Diagnostic Performance of Multidetector Computed Tomography (MDCT) to Differentiate Malignant from Benign Ampullary Lesions Causing Distal Common Bile Duct Obstruction

Sopa Pongpornsup MD*,
Parisut Pawananunt MD*, Wanwarang Teerasamit MD*

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

Objective: *To evaluate diagnostic performance of 64-slice multidetector computed tomography (MDCT) for differentiating the benign from malignant ampullary lesion.*

Material and Method: *A retrospective study was performed in 55 patients with obstructive jaundice from distal common bile duct (CBD) obstruction as a result of ampullary lesion underwent 64-slice MDCT. The patients were enrolled between February 2007 and August 2014. The patients' MDCT scans of abdomen were retrospectively evaluated by two gastrointestinal radiologists without knowledge of patient's history, clinical data, and final diagnosis. Readers recorded the presence or absence of ampullary mass, size, shape, margin, enhancing pattern of ampullary lesion, diameter of CBD, and additional finding.*

Results: *CBD dilatation in malignancy and benign groups were 1.9±0.7 cm and 1.5±0.5 cm, respectively ($p<0.05$). Intrahepatic duct dilatation was more present in malignant ampullary lesion. Target pattern of ampullary lesion were found in only benign group ($p<0.05$) and pancreatic divisum were found in only malignant group ($p>0.05$). As compared pathological results and CT findings of benign and malignant lesions represent 95.4% sensitivity and 58.3% specificity.*

Conclusion: *MDCT is helpful to differentiate benign and malignant nature of ampullary lesion that causes distal CBD obstruction. Benign and malignant ampullary lesion that cause distal CBD obstruction could not be definite differentiated by size, density, and enhancement pattern on CT image but degree of CBD, intrahepatic duct dilatation, pancreatic divisum, and target pattern may be distinguished.*

Keywords: *Ampullary tumor, Common bile duct obstruction, Multidetector computed tomography*

J Med Assoc Thai 2016; 99 (8): 940-8
Full text. e-Journal: *http://www.jmatonline.com*

Ampullary carcinoma is a malignant tumor arising within the ampullary complex, distal to the confluence of the distal common bile duct (CBD), and the pancreatic duct. Incidence of ampullary cancer is about four to six cases per 1,000,000 populations[1]. However, they are the second largest population of periampullary carcinomas, which comprise carcinomas of the ampulla, distal CBD, pancreas, and duodenum, as a proportion of 7 to 9% of periampullary cancer[2]. The peak age incidence is in the eighth decade, with men more commonly affected than women[3,4]. There is few case reports of ampullary cancer associated with pancreas divisum[5,6].

It has a relatively good prognosis when compared with all periampullar cancer. Most patients usually present with obstructive jaundice before other signs and symptoms. They are about 20% of all tumor-related the CBD obstruction[7]. In 64 slice-CT, the normal largest diameter of the CBD is up to 6 mm, if over 6 mm in patient under 50 years of age, had to be correlated with clinical and laboratory findings. An upper limit of 8 mm appears reasonable after the age of 50[8]. However, from our knowledge there is no imaging criterion for differentiating malignant and benign ampullary lesion. There is some evidence that the incidence of ampullary cancer has increased over the last 30 years[9]. Lesions at ampulla can be neoplasm or inflammation. Ampullary cancer is diagnosed using imaging techniques, endoscopy, and imaging studies that are based on patient history, physical examination, blood tests, and endoscopy.

Endoscopic ultrasound (EUS) is superior to CT and ultrasound (US) in detecting ampullary tumors, but EUS and Endoscopic retrograde cholangio-pancreatography (ERCP) are of similar sensitivity

Correspondence to:
Pongpornsup S, Department of Radiology, Faculty of Medicine Siriraj Hospital, 2 Prannok Road, Bangkok-noi, Bangkok 10700, Thailand.
Phone: +66-2-4199039, Fax: +66-2-4127785
E-mail: sopa2108@hotmail.com

(EUS 95%, ERCP 95%, CT 19%, US 5%)[10]. The accurate rate of detection of ampullary carcinoma with ultrasound, computed tomography, and ERCP is 26.83%, 84.62%, and 100% respectively[7]. Although ERCP is superior to ultrasound and computed tomography, it is an invasive procedure and has more complications than the other examinations. Additionally, it cannot detect infiltrative lesion into the adjacent organ. Furthermore, this study cannot demonstrate tumor staging. However, several imaging studies for diagnosis of ampullary lesion did not have the same alignment.

Ampullary cancer usually metastasized to regional nodes, liver, adjacent organ and lungs[11]. As compared with pancreatic tumor, resectability rates of ampullary cancer are higher, and five-year survival rates are approximately 30 to 50% in patients with limited lymph node involvement[7,12,13]. Thus, an aggressive approach to diagnosis and treatment of periampullary tumors is needed to ensure that patients with these comparatively favorable cancers are treated optimally.

The purpose of the present study was to assess the ability of multidetector computed tomography (MDCT) to isolate characteristic finding of benign from malignant ampullary lesion, which possibly cause obstruction of distal CBD.

Material and Method

Patient selection

All patients were selected from the list of the pathologic results including the keyword of "ampulla" presented with obstructive jaundice without previous treatment, and underwent the thin-sliced contrast-enhanced MDCT in the Siriraj hospital available for reviewing on the picture archiving and communication system (PACS) workstation between February 2007 and August 2014. The condition in the present study was also included determination of the duration time in pathologic result within two months after underwent MDCT and had evidence of distal CBD obstruction (CBD diameter more than 6 mm and 8 mm in the patient under 50 and over 50 years of age, respectively). Finally, 55 patients were included in the present study. This was the retrospective study. The informed consent was waived.

Imaging acquisition

All patients were examined with one of the two 64-detector MDCT scanners (Somatom Definition, Siemens Medical Solution and LightSpeed VCT, General Electric Medial System). Each patient had been injected of nonionic intravenous contrast medium 100 ml at a rate of 3-5 ml/second by using power injector. Scanning area was done from the hepatic dome to lower pole kidneys in upper abdominal study with following parameters: 500 mA (GE) or 250 mAs with care dose (Siemens), 120 KV, a gantry rotation time of 0.5 second, section thickness 1.25 to 1.5 mm and a pitch of 1:0.9 (Siemens) or 1:0.984 (GE). Our protocols included non-enhanced CT and dynamic contrast-enhanced CT (arterial phase: delayed 35 seconds after intravenous contrast agent injection, porto-venous phase: delayed 80 seconds and delayed phase: 5-10 minutes). These MDCT images consisted of non-contrast and porto-venous phases in four patients, non-contrast, arterial, and venous phases in 22 patients, and non-contrast, arterial, porto-venous, and delayed phases in 26 patients. For duodenal distention, 13 patients and 42 patients were given orally with positive diluted iodinated contrast and water, respectively.

Image analysis

MDCT images were analyzed retrospectively by two board-certified radiologists (Pongpornsup S, Teerasamit W) who had nine years of experience in abdominal radiology by consensus without prior data of endoscopic findings or pathological results. These cases were randomized for analysis. The ampullary tumors (defined as abnormal enhancing mass larger than 1 cm) were identified and described in these regards: tumor size (maximal diameter of the mass in the most obvious phase on the thin slice MDCT), shape (protruded or ulcerative shape), margin (well- or ill-defined margin), degree of density on enhanced CT (iso-, hyper-, and hypo-density compared with adjacent duodenal wall enhancement on same phase), pattern of enhancement on enhanced CT (homogeneous or heterogeneous enhancement), target pattern (central hypoattenuating area surrounded by a peripheral hyperenhancing ring and outer hypoattenuating halo), and presence of internal calcification. In addition, maximal diameter of CBD, maximal diameter of pancreatic duct, dilated intrahepatic duct, and pancreatic divisum were evaluated. In addition, evidence of tumor metastasized to regional nodes, liver, adjacent organ, and lungs were evaluated.

Statistical analysis

The statistical analysis was performed with SPSS statistical package version 13 (SPSS Inc. Chicago, Illinois, USA). Mean of age, size of ampulla

mass and CBD diameter in two groups were compared by using t-test. Sex, the differences in benign and malignant ampullary lesions were evaluated by using Chi-square tests. Pancreatic duct diameter was evaluated by using Mann-Whitney test. The *p*-value less than 0.05 indicated a statistically significant difference. To evaluate the inter-observer agreement of two radiological diagnosis of ampullary mass, we used Kappa statistics. Kappa is a measure of the difference, standardized to lie on a -1 to 1 scale, where 1 is perfect agreement, 0 is exactly what would be expected by chance, and negative values indicate agreement less than chance. It turns out that, using this scale[14]; a kappa (K) of 0.57 is in the "moderate" agreement range between our two observers. We assume that K <0 represents less than chance agreement, K between 0.01 and 0.20 represents slight agreement, K between 0.21-0.40 represents fair agreement, K between 0.41 and 0.60 represents moderate agreement, K between 0.61 and 0.80 represents substantial agreement and K between 0.81 and 0.99 represents almost perfect agreement.

Results

Among 55 patients included in the present study, there were 43 patients with malignant ampullary lesions (25 men and 18 women, age range 39-86 years), 12 patients with benign ampullary lesions (6 men and 6 women, age range 51-82 years). Pathological results from malignant ampullary group were adenocarcinoma (41 patients), squamous cell carcinoma (1 patient), and small cell neuroendocrine carcinoma (1 patient). Pathological results of benign group were chronic inflammation (6 patients), tubula adenoma (2 patients), villous adenoma (1 patient), tubulovillous adenoma (1 patient), adenomyoma (1 patient), hyperplastic polyp (1 patient). The data were no significant different on sex distribution of two groups (Chi-square tests: $p = 0.615$). The mean age of these patients was 63±8 years and 68±6 years in malignant and benign ampullary lesions, respectively, that was no significantly different.

All malignant ampullary lesions were found as ampullary mass on MDCT images. Benign ampulla mass were found in nine patients (75%, 9/12 patients). Three patients of benign group could not be detected ampullary mass on MDCT images (Table 1).

Different features of ampullary mass in the present study consisted with maximal size of the ampullary lesion in the most obvious phase on the thin-slice MDCT image, shape, margin, density, and target enhancement pattern (Table 1). The most obvious phase of ampullary mass in the CT images was porto-venous phase (53.5%, 23/43 patients of malignant lesions and 66.7%, 6/9 patients of benign lesions) that was no significantly different between benign and malignant ampullary lesion ($p>0.05$). Mean maximal diameter of ampullary mass, measured in the most obvious phase on the thin-slide CT image, was about 2.3±0.9 cm (range of 1 to 5.6 cm) and 1.7±1.2 cm (range of 0.7 to 4.5 cm) in malignant and benign ampullary mass, respectively, which was not significantly different ($p = 0.099$). Malignant ampullary mass represented protruded shape in 38/43 patients (88.4%) (Fig. 1) and ulcerative shape in 5/43 patients (11.6%). Benign ampullary mass represented protruded shape in 7/9 patient (77.8%) and ulcerative shape in 2/9 patients (22.2%). Both malignant and benign ampullary mass showed protruded shape more than ulcerative shape that was no difference from both groups. Malignant ampullary mass represented well-defined margin in 12 patients (27.9%) and ill-defined margin in 31 patients (72.1%). Benign ampullary mass represented well-defined margin in five patients (55.6%) and ill-defined margin in four patients (44.4%). Ill-defined margin in both

Table 1. Summarized feature of ampullary mass in most obvious phase, size, shape, and margin in benign and malignancy groups

Ampulla findings	Pathologic result		*p*-value
	Benign	Malignant	
Ampullary mass	(n = 12)	(n = 43)	
Absent	3 (25.0%)	0 (0%)	0.029[a]
Present	9 (75.0%)	43 (100%)	
Most obvious phase	(n = 9)	(n = 43)	
Non-contrast	0 (0%)	5 (11.6%)	0.676[a]
Arterial	3 (33.3%)	15 (34.9%)	
Porto-venous	6 (66.7%)	23 (53.5%)	
Delayed	0 (0%)	0 (0%)	
Size (cm)	(n = 9)	(n = 43)	
Mean	1.7±1.2	2.3±1.0	0.099[b]
Range	0.8-4.5	1.0-5.6	
Shape	(n = 9)	(n = 43)	
Protruded	7 (77.8%)	38 (88.4%)	0.284[a]
Ulcerative	2 (22.2%)	5 (11.6%)	
Margin	(n = 9)	(n = 43)	
Well defined	5 (55.6%)	12 (27.9%)	0.118[a]
Ill defined	4 (44.4%)	31 (72.1%)	
Target enhancement	(n = 9)	(n = 43)	
Absent	7 (77.8%)	43 (100%)	0.027[a]
Present	2 (22.2%)	0 (0%)	

[a] *p*-values were determined with Chi-square tests
[b] *p*-values were determined with t-test

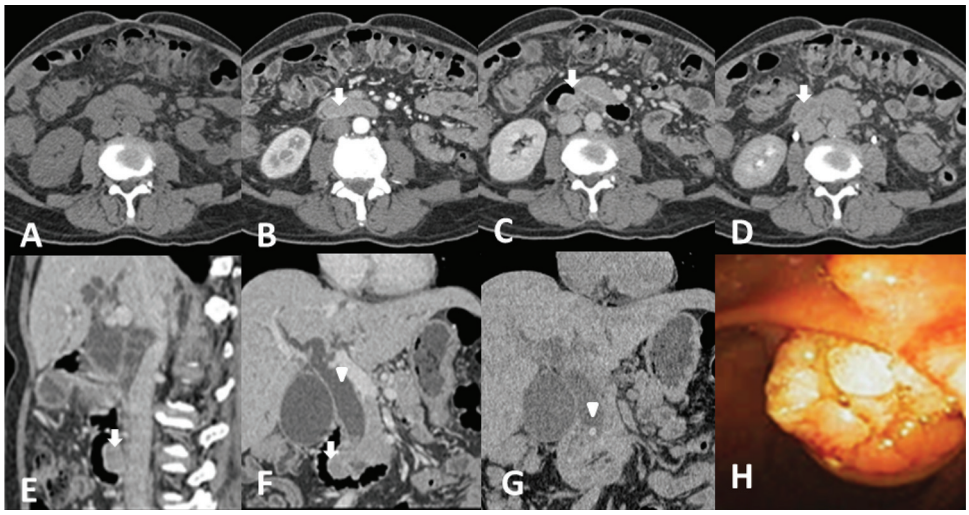

Fig. 1 A 67 year-old-man presented with obstructive jaundice from malignant ampullary mass. Transverse pre (A) and post contrast enhanced CT images during the arterial (B), venous (C), and delayed phases (D) showed well-defined, protruded, homogeneously enhancing ampullary mass (arrow in B-F) seen most obvious in porto-venous phase (image C). This lesion was difficult to evaluate in non-contrast phase (image A), arterial phase (image B), and delayed phase (image D). Dilatation of common bile duct, measuring 2.12 cm. in diameter (arrowhead in image F), and a small distal CBD stone (arrowhead in image G) were seen. After 15 days this patient was performed by ERCP with ampullary biopsy and found mass at ampulla (image H) which suspected ampullary cancer. The pathologic result was moderately differentiated adenocarcinoma.

malignant and benign ampullary mass was no significant difference.

On arterial phase, the most cases of both malignant and benign ampullary mass represented hypodensity 53.8% (21/39 patients) of malignant and 55% (5/9 patients) of benign ampullary lesions but was no statistically difference (p>0.05). However, hyperdensity pattern could be found in 15.8% (6/39 patients) of malignant ampullary mass but was not seen in benign ampullary mass. On porto-venous phase, hypodensity lesion were found in 20% (2/9 patients) benign group and in 55.8% (24/43 patients) malignant group that was no statistically difference (p>0.05). On delayed phase, there was no statistically difference in density of benign and malignant ampullary lesions (p>0.05). Enhancement including homogeneous and heterogeneous patterns was not significantly different in arterial, portal venous and delayed phases of both benign and malignant ampullary mass (p>0.05) (Table 2).

Benign ampullary mass of two patients showed target pattern (Fig. 2), could not be seen in the malignant group (p>0.05) (Table 1). Both malignant and benign groups had no evidence of associated internal calcification.

Eight patients had coincidental finding of distal CBD stone. The small CBD stone in seven patients

Table 2. Summarized density and enhancement pattern of the ampullary mass on the arterial, porto-venous and delayed phases in benign and malignancy groups

Enhancement pattern	Pathologic results		p-value
	Benign	Malignant	
Arterial density	(n = 9)	(n = 39)	
Isodensity	4 (44.4%)	12 (30.8%)	0.534[(a)]
Hyperdensity	0 (0%)	6 (15.4%)	
Hypodensity	5 (55.0%)	21 (53.8%)	
Arterial enhancement	(n = 9)	(n = 39)	
Homogeneous	4 (44.4%)	19 (48.7%)	0.727[(a)]
Heterogeneous	5 (55.6%)	20 (51.3%)	
Porto-venous density	(n = 9)	(n = 43)	
Isodensity	6 (66.7%)	15 (34.9%)	0.088[(a)]
Hyperdensity	1 (11.1%)	4 (9.3%)	
Hypodensity	2 (22.2%)	24 (55.8%)	
Porto-venous enhancement	(n = 9)	(n = 43)	
Homogeneous	3 (33.3%)	19 (44.2%)	0.727[(a)]
Heterogeneous	6 (66.7%)	24 (55.8%)	
Delayed density	(n = 4)	(n = 22)	
Isodensity	1 (25.0%)	14 (63.6%)	0.098[(a)]
Hyperdensity	1 (25.0%)	0 (0%)	
Hypodensity	2 (50.0%)	8 (36.4%)	
Delayed enhancement	(n = 4)	(n = 22)	
Homogeneous	1 (25.0%)	12 (54.5%)	0.593[(a)]
Heterogeneous	3 (75.0%)	10 (45.5%)	

[(a)] p-values were determined with Chi-square tests

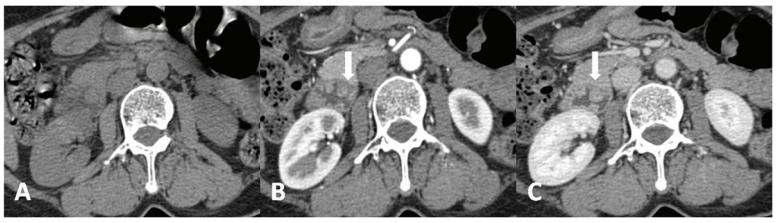

Fig. 2 A 57-year-old woman presented with obstructive jaundice by benign ampullary lesion. Transverse CT scan (A: non-contrast, B: arterial phase, C: porto-venous phase) of abdomen showed well-defined protruded lesion, measured about 1 cm at ampullary region which showed target pattern as describe as central hypoattenuating area surrounded by a peripheral hyperenhancing ring and outer hypoattenuating halo (arrow) that was seen on arterial and porto-venous phase (image B and C). After 2 day, she was performed by ERCP with ampullary biopsy and the result was papillitis. Then she was rebiopsy in next 3 months. The follow-up pathological result was adenomatous hyperplasia without malignancy.

with moderately differentiated adenocarcinoma not caused CBD obstruction. However, another one patient with mild chronic inflammation of ampullary region had a large and intense density of distal CBD stone that caused distal CBD obstruction.

Other characteristic findings that distinguish of benign and malignant ampullary lesion comprising with CBD diameter, pancreatic duct diameter, intrahepatic duct dilatation, and pancreatic divisum (Table 3). CBD diameter in the cases of malignant ampullary mass [1.9±0.7 cm (mean ± SD) in range of 0.6 to 3.9 cm] was significant larger than those of benign ampullary lesion [1.5±0.5 cm (mean ± SD) in range of 0.9 to 2.3 cm] (p>0.05). Median of pancreatic duct diameter was 0.3 cm (range of 0.2 to 0.6 cm) and 0.4 cm (range of 0.2 to 1.0 cm) in benign and malignant groups, no significant different (p>0.05). Intrahepatic duct dilatation in the cases of malignant ampulla significantly presented than those of benign ampullary lesion (p<0.05). Intraluminal growing to distal CBD lumen was observed in six patients of malignant ampullary. Pancreatic divisum was found in two patients of malignant group but none in benign group (p>0.05).

Table 3. Summarized of additional findings in benign and malignant ampullary lesions

Additional finding	Pathologic result		p-value
	Benign (n = 12)	Malignant (n = 43)	
CBD diameter (cm)			
Mean	1.5±0.5	1.9±0.7	0.046[a]
Range	0.9-2.3	0.6-3.9	
Pancreatic duct diameter (cm)			
Mean	0.3	0.4	0.162[a]
Range	0.2-0.6	0.2-1.0	
Intrahepatic duct dilatation			
Absent	4 (33.3%)	1 (2.3%)	0.006[b]
Present	8 (66.7%)	42 (97.7%)	
Pancreatic divisum			
Absent	12 (100%)	41 (95.3%)	1.000[b]
Present	0 (0%)	2 (4.7%)	

CBD = common bile duct
[a] p-values were determined with t-test
[b] p-values were determined with Chi-square tests

Authors determined impression on CT findings, including: definite benign, probably benign, indeterminate, probably malignant, and definite malignant ampullary lesion. The pathological results compared with CT findings that was analyzed retrospectively by two board-certified radiologists by consensus without prior data of endoscopic findings or pathological results. We found that 78.2% of all patients (43/55 patients) were malignant ampullary lesions from pathological results which were 4.7% (2/43) probably benign, 67.4% (29/43) probably malignant, and 27.9% (12/43) definite malignant from CT findings. By pathological results, 21.8% of all patients (12/55 patients) were benign ampullary lesions which 58.3% (7/12) probably benign, 33.3% (4/12) probably malignant, and 1% (1/12) definite malignant form CT findings. As compared benign and malignant lesions from pathological results and CT findings represents 95% sensitivity and 58% specificity (Table 4). However, two lesions were biopsy with benign result. In addition, within three months, the final pathological finding from open surgery showed malignancy in both cases.

The observer agreement was very high in visualized ampullary mass, the most obvious phase, ampullary shape, ampulalry margin, delayed density, CBD involvement, target enhancement pattern, and pancreatic divisum in range of 81.4 to 98.2%. However, the Kappa was moderated agreement when account

for chance and less than chance in pancreatic divisum. The percentage of inter-observer agreement in arterial density, arterial enhancement, porto-venous density, porto-venous enhancement, and delayed enhancement were in range of 54.1 to 69.2, rather high but were fair agreement in the Kappa (Table 5).

The authors continued retrospective study about systemic metastasis by evaluated follow-up CT image and other clinical data. Fifteen patients had no imaging follow-up (5 patients in benign group and 10 patients in malignant group) and the others showed metastasis in 10 patients. Metastasis to the liver in three patients, to lymph node and lung in two patients, to lymph node, lung, bone, lung and lymph node, lung and liver, lung liver and lymph node in one each. Eight patients with moderately differentiated had metastases within one year and the remaining two patients with well differentiated adenocarcinoma had metastasis after one year (1 years 3 months and 2 years 6 months).

Table 4. Relationship of pathologic result and computed tomography (CT) image for diagnosis benign and malignant ampullay mass to sensitivity and specificity

	Pathologic results	
	Benign (n = 12)	Malignant (n = 43)
CT image		
Benign	7	2
Malignant	5	41
	Specificity = 58.33%	Sensitivity = 95.34%

Table 5. Percent inter-observer agreement of two radiologists and Kappa

Imaging findings	% inter-observer agreement	Kappa
Visualized ampullary mass	98.2	0.613
The most obvious phase	82.7	0.675
Shape	88.5	0.558
Margin	82.7	0.571
Arterial density	60.4	0.392
Arterial enhancement	62.5	0.256
Porto-venous density	69.2	0.491
Porto-venous enhancement	63.5	0.249
Delayed density	81.4	0.656
Delayed enhancement	54.1	0.479
CBD involvement	94.5	0.697
Target enhancement	96.4	0.481
Pancreatic divisum	94.5	0.025

Discussion

Most patients of ampullary cancer usually present with obstructive jaundice before other signs and symptoms. Ampullary cancer is often curable if detected at an early stage. MDCT scan is noninvasive imaging technique for evaluation and staging.

The pathological results compared with MDCT findings that was analyzed retrospectively by two board-certified radiologists by consensus without prior data of endoscopic findings or pathological results represented 95% sensitivity and 58% specificity. The high sensitivity of study can help further investigation in this patient group with ERCP for definite tissue diagnosis and early treatment. The specificity was rather low due to difficulty to characterize of small size of lesion at ampulla especially absent of target-liked appearance.

Malignant lesion showed two patterns of gross morphology divided into protrusion and ulceration[15]. The protrusion pattern was more frequent than ulceration pattern. Margin of well-defined and ill-defined could not be differentiated lesions in both groups. Density and enhancement pattern of benign and ampullary mass were not significant difference, however, hypodensity lesion on porto-venous phase found in 20% (2/9 patients) benign group and in 55.8% malignant group (24/43 patients) that almost difference (*p*-value 0.088). Notwithstanding, the enhancing pattern of larger mass showed heterogeneous enhancement. Most lesions were small with isoenhancement as duodenal mucosa on all post contrast phases, resulting in difficulty to identified lesion and evaluate enhancing pattern in this study.

The CT study in these patients group with biliary obstruction should be used water as intraluminal contrast. It is better than water-soluble iodinate contrast to identify distal CBD stone, bowel mass, ampulla mass, and enhancing pattern. Ampullary lesion in patient with water-soluble contrast was clearly observed in precontrast image and obscured lesion in post contrast image. Then ampulla lesion was easily missed in this situation. Luminal distension at ampulla opening of duodenum was also one factor that influences the detected rate and sensitivity of lesion detection. Then, patient should be recommended to drink at least one cup of water (300 ml) immediately before image acquisition. Although pattern of density and enhancement could not separate benign and malignant lesion, in the present study the authors found two patients with target enhancement were benign lesions that did not present in malignant group.

Therefore, this finding should be further studied for more information. The target-like appearance of ampulla represented acute edematous process, which is found in benign cause such as papillitis, recent passed stone, and acute pancreatitis[15]. Intraluminal growing to distal CBD lumen were observed in six patients of malignant ampullary lesions. This sign was helpful to predict for malignant in nature. Both malignant and benign groups had no evidence of associated internal calcification.

All malignant ampullary lesions showed ampullary mass but 25% (3/9) of benign ampullary lesion had no detectable mass in the MDCT image. The most obvious CT image to detect ampullary mass was relatively good on porto-venous phase due to marked enhancement of adjacent duodenal mucosa in contrast to low density of tumor mass. However, all of MDCT images in the present study had non-contrast and porto-venous phases but some patients had no arterial and/or delayed phases, hence, porto-venous phase might be related with number of the most obvious phase.

The authors found eight patients (14% of all patients) with distal CBD stone. A small CBD stone in seven (16.3% of malignant group) patients with moderately differentiated adenocarcinoma represented chronic obstruction of the tumor growth. This observation reminded the reviewers that ampullary area should be evaluated even though the CBD stone was found.

There was no significant difference on sex and age distribution of the two groups. Mean age was about 68 years old (range of 51-82 years old) and 62 years old (range of 39 to 86 years old) in malignant and benign lesion, respectively. CBD diameter in the cases of malignant ampullary mass was significant larger [1.9±0.7 cm (mean ± SD)] than those of benign ampullary lesion (1.5±0.5 cm) (p<0.099). This finding is similar to prior study by Chang et al[16] which found size could be differentiated malignant from benign cause, cut off 12.3 mm with 91.7% sensitivity, 92.3% specification, and 92.0% accuracy. Intrahepatic bile duct dilatation in the cases of malignant ampulla is significantly presented than those of benign ampullary lesion (p<0.05) due to more severe of duct dilatation in malignant group.

Pancreatic divisum was found in two patients of malignant group, but none in benign group (p>0.05). The pancreatic divisum cause no dilatation of pancreatic duct in these patients due to difference in pancreatic duct opening. Then the ampullary mass cause only CBD dilatation. The associated between divisum and ampullary cancer was not found in any study report. This may be explained by coincidentally finding of the two findings and more numbers of malignant group in the present study.

Multiple limitations of the present study were present. First, this study is retrospective study. Second, other lesions of periampullary tumor were excluded from the present study, which may be increased specificity of this research. Third, enhancing pattern of ampullary lesions in patient with water-soluble contrast may be under estimate due to hyperdense of surrounding intraluminal fluid. Forth, the number of patients was too small to establish differentiated criteria of benign and malignant ampullary lesion.

Conclusion

MDCT is helpful to differentiate benign and malignant nature of ampullary lesion that causes distal CBD obstruction. The useful signs are size of ampullary mass, degree of CBD dilatation, and IHD dilatation. However, the tumor margin, shape, density, and enhancement pattern on CT image are not significant different between benign and malignant cause. Target enhancement pattern is suggestive of benign ampullary lesion.

What is already known on this topic?

Imaging detection rate of ampullary carcinoma is rather small compared with endoscopic ultrasound. The nodular type of ampullary carcinoma was more identified as compared with periductal thickening. The size of ampullary tumor is only variable finding that discriminate benign and malignant cause. Enhancement pattern and density value on portal venous phase of ampullary mass and maximal diameter of bile duct were not significant variables to be differentiate benign from malignant tumor.

What this study adds?

Pattern of density and enhancement could not separate benign and malignant lesion. However, target enhancement of ampulla is useful finding to interpret as benign cause. The more degree of bile duct dilatation and evidence of associated distal CBD stones are more commonly found in malignant ampullary mass.

Acknowledgements

The authors wish to thank Dr. Chulaluk Komoltri for the statistical analysis.

Potential conflicts of interest

This study was supported by the research funding from the Faculty of Medicine Siriraj Hospital, Mahidol University, Thailand.

References

1. Romiti A, Barucca V, Zullo A, Sarcina I, Di Rocco R, D'Antonio C, et al. Tumors of ampulla of Vater: A case series and review of chemotherapy options. World J Gastrointest Oncol 2012; 4: 60-7.
2. Howe JR, Klimstra DS, Moccia RD, Conlon KC, Brennan MF. Factors predictive of survival in ampullary carcinoma. Ann Surg 1998; 228: 87-94.
3. McCarthy DM, Hruban RH, Argani P, Howe JR, Conlon KC, Brennan MF, et al. Role of the DPC4 tumor suppressor gene in adenocarcinoma of the ampulla of Vater: analysis of 140 cases. Mod Pathol 2003; 16: 272-8.
4. Kim JH, Kim MJ, Chung JJ, Lee WJ, Yoo HS, Lee JT. Differential diagnosis of periampullary carcinomas at MR imaging. Radiographics 2002; 22: 1335-52.
5. Ito K, Noda Y, Fujita N, Horaguchi J, Kurose A, Sawai T. Ampullary cancer with pancreas divisum treated by endoscopic partial papillectomy: a case report. J Gastrointestin Liver Dis 2011; 20: 205-7.
6. Masu K, Ito K, Fujita N, Noda Y, Kobayashi G, Horaguchi J, et al. A case of ampullary cancer with pancreas divisum treated by endoscopic papillectomy. Nihon Shokakibyo Gakkai Zasshi 2011; 108: 1546-53.
7. Chen WX, Xie QG, Zhang WF, Zhang X, Hu TT, Xu P, et al. Multiple imaging techniques in the diagnosis of ampullary carcinoma. Hepatobiliary Pancreat Dis Int 2008; 7: 649-53.
8. Senturk S, Miroglu TC, Bilici A, Gumus H, Tekin RC, Ekici F, et al. Diameters of the common bile duct in adults and postcholecystectomy patients: a study with 64-slice CT. Eur J Radiol 2012; 81: 39-42.
9. Albores-Saavedra J, Schwartz AM, Batich K, Henson DE. Cancers of the ampulla of vater: demographics, morphology, and survival based on 5,625 cases from the SEER program. J Surg Oncol 2009; 100: 598-605.
10. Chen CH, Tseng LJ, Yang CC, Yeh YH, Mo LR. The accuracy of endoscopic ultrasound, endoscopic retrograde cholangiopancreatography, computed tomography, and transabdominal ultrasound in the detection and staging of primary ampullary tumors. Hepatogastroenterology 2001; 48: 1750-3.
11. Voutsadakis IA, Doumas S, Tsapakidis K, Papagianni M, Papandreou CN. Bone and brain metastases from ampullary adenocarcinoma. World J Gastroenterol 2009; 15: 2665-8.
12. Yeo CJ, Sohn TA, Cameron JL, Hruban RH, Lillemoe KD, Pitt HA. Periampullary adenocarcinoma: analysis of 5-year survivors. Ann Surg 1998; 227: 821-31.
13. Neoptolemos JP, Talbot IC, Carr-Locke DL, Shaw DE, Cockleburgh R, Hall AW, et al. Treatment and outcome in 52 consecutive cases of ampullary carcinoma. Br J Surg 1987; 74: 957-61.
14. Viera AJ, Garrett JM. Understanding interobserver agreement: the kappa statistic. Fam Med 2005; 37: 360-3.
15. Kim S, Lee NK, Lee JW, Kim CW, Lee SH, Kim GH, et al. CT evaluation of the bulging papilla with endoscopic correlation. Radiographics 2007; 27: 1023-38.
16. Chang S, Lim JH, Choi D, Kim SK, Lee WJ. Differentiation of ampullary tumor from benign papillary stricture by thin-section multidetector CT. Abdom Imaging 2008; 33: 457-62.

การประเมินก้อนเนื้อชนิดที่เป็นมะเร็งและชนิดไม่ใช่มะเร็งที่แอมพูลาร์โดยการตรวจเอกซเรย์คอมพิวเตอร์ 64 สไลซ์

โสภา พงศ์พรทรัพย์, ปาริสุทธิ ภวนานันท์, วรรณวรางค์ ตีรสมิทธิ์

วัตถุประสงค์: *เพื่อศึกษาความถูกต้องของการแยกก้อนเนื้อชนิดที่เป็นมะเร็งและชนิดไม่ใช่มะเร็งที่แอมพูลาร์โดยการตรวจเอกซเรย์คอมพิวเตอร์ 64 สไลซ์*

วัสดุและวิธีการ: *ศึกษาย้อนหลังจากผู้ป่วยที่ได้รับการตรวจเอกซเรย์คอมพิวเตอร์ 64 สไลซ์ จากผู้ป่วยจำนวน 55 ราย ที่ได้รับการวินิจฉัยว่ามีก้อนเนื้อที่แอมพูลาร์ ตั้งแต่เดือนกุมภาพันธ์ พ.ศ. 2550 ถึง สิงหาคม พ.ศ. 2557 โดยรังสีแพทย์ 2 คน ซึ่งจะประเมินลักษณะของก้อนเนื้อที่แอมพูลาร์, ขนาด, ขอบเขต, enhancement pattern, เส้นผ่าศูนย์กลางของท่อทางเดินน้ำดี และลักษณะข้างเคียงอื่น ๆ นำมาหาค่าความไว ความจำเพาะของการตรวจ*

ผลการศึกษา: *เส้นผ่าศูนย์กลางของท่อทางเดินน้ำดีรวมในกลุ่มก้อนเนื้อชนิดที่เป็นมะเร็งและชนิดไม่ใช่มะเร็งที่แอมพูลาร์มีขนาด 1.9±0.7 ซม. และ 1.5±0.5 ซม. ตามลำดับ ($p<0.05$) การขยายของท่อทางเดินน้ำดีภายในตับมักพบในกลุ่มก้อนเนื้อชนิดที่เป็นมะเร็ง target pattern ของก้อนเนื้อที่แอมพูลาร์พบเฉพาะในกลุ่มก้อนเนื้อชนิดที่ไม่ใช่มะเร็ง ($p<0.05$) pancreatic divisum มักพบในกลุ่มก้อนเนื้อชนิดที่เป็นมะเร็ง ($p>0.05$) เมื่อเปรียบเทียบกับผลทางพยาธิวิทยาพบว่า การตรวจประเมินด้วยเอกซเรย์คอมพิวเตอร์ 64 สไลซ์ ในการแยกระหว่างก้อนเนื้อชนิดที่เป็นมะเร็งและชนิดไม่ใช่มะเร็งที่แอมพูลาร์ มีค่าความไวและความจำเพาะที่ 95.4% และ 58.3% ตามลำดับ*

สรุป: *เอกซเรย์คอมพิวเตอร์ 64 สไลซ์ สามารถช่วยแยกก้อนเนื้อชนิดที่เป็นมะเร็งและชนิดไม่ใช่มะเร็งที่แอมพูลาร์ได้โดยประเมินจากเส้นผ่าศูนย์กลางของท่อทางเดินน้ำดีรวม การขยายตัวของท่อทางเดินน้ำดีในตับ pancreatic divisum และ target pattern แต่การใช้ลักษณะของขนาดก้อน, density และ enhancement pattern ไม่สามารถแยก 2 ภาวะดังกล่าวได้*