



دور التصوير بالأشعة المقطعية متعددة المقاطع فى تقييم انسداد القنوات المرارية

رسالة توطئة تمهيدا للحصول على درجة الماجستير فى الاشعة التشخيصية

مقدمة من الطبيب

مصطفى محمد فتحى الهلوى

بكالوريوس الطب والجراحة العامة

تحت اشراف

أ.د/سوزان بهيج علي

أستاذ الاشعة التشخيصية

كلية الطب-جامعة عين شمس

د/أحمد محمد بسيونى

مدرس الاشعة التشخيصية

كلية الطب-جامعة عين شمس

كلية الطب

جامعة عين شمس

٢٠١٥



Evaluation of the Role of Multi detector Computed Tomography in Biliary Obstruction

Essay

*Submitted for partial fulfillment of master Degree in Radio
diagnosis*

By

Mostafa Mohamed Fathy Ellahloby

M.B., B.Ch.

Under The Supervision Of

Prof. Dr. Suzan Baheeg Ali

Professor of Radio diagnosis
Faculty of Medicine-Ain Shams University

Dr. Ahmed Mohammed Bassiouny

Lecturer of Radio diagnosis
Faculty of medicine-Ain Shams University

Faculty of Medicine
Ain-shams University
2015

CONTENT

List of Figures	
List of Tables	
List of Abbreviation	
Instruction	1
Aim of the work	4
Anatomy of the biliary system	5
CT anatomy of the biliary system	15
Multi detector computed Tomography technique of biliary obstruction	29
Pathology of the biliary obstruction	47
Computed tomography (CT) imaging findings of biliaryobstruction	63
Illustrative Cases	83
Summary and Conclusion	88
References	91
Arabic summary	

List of Figures

No	Title	Page
1	Over all arrangement of the intrahepatic and extra hepatic biliary tree	5
2	Segmental liver anatomy based on couinaud classification (segment1-8).	6
3	Interior of the gallbladder and its cystic duct.	9
4	Drawing illustrates the normal biliary tract.	11
5	The extra hepatic biliary tract and four portions of the common bile duct.	13
6	Variations of the pancreatic ducts	14
7	Segment VII of the biliary duct originate from the right hepatic duct while segment II is located in the left hepatic lobe.	16
8	Normal intrahepatic duct .contrast enhanced computed tomography shows non –dilated left intrahepatic bile duct	17
9	CT scan shows normal common hepatic duct at the confluence of the right hepatic duct with the left hepatic duct	18
10	MDCT shows the normal gallbladder located at anterior – inferior edge of the liver. It is divided into three parts: neck, body and infundibulum	20
11	Contrast enhanced CT scan reveals normal appearance of gall bladder in coronal plane	21
12	Phrygian cap. CT image of the gallbladder fundus	23
13	Normal cystic duct anatomy. Axial CT scan shows the normal cystic duct	24
14	Schematic drawing of cystic duct variation	25
15	ERCP image shows parallel course of normal cystic duct.	26
16	Coronal intravenous contrast-enhanced reformatted image from CT data shows the CBD	27
17	MDCT shows normal pancreatic duct	28
18	CToblique coronal reformation	34
19	CT curved planar reformation	35

20	Minimum intensity projection	37
21	Choledocholithiasis after cholecystectomy. Coronal multiplanar reconstruction (section width, 1.25 mm) of drip infusion cholangiography with CT	39
22	Drip infusion cholangiography with CT was performed to detect bile duct injury. (a) On an axial 32-mm-thick slab maximum intensity projection image. (b) Axial image demonstrating bile leak from the cut margin of the liver	40
23	MDCT IV cholangiogram	42
24	MDCT Direct cholangiogram	46
25	Cholesterol stone	50
26	Brown pigment stone	51
27	Various types of cholangiocarcinoma	57
28	The bismuth classifications of perihilar cholangiocarcinoma	58
29	Variable Ct appearance of gall stones a) large gall stone with calcified peripheral rim .b) gall stones appear as layer of calcified microlith with high attenuation foci. C) multiple small, rim- like calcified stones in gallbladder (arrow) d) multiple gas containing stones	64
30	Distal common bile duct stone. a) Noncontract CT scan demonstrating high attenuation stone in distal common bile duct .b) following contrast enhanced CT.	65
31	(a) Axial image of a laminated gallstone (b) coronal view	66
32	gall stones (a) hypo attenuating cholesterol stone, floating in the gall bladder (b) Mercedes Benz sign associated with gas containing stone (c) ring calcification around stones, and (d) multiple pigment stone	66
33	Carcinoma of pancreatic head (a) peri-ampullary tumor with associated dilatation of common bile duct and pancreatic duct (double duct sign) (b) tumor of pancreatic head	70
34	intra hepatic mass forming cholangio carcinoma.(a-c) ct scan during arterial, portal, delayed phase	71
35	Peri-ductal –infiltrating CC in a 59-year-old woman.(a,b) contrast enhanced axial and coronal CT images during late arterial phase show dilatation of both intra hepatic duct and enhancing tumor at the hilum	72
36	Intra ductal papillary mucinous tumor of the bile duct in a 65-year-old woman.(a,b) axial and coronal contrast	73

	enhanced CT image during portal venous phase show a faintly enhancing intra ductal polypoid mass	
37	Extra hepatic, infiltrating type of CC. coronal scan of extrahepatic bile duct demonstrates thickening and abnormal enhancement of infiltrating mural mass	74
38	Gallbladder carcinoma mass replacing gallbladder fossa. (A) Hypo dense mass (M) in main lobar fissure replacing gallbladder. (B) Both hepatic metastasis and periportal lymphadenopathy from gallbladder mass (M).	75
39	Post contrast CT image demonstrates avidly contrast-enhancing polypoid gall bladder lesion from renal cell carcinoma	78
40	Axial contrast enhanced CT image with focal thickening of the gallbladder wall is seen to consist of small cyst like spaces, indicative of adenomyomatosis	78
41	CT of PSC associated with ulcerative colitis. (a) Note intra hepatic biliary dilatation in medial segment of left lobe. (b) There are scattered, discontinuous, peripherally dilated ducts in both right and left lobe	79
42	End stage sclerosing cholangitis with marked atrophy of right lobe. dilated biliary radicles and hypertrophied left lobe	80
43	Intra hepatic calculi complicating PSC. (a) Non contrast CT demonstrating high-attenuation stones with left hepatic duct. Areas of scattered dilated right hepatic duct are noted. (b) Contrast enhanced CT of same patient demonstrating hypertrophy of caudate lobe ("c"), as well as dilated biliary radicles.	81
44	Dilated pancreatic and common bile ducts caused by small ampullary carcinoma	82

List of tables

No	Title	Page
1	Scan parameters for PVP and HAP using 4, 16, and 64 slice multi detector computed tomography.	33

List of Abbreviation

CT	Computed tomography
MDCT	Multi detector computed tomography
IHBDS	Intra hepatic bile ducts
CHD	Common hepatic duct
CBD	Common bile duct
GB	Gall bladder
MinIP	Minimum intensity projection
MPR	Multiplanar reformation
VR	Volume rendering
PVP	Portal venous phase
HAP	Hepatic arterial phase
CPR	Curved planar reformation
PACS	Picture archiving and communication
TLC	Tumor to liver contrast
ER	Enhancement ratio
PSC	Primary sclerosing cholangitis
CDL	Choledochlithiasis
CC	Cholangiocarcinoma
ERCP	Endoscopic retrograde cholangiopancreatography
MRCP	Magnetic resonance cholangiopancreatography
US	Ultrasound
PTC	Percutaneous trans hepatic cholangiography

INTRODUCTION

The last two decades show improvement in the prognosis of cases of biliary obstruction thanks to the remarkable progress in the method of investigation of biliary channel, thus providing reliable (road map) that are helpful during surgery (**callery,2006**)

Biliary obstruction refers to the blockage of any duct that carries bile from the liver to the gallbladder or from the gallbladder to the small intestine. This can occur at various levels within the biliary system. (**Jennifer Lynn Bonheur, 2012**).

Biliary obstruction may be by mechanical means or by metabolic factors in the hepatic cells. Mechanical causes of biliary obstruction, further separating them into intrahepatic and extra hepatic causes. (**Niu, 2011**).

Intrahepatic causes are most commonly hepatitis and cirrhosis. Drugs may also cause direct damage to hepatocytes, such as anabolic steroids and chlorpromazine.

Extra hepatic causes may be further subdivided into those that are intra ductal and those that are extra ductal. (**Gwon, 2011**).

Biliary obstruction can be categorized into benign and malignant causes.

Benign causes as

- Choledocholithiasis.
- Benign stricture.

- ✓ Post-operative/traumatic.
- ✓ Post inflammatory.
- Choledochal cyst.
- Parasitic diseases.
- Benign tumors of the biliary tract.

Malignant as

- Cholangiocarcinoma.
- Carcinoma of gallbladder.
- Carcinoma of head of pancreas(**Jaganmohan,2011**)

Biliary obstruction is largely a clinical and radiographic diagnosis the major signs and symptoms of biliary obstruction result directly from the or failure of bile to reach its proper destination, and also may be from bacterial cholangitis and sepsis.(**Sultan, 2013**).

There are several diagnostic tests that may be administered to confirm the presence of a biliary obstruction. Initially, a physical examination and palpation of the abdominal area may be conducted to evaluate any distention, tenderness, or other abnormalities. Blood tests may be ordered to assess liver enzymes and bilirubin and alkaline phosphatase levels; results that indicate above normal levels of any of these substances may confirm the presence of a blockage. Imaging testing may be performed to evaluate the condition of the bile ducts and determine the presence and extent of any blockage. (**Afdhel, 2011**)

The radiological evaluation of obstructed biliary tract show advances with availability of US,CT,MRI including magnetic resonance cholangiopancreatography (MRCP) endoscopic retrograde cholangiopancreatography(ERCP)and percutaneous trans hepatic cholangiography (PTC),also there have been reports on the role of intravenous cholangiography with helical CT **(Sushma and Sanjay,2008).**

Although, MDCT is generally not considered to be a first line imaging technique for patient with biliary disease, advances in MDCT scanner have resulted in an increased capability to detect and categorize various biliary diseases **(Paulson, 2005)**

The advantage of MDCT of the biliary tract are increased speed and reduction of acquisition time and respiratory motion artefact furthermore, the thinner slice of MDCT result in reconstructed dataset with isotopic voxel for MPR and 3Ddisplays. Straight and curved MPR are especially valuable for visualization and evaluation biliary tree, which is typically, oriented either perpendicular tangential to the axial plane. **(Abdel moumen et al,2005)**

Aim of the work

To discuss the role of multi detector computed tomography in evaluation of biliary obstruction.

Biliary tree anatomy

The biliary tract consists of the system of ducts which collect and deliver bile from the hepatic parenchyma and transports it to the second part of the duodenum. By convention the biliary tree is divided into intra- and extra-hepatic bile ducts (**fig.1**). The intrahepatic bile ducts are formed from bile canaliculi that unite to form segmental bile duct. Intrahepatic bile ducts fuse at portahepatis of the liver into the right and left hepatic ducts. The extra hepatic bile ducts consist of the right and left hepatic ducts, the common hepatic duct, the cystic duct, gallbladder and the common bile duct. (**fig1**) (**knipe and Bashir ,2014**)

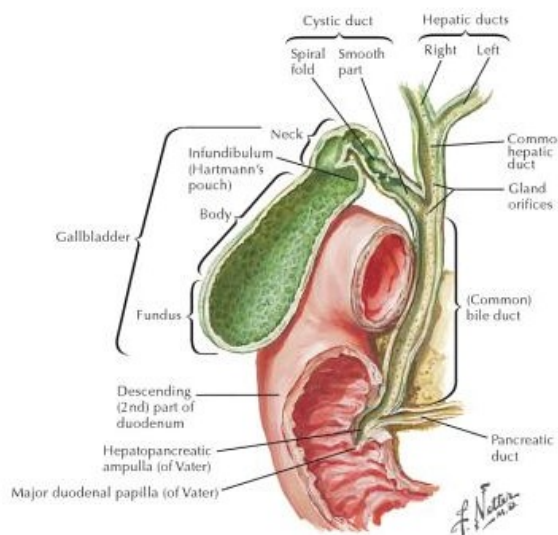


Figure 1: over all arrangement of the intrahepatic and extra hepatic biliary tree. The biliary tree to the level of the segment duct shown in relation to the conventional arterial anatomy. (**Sana bria et al, 2013**)

Hepatic duct

The Couinaud classification of liver anatomy divides the liver into eight functionally independent segments (**fig.2**). Each segment has its own vascular inflow, outflow and biliary drainage. In the Centre of each segment there is a branch of the portal vein, hepatic artery and bile duct. In the periphery of each segment there is vascular outflow through the hepatic veins. (**Scalea and bruns, 2014**)

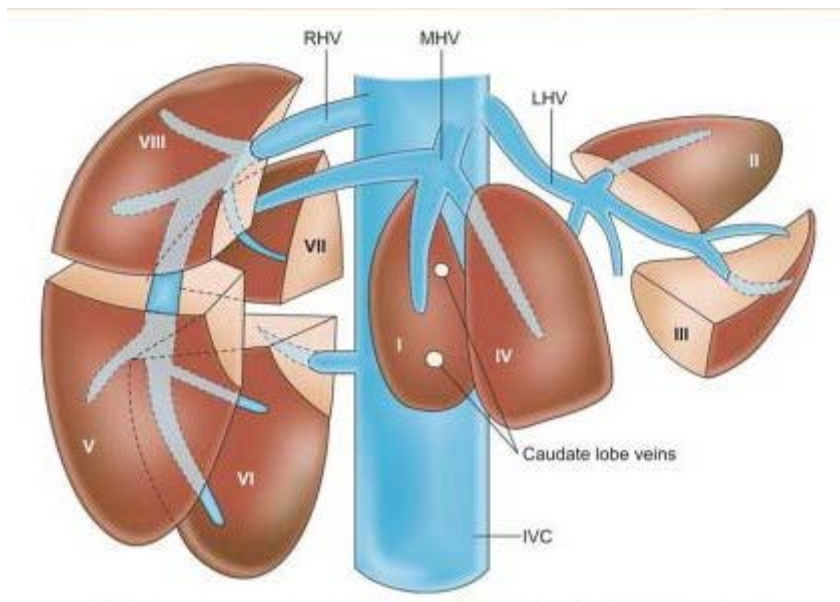


Figure 2: Segmental liver anatomy based on couinaud classification (segment1-8). (RHV right hepatic vein, LHV: left hepatic vein, MHV: middle hepatic vein, IVC: inferior vena cava. (**Chakravarty, 2010**)

The intrahepatic ductal anatomy is modeled on the segmental anatomy of the liver. **(Lee, 2013)**

At the hilum there are two- main hepatic duct, a short right and a much longer left, which join to form common hepatic duct. The left hepatic duct drains segments 2, 3, and 4 of the left hemi liver. The “normal” confluence comprises a duct formed from ducts of segments 2 and 3 and one or more ducts from segment 4. The right hepatic duct drains all segments of the right hemi liver (segments 5, 6, 7, and 8). The ducts of segments 6 and 7 form the posterior right hepatic duct and those of segments 5 and 8 form the anterior right hepatic duct. The anterior hepatic duct lies vertical, located to the left of the anterior branch of the portal vein. The direction of the posterior duct is more horizontal, running superior to the anterior portal branch and joins the anterior duct. **(Lee, 2013)**

The segment one has its own biliary drainage running to both hepatic ducts in 80% of the time, solely to the left hepatic duct in 15% of the time, and solely to the right hepatic duct in 5% of cases. **(Scalea and Bruns, 2014)**

The common hepatic duct

The main right and left hepatic ducts join soon after emerging from the liver to form the common hepatic duct at the