Journal of Bangladesh College of Physicians and Surgeons
Vol. 39, No. 4, October 2021

Comparison among the Role of Different Imaging Techniques in Diagnosis of Malignant Lesions Causing Obstructive Jaundice

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Abstract:

Introduction: The expanding spectrum of therapeutic options for patients with Obstructive /surgical jaundice makes it necessary for the surgeon to precisely assess the etiology, location, level and extent of disease before operation. Aims were to compare the diagnostic accuracy, sensitivity and specificity of different imaging techniques like ultrasonography (USG), Computed tomography (CT) and Magnetic Resonance Cholangiopancreatography (MRCP) and Endoscopic Retrograde Cholangiopancreatography (ERCP) in evaluation of patients with malignant obstructive jaundice and correlation of histopathological findings after surgical/ therapeutic intervention. Methods: It was a prospective observational study conducted in the Department of General Surgery and Hepatobilliary unit, Dhaka Medical College Hospital and Bangabandhu Sheikh Mujib Medical University, Dhaka during January 2015 to December 2015 for duration of one year to find out the role of different imaging techniques in diagnosis of malignant lesions causing obstructive jaundice in 50 cases who fulfilled the inclusion criteria. Initial USG evaluation was followed by CT scan, MRCP and ERCP. The results were read by radiologists blinded to other imaging findings. Surgically fit patients with a stage of resectability should be offered the option of surgical resection for cure. For unresectable malignancies, the choice is between surgical palliation/bypass and ERCP with drainage. The characteristic surgical findings or ERCP features and histopathological diagnosis were recorded methodically as final. Results: Malignant obstructive jaundice is the commonest amongst the males and mean age was 47.56 ± 13.191 and the commonest etiology was Ca head of pancreas (30%). Diagnostic accuracy of MRCP (98%) in the diagnosis of malignant obstructive jaundice was relatively high (98%) as compared to ERCP (89.5%), CT (91.43%), USG (89.97%) in malignant obstructive jaundice respectively. In the diagnosis of malignant diseases, MRCP was more sensitive (95.83%) as compared to ERCP (89%), CT scan (91.67%) and ultrasonography (78.17%). Regarding specificity MRCP (100%) was the high in comparison among ERCP (94%), CT (90.91%) and USG (96.15%).Conclusion: It is concluded that malignant obstructive jaundice is the commonest amongst the males. Ca head of pancreas was the commonest malignant etiology in malignant obstructive jaundice. MRCP was superior to among USG, CT scan or ERCP in studying the malignant lesions.

Keywords: Imaging Techniques ,Ultrasonography (USG), Computed tomography (CT) and Magnetic Resonance Cholangiopancreatography (MRCP) and Endoscopic Retrograde Cholangiopancreatography (ERCP),Malignant Lesions, Obstructive jaundice.

(J Bangladesh Coll Phys Surg 2021; 39: 233-240)
DOI: https://doi.org/10.3329/jbcps.v39i4.55944

Introduction:

Jaundice is a common problem in medical and surgical gastroenterological practice.[1] Obstructive jaundice is caused by the interruption of bile drainage in the biliary system. It is the most common type and is a serious hepatobiliary disease. It can cause problems in diagnosis and treatment, especially intrahepatic cholestasis. [2] Malignant obstructive jaundice as this is more relevant

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Receive: 26 November, 2020 **Accept:** 25 May, 2021

to surgeons. Malignant obstructive jaundice is result of mechanical obstruction of bile ducts from primary pancreato-billiary malignancies or metastatic deposits from the lung, breast or melanoma. The most common cause of malignant billiary obstruction is pancreatic adenocarcinoma, followed by cholangiocarcinoma, ampullary neoplasm and extrinsic compression by a metastatic lymphadenopathy in the liver [3].

Despite the technical advances, the operative modes of management of obstructive jaundice were associated with very high morbidity and mortality. Yet, during the last decade significant advances in have been made for the pathogenesis diagnosis, staging and the efficacy of management of obstructive jaundice [4]. The expanding spectrum of therapeutic options for the jaundiced patient has made it necessary for the surgeons to do more than simply discriminating between obstructive jaundice. Correct choices among therapeutic options usually rest upon a precise assessment of etiology, location, level and extent of disease [5]. So, it is mandatory to determine pre-operatively the existence, the nature and site of obstruction because an ill chosen therapeutic approach can be dangerous. Ultrasonography (USG) has been always considered the first choice technique in the study of biliary obstructive disease, due to its accessibility, speed, ease of performance and low cost [6]. Traditional Computed Tomography (CT) scan is usually considered more accurate than USG for helping determine the specific cause and level of obstruction [7]. Both USG and CT scan are regarded as safe and non-invasive procedures in evaluating the status of the biliary tract. USG is used as an initial modality to confirm or exclude duct obstruction, which it does with at least 90% accuracy [8]. The range of application of CT has been partially restricted by MRCP [9]. MRCP techniques have greatly evolved, providing high Radiology Section resolution images of the biliary tree with short exam duration, while remaining noninvasive without contrast medium injection [10].The diagnostic accuracy, sensitivity and specificity of USG 93.13%, 61.12%, 98.23% and 92.59%, 90.9%, 93.75% of CT and 93.13%, 90%, 94% of MRCP respectively [11]. ERCP also plays an important role in the diagnosis and palliation of pancreaticobiliary tumors.[4] Radiographic findings may be suggestive of malignancy, but a definitive diagnosis requires tissue sampling. The overall results for determining the correct diagnosis was 89%. The rationale for the use of ERCP lies in the possibility of taking histological samples and performing minimally invasive surgical interventions. The overall sensitivity of ERCP in combining the results of brush cytology, fine needle aspiration, and/or forceps biopsy in diagnosing pancreatic and biliary cancers [11-13].

The aim of our study was to compare the diagnostic accuracy, sensitivity and specificity of different imaging techniques like ultrasonography (USG), Computed tomography (CT) and Magnetic Resonance Cholangiopancreatography (MRCP) and Endoscopic Retrograde Cholangiopancreatography (ERCP) in evaluation of patients with malignant obstructive jaundice and correlation of histopathological findings after surgical/ therapeutic intervention.

Methods:

It was a prospective observational study conducted in the Department of General Surgery and Hepatobilliary unit Dhaka Medical College Hospital and Bangabandhu Sheikh Mujib Medical University, Dhaka during January 2015 to December 2015 for duration of one year to find out the role of different imaging techniques in diagnosis of malignant lesions causing obstructive jaundice in 50 cases. Initial noninvasive like USG evaluation was followed by CT scan, MRCP and ERCP. The noninvasive tests like USG, CT and MRCP results were read by radiologists blinded to other imaging findings. The invasive ERCP are the gold standard technique for unresectable malignancies both in diagnostic and therapeutic procedures and were done by surgeons. Surgical palliation/bypass with drainage as well as biopsy is done by ERCP. Surgically fit patients with a resectable stage of tumor after imaging should be offered the option of surgical resection and histopathological diagnosis were recorded methodically as final. The statistical terms will be included in this study are mean, standard deviation, percentage. All statistical analysis were performed using SPSS 24.0 for Windows (SPSS Inc., Chicago, Illinois, USA) level of significance was set at .05 and p-value <0.05 was considered significant.

Results:

A prospective observational study was conducted in the Department of General Surgery and Hepatobilliary

unit, Dhaka Medical College Hospital and Bangabandhu Sheikh Mujib Medical University, Dhaka. 50 patients with malignant obstructive jaundice (29 male and 21 female) and male: female ratio 1.38:1 were included in the study (Table1).

Table-I

Distributions of sex

Sex	Frequency	Percent (%)	Ratio
Male	29	58	1.38
Female	21	42	1
Total	50	100.0	

The mean ages of the patient group was within the range of 47.28 ± 13.191 and maximally were seen between in 30–70 years of age (Table II).

Table-II

Distributions of age

Age in years	No of cases	Percent (%)
≤30	4	8.0
30-50	24	48.0
50-70	19	38.0
>70	3	6.0
Total	50	100.0
Mean ± SD	47.56 ± 13.191	

Each patient had multiple personal habits. Male had the highest incidence of smoking (52%) and alcohol consumption (38%) (Table III)

Table-III

Habitual relationships in malignant obstructive jaundice

Personal history	Total	Percentage	Male	Female
Smoking	38	76	26(52%)	12(24%)
Betel nut	15	30	7(20%)	8(8%)
Alcohol	20	40	19(38%)	1(2%)
Total	50	100	29 (58%)	21(42%)

Each patient had multiple symptoms and signs. Anorexia / weight loss (96%), Clay coloured stools (92%) and jaundice (92%) were the most frequent clinical presentations (Table IV).

Table-IV

Symptoms and signs for malignant obstructive jaundice

Symptoms and signs	Frequency*	Percent (%)
Anorexia/ weight loss	48	96
Clay coloured stools	46	92
Abdominal pain	30	60
Jaundice	46	92
Pruritis	43	86
Abdominal mass	34	64
Scratch marks	27	54
Total	266	

*Each patient had multiple symptoms and signs

Ca head of pancreas(24%) and Cholangiocarcinoma (20%) were more common in male whereas Periampullary carcinoma(16%) and Ca gall bladder(12%) were more common in case female of all presented cases (Table:5).

The diagnostic accuracy, for different malignant lesions confirmed by histopathology were as shown in Table: 6. Thirteen (13) out of 15 cases of Ca head of pancreas and DA is 86.67%, 13 out of 14 cases of Cholangiocarcinoma and DA is 92.86%, 12 out of 13 cases of periampullary carcinoma and DA is 92.30% and 7 out of 8 cases of Ca gall bladder and DA is 87.50 % in which ultrasound were performed were accurately diagnosed. Ultrasound was unable to diagnose a specific cause for 3 cases where ERCP confirmed the diagnosis to be 2 cases cholangiocarcinoma and another periampullary carcinoma.

Fourteen(14) out of 15 cases of Ca head of pancreas and DA is 86.67% , 13 out of 14 cases of Cholangiocarcinoma , 12 out of 13 cases of Periampullary carcinoma and 7 out of 8 cases of Ca gall bladder in which CT scan were performed and accurately diagnosed. CT scan was unable to diagnose a specific cause for 4 cases where final diagnosis confirmed the diagnosis to be periampullary carcinoma and rest 2 cases diagnosed as Ca head of pancreas

All cases of periampullary carcinoma and cholangiocarcinoma in which MRCP was performed were accurately diagnosed and there DA is 100%. Fourteen(14) out of 15 cases of Ca head of pancreas

and DA is 93.33% , 7 out of 8 cases of Ca gall bladder and DA is 87.50 % in which MRCP were performed and diagnosed.

Seven (7) cases of cholangiocarcinoma in which ERCP was performed were accurately diagnosed and the DA is 100%. 5 out of 6 cases of Periampullary carcinoma and there DA is 83.33%., 2 out of 4 cases of Ca head of pancreas and DA is 50%. Cholangiocarcinoma, 3 out of 5 cases of Ca gall bladder and the DA is 100% in which ERCP were performed and accurately diagnosed.

The diagnostic accuracy, sensitivity and specificity of malignant lesions that causing malignant obstructive jaundice shown in Table: 7. In case of Ca head of pancreas MRCP is more diagnostic (93.33%) and ERCP is least (50%). In case of Cholangiocarcinoma MRCP and ERCP are 100% diagnostic. In periampullary Ca MRCP is more diagnostic 100% but ERCP is least. For Ca gallbladder MRCP (87.66%) is more diagnostic than ERCP (60%). Their sensitivity and specificity also reflect the result.

The overall accuracy, sensitivity and specificity of USG, CT, MRCP and ERCP in malignant lesions observed are as shown in Table: 8. MRCP is the most reliable diagnostic technique where DA 98 %, SE 95.83 % and SP 100 %.

Table-V

Distributions of Malignant Pathologies according to histopathology

Distributions of malignancy	Total	Percentage	Male	Female
Ca head of pancreas	15	30	12(24%)	3(6%)
Cholangiocarcinoma	14	28	10(20%)	4(8%)
Periampullary carcinoma	13	26	5(10%)	8(16%)
Ca gall bladder	8	16	2(4%)	6(12%)
Total	50	100	29 (58%)	21(42%)

*Ca=Carcinoma

Table-VI

Comparison of diagnostic accuracy of types of malignancies causing obstructive jaundice confirmed by histopathology in relation to USG, CT, MRCP and ERCP

Malignancy	USG			CT			MRCP			ERCP		
logical	Histopatho-logical diagnosis	Diagnosed by USG	DA *%	Histopatho-logical diagnosis	Diagnosed by CT	DA %	Histopatho-logical diagnosis	Diagnosed by MRCP	DA %	Histopatho-logical diagnosis	Diagnosed by ERCP	DA *%
Ca head of pancreas	15	13	86.67	15	14	93.33	15	14	93.33	4	2	50
Cholangio-carcinoma	14	13	92.86	14	13	92.86	14	14	100	7	7	100
Periampullary Ca	13	12	92.30	13	12	92.30	13	13	100	6	5	83.33
Ca gall bladder	8	7	87.50	8	7	87.50	8	7	87.50	5	3	60

DA*= diagnostic accuracy

Table-VII

Diagnostic accuracy, sensitivity and specificity of USG, CT, MRCP and ERCP of different type's malignant lesions

Malignancy	USG			CT			MRCP			ERCP		
	DA*%	SE**%	SP*** %	DA%	SE%	SP%	DA%	SE%	SP%	DA%	SE%	SP%
Ca head of pancreas	86.67	72.3	94	93.4	89.33	97.90	93.33	89.40	98	50	68.3	88.5
Cholangio-carcinoma	92.86	66.67	100	92.86	83.33	100	100	83.33	100	100	87.2	97
Periampullary Ca	92.30	57.14	100	92.30	85.71	100	100	100	100	83.33	89	98
Ca gall bladder	87.50	62.3	97	87.50	95.7	98.9	87.66	98.40	100	60	78.3	89.8

DA*= diagnostic accuracy, SE**= sensitivity,SP***= specificity

Table-VIII

The Overall accuracy, sensitivity and specificity of USG, CT, MRCP and ERCP in malignant lesions

Malignant	USG			CT			MRCP			ERCP		
	DA%	SE%	SP%	DA%	SE%	SP%	DA%	SE%	SP%	DA%	SE%	SP%
Malignant conditions	89.97	78.17	96.15	91.43	91.67	90.91	98	95.83	100	89.5	89	94

DA= diagnostic accuracy.SE= sensitivitySP= specificity

Discussion:

The obstructive lesions of the biliary system are difficult problem for the surgeon as most of the patients are old and major surgical risks [2]. This prospective study was conducted in two tertiary referral centers in Dhaka where subjects who were referred from different areas of the country. This study was done in a defined population revealed clinically the causes of obvious malignant obstructive jaundice in our setting over a 1 year period, the jaundice being proved by history, examination and proper laboratory investigations. The patients were selected who fill the inclusion and exclusion criterias and had malignant obstructive jaundice.

In this study, malignant obstructive jaundice is found more in the males than females. The male to female ratio was 1.38:1 for the malignant obstructive jaundice and male had history of smoking (52%) and alcohol abuse (38%) more than female. The increased incidence of malignant obstructive jaundice amongst the males is due to smoking and possibly related to alcohol abuse [14-16] which is consistent with our observation.

The mean age of the patients with the malignant etiology of obstructive jaundice was 47.56 ± 13.191 years. It was more common in the older patients and was maximally seen between 30–70 years of age. One recent study showed that the increased incidence of malignant obstructive jaundice with the increasing age [17].

Our observation showed that each patient had multiple symptoms and signs .Among the symptoms and signs anorexia/ weight loss (96%), clay coloured stools (92%) and jaundice (92%) were the most frequent clinical presentation in the patients of malignant jaundice. Some literature presented that clay coloured stools and jaundice were reported more commonly by patients with the malignant jaundice. Pruritis and abdominal pain were also seen equally in malignant cases. While almost 30% of the patients with malignancy also had abdominal pain on presentation possibly due to advanced disease [18, 19]. The abdominal masses was appreciated in 30/50 (60%) of the patients with malignancy due to the local spread of tissues thus supporting the 'Courvoisier's law' [20]. The scratch marks were also seen in malignant conditions. The presence of these signs and symptoms has also been confirmed by other studies[17-18, 21-22].

Regarding the diagnosis, Ca head of pancreas (30%) was the commonest amongst the malignancies, followed by Cholangiocarcinoma (28%), Periampullary carcinoma (26%) and Ca gall bladder (16%) in our series. Similar incidence of various malignancies in patients of obstructive jaundice has been shown in various studies [16-17, 22-23]. Six (12%) female patients and two (4%) male had Ca gall bladder also had gall stones. The association of Carcinoma Gall Bladder with gall stones has been reported in literature [15-16, 21-22]. . The patients with these malignancies also had the palpable masses in the right hypochondrium thus supporting the Courvoisier's law.[20]

Amongst the diagnostic radiological investigations USG abdomen picked the dilated intra-hepatic channels in 24%; the dilated extra-hepatic in 22% while CBD stones were found in 12% [23, 24]. The CBD was found to be dilated in 24% of the patients and its measurement ranged from 1.4 cm to 2.4 cm with a mean value of 1.46cm. Mass was picked up in only 26% of the patients and most of the time it was mass of head of pancreas and diagnostic accuracy was 85% [25] . The diagnostic accuracy of by USG was Ca head of pancreas 87.2%, Cholangiocarcinoma, 92.86%, Periampullary Ca 92.30%, Ca gall bladder 87.50% and overall diagnostic accuracy 89.97%. So this study was considered reliable in the other studies as well [23, 24].

The overall sensitivity was 66.67%, specificity was 100% and accuracy was 92.86% for cases with cholangiocarcinoma on USG in our present research

was consistent previously reported study that USG detected 87% of Klatskin's tumor [26]. One study demonstrated that the sensitivity and specificity of 88.4% and 85.3% on USG , 94.2% and 85% on CT, 86% and 92% respectively for detecting the malignant etiology of obstruction [27].

This present study showed that sensitivity, specificity and diagnostic accuracy respectively 95.83%, 100% and 98 % .

Among literatures review showed that diagnostic accuracy, sensitivity and specificity of MRCP are comparable to those reported in those studies where sensitivity, specificity and diagnostic accuracy respectively range between 81–100%, 84–100% and 90–96% [11,28,29]. Another study concluded in their study that MRCP was more accurate than CT in differentiating between malignant and benign lesions in patients with suspected periampullary tumors[30]. This is consistent with present study where MRCP showed 100 % accuracy in diagnosing cases with periampullary carcinoma.

ERCP was performed in the most of the cases where needed therapeutic intervention as well as diagnostic procedure [32]. The results of ERCP in picking up the diagnosis in case of malignant obstructive jaundice was relatively good but it was not possible to perform ERCP in all cases as it was difficult to cannulate the Ampulla of Vater either because of localized oedema or because of the external compression caused by the tumour [31]. Though the findings in these cases included projections from the ampulla and dilated duodenum. ERCP revealed dilated CBD in about 74% of cases who had malignancy either because of Ca Head of Pancreas, Ca Gall Bladder and Cholangiocarcinoma. One of the study also showed that the diagnosis of these tumours can be diagnosed by ERCP [32]. CT-Scan was done for all the cases suspected of malignancy and the ones in which ERCP was unsuccessful and the diagnosis was made on the basis of its findings.[12, 33]. Eighteen patients (30%) had Ca-Head of Pancreas, 8 patients (13.33%) had Ca Gall Bladder, 7 (11.66%) had Cholangiocarcinoma with 2 (3.33%) having the Klatskin's tumour, 1 (1.66%) patient had the Periampullary carcinoma [34]. The present study showed that 7(14%) cases of cholangiocarcinoma in which ERCP was performed were accurately diagnosed. 5(10%) out of 6 cases of Periampullary carcinoma, 2(4%) out of 4 cases of Ca head of pancreas Cholangiocarcinoma , 3(6%) out of 5 cases of Ca gall bladder in which ERCP were performed and accurately diagnosed.

The final diagnosis was then made based upon the results of histopathology and then results were drawn. Literature reviews of various others centers showed that the diagnostic accuracy of USG in defining the malignant obstruction was 91.8% as compared to 97.5 %, 90% and 100% for CT scan, MRCP and ERCP respectively. The studies showed that sensitivity for a diagnosis of malignant diseases was 88.4 %, 94.2 %, 92.3 % and 100% for USG, CT, MRCP and ERCP respectively whereas specificity was 85.3%, 85%, 98% and 100% respectively [11, 18, 31, 19-22]. Above these studies were consistent with our present observation. However the relatively lower sensitivities noted in older studies with regard to USG and CT could be due to resolution and technical factors which have vastly improved in last decade and hence this study sheds new light on diagnostic accuracies of the modern high tech equipment (including high resolution USG and spiral CT) in context to biliary obstruction [14,21].The final diagnosis was then made based upon the results of histopathology (post ERCP/biopsy/cytology/surgery) and then results were drawn and analyzed.

Conclusion:

The malignant obstructive jaundice was the commonest amongst the males. Ca head of pancreas was the commonest malignant etiology in malignant obstructive jaundice. MRCP was the modality of choice for optimal characterization of the causative lesions in most of the cases of obstructive jaundice. MRCP was superior to among USG and CT scan or ERCP in studying the malignant lesions.

Limitations of the study:

The study was conducted in only two centers in Dhaka city which might not be representative to the whole population. Small sample size was a limitation of the present study. Moreover the duration of follow up was also short.

Funding: No funding sources.

Conflict of interests:

The authors declare that there was no conflict of interests regarding the publication of this paper.

Acknowledgement:

We would like to show our gratitude to the faculty members of the Department of General Surgery and

Hepatobilliary unit, Dhaka Medical College Hospital and Bangabandhu Sheikh Mujib Medical University, Dhaka for sharing their pearls of wisdom with us during the course of this research. We are also immensely grateful to doctors and staffs of these institutes for their unconditional supports for collecting data.

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