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Original Article

Radiology Section

Assessment of Malignant Biliary Obstruction by Percutaneous Transhepatic Cholangiography: A Prospective Cohort Study

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ABSTRACT

Introduction: Malignant Biliary Obstruction (MBO) is caused by hepatic metastasis, gall bladder carcinoma, other distant metastasis, icteric hepatocellular carcinoma and lymphoma. Different signs and symptoms of obstruction includes pruritus, jaundice, altered food taste, renal dysfunction, anorexia, malnutrition which ultimately leads to impaired immune dysfunction and impaired quality of life.

Aim: To determine the extent of biliary ductal involvement in patients with MBO through Magnetic Resonance Cholangiopancreatography (MRCP) and Percutaneous Transhepatic Cholangiography (PTC) technique and to compare the number of biliary drainage required.

Materials and Methods: A prospective cohort study was undertaken at Department of Radiodiagnosis, Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow, India. It included total 40 patients (24 females and 16 males) with strong clinicopathological and laboratory investigation suspicious of MBO. Patients with suspected MBO were examined with MR cholangiography. All patients then underwent PTC and Biliary Drainage (PTBD) and/or stent placement after MR cholangiography. The statistical analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0.

Results: As out of 40 patients, 16 (40%) were males and 24 (60%) were females and the mean age was 53.87±9.49 years with maximum age noted to be 75 years and minimum age of patient in study was 35 years. The most common block observed on MRCP was type IIIA (35%) and after MRCP the distribution of level of hilar block on PTC was obtained with the most common block found was of type II (32.5%). Maximum number of biliary drains during PTBD was three. In MRCP three biliary drain were used in 47.5% patients while in PTC it was used only in 40% patients.

Conclusion: Based on diagnostic performance, PTC was found to be superior for the assessment of MBO. PTC played an important role in scheduling the therapeutic strategy for malignant biliary stricture.

Keywords: Benign biliary obstruction, Pancreatic adenocarcinoma, Secondary hepatic malignancies

INTRODUCTION

The Malignant Biliary Obstruction (MBO) most commonly results from pancreatic adenocarcinoma, cholangiocarcinoma ampullary carcinomas and adenopathy [1,2]. Other aetiologies includes primary or secondary hepatic malignancies, gall bladder carcinoma, lymphoma and other distant metastasis. MBO generally presents with painless jaundice and biliary obstruction may spoil the quality of life [3,4] and consequently pruritus, cholangitis and liver failure occurs [5,6]. The gold standard procedure for assessment of the biliary obstruction is direct cholangiography and biliary drainage can be attained surgically through PTC. The employment of this approach will depend on whether the carcinoma is operable and its location. PTC facilitates external and internal biliary tree drainage and is the primary method of relieving biliary obstruction for malignant lesions above the level of the common hepatic duct [7]. PTC is a non invasive process which confirms the diagnosis and characterises the biliary obstruction; it is advantageous in screening of high risk patients by determining the pretherapeutic staging.

PTC is usually considered superior to Endoscopic Retrograde Cholangiopancreatography (ERCP) for assessment of the biliary ducts in hilar obstruction, particularly when there is a complete obstruction of the biliary duct. Though, incomplete opacification of intrahepatic ducts is not an unusual incident [8]. Manifold projections with tilting and rolling of the patient are frequently essential to improve the diagnostic accurateness of PTC [9]. Even though PTC is considered as safe practice, severe and even fatal procedure-related complications have also been reported and it varies between 3.4% and 4.8% [10]. The aim of this study was to assess the extent of biliary ductal involvement in patients with MBO through MRCP and PTC technique and to compare the number of biliary drainage required.

MATERIALS AND METHODS

This prospective cohort study was conducted at Department of Radiodiagnosis, Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow, India, from May 2016 to August 2017, after obtaining the approval from the Institutional Ethics Committee (IEC Reg. No.48/15), all eligible patients and their guardians received a complete elucidation of the nature and purpose of the study. Written informed consent from the patients (or their Legal guardian) enrolled in the study was obtained. All the 40 cases came during stated period were included in the study.

Inclusion criteria: All patients with strong clinicopathological and laboratory investigation suspicious of MBO, which mandates the prospective imaging and percutaneous intervention and these 40 patients have unresectable disease or were not suitable candidates for surgery were included.

Exclusion criteria: Patient with clinicopathological and laboratory investigation suspicious of benign biliary obstruction were excluded from the study.

The patients included were willing and reliable for follow-up and all the 40 patients came for follow-up and signed the study specific consent form.

Magnetic Resonance Cholangiography

Patients with suspected MBO were examined with MR cholangiography. MR images were evaluated by two radiologists to decide the extent of biliary ductal involvement. A hypothetical plan for biliary drainage was established prior to any intervention. All patients then underwent PTBD and/or stent placement after MR cholangiography. PTC technique was used as the standard of reference, to evaluate the role of MR cholangiography in defining the extent of biliary ductal involvement. The radiologists determined

the severity of biliary ductal involvement by using the classification proposed by Bismuth H and Corlette MB [11]:

- Type I obstruction takes place distal to the confluence of the right and left hepatic ducts known as primary confluence,
- Type II obstruction involves the primary confluence but not the secondary confluences while
- Type III involves the primary confluence and either the right (type IIIA) or the left (type IIIB) secondary confluence, and
- Type IV obstruction involves the secondary confluence of the both the right and left hepatic ducts. The type of drainage performed was compared with the type of obstruction that had been anticipated at MR cholangiography.

PTC and Drainage

Percutaneous interventions were performed by an interventional radiologist in accordance to MR cholangiographic result. All patients underwent PTC, and biliary drainage and/or stent placement after MR cholangiography. The best access route for drainage was established by the interventional radiologist by using results of these imaging examinations, and the specific type of drainage procedure performed were established with PTC findings. Drainage was performed under local/epidural anaesthesia and mild sedation. Broad-spectrum antibiotics were administered to patient prior to procedure. Access to the biliary ductal system was done by puncture through ultrasound guidence. After puncture and opacification of a dilated peripheral duct, biliary drainage was performed by using a coaxial 18 gauge needle (Vygon, UK). The stricture was traversed by using hydrophilic guide wires (Radifocus wire, Terumo). For catheter drainage, 10-french Mallecot's Catheter (Ultrathane; Devon) were used. Metallic stents or plastic stents were placed wherever required. The technique for placing stents in a linear, Y- or T-shaped configuration was used as reported [12]. Any number after this procedure related complications were recorded, and patients were followed-up clinically with physical examination after the biliary intervention. In addition, bilirubin levels were measured four weeks after the procedure.

STATISTICAL ANALYSIS

The data were entered in microsoft excel spreadsheet and analysis was done using Statistical Package for the Social Sciences (SPSS) version 21.0. Categorical variables were presented in number and percentage. Qualitative variables were compared using Pearson Coefficient. The p-value of <0.05 were considered statistically significant.

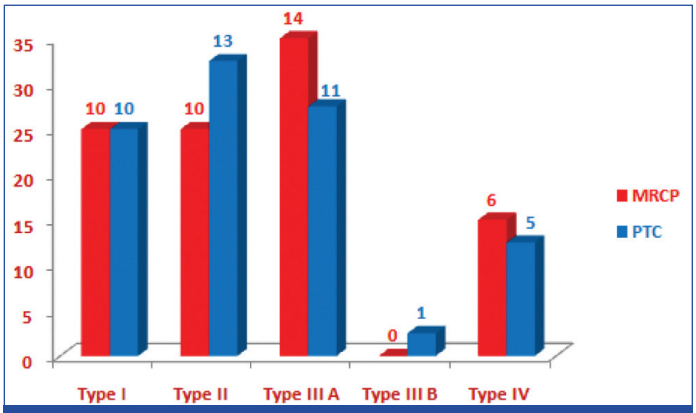
RESULTS

A total of 40 patients were included in final analysis of which 28 patients were due to gall bladder carcinomas and 12 were due to cholangiocarcinoma. Pre PTBD bilirubin level ranges from 8-22 mg/dL in these patients. 16 (40%) were males and 24 (60%) were females and the mean age was 53.87±9.49 years with maximum age noted to be 75 years and minimum age of patient in study was 35 years [Table/Fig-1].

Variables	Values
Gender n (%)	
Male	16 (40%)
Female	24 (60%)
Mean age (Mean±SD)	53.87±9.49
Range (Years)	35-75
Diagnosis of cancer n (%)	
Gall bladder carcinomas	28 (70%)
Cholangiocarcinoma	12 (30%)

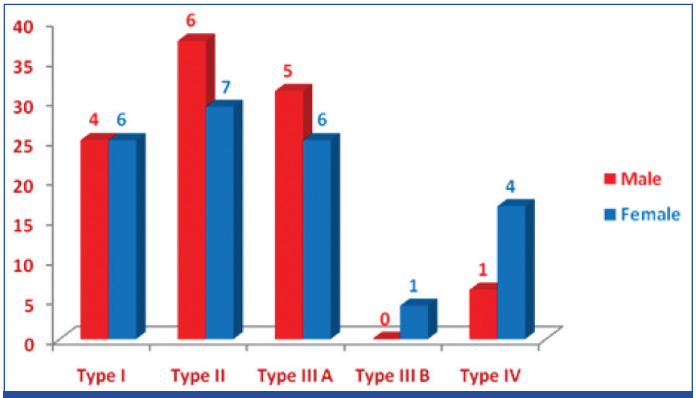
[Table/Fig-1]: Characteristics of patients with malignant disease causing biliary obstruction.

The most common block observed on MRCP was type IIIA (35%), after MRCP the distribution of level of hilar block on PTC was obtained, the most common block found was type II Block (32.5%) [Table/Fig-2].



[Table/Fig-2]: Type of block based on MRCP and PTC findings.
(X axis showing type of block based on MRCP and PTC finding, percentage on Y Axis and number of patients above bar)

On PTC the gender wise distribution of most common type II block present in 6 males and 7 females [Table/Fig-3] and among the patients of the age group 51-65 years (total 20 patients) type II block was present in 50% (10 patients) [Table/Fig-4].



[Table/Fig-3]: Gender wise distribution of block based on PTC findings.
(X axis represents type of block based on PTC findings, percentage on Y axis and number of patients above the bar).

Type of block on PTC	Age intervals			Total
	35 to 50 years	51 to 65 years	Above 65 years	
Type I	3 (17.6%)	6 (30.0%)	1 (33.3%)	10 (25.0%)
Type II	3 (17.6%)	10 (50.0%)	0 (0)	13 32.5%)
Type IIIA	8 (47.1%)	3 (15.0%)	0 (0)	11 (27.5%)
Type IIIB	0 (0)	0 (0)	1 (33.3%)	1 (2.5%)
Type IV	3 (17.6%)	1 (5%)	1 (33.3%)	5 (12.5%)
Total	17 (100%)	20 (100%)	3 (100%)	40 (100%)

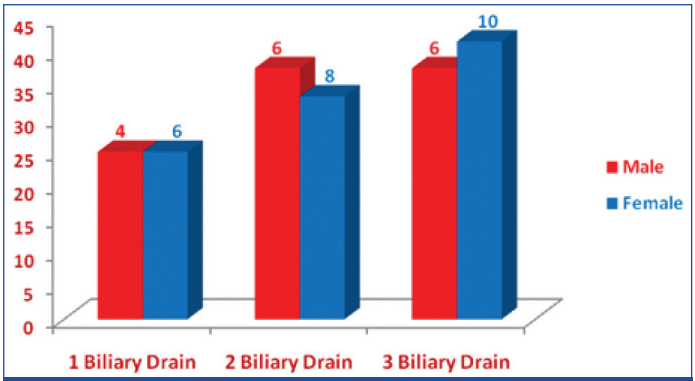
[Table/Fig-4]: Age wise distribution of block based on PTC findings.

The gender wise distribution obtained on PTC for number of biliary drains to be used in PTBD was three biliary drain used in 6 males and in 10 females [Table/Fig-5].

Three biliary drain were used in the 16 (40%) patients followed by two biliary drain which was used in 14 (35%) patients and among the patients of the age group 35-50 years (17 patients) three biliary drain was used in 11 patients (64.7%) [Table/Fig-6].

[Table/Fig-7] showed the comparison of number of biliary drains to be used during PTBD in MRCP and PTC. In MRCP 3 biliary drain was used in 19 (47.5%) patients while in PTC was used only in 16 (40%) patients.

The bilirubin level 4 weeks post PTBD comes down to almost normal level and was less than 4 mg/dL in all the patients. Temporary



[Table/Fig-5]: Gender based calculations obtained on PTC for number of biliary drains to be used in PTBD (X axis: Number of biliary drains to be used in PTBD, percentage on Y axis and number of patients above the bar).

Number of biliary drains (PTC)	Age intervals			Total
	35 to 50 years	51 to 65 years	Above 65 years	
1 Biliary drain	3 (17.6%)	6 (30%)	1 (33.3%)	10 (25%)
2 Biliary drain	3 (17.6%)	11 (55%)	0 (0)	14 (35%)
3 Biliary drain	11 (64.7%)	3 (15%)	2 (66.7%)	16 (40%)
Total	17 (100%)	20 (100%)	3 (100%)	40 (100%)

[Table/Fig-6]: Age based calculations obtained on PTC for number of biliary drains to be used in PTBD.

Number of biliary drains	MRCP	PTC
1 Biliary drain	10 (25%)	10 (25%)
2 Biliary drain	11 (27.5%)	14 (35%)
3 Biliary drain	19 (47.5%)	16 (40%)

[Table/Fig-7]: Number of biliary drains to be used for MRCP and PTC during PTBD.

haemobilia occurred in five patients during PTC. Minimal bile leakage was observed in four patients. No case fatality seen during and after four weeks of PTC.

There was difference in four patients in planning of drainage, as their levels of blocks were wrongly estimated on MRCP and differed from the final PTC findings. The accuracy of MRCP in planning the number of biliary drains were 90% (36 out of 40) based on the findings for level of block perspective planning for percutaneous drainage of the patients were planned and number of biliary drains were estimated which were found to be in correlation to the final PTC based planning (Pearson's correlation coefficient=0.909, two-tailed test of significance, p≤0.001) [Table/Fig-8].

Variables		MRCP	PTC
MRCP	Pearson correlation	1	0.909
	Sig. (2-tailed)		0.001
	N	40	40
PTC	Pearson correlation	0.909	1
	Sig. (2-tailed)	0.001	
	N	40	40

[Table/Fig-8]: Pearson's correlation coefficient showing correlation between MRCP and PTC.

DISCUSSION

In patients with unresectable MBO, management of biliary obstruction is of utmost importance. Impaired biliary drainage not only severely affects the prospect of systemic therapy in inoperable MBO but also reduces quality of life with increase in morbidity and mortality rate [13]. There are several studies where it was reported that quality of life can be improved through biliary drainage [14,15]. Although non invasive imaging are known to be an indicative method which provides information of the existence of biliary stricture and the extent of bile duct dilation [16] but alone it cannot confirm the pathological diagnosis of MBO, hence to confirm diagnosis it is mandatory to ascertain the optimal sampling procedure. MRCP, considered as a replacement for diagnostic ERCP, is a widely employed technique that can provide instinctive and consistent information about the pancreaticobiliary duct [17]. However, Sun N et al., in their observation found that MRCP images are heavily T2-weighted with deficient soft tissue contrast and usually highlighting water hence they considered MRCP not to be appropriate for monitoring lesions and structure exterior to the lumen or for the qualitative diagnosis of bile duct obstruction [18].

PTC is a technique that has been in exercise since the 1960s for the diagnosis of biliary stricture and its management [19]. Along with relief in symptom it offers character and degree of the occlusion which is necessary for the diagnosis. In present study, minor complications like temporary haemobilia and bile leakage was found during PTC which was in accordance to the several studies [20-22]. The level of biliary obstruction decides the type of biliary drainage [23]. There are studies from England where when ERCP has unsuccessful PTBD is frequently the preferred technique for lesions above the common hepatic duct [7,24]. In this study, it was found that number of biliary drainage was more in MRCP than PTC during PTBD. In a very recent cohort study Rees J et al., suggested to identify associated risk factors prior to PTBD, and to confirm that the patient is expected to get benefit from PTBD, in terms of either relief in symptoms or as a link to chemotherapy [25], in this study too, observed relief in symptoms after PTBD and the planning of PTBD after MRCP and PTC helped in knowing the best route and any anomalous biliary anatomy was known before hand which helped in overall success rate of PTBD which is also in accordance to a recent systematic review it was concluded that PTBD was associated with higher rates of successful biliary drainage and lower rates of cholangitis [26]. Normal bilirubin levels 4 weeks after PTBD was observed which was also reported in several studies where a significant decrease in plasma bilirubin was observed during the first week after PTBD [27-30]. There is several data which after comparison of different technique suggested PTBD as superior technique for achieving complete drainage of MBO [31-33].

Limitation(s)

The sample size in this study was less and long term follow-up could not be done. PTC is an invasive procedure and needs expertise and experience to do the complication free procedure. This procedure cannot be done in patients having ascites due to high risk bleeding from liver surface.

CONCLUSION(S)

The present study demonstrated superiority of diagnostic performance of PTC for the assessment of MBO and increasing the positioning and qualitative diagnostic accuracy. Although MRCP was found to be accurate in terms of delineating blocks and directing towards the causes of block but PTC played an important role in scheduling the therapeutic strategy for malignant biliary stricture.

Author's contribution: PKD and PKS contributed in form of MRCP image presentation and manuscript prepration.

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