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Effectiveness of Ultrasonography for Diagnosis of Obstructive Jaundice Caused by Cancer of Pancreas head

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Abstract: *Jaundiceis theprecipitation of bilirubin in the tissues of the skin, sclera and mucous membranes causing a yellowish staining.It is pre-hepatic, hepatic or post hepatic. The post hepatic form is usually caused by obstruction of the common bile duct (CBD). Carcinoma of the head of pancreas (CPH)is a major cause of CBDobstructionsince it passes posterior to the head of the pancreas. The objective of this study is toassessthe effectiveness of the gray scale ultrasound to differentiate and diagnose the causes of obstructive jaundicewith an emphasis on the obstructive jaundice caused by CPH. Furthermore the influences of age, gender and occupation on CPH obstructive jaundice were also evaluated. This study was carried at Ebn-Siena Specialized Hospital - Khartoum state – Sudan, from January 2013 till June 2014. One hundred patients who were initially diagnosed to have obstructive jaundice were included in this study. Patients were selected thorough a good history and clinical examination, followed by laboratory tests and confirmed with radiological methods (CT-, MRCP & ERCP). For the purpose of this study all patients were further scrutinized with advanced different types of gray scale ultrasound machines (Duplex Doppler machines) that can emit 2 to 5 MHz from a convex transducer. The results ofthe gray scale ultrasound revealed asignificantly high ($p<0.001$)incidence of obstructive jaundice caused by CPHcompared to other causes. The obstruction was either middle or distal and no proximal obstruction was recorded.The incidence of CPH obstructive jaundice significantly ($p<0.001$) increases with the increment of age. The most susceptible groupsare the age groups of ≥ 60 years (56.1%) and the age group of 40-59 years (39.0%). Gender did not influenced ($p>0.05$) the incidence of CPH obstructive jaundice. Among occupations housewives were highly ($p<0.001$) susceptible followed by farmers and free lancers (($p<0.03$) compared to other occupations. In conclusion the non invasive gray scale ultrasound is an effective tool to diagnose and differentiate between the different causes of obstructive jaundice.Furthermore CPH causes high incidence of obstructive jaundice and elderly and housewives are more susceptible to this kind of obstructive jaundice.*

Key words: *Ultrasound, cancer of pancreas head, obstructive jaundice, gender, age, occupation.*

I. Introduction

During the first half of the twentieth century the pancreatic head carcinoma is diagnosed after surgical interference and/or after autopsy (Whipple, et al 1935). Pancreatic head cancer causes obstruction of the bile ducts and consequently impairs the liver functions leading to jaundice (Hubbard, 1958; Flammet al. 2002). Jaundice appears in varying symptoms such as: pruritus, nausea, weight loss and is associated with numerous changes such as increased icterus index, albumin & globulins concentrations in urine, prothrombin time, coloring of eye sclera, darkness of urine, abdominal pain, weakness and other symptoms (Hubbard, 1958).

Many laboratory tests are done to verify jaundice such as checking bilirubin, alanine transaminase (ALT), aspirate transaminase (AST), alkaline phosphatase (ALP), and amylase. All these tests confirm the occurrence of jaundice; however the biggest challenge facing workers in the medical field is to determine the cause of jaundice and to differentiate obstructive jaundice from other types. Initially obstructive jaundice is diagnosed by ultrasound and is confirmed by radiological means such as: direct-cholangiography, CT- scan, magnetic resonance cholangio-pancreatography (MRCP), magnetic resonance imaging (MRI), percutaneous trans-hepatic cholangiography (PTC) and endoscopic ultrasonography (Krige et al. 2007). Unfortunately most of these methods are invasive and might cause post-interventional hemorrhage in addition to the radiation hazards that can occur.

The first essential step to explore the problems of the gall bladder and the biliary duct is to use ultrasound (Shea et al. 1994). With ultrasound the cause of biliary duct obstruction, its degree and site can be determined in many cases of obstructive jaundice (Laing et al. 1986). Obstruction of the biliary duct is caused by gall stones, strictures, carcinoma of the gall bladder, cholangio-carcinoma, periampullary carcinoma and carcinoma of the head of the pancreas (Khurram et al. 2003). Also gray scale ultrasound was used successfully used to assess prostate pathologies and stones of the urinary system (Ahmed et al. 2015).

Thusthe objective of the current investigation is to evaluate the effectiveness of trans-abdominal gray scale ultrasound in assessing the incidence of carcinoma of the head of the pancreas (CPH) among patients suffering obstructive jaundice. Additionally the influences of age, gender and occupation on the incidence of CPH were also evaluated.

II. Materials And Methods

One hundred patients who were initially diagnosed to have obstructive jaundiced; at Ibn-Siena Specialized Hospital - Khartoum state – Sudan, from June 2012 till June 2014; were included in this study. All patients were studied for clinical purposes rather than research interest.Patients are ofdifferent age, gender and profession. The symptoms of Jaundice were confirmed from cases history, physical examination and were confirmed with biochemical tests including bilirubin, alanine transaminase (ALT), aspirate transaminase (AST), alkaline phosphatase (ALP)and amylase. The obstructive jaundice was further confirmed by one of the radiological methods like CT-Scan, MRCP & ERCP.For the purpose of this study all patients were further scrutinized with advanced different types of gray scale ultrasound machines (Duplex Doppler machines)that can emit 2to 5 MHz from a convex transducer.The machines are furnished withsuperior image quality facilities, thermal printer, color printer, hard copy devices and video recorder**.**The patients were scrutinized after 8 hours of fasting. Mineral oil was used topically as the coupling agent. The extrahepatic ductal structures (extrahepatic biliary system to the hepatoduodenal ligament and the head of pancreas) wereexamined with transverse, sagittal, subcostal and intercostal scans in supine, left lateral decubitus,semierectpostures or as needed.The CBD was identified anterolateral to the portal vein whereas the hepatic artery was identified anteromediallyat the portahepatis. An electronic caliber was used to measure theCBD diameter in an anteroposterior dimension from inner to inner border.The pancreas head, uncinate process, body, and tail were scanned longitudinally, transversely and obliquewith different angulations. The pancreatic tail can be seen medial to the spleen as it acts as an acoustic window.

III. Statistical Analysis

Data were analyzed using statistical package for social sciences version 16 (SPSS, Chicago, Illinois, USA). Differences between groups were determined with Chi- $\times^2$. Probabilities of $p < 0.05$were considered statistically significant.

IV. Results

IV. 1. Incidence of different causes ofobstructive jaundice

As shown in table (1) the incidence of obstructive jaundice caused by carcinoma of head of the pancreas and choledocholithiasis were significantly ($p<0.001$) higher than other causes. A total number of 41 patients (41.0%) scrutinizedwith gray scale ultrasound were confirmed to have CPH obstructive jaundice. CPH obstructs the common bile duct (CBD); at different sites and in varying degrees; leading to jaundice (Fig. 1& 2).

Table 1. Incidences of different causes of obstructive jaundice.

Cause	Number of patients	Percentage
Choledocholithiasis	39	39.0% **
Cholangiocarcinoma	08	08.0% *
Stricture	03	03.0% *
Mirrizi syndrome	03	03.0% *
Gall blader cancer	04	04.0% *
Perimpulary carcinoma	02	02.0% *
Cancer of head of pancreas	41	41.0% **
Total	100	100.0%

*, ** $p<0.001$.

Figure (1) Pancreatic head tumor obstructing the CBD and the pancreatic duct

Figure (2). Hypo-echoic pancreatic head tumor obstructing the CBD

IV. 2. Site of obstruction and caliber of CBD

The site of obstruction of the CBD did not differ (p>0.05)between males and females. The percentage of patients with middle obstruction of the CBD was 46.3% and those with distal obstruction were 53.7%. No proximal obstruction was recorded (Table 4).Six patients with CPH suffered moderate obstruction (CBD diameter= 11-12 mm), 14 patients suffered severe obstruction (CBD diameter= 13 - 15 mm) and 21 patients suffered gross obstruction ((CBD diameter ≥ 16 mm).

Table 4. The incidence of site of obstruction of CBD with CPH

Gender	Number (%)		
	Middle	Distal	Total (%)
Male	9 (40.9%)	13 (59.1%)	22 (100%)
Female	10 (52.6%)	9 (47.4%)	19 (100%)
Total	19 (46.3%)	22 (53.7%)	41 (100%)

IV. 3. Influences of age and gender on the incidence of CPH obstructive jaundice

Table (2) shows the impacts of age and gender on the incidences of CPH obstructive jaundice. CPH obstructive jaundice incidence significantly (p<0.001) increased with the increment of age. The age group of ≥ 60 years old showed the highest incidence (56.1%), however it was not significantly different from that of the age group of 40-59 years (39.0%). The least incidence was recorded in the age group of 20-39 (4.9%). The two genders showed similar (p>0.05) incidences (males=53.7%; females=46.3%).

Table 2. Influences of age and gender on the incidences of CPH obstructive jaundice

Gender	Age group			Total (%)
	20 - 39	40 - 59	60 or above	
Male	0	10	12	22 (53.7%)
Female	2	6	11	19 (46.3%)
Total (%)	2 (4.9%) *	16 (39.0%) **	23 (56.1%) **	41 (100%)

*' ** p<0.001.

IV. 4. Influence of occupation on the incidence of CPH obstructive jaundice

The incidence of CPH obstructive jaundice differed significantly ($p<0.05$) with occupation. The incidence was very high ($p<0.001$) in housewives followed by a similar incidences in farmers and free lancers ($p<0.03$). The other occupations studied had similarly low incidences of CPH obstructive jaundice (Table 3).

Table 3. Influence of occupation on CPH obstructive jaundice incidence

Gender	Occupation	Number (%)
Male	Workers	03 (07.3%)
	Free lancers	06 (14.6%) *
	Farmers	08 (19.5%) *
	Drivers	01 (02.4%)
	Mechanics	01 (02.4%)
	Retired	02 (04.8%)
	Animal traders	01 (02.4%)
	Total	22 (53.7%)
Female	House wives	17 (41.5%) **
	Employers	01 (02.4%)
	Students	01 (02.4%)
	Total	19 (46.3%)

* p<0.03; ** p<0.001.

V. Discussion

The current study proofed that the gray scale ultrasound can be used effectively in diagnosis of obstructive jaundice especially CPH. Cancer of the pancreas head was clearly observed with the gray scale ultrasound and all the cases of CPH patients were distinguished from other causes of obstructive jaundice. The incidence of obstructive jaundice caused by CPH was found higher than other causes. This incidence reported in the current study is higher what reported elsewhere(Siddique et al. 2008; Verma et al. 2010). This finding contrasts the finding of Mabula et al. (2013) who reported in a prospective study a higher incidence of CPH among Tanzanian patients who suffered obstructive jaundice.In this investigation the obstruction of CBD with CPH is most common at the lower end and few cases were obstructed at the middle. This finding confirms what was reported by Dwivedi et al. (1989 who found that the commonest cause of obstructive jaundice at the lower end of the CBD is the pancreatic carcinoma. Also the findings of this study agree with that of Admassie et al. (2005) who stated that the degree of CBD obstruction and the consequent enlargement of CBD are most common with CPH.

In the current study the incidence of obstructive jaundice caused by CPH was augmented with the increment of age. This finding is in accordance with what was reported by Gameraddin et al. (2015).There is no effect of gender difference on the incidence of CPH among patients suffering obstructive jaundice (males = 53.7%; females = 46.3%). This finding contradicts with that reported by Saiddique et al. (2008) who reported a higher incidence among females. However the occupation has a high effect on the incidence of CPH. In the current study the housewives were highly affected by CPH obstructive jaundice. The second categories of occupations affected by CPH obstructive jaundice are farmers and free lancers. This is probably due to the nature of the job because housewives and farmers usually are exposed to chemicals such as cleaners, disinfectors and fertilizers.

In conclusion gray scale ultrasound is an effective tool to diagnose and differentiate between the different causes of obstructive jaundice especially that caused by CPH. Furthermore elderly and housewives are more susceptible to CPH obstructive jaundice.

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