



Study of Patients with Obstructive Jaundice in Sohag University Hospital

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Abstract

Background: Obstructive jaundice is a clinical condition characterized by the blockage of bile flow, often due to both benign and malignant causes. Early diagnosis and appropriate management are critical to improving patient outcomes.

Aim: To evaluate the clinical presentation, diagnostic approaches, and therapeutic interventions for patients diagnosed with obstructive jaundice at Sohag University Hospital.

Methods: This observational study included 150 patients diagnosed with obstructive jaundice and referred to the Department of Internal Medicine. Clinical data, including demographic information, presenting symptoms, laboratory tests, and imaging results, were collected. Liver function tests, abdominal ultrasound, MRCP, and ERCP were used for diagnosis, while therapeutic interventions such as ERCP with stent placement and stone removal were performed when indicated.

Results: The mean age of the patients was 55.36 ± 14.4 years, with a majority of females (64%). The most common symptoms included jaundice (100%), dark urine (100%), and pale stool (98%). Liver function tests revealed elevated bilirubin levels, while imaging studies showed dilated intrahepatic and extrahepatic bile ducts. Malignant lesions were found in 34% of patients, with distal cholangiocarcinoma and pancreatic cancer being the most common diagnoses. ERCP procedures were performed in 82% of patients, with successful biliary decompression and stone removal in many cases.

Conclusion: Obstructive jaundice is frequently associated with malignant lesions, particularly cholangiocarcinoma and pancreatic cancer. Early diagnosis and appropriate interventions, such as ERCP, play a crucial role in managing this condition and improving patient outcomes.

Keywords: Obstructive jaundice, cholangiocarcinoma, pancreatic cancer, ERCP, MRCP.

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Introduction

Obstructive jaundice (OJ) is a condition characterized by the blockage of bile flow, leading to a buildup of bilirubin in the bloodstream. This condition is often associated with various pathologies, including benign and malignant diseases. The various causes of obstructive jaundice, including gallstones, pancreatic tumors, and cholangiocarcinoma, with malignant causes being particularly significant in older patients. ⁽¹⁾

The etiology of obstructive jaundice is diverse, and it has a profound impact on the liver's function and patient health. Studies have demonstrated that obstructive jaundice is commonly caused by conditions such as cholangiocarcinoma, pancreatic cancer, and benign bile duct strictures. ⁽²⁾ Accurate diagnosis, therefore, requires advanced imaging techniques such as ultrasound, CT scans, and magnetic resonance cholangiopancreatography (MRCP) to distinguish between benign and malignant conditions effectively. ⁽³⁾

Pathophysiologically, obstructive jaundice leads to complications like hepatic dysfunction, coagulopathies, and renal impairment. These complications significantly impact the management and prognosis of patients undergoing treatment for obstructive jaundice. ⁽⁴⁾

Treatment strategies for obstructive jaundice vary depending on the underlying cause. Surgical intervention, including biliary drainage and resection, remains a cornerstone of therapy for both benign and malignant cases. ⁽⁵⁾ However, preoperative biliary drainage has been found to improve surgical outcomes in patients with malignant obstructive jaundice, particularly when the obstruction is located proximally. ⁽⁶⁾

Moreover, the nutritional status of patients with obstructive jaundice is a critical factor influencing recovery. The malnutrition is common in these patients, necessitating careful management of their dietary intake and supplementation to improve postoperative recovery. ⁽⁷⁾

This study aims to explore the clinical, diagnostic, and therapeutic aspects of obstructive jaundice by examining various patient cases.

Patients and methods

This observational study, prospective, was conducted from May 2024 to November 2024 at the Department of Internal Medicine, Sohag University Hospital, Sohag, Egypt. Ethical approval was obtained from the Medical Ethics Committee of Sohag University, and written informed consent was provided by all participants. The study adhered to the ethical principles of the Declaration of Helsinki.

Patients aged 18 years or older who presented with clinical and laboratory evidence of obstructive jaundice were eligible for inclusion in the study. Exclusion criteria included patients under 18 years of age and those with jaundice attributable to non-obstructive causes, such as hemolytic or hepatocellular jaundice.

Each patient enrolled in the study underwent a thorough clinical evaluation to establish a baseline and guide further diagnostic and therapeutic measures. The clinical assessment included a detailed medical history to gather information on presenting symptoms such as jaundice, pruritus, abdominal pain, changes in urine or stool color, weight loss, and fever. A comprehensive physical examination was conducted to identify signs of obstructive jaundice, such as scleral icterus, skin discoloration, hepatomegaly, or a palpable gallbladder. Additional attention was given to signs of systemic disease or malignancy.

Laboratory tests were performed to assess liver function, confirm the diagnosis of obstructive jaundice, and identify possible underlying causes. The liver function tests (LFTs) included measurements of total and conjugated bilirubin, alkaline phosphatase (ALP), gamma-glutamyl transferase (GGT), aspartate transaminase (AST), alanine transaminase (ALT), total protein, and serum albumin.

A complete blood count (CBC) was obtained to assess for anemia, infection, or thrombocytopenia, while a coagulation profile, including prothrombin time (PT) and international normalized ratio (INR), was used to evaluate liver dysfunction and coagulation status. Renal function was assessed by

measuring blood urea nitrogen (BUN) and serum creatinine, and serum electrolytes (sodium, potassium, and chloride) were also checked for potential imbalances. Tumor markers, including carcinoembryonic antigen (CEA), alpha-fetoprotein (AFP), and carbohydrate antigen 19-9 (CA 19-9), were measured to investigate the possibility of malignancies contributing to biliary obstruction.

Radiological evaluation was an essential component of the diagnostic process. Abdominal ultrasound was performed as the initial imaging modality to assess bile duct dilation, gallstones, and any masses. Magnetic resonance cholangiopancreatography (MRCP) was used to provide detailed non-invasive imaging of the biliary tree and pancreatic duct, allowing for evaluation of the level and cause of obstruction. In selected cases, multislice computed tomography (MSCT) of the abdomen and pelvis was conducted to further investigate the anatomy and staging of suspected malignancies.

When indicated, therapeutic interventions were carried out. Endoscopic retrograde cholangiopancreatography (ERCP) was performed for diagnostic and therapeutic purposes, such as bile duct decompression, stent placement for malignant obstructions, or stone removal in cases of choledocholithiasis. In situations where ERCP was contraindicated or not available, other interventional procedures such as percutaneous biliary drainage were considered. Patients were closely monitored during their hospital stay and through subsequent outpatient follow-ups to evaluate the effectiveness of therapeutic interventions and track the progression of their condition.

Statistical analysis:

Data collected during the study were analyzed using IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY). Descriptive statistics for qualitative data were presented as frequencies and percentages. For quantitative data, the Shapiro-Wilk test was applied to assess normality of distribution. Continuous variables were summarized using means and standard deviations, or medians and interquartile ranges (IQR), as appropriate. Statistical analyses were performed to determine significant relationships and trends.

Results

A total of 150 patients diagnosed with obstructive jaundice and referred to the Department of Internal Medicine at Sohag University Hospital between May 2024 and November 2024 were included in the study. The mean age of the patients was 55.36 ± 14.4 years, with a range of 20 to 82 years. The majority of the cohort were female (64%), while males comprised 36% of the study population. The most common presenting symptoms were jaundice and dark urine, which were reported by all patients (100%), followed by pale stool (98%), itching (90%), anorexia (78%), vomiting (70%), abdominal pain (60%), fever (46%), and cholangitis (40%). Less frequently observed symptoms included weight loss (38%) and bleeding (24%) (Table 1). Physical examination revealed that 18% of patients ($n=27$) exhibited lower limb edema, while 4% ($n=6$) had ascites. No patients were found to have an abdominal mass (Table 2).

Liver function tests showed the following mean values: total bilirubin 13.81 ± 5.54 mg/dL, direct bilirubin 11.45 ± 4.99 mg/dL, AST 49.46 ± 29.56 IU/L, ALT 34.14 ± 24.83 IU/L, GGT 95.50 ± 17.73 IU/L, and ALP 407.12 ± 33.81 IU/L. The mean albumin level was 3.36 ± 0.53 g/dL, and the mean INR was 1.28 ± 0.45 . Regarding renal function, the mean serum creatinine level was 1.56 ± 0.83 mg/dL, and the mean BUN was 45.46 ± 28.63 mg/dL. Electrolyte levels were as follows: sodium 134.60 ± 4.57 mEq/L, potassium 3.76 ± 0.51 mEq/L, and calcium 9.41 ± 0.88 mg/dL. Hematological results indicated a mean hemoglobin level of 11.15 ± 1.83 g/dL. The mean TLC and platelet count were $12.47 \pm 4.97 \times 10^3/\mu\text{L}$ and $271.38 \pm 89.35 \times 10^3/\mu\text{L}$, respectively (Table 3).

Abdominal ultrasound revealed that 4% ($n=6$) of patients had HFLs. All patients demonstrated dilated IHBD. The majority (94%) had dilated EHBD, while 4% had normal EHBDs and 2% showed bile duct strictures. Most patients (88%) had a dilated CBD, with 4% showing a normal CBD and 8% having CBD strictures. Gallbladder stones were present in 60% of cases, and ascites was observed in 6% of patients (Table 4).

MRCP findings indicated that all patients had dilated IHBD. A majority (84%) exhibited dilated EHBD, while 4% had normal EHBDs and 12% presented with bile duct strictures. Most cases (88%) showed a dilated CBD, while 4% had a normal CBD and 8% demonstrated CBD strictures. Filling defects, indicative of obstructive lesions, were observed in 52% of the patients (Table 5). ERCP revealed CBD stricture in 50% (n=75) of patients, with the distal CBD being the most frequent site (54%). CBD dilation was observed in 88% (n=132) of patients, and 50% (n=75) showed

filling defects consistent with bile duct stones. Masses were identified in 24% (n=36) of patients, with 8% having an ampullary mass. CBD stone extraction was performed in 62% (n=93) of cases, and ERCP with stent insertion was carried out in 82% (n=123) of patients. In 6% (n=9) of cases, PTD was performed. Malignant lesions were diagnosed in 34% (n=51) of patients. The most common malignancies identified were distal cholangiocarcinoma and pancreatic cancer, each accounting for 15% of the cases (Table 6).

Table 1: Demographic and Clinical manifestation of the studied patients.

		Studied patients (N= 150)	
		N	%
Sex	Male	54	36.0%
	Female	96	64.0%
Age (years)	Mean± SD	55.36± 14.4	
	Median (Range)	59 (20 – 82)	
Manifestation	Jaundice	150	100.0%
	Dark urine	150	100.0%
	Pale stool	147	98.0%
	Itching	135	90.0%
	Anorexia	117	78.0%
	Vomiting	105	70.0%
	Abdominal pain	90	60.0%
	Fever	69	46.0%
	Cholangitis	60	40.0%
	Weight loss	57	38.0%
	Bleeding	36	24.0%

Table 2: Clinical examination among the studied patients.

Parameters		Studied patients (N= 150)	
		N	%
Abdominal mass	No	150	100.0
	Yes	0	0.0%
Ascites	No	144	96.0%
	Yes	6	4.0%
Lower limb edema	No	123	82.0%
	Yes	27	18.0%

Table 3: Laboratory results among the studied patients.

	Studied patients (N= 150)						
	Mean	±SD	Median	IQR		Range	
Total bilirubin (mg/dl)	13.81	±5.54	13.30	9.0	17.0	5.4	27.0
Direct bilirubin (mg/dl)	11.45	±4.99	10.95	7.3	15.0	3.2	23.0

AST (IU/L)	49.46	±29.56	42.5	32.0	65.0	8.0	142.0
ALT (IU/L)	34.14	±24.83	29.0	14.0	46.0	10.0	112.0
GGT (IU/L)	95.50	±17.73	97.5	87.0	99.0	5.0	142.0
ALP (IU/L)	407.12	±33.81	399.5	388.	418.0	339.0	514.0
Albumin (g/dl)	3.36	±0.53	3.4	2.9	4.0	2.30	4.1
INR	1.28	±0.45	1.19	1.06	1.32	1.02	4.0
Creatinine (mg/dl)	1.56	±0.83	1.3	0.9	2.1	0.6	4.3
Urea (mg/dl)	45.46	±28.63	41.0	23.0	60.0	20.0	165.0
Na+ (mEq/L)	134.60	±4.57	135.50	130.0	139.0	127.0	142.0
K+ (mg/dl)	3.76	±0.51	3.85	3.4	4.0	2.9	5.0
Ca++ (mg/dl)	9.41	±0.88	9.45	8.6	10.0	8.0	11.0
TLC (×10 ³ /μL)	12.47	±4.97	12.0	8.0	16.0	4.6	24.0
Hb (g/dl)	11.15	±1.83	11.7	9.7	12.4	7.4	14.0
Platelets count (×10 ³ /μL)	271.38	±89.35	250.0	201.0	338.0	89.0	540.0

Table 4: Abdominal ultrasound findings of the studied patients.

Parameters		Studied cases (N= 150)	
		N	%
HFLs	Yes	6	4.0%
	No	144	96.0%
IHBD	Dilated	150	100.0%
Extra HBD	Normal	6	4.0%
	Dilated	141	94.0%
	Stricture	3	2.0%
CBD	Normal	6	4.0%
	Dilated	132	88.0%
	Stricture	12	8.0%
GB stones	No	60	40.0%
	Yes	90	60.0%
Ascites	No	141	94.0%
	Yes	9	6.0%

HFLs: Hepatic focal lesions, IHBD: Intrahepatic bile ducts,
 CBD: Common bile duct, GB: Gall bladder, HBD: Hepatic bile duct

Table 5: MRCP findings of the studied patients.

MRCP		Studied cases (N= 150)	
		N	%
IHBD	Dilated	150	100.0%
Extra HBD	Normal	6	4.0%
	Dilated	126	84.0%
	Stricture	18	12.0%
CBD	Normal	6	4.0%
	Dilated	132	88.0%
	Stricture	12	8.0%
Filling defects	No	72	48.0%
	Yes	8	2.0%

HFLs: Hepatic focal lesions, IHBD: Intrahepatic bile ducts,
 CBD: Common bile duct, GB: Gall bladder

Table 6: ERCP findings of the studied patients.

MRCP		Studied cases (N= 150)	
		N	%
CBD stricture	No	75	50.0%
	Yes	75	50.0%
Site of CBD stricture	No	75	50.0%
	Distal	54	36.0%
	Proximal	15	20.0%
	Mid segment	6	4.0%
CBD dilatation	No	18	12.0%
	Yes	132	88.0%
Filling defects (stones)	No	75	50.0%
	Yes	75	50.0%
IHBD	Dilated	150	100.0%
Mass	No	126	84.0%
	Ampullary	12	8.0%
	Hepatic Mets	6	4.0%
	Pancreatic	3	2.0%
	Ampullary	3	2.0%
CBD stone extraction	No	57	38.0%
	Yes	93	62.0%
Plastic stent insertion	No	27	18.0%
	Yes	123	82.0%
PTD insertion	No	141	94.0%
	Yes	9	6.0%
Calcular	No	54	36.0%
	Yes	96	64.0%
Malignant	No	99	66.0%
	Yes	51	34.0%
Type of malignancy	No	99	66.0%
	Distal cholangiocarcinoma	15	10.0%
	Pancreatic cancer	15	10.0%
	Hillar cholangiocarcinoma (Klatskin tumor)	12	8.0%
	Pancreatic	3	2.0%
	Gastric cancer, Hepatic Mets	3	2.0%
	Thyroid cancer with hepatic mets.	3	2.0%

HFLs: Hepatic focal lesions, IHBD: Intrahepatic bile duct,
CBD: Common bile duct, GB: Gall bladder

Discussion

Obstructive jaundice is a common clinical condition resulting from impaired bile flow due to benign or malignant causes, often presenting with a complex diagnostic and therapeutic challenge. ⁽¹⁾ This study was conducted to evaluate the clinical, radiological, and endoscopic findings among patients presenting with obstructive jaundice at Sohag University Hospital. By analyzing patient characteristics, bio-

chemical profiles, imaging results, and ERCP outcomes.

This study investigated 150 patients diagnosed with obstructive jaundice. The mean age of patients was 55.36 ± 14.4 years, with a female predominance (64%). In the same line, Alatis et al. ⁽⁸⁾ reported a mean age of 53.7 ± 15.95 years and a gender distribution of 50.7% females and 49.3% males.

This study supports our own results, although our cohort showed a slightly higher female representation (64%).

In the present study, the most frequently reported symptoms among patients were jaundice and dark urine (100%), followed closely by pale stools (98%), pruritus (90%), anorexia (78%), vomiting (70%), and abdominal pain (60%). Less common symptoms included fever (46%) and clinical signs of cholangitis (40%). Weight loss and bleeding were observed in 38% and 24% of patients, respectively, while ascites and lower limb edema were noted in a smaller proportion (4% and 18%, respectively). No cases presented with palpable abdominal masses.

Our findings are in line with those reported by Tripathi et al. ⁽⁹⁾, who examined the clinical characteristics of 35 patients with obstructive jaundice. In their study, the most common presenting symptom was abdominal pain (97%), followed by scleral icterus (94%), vomiting (77%), pruritus (63%), and fever (37%).

Similarly, Khan et al. ⁽¹⁰⁾ reported comparable clinical profiles in their cohort of patients with obstructive jaundice, noting high frequencies of jaundice, abdominal discomfort, pruritus, anorexia, weight loss, and dark-colored urine. However, it should be noted that some of the percentages cited in their report appear to exceed 100%, suggesting possible reporting or typographical errors.

In our study, liver function tests indicated elevated levels of total and direct bilirubin, AST, ALT, GGT, and ALP, alongside a modest reduction in albumin and a slightly increased INR. These findings are characteristic of hepatic dysfunction commonly seen in obstructive jaundice.

Our results are consistent with those reported by Zhao et al. ⁽¹¹⁾, who investigated the laboratory profiles of patients with obstructive jaundice, both with and without dyslipidemia. They similarly observed increased levels of ALT, AST, and ALP, particularly in patients with concurrent dyslipidemia, supporting the trends noted in our cohort.

Additionally, our findings align with those of Abou Bakr et al. ⁽¹²⁾, who assessed the diagnostic value of endoscopic ultrasound (EUS) in patients with

common bile duct dilatation undetected by conventional ultrasound. Their study also reported elevated bilirubin, liver enzymes, and INR values in this patient population, reinforcing the clinical relevance of our observations.

In our study, imaging findings demonstrated that 94% of patients had dilated extrahepatic bile ducts, while 88% exhibited dilated common bile ducts. These findings are in agreement with the work of Padhy et al. ⁽¹³⁾, who reported dilated common bile ducts in 93% of their patients, as well as dilated intrahepatic bile ducts in 83%. Similarly, Chhettri et al. ⁽¹⁴⁾ and Fadahunsi et al. ⁽¹⁵⁾ found that MRCP is highly effective in detecting biliary obstructions, which was confirmed in our study where MRCP revealed dilated intrahepatic bile ducts (100%) and common bile ducts (88%).

According to our ERCP findings, CBD strictures were observed in half of the cases, with the distal CBD being the most frequent site. CBD dilatation was noted in the majority of patients, while filling defects, primarily stones, were also detected in approximately half of the cases. Mass lesions were identified in a significant proportion, with ampullary masses being less common. CBD stone extraction was successfully performed in over half of the patients, and CBD stent insertion was carried out in the majority. In a smaller subset, ERCP combined with PTD was necessary. Malignancy was diagnosed in about one-third of patients, with distal cholangiocarcinoma and pancreatic cancer being the most prevalent malignancies.

Our findings are in agreement with those of Alatisse et al. ⁽⁹⁾, who reported that the most common ERCP findings in patients with malignant etiologies included proximal and distal bile duct strictures, periampullary cancer, and mid bile duct strictures. However, a variance was noted in benign conditions. Alatisse et al. observed that choledocholithiasis was the predominant finding among patients with benign etiologies, while mid-duct obstruction due to post-cholecystectomy bile duct injury and choledochal cysts were less commonly encountered. In our study, the prevalence of benign conditions, such as choledocholithiasis, was relatively lower compared to their findings.

One limitation of this study is the lack of histopathological confirmation for suspected malignancy,

as diagnoses were based on imaging and clinical evaluation. Future research should focus on biopsy confirmation and a deeper understanding of obstructive jaundice causes. Additionally, the prospective design may introduce selection bias. Larger, multicenter studies are needed to validate findings.

Conclusion

This study highlights the clinical presentation and management of obstructive jaundice at Sohag University Hospital. Most patients were middle-aged females, with jaundice and dark urine being the most common symptoms. Imaging techniques, such as MRCP and ERCP, were crucial for diagnosis and treatment. Malignant lesions, especially cholangiocarcinoma and pancreatic cancer, were frequently observed, underscoring the importance of early diagnosis and intervention.

References

- Kim SD. Obstructive jaundice. *Soonchunhyang Medical Science*. 2022;28(2):85-9.
- Yadav GD, Yadav A, Verma S, Hussain MT. Clinical profile, management, and outcome of obstructive jaundice patient at a tertiary care center: A prospective study. *Asian Journal of Medical Sciences*. 2022;13(5):94-9.
- Kaomba L, Ng'ombe J, Mulwafu W. Clinicopathological features and management of obstructive jaundice at Queen Elizabeth Central Hospital, Malawi. A retrospective cohort analysis. *Surgery Open Science*. 2024;20:14-9.
- Wang Y, Zhao X, She Y, Kang Q, Chen X. The clinical efficacy and safety of different biliary drainage in malignant obstructive jaundice: a meta-analysis. *Frontiers in Oncology*. 2024;14:1370383.
- Ghulam B, Ahmed S, Ather MM, Nighat S, Tariq A, Khan S. Outcome of Different Surgical Modalities in the Management of Benign Surgical Jaundice. *InMedical Forum Monthly* 2024; 35(11):73-8.
- Gao Z, Wang J, Shen S, Bo X, Suo T, Ni X, Liu H, Huang L, Liu H. The impact of preoperative biliary drainage on postoperative outcomes in patients with malignant obstructive jaundice: a retrospective analysis of 290 consecutive cases at a single medical center. *World Journal of Surgical Oncology*. 2022 Jan 6;20(1):7.
- Albargawi M, Abdulaal I. Significant High Lipid Profile in a Woman With Obstructive Jaundice. *JCEM Case Reports*. 2023 Jul;1(4):luad080.
- Alatise OI, Owojuyigbe AM, Omisore AD, Ndububa DA, Aburime E, Dua KS, et al. Endoscopic management and clinical outcomes of obstructive jaundice. *Niger Postgrad Med J*. 2020;27:302–10.
- Tripathi C, Yeola M, Gharde P. To study the clinical profile of the patients with obstructive jaundice. *Eur J Biomed*. 2019;6(2):343–55.
- Khan ZA. Clinical profile of patients with obstructive jaundice: a surgeon's perspectives. *Int Surg J*. 2019;6(6):1876–80.
- Zhao Y, Wang S, Liang S, Zhang H, Zhang Y, Yu R, et al. Clinical laboratory characteristics of patients with obstructive jaundice accompanied by dyslipidemia. *Clin Biochem*. 2021;94:42–7.
- Abou Bakr S, Eleessawy H, Ghaly S, Elezz MA, Farahat A, Zaghloul MS. Diagnostic accuracy of endoscopic ultrasound in evaluation of patients with obstructive jaundice: single-center experience. *Egypt Liver J*. 2022;12(1):16.
- Padhy B, Murmu D, Samal D, Jha S. Clinical study of surgical jaundice: an institutional experience. *Int Surg J*. 2018;5(1):138–42.
- Chhettri P, Rana H. Ultrasonography and magnetic resonance cholangiopancreatography in patients with obstructive jaundice. *J Coll Med Sci Nepal*. 2020;16(1):6–11.
- Fadahunsi OO, Ibitoye BO, Adisa AO, Alatise OI, Adetiloye VA, Idowu BM. Diagnostic accuracy of ultrasonography in adults with obstructive jaundice. *J Ultrasonogr*. 2020;20(81):100–5.