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Management and outcomes of patients with obstructive jaundice from pancreatobiliary diseases in Rwanda

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Abstract

Background Obstructive jaundice from pancreatobiliary diseases represents a significant global health challenge, particularly in resource-limited settings like Rwanda. While endoscopic retrograde cholangiopancreatography (ERCP) and percutaneous transhepatic biliary drainage (PTBD) are now available at tertiary centers in Kigali, there is limited local clinical data on the management and outcomes of these conditions. This study aims to assess the patterns, therapeutic approaches, and outcomes of obstructive jaundice in the Rwandan healthcare context.

Methods A cross-sectional study was conducted across three tertiary hospitals (KFH, RMH, and CHUK) in Rwanda from July 2023 to June 2024. Using Fischer's formula, 158 patients with obstructive jaundice from pancreatobiliary diseases were enrolled. Data collection involved chart reviews at admission, procedure, post-procedure, discharge, and 30-day follow-up. Analysis was performed using Stata version 13, with descriptive statistics, bivariate analysis using chi-square, and multivariate analyses examining predictors of 30-days mortality among the participants at 95% confidence interval and p value < 0.05 considered statistically significant. Multicollinearity assessment was also performed considering the target variance inflation factor (VIF) < 5.

Results In this study of 158 patients with obstructive jaundice in Rwanda, ERCP was the predominant intervention (77.54%), followed by PTBD (17.39%) and surgical procedures (5.07%). The overall procedures technical success rate was 82.61%; with PTBD success rate of 91.67%, surgical procedures showed higher success rate 100%, while ERCP had a success rate of 79.44%. Post-procedure complications occurred in 16.67% of cases, including pancreatitis (5%), bleeding (3.62%), and mortality (4.34%). The 30-day survival rate was 92.41%, demonstrating generally favorable outcomes in managing pancreaticobiliary diseases. The multivariate analysis showed that weight loss increased mortality risk (aOR = 10.647, 95% CI: 1.190-95.256, $p = 0.034$), while the absence of CBD stones was protective (aOR = 0.087, 95% CI: 0.008–0.888, $p = 0.039$). Having a procedure performed significantly reduced mortality odds (aOR = 0.025, 95% CI: 0.006–0.117, $p < 0.001$). ICU/HDU admission was associated with higher mortality risk in 30 days (aOR = 13.051, 95% CI: 2.010-84.731, $p = 0.007$).

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Conclusion This study from Rwanda provides crucial insights into the management and outcomes of obstructive jaundice from pancreatobiliary diseases. PTBD was demonstrated high success. While post-procedure complications occurred, the 30-day survival rate was favorable. Weight loss and ICU admission were associated with increased mortality, while procedural interventions showed protective effects, highlighting the importance of timely management.

Keywords Obstructive jaundice, Common bile duct stones, ERCP, Cholangiocarcinoma, Rwanda

Background

Obstructive jaundice (OJ), a mechanical obstruction of the bile ducts inside and outside the liver caused by various reasons, is a common hepatobiliary surgery disease [1]. Obstructive jaundice is a common problem that occurs when there is an obstruction to the passage of conjugated bilirubin from the liver to the duodenum [2]. Obstructive jaundice resulting from pancreatobiliary diseases represents a significant global health challenge, affecting millions of people worldwide [3, 4]. The Global Burden of Disease Study 2019 reported that pancreatobiliary diseases accounted for approximately 2.1 million disability-adjusted life years (DALYs) globally [5]. The management of obstructive jaundice is a challenge to physicians working in resource limited settings due to the late presentation of the disease, limited modern diagnostic and therapeutic facilities, and increased risk of morbidity and mortality associated with long-lasting biliary stasis [2, 6].

In Africa, the landscape of pancreatobiliary diseases presents unique challenges due to limited healthcare resources and delayed presentation of patients. Recent studies indicate that the prevalence of obstructive jaundice in African populations ranges from 8 to 25% of all hepatobiliary admissions [7, 8]. Limited access to advanced diagnostic and therapeutic facilities, including Endoscopic Retrograde Cholangiopancreatography (ERCP and specialized surgical care, contributes to poorer outcomes across the continent [9].

Rwanda, like many developing nations, faces challenges in managing these pancreatobiliary diseases due to limited specialized healthcare facilities and workforce. The country has made significant strides in improving its healthcare system, but access to advanced hepatobiliary care remains concentrated in urban centers, particularly Kigali city [10].

The cause of obstructive jaundice includes benign or malignancies [11]. Among benign causes; the strictures of the biliary ducts are common complications of cholecystectomy, previous biliary surgery, recurrent cholangitis and chronic inflammation [12]. Severe strictures cause biliary stasis and or primary bilirubin stones [13]. Choledocholithiasis accompanied by significant pain, ascending infection and pancreatitis, while malignant causes include carcinoma of head of pancreas, ampullary carcinoma, cholangiocarcinoma and metastasis [14]. The diagnosis of obstructive jaundice requires cholestatic picture of liver panel and imaging studies showing obstructed bile ducts [15]. Abdominal ultrasound is the simplest exam in obstructive jaundice, followed by abdominal computerized tomography (CT) scan and Magnetic Resonance Imaging (MRI) for advanced characterization and accurate diagnosis [16].

The management approach varies significantly based on etiology, available resources, and local expertise. While endoscopic intervention remains the gold standard for many conditions, surgical management continues to play a crucial role in many African settings where advanced endoscopic facilities are limited [9, 17]. Management of obstructive jaundice includes ERCP, percutaneous biliary drainage (PTBD) and surgery. These procedures require expertise and can be associated with adverse events which are associated with patients comorbidities, procedure its self and also anesthesia related [11, 18, 19].

While ERCP and PTBD were previously limited in Rwanda, requiring many patients to undergo surgery, these procedures are now available at tertiary care centers in Kigali. Despite advancements in diagnostic and management technologies for pancreatobiliary diseases, there is a notable absence of local clinical data on obstructive jaundice in Rwanda. This lack of data hinders the understanding of the magnitude, diagnostic practices, and outcomes associated with obstructive jaundice within the Rwandan healthcare context. Therefore, this study was conducted to to assess the management and outcomes of patients with obstructive jaundice from pancreaticobiliary disorders.

Methodology

Study design

This cross-sectional study employed a quantitative approach over a period of 12 months, from July 2023 to June 2024, to investigate the management and outcomes of patients presenting with obstructive jaundice due to pancreatobiliary diseases in three tertiary hospitals, Rwanda. The study design enabled a systematic examination of disease patterns, therapeutic strategies, and prognosis among patients with obstructive jaundice in the Rwandan healthcare context.

Study setting

The study was conducted at three tertiary healthcare institutions in Rwanda: King Faisal Hospital Rwanda (KFHR), Kigali University Teaching Hospital (CHUK), and Rwanda Military Hospital (RMH). Data collection was conducted in the departments of internal medicine and surgery, leveraging the comprehensive clinical resources and patient populations of these major healthcare facilities. These hospitals represent key referral centers in Rwanda's healthcare system, offering advanced medical and surgical services that enabled a comprehensive assessment of obstructive jaundice in pancreatobiliary diseases. Biliary drainage procedures such as ERCP, PTBD and surgery were used. ERCP were conducted by endoscopic surgeons, gastroenterologist while PTBD were conducted by interventional radiologist, and surgery were conducted by general surgeon.

Study population

The population of this study was patients with obstructive pancreaticobiliary disease who consulted KFH, CHUK, RMH during July 2023 to June 2024. Patients aged 18 years and above with clinical diagnosis of obstructive jaundice due to mechanical causes, who presented in 12 months of the study period. They included jaundiced patient suspected of having biliary obstruction from choledocholithiasis, cholangiocarcinoma, biliary strictures from different causes, pancreatic cancer, gallbladder cancer, ampullary neoplasms.

Sampling and sample size

The sample size was calculated using a comprehensive formula accounting for population characteristics and statistical precision. Fischer's formula was used in sample size calculation. Utilizing a 95% confidence interval (Z = 1.96), a 5% precision level, and standard sample size calculation parameters, the minimum required sample was determined to be 132 patients. To maximize data availability and analytical precision, the final sample was extended to 158 patients, ensuring a representative and statistically sound investigation of the study population. Patient allocation to drainage modalities was based on clinical judgement (factors such as cause of obstruction, location of obstruction, degree of biliary obstruction, patient comorbidities) in consideration of ERCP as initial methods. Patient with resectable tumor were assigned to surgery. Peri-procedural coagulopathy was managed according to institutional protocols, with INR correction to < 1.5 using fresh frozen plasma or vitamin K, and platelet transfusion for counts < 50,000/μL prior to intervention.

Data collection

In collaboration with the internal medicine and surgical departments team, principal investigator enrolled consenting patients with obstructive pancreaticobiliary disease. Data were collected through comprehensive chart reviews at multiple timepoints: admission, procedure day, 24 h post-procedure, hospital discharge, and 30 days post-discharge. A de-identified excel sheet captured key information including demographics, laboratory tests, imaging results, procedure details, post-procedure data, adverse events, morbidities, and 30-day follow-up outcomes. The follow-up period commenced from the hospital admission date, ensuring consistent tracking of patient progression and clinical outcomes.

Data analysis

Data were entered in Epidata 3.1 and analyzed using Stata version 13. Descriptive statistics were applied to all collected parameters, presenting results in figures and tables using frequencies and percentages. Bivariate by using chi-square test, and multivariate analyses were conducted to determine associations between predictors and 30-day mortality, with statistical significance set at a 95% confidence interval and p-value < 0.05. Multivariate analysis considered all variables in significant in the bivariate analysis, and employed the enter method of the model. Multicollinearity assessment was also performed considering the target variance inflation factor (VIF) < 5.

Ethical considerations

The study received approval from the University of Rwanda, College of Medicine and Health Sciences Institutional Review Board (UR-CMHS/IRB) [Ref No: 299/CMHS IRB/2023], King Faisal Hospital Rwanda Institutional Review Board (Ref No: KFH/2023/107/IRB), Kigali University Teaching Hospital ethical committee (Ref No: EC/CHUK/142/2023), and Rwanda Military Hospital Institutional Review Board (Ref No: 294/RMH/CMDT/2024). Patients provided informed consent before data collection. Data were protected through password-locked computers, with participant identities restricted to study investigators and only de-identified data used for analysis, ensuring confidentiality throughout the research process. This study was conducted in accordance with the ethical standards of our institutional review board and with Helsinki Declaration.

Results

Baseline patients' flow and characteristics

A total of 186 patients were recruited from 3 tertiary hospitals in this study; 93 patients were recruited from KFH, 61patients were recruited from CHUK and 32 patients were recruited from RMH. After exclusion, 158 patients were included in the final analysis (Fig. 1).

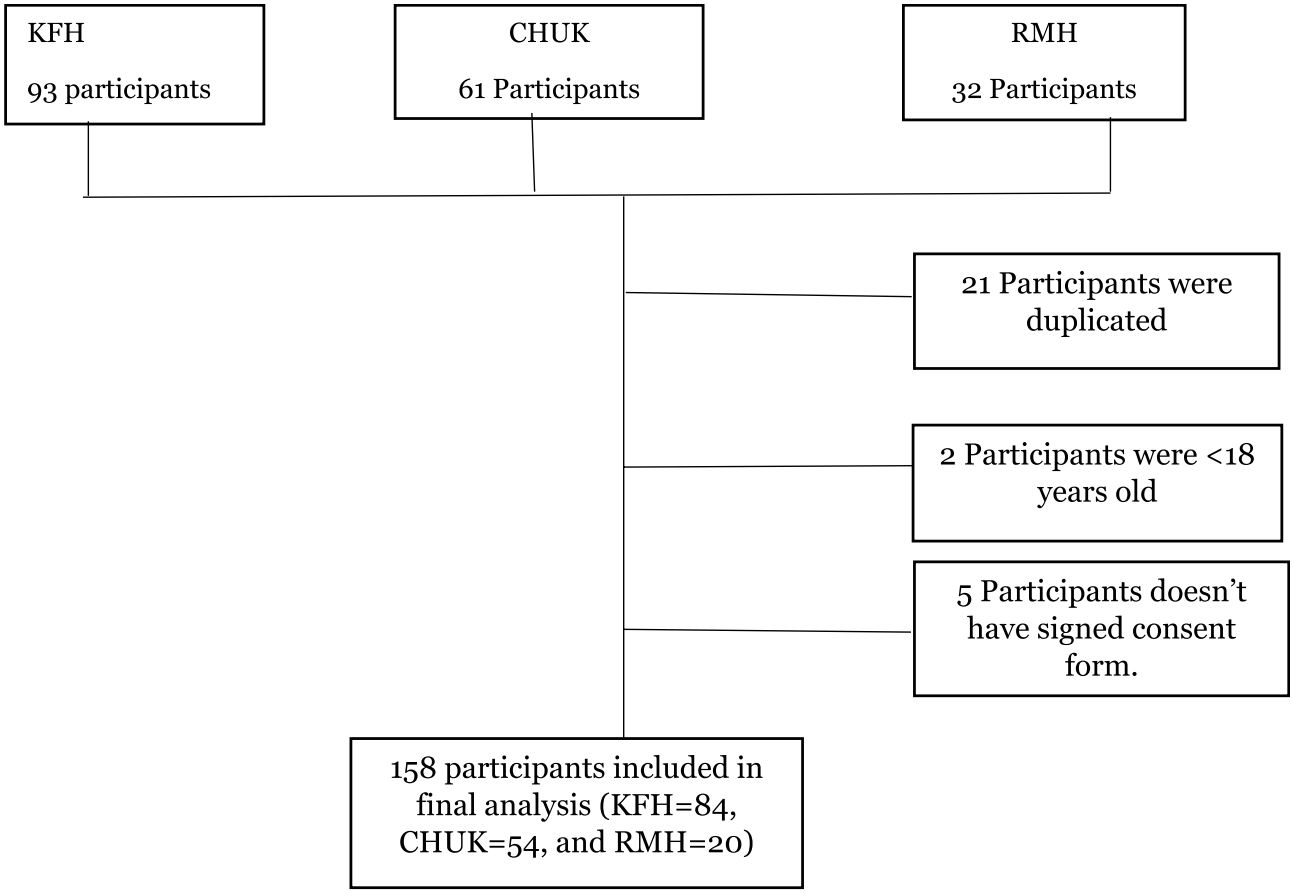

Fig. 1 Patients' flow

Sociodemographic and clinical characteristics of participants

The study analyzed 158 participants, the mean age was 56 ± 16.90 years (range: 18–90 years) and spent an average of 2.43 ± 0.54 days in ICU (range: 2–3 days), with participants predominantly from Kigali City (27.22%) and the Southern Province (23.42%). The sample consisted of 56.33% females and 43.67% males. Notably, 35.44% of participants had cancer, with cholangiocarcinoma (35.71%) being the most prevalent cancer type. Significant comorbidities included anemia (22.15%), diabetes mellitus (13.92%), and hypertension (13.29%). Most participants were managed as outpatients (63.92%), while 35.44% were inpatients, and a minimal proportion (0.63%) required intensive care (as shown in Table 1).

Clinical presentations

The clinical presentation of the participants was characterized by a high prevalence of abdominal pain (93.7%) and itching (70.8%), while nearly half of the patients reported weight loss (44.3%). Other symptoms included abdominal distension (28.5%), cholangitis (9.5%) and ascites (8.9%). Patients who presented with signs of right upper abdominal pain, fever and jaundice were classified as cholangitis (9.5%), (as shown in Fig. 2).

Pre-procedure causes of obstructive jaundice

The primary cause of obstruction among the study patients was stones accounting for 34.2%, followed by indeterminate CBD stricture (24.1%), cholangiocarcinoma (13.9%), and pancreatic cancer (12.7%). Other notable causes included biliary strictures at other sites besides CBD (10.8%) and ampullary lesions (8.2%). Less common causes were chronic pancreatitis (1.9%) and ampullary stenosis (1.3%). Additionally, 5.0% of the obstructions were due to other causes (Fig. 3).

The study revealed that the mean time between patient presentation and procedure was 28.22 ± 23.26 days. Among participants, 24.05% had a history of previous procedures, with ERCP being the most common (65.79%), followed by surgical interventions (31.58%). Of the surgical procedures performed, 83.33% were open surgeries, while 16.67% were laparoscopic (As shown in Table 2).

Imaging investigations revealed diverse findings across different modalities (as shown in Table 3). Abdominal ultrasound primarily identified choledocholithiasis (84.61%), while computed tomography (CT) scans detected choledocholithiasis (34.09%), head of pancreas cancer (18.18%), and cholangiocarcinoma (13.63%).

Table 1 Sociodemographic and clinical characteristics of participants

Characteristics	Frequency	Percentage
Age group of the participants (in years)		
<=25 years	8	5.0
25.1–35 years	16	9.9
35.1–45 years	34	21.1
>=45 years	82	50.9
Location		
Kigali City	43	27.22
Northern	25	15.82
Southern	37	23.42
Western	18	11.39
Eastern	35	22.15
Gender		
Male	69	43.67
Female	89	56.33
Comorbidities		
Cancer	56	35.44
Cholangiocarcinoma	20	35.71
Pancreatic cancer	16	28.57
Gallbladder cancer	12	21.43
Ampullary cancer	4	7.14
Gastric cancer	4	7.14
Anemia	35	22.15
Diabetes mellitus	22	13.92
Hypertension	21	13.29
Prior cholecystectomy	17	10.76
Liver disease	11	6.96
HIV	5	3.16
Kidney disease	5	3.16
Others	15	9.49
Disposition		
Outpatient	101	63.92
Inpatient	56	35.44
Intensive care	1	0.63

Magnetic resonance imaging (MRI) results showed cholangiocarcinoma (30.60%), indeterminate common bile duct strictures (22.73%), and choledocholithiasis (20.45%). These findings highlight the complexity of pancreaticobiliary diseases and the importance of comprehensive imaging techniques in diagnosis.

The mean hemoglobin level was 12.003 g/dl, indicating mild anemia, while the platelet counts averaged 312.054 µL, which falls within the normal to slightly elevated range. Coagulation assessment showed a mean INR of 1.237, suggesting mild coagulopathy. Liver function tests demonstrated significant abnormalities, with elevated mean AST (111.193 IU/L) and ALT (86.464 IU/L) levels indicating hepatocellular injury, while alkaline phosphatase was markedly elevated at 709.06 IU/L, suggesting cholestatic liver dysfunction. Bilirubin levels were substantially increased, with total bilirubin averaging 241.540 IU/L and direct bilirubin at 216.422 IU/L, confirming significant hepatic impairment and cholestasis. These laboratory abnormalities collectively suggest a pattern consistent with hepatobiliary disease with both hepatocellular and cholestatic components. (as shown in Table 4).

Among participants, 87.34% underwent procedures, with ERCP being the most common (77.54%), followed by PTBD (17.39%) and surgical interventions (5.07%). Reasons for not performing procedures included spontaneous stone passage (1.27%), advanced malignancy (10.76%), and gastric outlet obstruction (0.63%). The median procedure duration was 54 min overall, with ERCP at 54 min, PTBD at 45 min, and surgical procedures at 68 min. Open surgeries (71.43%) were more frequent than laparoscopic approaches (28.57%), (as shown in Table 5).

The level of obstruction was primarily at the common bile duct (66.7%), with other locations including the common hepatic duct (19.4%), hilum (13.2%), and intrahepatic (0.8%). Strictures were present in 47.8% and stones were present in 27.5% of cases. (Table 6). The 27.54% of cases with choledocholithiasis, 24.54% were managed by ERCP, and the remaining 3% were assigned to interventional radiology drainage.

Biliary stent placement was performed in 50.72% of cases, with standard metal stents (62.86%) predominantly being covered (75%). Cytology brushing/biopsy was done in 28.26% of procedures. The overall procedures technical success rate was 82.61%; with PTBD success rate of 91.67%, surgical procedures showed higher success rate 100%, while ERCP had a success rate of 79.44%. Procedure failure occurred in 17.39% of cases, primarily due to inability to relieve obstruction (83.33%) and hemodynamic instability (16.67%), (as shown in Table 7).

Half of the patients (50%) had a 1-day post-procedure stay, with 41.3% staying 2–7 days and 8.7% staying over 7 days. Post-procedure adverse events occurred in 16.67% of cases, with pancreatitis (5%), bleeding (3.62%), and death (4.34%) being the most notable. Only 5.8% required Intensive Care Unit/High Dependency Unit (ICU/HDU) admission. At the 30-day follow-up, 92.41% of patients were alive. Final cytology/histology revealed malignancy in 15.21% of cases, normal findings in 9.4%, and atypical cells in 3.62% (as shown in Table 8).

Analysis of in-hospital deaths revealed equal distribution (0.72%) across infection-related complications in all three procedures (ERCP, Surgical, PTBD). ERCP was associated with two deaths (bleeding and disease progression, 0.72% each), while PTBD had one additional death due to pulmonary embolism (0.72%), (as shown in Table 9).

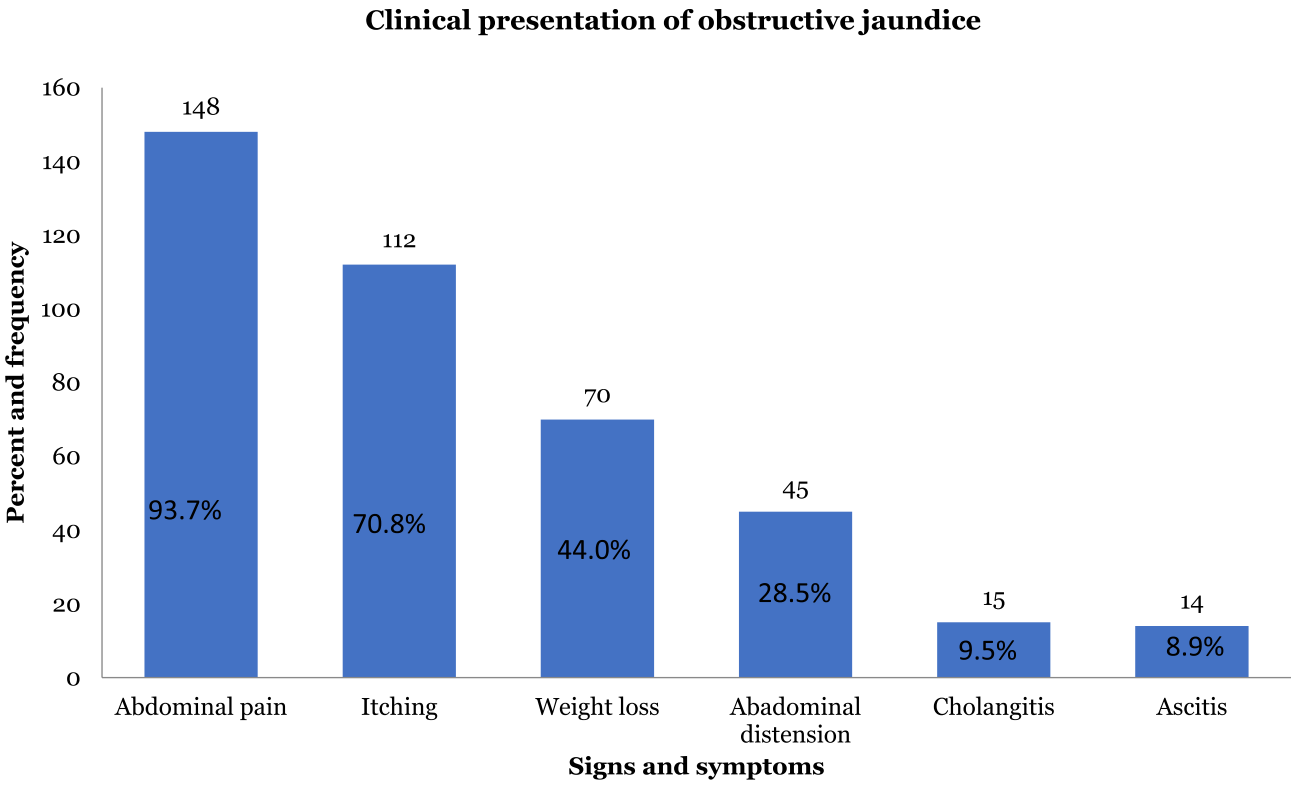

Fig. 2 Clinical presentations of obstructive jaundice among the participants

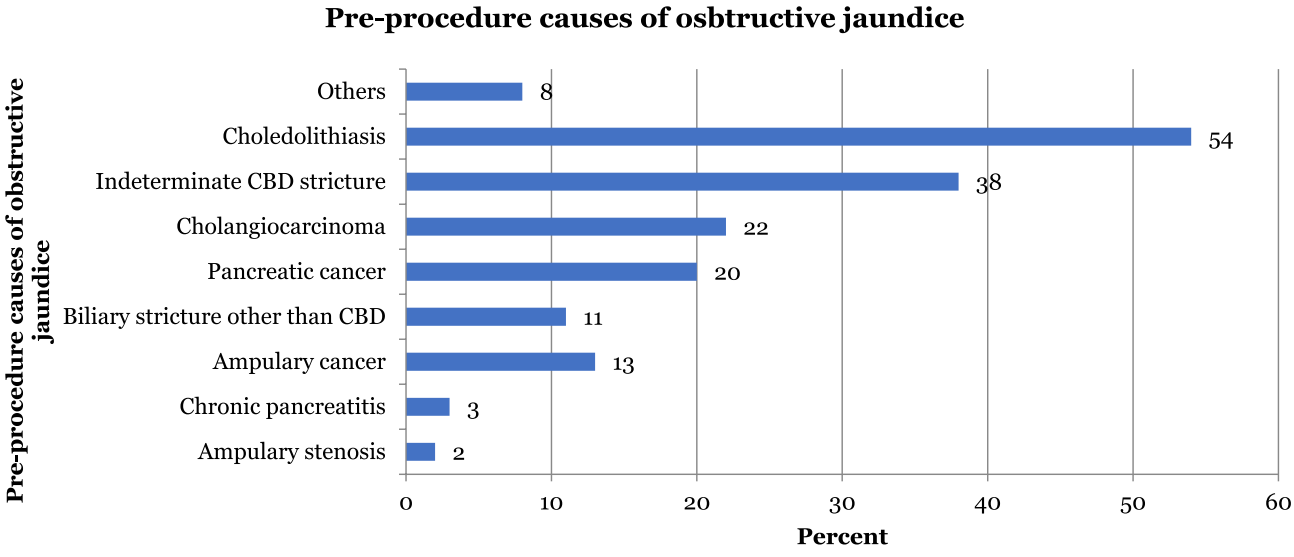

Fig. 3 Causes of obstructive jaundice among the participants

Factors associated with mortality among the participants

In bivariate analysis of factors associated with 30-days mortality, several variables showed significant associations (as shown in Table 10). Age group was significantly associated with mortality (95% CI: 0.013–0.137, $p = 0.018$), as was weight loss (95% CI: −0.276–0.020, $p = 0.024$) and the presence of pulmonary disease (95% CI: 0.087–0.831, $p = 0.016$) and cardiac diseases (95% CI: −0.844–0.081, $p = 0.018$). Among procedural and disease-related factors, CBD stone (95% CI: 0.057–0.310, $p < 0.005$), pancreatic mass (95% CI: −0.378–0.078, $p < 0.003$), and Sphincter of Oddi dysfunction (SO) dysfunction (95% CI: −1.505–0.284, $p < 0.004$) were significantly associated with mortality. Post-procedural complications (95% CI: −0.495–0.130, $p < 0.001$), adverse events such prolonged hospital stay (95% CI:

Table 2 Delay between presentation and biliary drainage and prior drainage procedures

Variable	Frequency	Percentage
Time between presentation and procedure in days		
Mean ± SD	28.22 ± 23.26	
History of previous procedure		
Yes	38	24.05
ERCP	25	65.79
Surgical	12	31.58
PTBD	1	2.63
Types of surgical procedure		
Open	10	83.33
Laparoscopy	2	16.67

Table 3 Summary of investigations (imaging) findings among the participants

Variable	Frequency	Percent
Abdominal ultrasound ($n=27$)		
Choledocholithiasis	22	84.61
Cholelithiasis	3	11.53
Cholecystitis	2	7.69
Abdominal CT scan ($n=44$)		
Choledocholithiasis	15	34.09
Head of pancreas cancer	8	18.18
Cholangiocarcinoma	6	13.63
Indeterminate CBD stricture	5	11.36
Ampullary cancer	4	9.09
Gallbladder cancer	3	6.82
Gastric cancer	1	2.27
Hillar stricture	1	2.27
Abdominal MRI ($n=88$)		
Cholangiocarcinoma	27	30.60
Indeterminate CBD stricture	20	22.73
Choledocholithiasis	18	20.45
Head of pancreas cancer	13	14.77
Gallbladder cancer	8	9.09
Ampullary cancer	2	2.27
Common bile duct cyst	1	1.14
Common hepatic duct and hilar stricture	2	2.28

Table 4 Laboratory findings among participants

Variables	Mean
Hemoglobin (g/dl)	12.003
Platelets (µL)	312.054
INR	1.237
AST (IU/L)	111.193
ALT (IU/L)	86.464
Alkaline phosphate (IU/L)	709.06
Total bilirubin (IU/L)	241.540
Direct bilirubin (IU/L)	216.422

−0.299–0.115, $p<0.001$), ICU/HDU admission (95% CI: −0.354–0.062, $p=0.006$), and cholangitis/sepsis in 30 days post discharge (95% CI: −0.232–0.102, $p<0.001$) were also significantly associated with mortality.

Table 5 Procedures done among the participants

Characteristics	Frequency	Percentage
Procedure done		
Yes	138	87.34
No	20	12.66
Spontaneously passed stone	2	1.27
Advanced malignancy	17	10.76
Gastric outlet obstruction	1	0.63
Type of procedure		
ERCP	107	77.54
PTBD	24	17.39
Surgical	7	5.07
Open	5	71.43
Laparoscopy	2	28.57
Duration of procedure in minutes		
General [Median (IQR)]	54 (45–68)	
ERCP	54 (45–72)	
PTBD	45 (40.5–54)	
Surgical	68 (54–68)	

Table 6 Procedure findings among the participants

Variables	Frequency	Percent
Level of obstruction		
Common bile duct	86	66.67
Common hepatic duct	25	19.38
Hilum	17	13.18
Intrahepatic	1	0.78
Etiology of obstruction		
Presence of stones	38	27.54
Presence of strictures	66	47.83

Table 7 Intraprocedural interventions and treatment success rates among study participants

Characteristics	Frequency	Percentage
Biliary stent placement		
Yes	70	50.72
Types of biliary stent		
Standard metal stent (for ERCP)	44	62.86
Covered	33	75
Uncovered	11	25
Plastic stent	26	37.14
PTBD	20	76.92
ERCP	4	15.38
T-tube	2	7.69
Cytology brushing/biopsy		
Yes	39	28.26
Success of procedure		
Yes	114	82.61
ERCP ($n=107$)	85	79.44
PTBD ($n=24$)	22	91.67
Surgical ($n=7$)	7	100
No	24	17.39
Unable to relieve obstruction	20	83.33
Hemodynamic instability	4	16.67

Table 8 In-hospital management and 30 days outcomes

Characteristics	Frequency	Percentage
Length of stay post procedure		
1 day	69	50
2-7days	57	41.3
> 7 days	12	8.7
Post procedure adverse events		
Yes	23	16.67
Pancreatitis	7	5
Bleeding	5	3.62
Death	6	4.34
Infection	3	2.17
Acute kidney injury	2	1.45
Hypoxia (pulmonary embolism)	1	0.7
Admission in ICU/HDU		
Yes	8	5.8
No	130	94.2
Patient alive at 30 days		
Yes	146	92.41
No	12	7.59
Final cytology/Final histology (*n* = 39)		
Normal	13	9.4
Atypia/atypical cells	5	3.62
Malignancy	21	15.21

Table 9 In hospital cause of death according to the type of procedure

Cause of death	Procedure		
	ERCP	Surgical	PTBD
Infection (2.1%)	1(0.72%)	1(0.72%)	1(0.72%)
Bleeding (0.72%)	1 (0.72%)	0 (0.0)	0(0.0)
Pulmonary embolism (0.72%)	0 (0.0)		1(0.72%)
Disease progression (0.72%)	1(0.72%)	0 (0.0)	0 (0.0)

In multivariate analysis, five of thirteen variables were significantly associated with mortality (Table 11). Multicollinearity diagnosis indicated that the VIF ranged between 1.064 and 1.704. Patients with weight loss had higher odds of mortality (aOR = 10.647, 95% CI: 1.190-95.256, $p = 0.034$), while those without CBD stones had reduced mortality odds (aOR = 0.087, 95% CI: 0.008–0.888, $p = 0.039$). Having a procedure performed was protective against mortality (aOR = 0.025, 95% CI: 0.006–0.117, $p < 0.001$). ICU/HDU admission was associated with increased mortality risk (aOR = 13.051, 95% CI: 2.010-84.731, $p = 0.007$). Other factors were not significantly associated with 30 days mortality in the adjusted analysis.

Discussion

The demographic profile of the study patients shows a mean age of 56 years, with a broad geographical distribution across Rwanda, indicating a diverse sample. The slight female predominance in this study is explained by the high incidence of gallstones, females usually seek health attention and on the other hand, Rwandan population is slightly female dominant country. The mean age in the current study is the same as the one reported from other studies done in either in neighborhood countries by Odongo et al. (2022) in Uganda who reported that the mean age in patients with Obstructive jaundice was 56 years [20]. As advanced age is the risk factor for both gallstones and tumors which are the most causes of obstructive jaundice, the mean age in this study would be justified.

The clinical presentation of obstructive jaundice in this cohort is characterized by high prevalence rates of abdominal pain, and weight loss also was reported frequently. These symptoms are consistent with known presentations of obstructive jaundice, as reported from other studies. The study done in Uganda by Odongo et al. (2022) who reported that the most common presenting symptoms were abdominal pain at 93% and gray-colored stool was present in 76% of patients explaining icterus [20]. The study conducted by Mangam et al. (2018) reported that all patients (100%) who participated in their study presented with abdominal pain in 68.8% and weight loss was reported in 57.5% [21]. Weight losses being the symptom of advanced illness; we could utter the delay of seeking medical help or the delay in making the diagnosis.

The primary causes of obstructive jaundice among the participants in this study include CBD stones followed by CBD stricture and cholangiocarcinoma. The presence of CBD stricture and mass suggests a considerable proportion of cases that could be attributed to structural abnormalities or malignancies. Moreover, findings are in accordance with those from the study conducted by Khan (2019) in India among 201 patients with obstructive jaundice who reported choledocholithiasis to be the most common cause of obstruction at 30.4%, followed by carcinoma of the pancreas [22]. Mabula et al. (2014) from Tanzania also reported that choledocholithiasis was the most common benign cause of obstructive jaundice among their study patients at 51.9% but they reported that carcinoma of the head of pancreas was also the common malignant cause in 65% of patients with malignant causes [23].

Our study found that, abdominal ultrasound mostly identified gallstones and CT scan identified gallstones and tumors most frequently. MRI/MRCP provided additional insights into masses and strictures. As our population was in middle age and nearly third of them had malignant comorbidities, MRCP was the diagnostic modality in more than half of our participant in order to maximize the diagnostic accuracy.

The findings regarding procedure success rates and complications in this study demonstrate comparable outcomes to international standards. The overall success rate

Table 10 Bivariate analysis factors associated with 30 days mortality among study the participants

	Variables	Alive in 30 Days						
		Yes		No		95% CI		P value
		n	%	n	%	Lower	Upper	
Demographic characteristics								
Age group of the participants (years)	<=25 years	8	6.6	0	0.0	0.013	0.137	**0.018***
	25.1-35 years	17	14.0	0	0.0			
	35.1-45 years	30	24.8	3	16.7			
	45.1-55 years	66	54.5	15	83.3			
Region (province)	Kigali City	39	28.3	4	21.1	-0.043	0.038	0.918
	Eastern	29	21.0	6	31.6			
	Southern	32	23.2	5	26.3			
	Western	16	11.6	2	10.5			
	Northern	22	15.9	2	10.5			
Gender of participants	Female	77	55.8	12	63.2	-0.160	0.065	0.408
	Male	61	44.2	7	36.8			
Sign and symptom								
Icterus	Yes	77	55.8	12	63.2	-0.225	0.202	0.917
	No	61	44.2	7	36.8			
Itching	Yes	125	90.6	19	100.0	-0.161	0.166	0.973
	No	13	9.4	0	0.0			
Weight loss	Yes	110	79.7	19	100.0	-0.276	-0.020	**0.024***
	No	28	20.3	0	0.0			
Abdominal pain	Yes	52	37.7	18	94.7	-0.218	0.180	0.851
	No	86	62.3	1	5.3			
Abdominal distension	Yes	128	92.8	19	100.0	-0.241	0.038	0.154
	No	10	7.2	0	0.0			
Ascites	Yes	31	22.5	13	68.4	-0.349	0.045	0.130
	No	107	77.5	6	31.6			
Anemia	Yes	8	5.8	6	31.6	-0.063	0.195	0.312
	No	130	94.2	13	68.4			
Comorbidities								
Cancer	Yes	110	79.7	12	63.2	-0.201	0.045	0.211
	No	39	28.3	14	73.7			
Pulmonary diseases	Yes	99	71.7	5	26.3	0.087	0.831	**0.016***
	No	4	2.9	0	0.0			
Cardiac diseases	Yes	134	97.1	19	100.0	-0.844	-0.081	**0.018***
	No	3	2.2	1	5.3			
Connective tissue disease	Yes	135	97.8	18	94.7	-0.560	0.670	0.861
	No	1	0.7	0	0.0			
Diabetes mellitus	Yes	137	99.3	19	100.0	-0.091	0.234	0.388
	No	19	13.8	3	15.8			
GERD	Yes	119	86.2	16	84.2	-0.304	0.291	0.966
	No	4	2.9	1	5.3			
HIV	Yes	134	97.1	18	94.7	-0.397	0.165	0.415
	No	3	2.2	2	10.5			
Hypertension	Yes	135	97.8	17	89.5	-0.177	0.131	0.770
	No	18	13.0	3	15.8			
Chronic Kidney Diseases	Yes	120	87.0	16	84.2	-0.056	0.507	0.115
	No	5	3.6	0	0.0			
Liver disease	Yes	133	96.4	19	100	-0.211	0.176	0.860
	No	10	7.2	1	5.3			
Pancreatitis	Yes	2	1.4	0	0	-0.268	0.611	0.442
	No	136	98.6	19	100			

Table 10 (continued)

	Variables	Alive in 30 Days						
		Yes		No		95% CI		P value
		n	%	n	%	Lower	Upper	
Surgical history								
Cholecystectomy	Yes	17	12.3	0	0.0	-0.079	0.238	0.322
	No	121	87.7	19	100			
Gastric bypass	Yes	3	2.2	1	5.6	-0.378	0.235	0.646
	No	135	97.8	17	94.4			
Medication history								
Opioids	Yes	30	21.9	13	68.4	-0.399	-0.122	**<0.001***
	No	107	78.1	6	31.6			
Antiplatelets	Yes	4	2.9	1	5.3	-0.147	0.460	0.308
	No	132	97.1	18	94.7			
Cause of obstruction								
Ampulary lesion	Yes	12	8.8	1	5.9	-0.100	0.297	0.327
	No	124	91.2	16	94.1			
Ampular stenosis	Yes	1	0.7	0	0.0	-0.531	0.716	0.770
	No	135	99.3	17	100			
Biliary stricture	Yes	12	8.8	3	17.6	-0.219	0.133	0.631
	No	124	91.2	14	82.4			
CBD mass	Yes	16	11.8	6	35.3	-0.262	0.049	0.179
	No	120	88.2	11	64.7			
CBD stricture	Yes	35	25.7	3	17.6	-0.016	0.231	0.087
	No	101	74.3	14	82.4			
CBD stone	Yes	53	39.0	1	1	0.057	0.310	**<0.005**
	No	83	61.0	17	100			
Cholangitis	Yes	12	8.8	2	11.8	-0.221	0.123	0.577
	No	124	91.2	15	88.2			
Chronic pancreatitis	Yes	2	1.5	0	0.0	-0.348	0.528	0.685
	No	134	98.5	17	100			
Jaundice	Yes	48	35.3	6	35.3	-0.072	0.140	0.526
	No	88	64.7	11	64.7			
Pancreatic mass	Yes	14	10.3	6	35.3	-0.378	-0.078	**<0.003**
	No	122	89.7	11	64.7			
SO Dysfunction	Yes	1	2.3	1	5.9	-1.505	-0.284	**<0.004**
	No	136	97.7	16	94.1			
Previous surgery done								
Previous surgery	Yes	30	22.2	4	22.2	-0.125	0.125	0.765
	No	105	77.8	14	77.8			
Procedural findings								
Procedure done	Yes	129	94.2	7	36.8	0.420	0.677	**<0.001***
	No	8	5.8	12	63.2			
Stones present	Yes	38	29.7	0	0.0	-0.022	0.164	0.131
	No	90	70.3	7	100.0			
Stricture	Yes	62	49.2	4	57.1	-0.076	0.088	0.884
	No	64	50.8	3	42.9			
Leak	Yes	1	0.8	0	0.0	-0.366	0.538	0.707
	No	127	99.2	7	100			
Cytology or biopsy	Yes	36	28.1	3	42.9	-0.111	0.067	0.629
	No	68	53.1	2	28.6			
Stent placed	Yes	60	46.9	5	71.4	-0.053	0.168	0.304
	No	30	24.2	3	42.9			
Rectal NSAID	Yes	94	75.8	4	57.1	-0.174	0.044	0.243
	No	47	38.5	4	57.1			

Table 10 (continued)

	Variables	Alive in 30 Days						
		Yes		No		95% CI		P value
		n	%	n	%	Lower	Upper	
Antibiotics received	Category 1	75	61.5	3	42.9	-0.207	0.013	0.083
	Category 2	110	84.6	3	42.9			
Successfulness of procedure								
Success	Yes	20	15.4	4	57.1	-0.072	0.286	0.239
Adverse events	No	68	53.1	2	28.6			
Complication	Yes	4	3.1	2	28.6	-0.495	-0.130	**<0.001***
	No	126	96.9	5				
Signs and symptoms 24 hours post procedure								
Abdominal pain	Yes	43	33.1	3	42.9	-0.099	0.082	0.851
	No	87	66.9	4	57.1			
Vomiting	Yes	15	11.5	1	14.3	-0.097	0.183	0.548
	No	115	88.5	6	85.7			
Distension	Yes	21	16.2	2	28.6	-0.159	0.074	0.474
	No	109	83.8	5	71.4			
Hematemesis/melena	Yes	4	3.1	0	0.0	-0.105	0.337	0.300
Discharge								
	No	125	96.9	7	100			
Prolonged hospital stays	Yes	18	14.0	7	100	-0.299	-0.115	**<0.001***
	No	111	86.0	0	0.0			
Repeated procedure	Yes	5	3.9	0	0.0	-0.036	0.288	0.127
	No	124	96.1	6	100			
ICU/HDU	Yes	5	3.8	3	42.9	-0.354	-0.062	**0.006***
	No	125	96.2	4	57.1			
30 days post discharge								
Pancreatitis	Yes	1	0.7	0	0.0	-0.164	0.179	0.932
	No	133	99.3	1	100			
Bleeding	Yes	2	1.5	0	0.0	-0.114	0.129	0.903
	No	132	98.5	1	100.0			
Cholangitis/sepsis	Yes	5	3.7	1	100.0	-0.232	-0.102	**<0.001***
	No	130	96.3	0	0.0			

ICU/HDU Intensive Care Unit/High Dependency Unit, *NSAID* Non-steroidal anti-inflammatory drugs, *CBD* Common bile duct, *GERD* Gastro-oesophageal reflux disease, *HIV* Human Immunodeficiency Virus, *CI* Confidence Interval, *SO* Sphincter of Oddi

of 82.61% aligns with findings from a study in Germany Padersoli et al. (2022), which reported high success rates for biliary interventions [24]. The slight variations can be attributed to differences in patient selection criteria, complexity of cases, and institutional expertise levels. The higher success rates observed with PTBD (91.67%) and surgical procedures (100%) compared to ERCP (79.44%) are consistent with findings from a multicenter study in China by Cai et al. (2021), though our ERCP success rates were slightly lower than their reported 86.7% [25].

The observed mortality and complication rates in our study are particularly noteworthy. The 30-day survival rate of 92.41% is encouraging and comparable to findings from Birmingham in UK, such as the study by Bramahall et al. (1995) which reported 45.2% survival rates [26]. Several factors may explain this discrepancy. First, the 30-year interval between studies represents significant advances in endoscopic techniques, perioperative care, and patient management. Second, patient selection criteria have likely evolved, with better risk stratification excluding higher-risk patients from endoscopic intervention. Third, improvements in supportive care, antibiotic prophylaxis, and post-procedural monitoring have contributed to better outcomes. While direct comparison of adverse event rates between ERCP/PTBD and surgical interventions may not be appropriate due to their inherently different risk profiles, our post-procedure adverse event rate of 16.67% demonstrates the potential safety advantages of minimally invasive endoscopic and percutaneous techniques compared to more invasive surgical alternatives. The multivariate analysis revealed several significant predictors of mortality, with some notable differences from other studies. The strong association between weight loss and mortality (aOR = 10.647) was consistent with the findings of the study which was

Table 11 Multivariate analysis factors associated with 30 days mortality among the participants

Variables		aOR	95% C.I		*P* value
			Lower	Upper	
Demographic characteristics					
Age group of the participants (years)	<=25 years	Ref			
	25–35 years	23	0.667	17.904	0.879
	35–45 years	18	0.456	12.9	0.569
	45–55 years	2.996	0.654	14.03	0.89
Sign and symptom					
Weight loss	No	Ref			
	Yes	10.647	1.190	95.256	**0.034***
Comorbidities					
Pulmonary diseases	No	Ref			
	Yes	8.93	0.034	11.019	0.999
Cardiac diseases	No	Ref			
	Yes	3.845	0.197	75.026	0.374
Surgical History					
Received opioid	No	Ref			
	Yes	2.530	0.712	8.995	0.152
Cause of obstruction					
CBD Stone	Yes	Ref			
	No	0.087	0.008	0.888	**0.039***
Pancreatic Mass	No	Ref			
	Yes	3.004	0.659	13.687	0.155
SO Dysfunction	No	Ref			
	Yes	1.439	0.562	11.78	0.348
Procedure data					
Procedure done	No	Ref			
	Yes	0.025	0.006	0.117	**< 0.001***
Adverse events					
Complications	No	Ref			
	Yes	6.355	0.664	60.775	0.108
Discharge					
Admitted in ICU/HDU	No	Ref			
	Yes	13.051	2.010	84.731	**0.007**
30 days post discharge					
Prolonged hospital stays	No	Ref			
	Yes	13.019	0.102	3.291	0.696
Cholangitis/sepsis	No	Ref			
	Yes	16.191	0.189	4.109	0.715

ICU/HDU Intensive Care Unit/High Dependency Unit, *CBD* Common bile duct, *CI* Confidence Interval, *SO* Sphincter of Oddi, *aOR* Adjusted Odd Ratio

conducted in the USA by Danna et al. (2024) which reported higher odd of mortality among the cachectic patients with pancreatobiliary diseases [27]. Our finding showed that patients without CBD stones had lower mortality risk, and this aligns with multiple international studies, reflecting the generally better prognosis of benign biliary obstruction compared to malignant causes. The protective effect of undergoing procedure (aOR = 0.025) was more pronounced in our study compared to similar studies in other developing regions [28, 29], highlighting the critical importance of technical success in our setting.

Strength and limitation

The study's key strength lies in being the first study about pancreatobiliary disease management and outcomes in Rwanda, providing valuable baseline data for future healthcare planning and resource allocation. The inclusion of multiple interventional approaches (ERCP, PTBD, and surgical procedures) and detailed documentation of laboratory findings, complications, and mortality predictors offers a thorough understanding of current practice patterns and outcomes. However, the study had several limitations. The study was conducted in three referral hospitals, not fully represent the national disease burden or management patterns. The relatively small sample size, particularly in some subgroup analyses, may have limited the statistical power to detect significant associations. Future study should focus on the large sample size. Additionally, the lack of long-term follow-up data beyond 30 days prevents assessment of more extended outcomes and quality of life measures. And also, given the heterogeneity in etiology (stones vs. malignancy), procedures (ERCP vs. PTBD vs. surgery), and patient presentation (inpatient vs. outpatient), failure to stratify outcomes accordingly rendered the findings restrictive. And also, the lack of systematic concordance analysis between imaging modalities represents a study limitation that could affect the interpretation of diagnostic findings.

Conclusion

This study from Rwanda provides crucial insights into the management and outcomes of obstructive jaundice from pancreatobiliary diseases, revealing a complex landscape of patient presentations and treatment approaches. The findings demonstrate that while stones were the predominant cause of obstruction, there was a significant cancer burden with cholangiocarcinoma being the most prevalent malignancy. The multivariate analysis identified several significant prognostic factors, with weight loss and ICU/HDU admission associated with increased 30 days mortality risk, while having the procedure done showed a protective effect, emphasizing the importance of timely intervention in managing these conditions.

Abbreviations

ALT	Alanine aminotransferase
AST	Aspartate aminotransferase
CBD	Common bile duct
CD4	Clusters of Differentiation 4
CHD	Common hepatic duct
CHUK	Centre Hospitalier Universitaire de Kigali/University Teaching Hospital of Kigali
CMHS	College of Medicine and Health Sciences

CT	Computerized Tomography
SO	Sphincter of Oddi
ERCP	Endoscopic Retrograde Cholangiopancreatography
GGT	Gamma-glutamyl transferase
INR	International Normalized Ratio
IRB	Institutional Review Board
KFHR	King Faisal Hospital Rwanda
MRCP	Magnetic Resonance Cholangiopancreatography
PTBD	Percutaneous transhepatic biliary drainage
PTBS	Percutaneous transhepatic biliary stenting
RMH	Rwanda Military Hospital
UR	University of Rwanda

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Authors' contributions
IZ conceptualized the study, and wrote initial draft, ES analyzed data, both IZ and ES wrote the final manuscript. HA, JM, GSM, ER, FS, MSM, DN, ID, KD and BR provided substantial revisions to the manuscript. All authors read and approved the final manuscript.

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Data availability
The datasets generated and analyzed during this study are available from the corresponding author upon reasonable request. All data were collected and stored securely in accordance with ethical guidelines, with personal identifiers removed to maintain participant confidentiality. The statistical analysis code used in this study is also available upon request.

Declarations

Ethics approval and consent to participate
The study received approval from the University of Rwanda, College of Medicine and Health Sciences Institutional Review Board (UR-CMHS/IRB) [Ref No: 299/CMHS IRB/2023], King Faisal Hospital Rwanda Institutional Review Board (Ref No: KFH/2023/107/IRB), Kigali University Teaching Hospital ethical committee (Ref No: EC/CHUK/142/2023), and Rwanda Military Hospital Institutional Review Board (Ref No: 294/RMH/CMDT/2024). Patients provided informed consent before data collection. Data were protected through password-locked computers, with participant identities restricted to study investigators and only de-identified data used for analysis, ensuring confidentiality throughout the research process. This study was conducted in accordance with the ethical standards of our institutional review board and with Helsinki Declaration.

Consent for publication
Not applicable as this study used de-identified data and no individual patient information or images are presented in this publication. The institutional review boards of participating hospitals approved the use of anonymized patient data for research purposes.

Competing interests
The authors declare no competing interests.

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