adenopathy	7	14
Arterial involvement	1	0
Severity of biliary involvement		
Mild	5	5
Moderate	21	21
Severe	8	8
Portal venous involvement	0	12

Table 2. Correlation between HAP and PVP

Details	Correlation between HAP and PVP (Kappa value)
Hilar tumoral mass	0.69
Tumor enhancement pattern	0.31
Detection of adenopathy	0.61
Arterial involvement	0.94
Portal venous involvement	0.35
Severity of biliary involvement	1.00

diagnosis were from PVP imaging. Because cholangiocarcinoma is not hypervascular tumor, the portal phase can detect the tumor[10,11]. So it seems to be unnecessary to perform HAP in cases of cholangiocarcinoma. The authors chose to the study hilar type cholangiocarcinoma only because most of the hilar masses with evidence of intrahepatic bile duct dilatation were hilar cholangiocarcinoma. Previously the authors used ultrasound to detect them[12], but in the peripheral type of cholangiocarcinoma, the authors must differentiate many types of liver tumor.

The present study demonstrated that PVP could detect hilar mass, dilation of IHD and adenopathy better than HAP. All of the cases that the authors were able to detect hilar mass and adenopathy by HAP were also detected by PVP, but some cases of hilar mass and adenopathy detected by PVP were not detect by HAP. Thus, regarding detection of portal venous involvement, PVP is superior to HAP because the detection of portal venous involvement can only be done in PVP. In the present study, only one in thirty four cases detected right hepatic artery encasement by HAP and none detected arterial involvement in PVP, but it not was statistically significant. This result was not significantly different from the study of Feydy et al[2], where arterial involvement was shown in 4 of 11 patients, but three patients were false-positive, they suggested that helical CT is not effective in the assessment of arterial involvement. Both HAP and PVP detected the severity of biliary involvement equally, but PVP outlines the dilated intrahepatic bile ducts better than HAP.

Limitations of the present study were the small number of patients, as to some of the patients underwent CT scan at other hospitals, because many of them were referred to the authors' institution for treatment of hilar cholangiocarcinoma. Many patients did not undergo surgical resection or liver biopsy because many had advanced disease, the clinicians and patients preferred percutaneous transhepatic biliary drainage (PTBD) for supportive treatment rather than surgical resection.

Conclusion

All of the radiographic findings detected by HAP were also detected by PVP, and some could only be detected by PVP. The authors recommend only

pre-contrast study. Furthermore, PVP should be performed in case of suspected hilar type cholangiocarcinoma. Overall, this approach was helpful in decreasing radiation exposure and decreasing consumption and CT scan tube load.

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References

1. Green A, Uttaravichien T, Bhudhisawasdi V, Chartbanchachai W, Elkins DB, Marieng EO, et al. Cholangiocarcinoma in northeast Thailand. A hospital-based study. Trop Geogr Med 1991; 43: 193-8.
2. Feydy A, Vilgrain V, Denys A, Sibert A, Belghiti J, Vullierme MP, et al. Helical CT assessment in hilar cholangiocarcinoma: correlation with surgical and pathologic findings. AJR Am J Roentgenol 1999; 172: 73-7.
3. Tillich M, Mischinger HJ, Preisegger KH, Rabl H, Szolar DH. Multiphasic helical CT in diagnosis and staging of hilar cholangiocarcinoma. AJR Am J Roentgenol 1998; 171: 651-8.
4. Keogan MT, Seabourn JT, Paulson EK, McDermott VG, Delong DM, Nelson RC. Contrast-enhanced CT of intrahepatic and hilar cholangiocarcinoma: delay time for optimal imaging. AJR Am J Roentgenol 1997; 169: 1493-9.
5. Sheafor DH, Frederick MG, Paulson EK, Keogan MT, Delong DM, Nelson RC. Comparison of unenhanced, hepatic arterial-dominant, and portal venous-dominant phase helical CT for the detection of liver metastases in women with breast carcinoma. AJR Am J Roentgenol 1999; 172: 961-8.
6. Choi BI, Cho JM, Han JK, Choi DS, Han MC. Spiral CT for the detection of hepatocellular carcinomas: relative value of arterial- and late-phase scanning. Abdom Imaging 1996; 21: 440-4.
7. Khan SA, Davidson BR, Goldin R, Pereira SP, Rosenberg WM, Taylor-Robinson SD, et al. Guidelines for the diagnosis and treatment of cholangiocarcinoma: consensus document. Gut 2002; 51(Suppl 6): VI1-9.
8. Hollett MD, Jeffrey RB Jr, Nino-Murcia M, Jorgensen MJ, Harris DP. Dual-phase helical CT of the liver: value of arterial phase scans in the detection of small (< or = 1.5 cm) malignant hepatic neoplasms. AJR Am J Roentgenol 1995; 164: 879-84.
9. Bluemke DA, Fishman EK. Spiral CT arterial portography of the liver. Radiology 1993; 186: 576-9.
10. Choi BI, Lee JM, Han JK. Imaging of intrahepatic and hilar cholangiocarcinoma. Abdom Imaging 2004; 29: 548-57.
11. Sahani D, Saini S, Pena C, Nichols S, Prasad SR, Hahn PF, et al. Using multidetector CT for preoperative vascular evaluation of liver neoplasms: technique and results. AJR Am J Roentgenol 2002; 179: 53-9.
12. Valls C, Guma A, Puig I, Sanchez A, Andia E, Serrano T, et al. Intrahepatic peripheral cholangiocarcinoma: CT evaluation. Abdom Imaging 2000; 25: 490-6.

การตรวจมะเร็งท่อน้ำดีบริเวณขั้วตับโดยเครื่องเอกซเรย์คอมพิวเตอร์ชนิดเฮลิคอล: ความสัมพันธ์ระหว่างสิ่งที่ตรวจพบในระยะ arterial และระยะ portovenous

ชลิดา อภินิเวศ, ปาณยา ทุ้มสทาน, จิราภรณ์ ศรีนัครินทร์, วัลลภ เหล่าไพบูลย์, พจน์ชวิทย์ อภินิเวศ

วัตถุประสงค์: *เพื่อศึกษาความสัมพันธ์ระหว่างสิ่งที่ตรวจพบจากเครื่องเอกซเรย์คอมพิวเตอร์ชนิดเฮลิคอล ในระยะ arterial และระยะ portovenous ในผู้ป่วยที่เป็นมะเร็งท่อน้ำดีในตับบริเวณขั้วตับ โดยเปรียบเทียบว่าการตรวจในระยะ arterial ให้ข้อมูลมากกว่าระยะ portovenous หรือไม่*

วัสดุและวิธีการ: *เป็นการศึกษาย้อนหลัง แบบพรรณนาความ ในผู้ป่วย 34 รายที่ได้รับการผ่าตัดพิสูจน์แล้วว่าเป็นมะเร็งท่อน้ำดีบริเวณขั้วตับในระหว่างปี พ.ศ.2545 ถึง พ.ศ. 2547 โดยทำการทบทวนภาพถ่ายเอกซเรย์คอมพิวเตอร์ดังต่อไปนี้ 1) ลักษณะของเนื้องอก 2) ต่อมน้ำเหลือง 3) หลอดเลือดแดง 4) หลอดเลือดดำ และ 5) ท่อน้ำดีในตับ*

ผลการศึกษา: *สิ่งตรวจพบที่มีความสัมพันธ์กันในระดับสูง ระหว่างระยะ arterial และระยะ portovenous ได้แก่ ลักษณะของเนื้องอก, รูปแบบ enhancement ของเนื้องอก, ท่อน้ำดีในตับและหลอดเลือดแดงที่เกี่ยวข้อง สิ่งตรวจพบที่มีความสัมพันธ์กันในระดับต่ำ ได้แก่ หลอดเลือดดำ ซึ่งจะตรวจพบได้ดีกว่าในระยะ portovenous*

สรุป: *การตรวจมะเร็งท่อน้ำดีในตับบริเวณขั้วตับ ด้วยเอกซเรย์คอมพิวเตอร์ชนิดเฮลิคอล สามารถละเว้นการตรวจในระยะ arterial ได้ เพราะการตรวจในระยะ portovenous สามารถให้ข้อมูลที่ครบถ้วน รวมทั้งที่ตรวจพบในระยะ arterial ด้วย ดังนั้นจึงเสนอว่า สามารถตรวจผู้ป่วยที่เป็นโรคนี้ด้วยการถ่ายภาพเอกซเรย์ในระยะก่อนฉีดสารทึบรังสีและระยะ portovenous เท่านั้น*