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Etiology, Clinical Presentations, and Short-Term Treatment Outcomes of Extrahepatic Obstructive Jaundice in South-Western Uganda

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Background: The diagnosis of extrahepatic obstructive jaundice (EHOJ) remains a challenge and is often made late in low-resource settings. Systematic data are limited on the etiology and prognosis of patients with obstructive jaundice in Uganda. The objective of this study was to determine the etiology, clinical presentations, and short-term treatment outcomes of patients managed for EHOJ at Mbarara Regional Referral Hospital (MRRH) in south-western Uganda.

Methods: Between September 2019 and May 2020, we prospectively enrolled a cohort of patients who presented with EHOJ at MRRH. A pretested, semi-structured data collection tool was used to abstract data from both the study participants and their files.

Results: A total of 72 patients, 42 (58.3%) of whom were male with a median age of 56 (range of 2 months to 95 years) were studied. Forty-two (58.3%) participants had malignancies: Pancreatic head tumors 20 (27.8%), cholangiocarcinoma 13 (18.1%), duodenal cancers 5 (6.94%), and gall bladder cancer 4 (5.6%). The remaining 30 (41.7%) participants had benign etiologies: choledocholithiasis 10 (13.9%), biliary atresia 7 (9.7%), pancreatic pseudo cyst 6 (8.3%), Mirizzi syndrome 5 (6.9%) and 1 (1.4%) each of chronic pancreatitis and choledochal cyst. Sixty-seven (93.1%) patients presented with right upper quadrant tenderness, 65 (90.3%) abdominal pain and 55 (76.3%) clay-colored stool. Cholecystectomy 11 (25.6%) and cholecystojejunostomy + jejunojunctionostomy 8 (18.6%) were the commonest procedures performed. Twelve (17.0%) of cases received chemotherapy (epirubicin/cisplatin/capecitabine) for pancreatic head tumors and (gemcitabine/oxaliplatin) for cholangiocarcinoma. Mortality rate was 29.2% in the study, of which malignancy carried the highest mortality 20 (95.24%).

Conclusion: Malignancy was the main cause of EHOJ observed in more than half of the patients. Interventions aimed at early recognition and appropriate referral are key in this population to improve outcomes.

Keywords: Uganda, malignant obstructive jaundice, benign obstructive jaundice

Introduction

Extrahepatic obstructive jaundice (EHOJ) results from structural obstruction of bile flow to the duodenum from the right and left hepatic ducts to the duodenal papilla.¹ EHOJ is one of the most common hepatobiliary surgical conditions managed by general surgeons and hepatobiliary surgeons.² Both benign and malignant etiologies of EHOJ have been described with the commonest cause being choledocholithiasis and pancreatic head tumors.^{1,3,4} Biliary atresia is the predominant cause of EHOJ among infants. The symptoms of EHOJ include abdominal pain, yellowish discoloration of the eyes (jaundice), dark-colored urine, skin itching, clay-colored stools, weight loss and anorexia. Jaundice in choledocholithiasis is intermittent and associated with pain.^{5,6} Malignant EHOJ commonly presents with persistent and progressive painless jaundice, often accompanied by weight loss, anemia, and abdominal mass.⁵⁻⁷

Abdominal ultrasonography is the first-line imaging modality used for the diagnosis of EHOJ because it is noninvasive, fast and widely accessible.⁸ However, it is necessary to combine ultrasonography with other imaging techniques such as endoscopic retrograde cholangiopancreatography (ERCP), computed tomography (CT), endoscopic ultrasonography (EUS) or magnetic resonance cholangiography (MRCP) to establish local and distant complications and make a choice of the right therapeutic approach.⁹ Laboratory evaluation to determine the etiology of EHOJ should include a complete panel of liver function tests and liver biochemistry. An elevated alkaline phosphatase gives the highest index of suspicion for a biliary obstruction.¹⁰

In resource-limited countries, open surgery is still the only option for the management for EHOJ. Because most patients with EHOJ present late, surgery is done only for a small proportion of the patients.¹¹ Operative procedures for choledocholithiasis include cholecystectomy with common bile duct (CBD) exploration and T-tube drainage, open cholecystectomy with CBD exploration and choledochoduodenostomy, open cholecystectomy with choledochojejunostomy and open cholecystectomy with CBD stenting.¹² ERCP with partial sphincterotomy followed by stone extraction is performed using a Dormia basket.¹³ Postoperative complications related to EHOJ are still challenging and are associated with high mortality. Predictors of poor outcome are long duration of jaundice, malignant causes, and high bilirubin levels.⁷

In Uganda, there is a paucity of data on the etiology and prognosis of patients with EHOJ. In this study, therefore, we aimed to determine the etiology, clinical presentations, and short-term treatment outcomes of patients managed for EHOJ in MRRH, south-western Uganda.

Patients and Methods

Study Design

This was a prospective cohort study conducted at the Department of Surgery, MRRH in Uganda. Each patient was followed for thirty days from the time of recruitment into the study. The study period was from September 2019 to May 2020.

Study Setting

The study was conducted in the surgery department, MRRH, Western Uganda.

Inclusion Criteria

Any patient admitted with EHOJ evident by dilated biliary ducts on abdominal ultrasound scan and serum bilirubin of ≥ 5.85 mg/dL (≥ 100 mmol/L) or >1 mg/dL (≥ 17 mmol/L) in infants/children.

Exclusion Criteria

Patients admitted after surgery performed for EHOJ from other health facilities prior to admission were excluded.

Study Procedure

The principal investigator took detailed history, clinical examination, and investigations for all the patients together with trained intern doctors who then did consecutive enrollment of patients. Information regarding sociodemographics, presenting symptoms, comorbidities, physical examination findings, investigations, procedures performed, and complications were recorded.

Data Entry and Analysis

Data were entered and cleaned in EpiData entry sheet, then exported to STATA version 15 for analysis. Normality of distribution was tested using histogram, box/whisker plot and Shapiro–Wilk test. Baseline and clinical characteristics of study participants were described using different measures of central tendencies. The etiology was presented in simple proportions and percentages. Inferential analysis with Chi-square and Cramér's V coefficient was used to determine the clinical presentation of EHOJ. The treatment modality was analyzed by cross tabulations stratified by etiology and

presented as simple proportions and percentages. Short-term treatment outcome of EHOJ was achieved using error bars, bar graphs and Chi-square stratified by etiology and treatment modality. A $p < 0.05$ and Cramér's V coefficient > 0.5 were considered statistically significant.

Ethics

Ethical clearance was obtained from Mbarara University Faculty of Medicine Research Committee, MUST-REC09/07-19. Informed consent and assent were obtained from eligible participants before enrollment into the study. Assent was obtained from legal guardians/parents of children younger than 18 years.

Results

Socio-Demographic Characteristics of Participants

Seventy-two participants were enrolled in the study with male predominance of 42 (58.3%) with a median age of 56 years. Majority of study participants were in the age group of > 50 years (Table 1). Nineteen cases of study participants were diagnosed with other chronic conditions including human immunodeficiency virus (HIV) (8), diabetes mellitus (6), hypertension (3), and sickle cell disease in 2 cases. Obstruction was predominantly distal below the confluent of cystic and common hepatic ducts in 40 (55.6%) cases. The median direct bilirubin level was 105.2 $\mu\text{mol/L}$, and ALP was significantly elevated more than 3 times normal range, median of 1194 U/L (Table 2).

Etiology

Overall, the most common cause of EHOJ was pancreatic head tumors 20 (27.8%) followed by cholangiocarcinoma 13 (18.1%) in adults, and biliary atresia among the infants (Table 3). Among the age group of 1–14 years, gallstones formed 2 (50%) cases of obstructive jaundice, and these were all children living with sickle cell disease. Biliary stones were the most common cause of EHOJ among the age group of 36–50 years with predilection for male gender in this study.

Clinical Presentation

Jaundice, right upper quadrant (RUQ) tenderness and non-specific abdominal pain were the predominant manifestations. Loss of appetite, body itching, clay-colored stool, abdominal distension, scratch marks, and Courvoisier's sign showed a strong association with malignancy ($p < 0.05$), (Table 4). The characteristic of jaundice was predominantly continuous and progressive in nature among the malignant group (Figure 1). Over 43% of study participants presented after one year of onset of symptoms (Figure 2).

Table 1 Descriptive Statistics for Basic Socio-Demographics of Participants

Socio-Demographics (N = 72)	Variable	Frequency (%)
Age	<1 year	7 (9.7)
	1–14 years	3 (4.2)
	15–35 years	4 (5.6)
	36–50 years	14 (19.4)
	> 50 years	44 (61.1)
Gender	Male	42 (58.3)
	Female	30 (41.7)
History of smoking + alcohol intake	Alcohol consumption	32 (44.4)
	Smoking	23 (32.0)
Other chronic conditions	Human immunodeficiency virus	8 (11.1)
	Diabetes mellitus	6 (8.3)
	Hypertension	3 (4.2)
	Sickle cell disease	2 (2.8)

Table 2 Descriptive Statistics for Clinical Characteristics of Participants

Ultrasound Scan Findings	Findings	Frequency (%)
Infants	Absence of gallbladder	7 (100)
	Atretic extrahepatic duct	6 (85.7)
	Ascites	2 (28.6)
Children and adults	Dilated bile ducts	47 (66.2)
	Distended gall bladder	34 (47.9)
	Pancreatic mass	28 (39.4)
	RUQ abdominal mass	21 (29.6)
	Ascites	20 (27.8)
	Stones in common bile duct	15 (21.1)
	Stones in gallbladder	11 (15.5)
Level of obstruction		
	Lower third	40 (55.6)
	Middle third	22 (30.6)
	Upper third	10 (13.9)
Liver function tests		
Liver function tests	Value	Interquartile range (IQR)
Conjugated bilirubin ($\mu\text{mol/L}$)	105.20	(78.2–111.0)
Unconjugated bilirubin ($\mu\text{mol/L}$)	20.4	(6.8–23)
Total bilirubin ($\mu\text{mol/L}$)	119.8	(112.4–128)
Alkaline phosphatase (U/L)	1194	(1001–1327)
Gamma-glutamyl transferase (U/L)	200	(122–250)
Aspartate transaminase (U/L)	36	(23.0–46.0)
Alanine transaminase (U/L)	33	(21.0–43.0)
Hematology and clotting profiles		
White cell counts ($\times 10^9$ cells /ul)	6.4	(5.2–10)
Red blood count ($\times 10^9$ cells /ul)	3.4	(2.9–4.4)
Hemoglobin (g/dL)	11.9	(10.7–13.0)
International normalized ratio	1.2	(1.1–1.3)
Prothrombin time (S)	12	(9.7–13.6)
Activated partial thromboplastin time (s)		33 (30–35)

Treatment Modalities

Forty-two (58.3%) of patients were treated with laparotomy and 30 (41.7%) were inoperable (Figure 3). There were more cases who received surgical treatment in the benign group. Cholecystectomy and cholecystojejunostomy + jejunoejunostomy were performed predominantly accounting for over 25.6% and 18.6%, respectively (Table 5). Pancreatic pseudocyst was approached via Roux-en-Y pseudocystojejunostomy and transgastric pseudocystogastrostomy. Roux-en-Y, hepaticojejunostomy was the surgical approach for choledochal cyst and cholangiocarcinoma. Kasai portoenterostomy was performed in one case of biliary atresia. Chemotherapy was given in six cases of patients with cholangiocarcinoma and six patients received chemotherapy for pancreatic head tumors.

Mortality and Morbidities

Overall malignancy carried the highest mortality of 20 cases out of 21 cases who died. Death frequency among the operated and non-operated groups was statistically significant as shown by error bars in Figure 4. Pancreatic head tumors contributed the highest cause of mortality in 9 cases followed by cholangiocarcinoma (Figure 5). In Table 6, 53 (73.6%) patients developed complications. Complication rate was higher among patients with malignancy 36 (67.9%) than patients with benign lesions 17 (32.1%). The commonest morbidities in this study were anemia 14 (26.4%) and

Table 3 Etiology of Extrahepatic Obstructive Jaundice

Type	Aetiology	<1 yr	1–14 Yrs	15–35 Yrs	36–50 Yrs	>50 Yrs	Total, N (%)
Benign	Choledocholithiasis						
	Male	0	0	0	2	4	10 (13.9)
	Female	0	0	0	2	2	
	Biliary atresia						
	Male	3	0	0	0	0	7 (9.7)
	Female	4	0	0	0	0	
	Pancreatic pseudo cyst (head)						
	Male	0	0	0	3	2	6 (8.3)
	Female	0	1	0	0	0	
	Mirizzi syndrome						
	Male	0	1	1	0	1	5 (6.9)
	Female	0	0	1	1	0	
	Chronic head pancreatitis						
	Male	0	0	1	0	0	1 (1.4)
	Female	0	0	0	0	0	
	Choledochal cyst disease						
Male	0	1	0	0	0	1 (1.4)	
Female	0	0	0	0	0		
	Total						30 (41.7)
Malignant	Pancreatic head tumors						
	Male	0	0	0	1	10	20 (27.8)
	Female	0	0	0	2	7	
	Cholangiocarcinoma						
	Male	0	0	0	2	6	13 (18.1)
	Female	0	0	0	0	5	
	Duodenal cancer						
	Male	0	0	0	1	2	5 (6.9)
	Female	0	0	1	0	1	
	Gallbladder cancer						
Male	0	0	0	0	1	4 (5.6)	
Female	0	0	0	0	3		
	Total						42 (58.3)

ascending cholangitis 9 (17.0%). There was no association between chronic illness such as HIV, diabetes mellitus, hypertension, and sickle cell disease and treatment outcome.

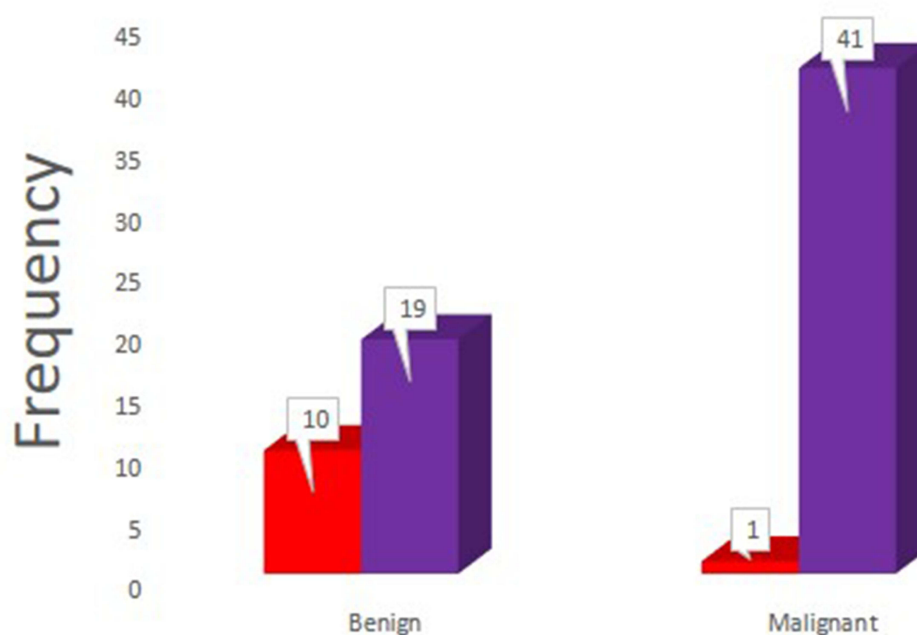
Discussion

Malignancy was the leading cause of EHOJ, accounting for 58.3%, with pancreatic head tumors and cholangiocarcinoma being the leading causes. This explains why jaundice was typically continuous and progressive in nature, and associated with significant weight loss and positive Courvoisier's sign. Late presentation was evident by 43% of the study

Table 4 Clinical Presentations

Clinical Manifestations	Benign n, (%)	Malignant n, (%)	Total n, (%)	P value
Yellow discoloration of eyes	30 (41.6)	42 (58.4)	72 (100)	0.226
RUQ pain/tenderness	25 (34.7)	42 (58.4)	67 (93.1)	0.013
Abdominal pain	25 (34.7)	40 (55.6)	65 (90.3)	0.179
Dark urine	21 (29.1)	34 (47.2)	55 (76.3)	0.397
Nausea and vomiting	19 (26.3)	31 (43.0)	50 (69.3)	0.452
Loss of appetite	10 (1.4)	39 (54.1)	49 (55.5)	<0.001
Loss of weight	15 (20.8)	30 (41.6)	45 (62.4)	0.125
Body itching	13 (18.1)	31 (43.1)	44 (61.2)	0.013
Clay-colored stool	12 (16.6)	30 (41.6)	42 (58.2)	0.031
Abdominal distension	8 (11.1)	33 (45.8)	41 (56.9)	<0.001
Scratch marks	9 (12.5)	31 (43.0)	40 (55.5)	<0.001
Abdominal mass	10 (1.4)	20 (27.7)	37 (29.1)	0.325
Courvoisier's sign	0 (0)	30 (41.6)	30 (41.6)	<0.001
Fever	4 (5.5)	6 (8.3)	10 (13.8)	0.099
Confusion	1 (1.3)	5 (6.9)	6 (8.2)	0.208
Hypotension	1 (1.3)	4 (5.5)	5 (6.8)	0.162
Anemia	0 (0)	5 (6.9)	5 (6.9)	0.056

participants presenting after one year of symptoms, therefore with limited resources in our setting, the only option available was palliative surgery (cholecystojejunostomy and jejunoejunostomy) which was performed in 18.6% among the operable study participants. Malignancy was still the leading cause of mortality and morbidity in the study. Biliary atresia was the most common cause of EHOJ among infants in the study. This was also observed by [Kakembo et al, 2016]. However Kakembo et al, 2016¹¹ found that BA is more common in males than females.¹¹ Biliary atresia is more common in females because of deficiency in glutathione S-transferase Mu1 in females.¹¹ Mu1 enzymes function in the detoxification of environmental toxins including aflatoxin B1 which has been strongly implicated in inducing toxic injury/inflammation of extrahepatic ducts [Sookpotarom et al, 2006].¹⁴ The difference in the findings of Kakembo et al,

**Figure 1** Clinical characteristics of extrahepatic obstructive jaundice.

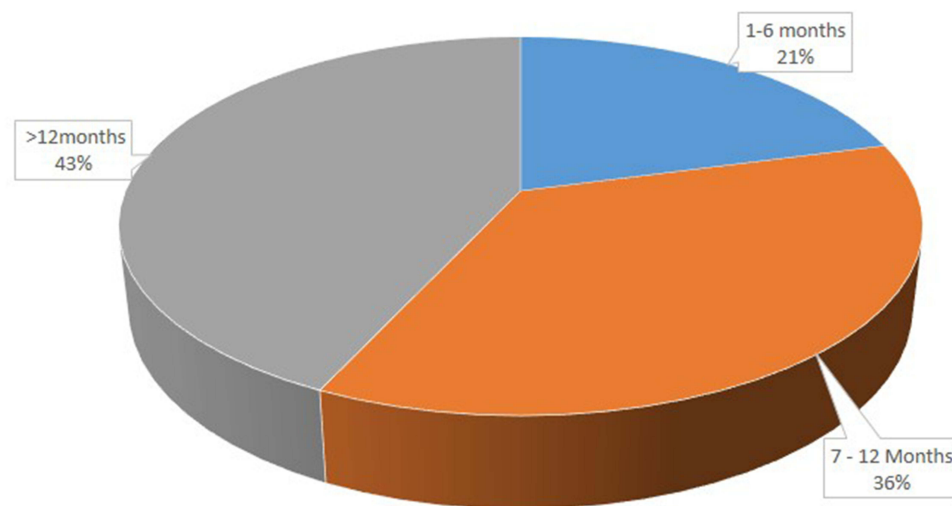


Figure 2 Duration of symptoms at admission.

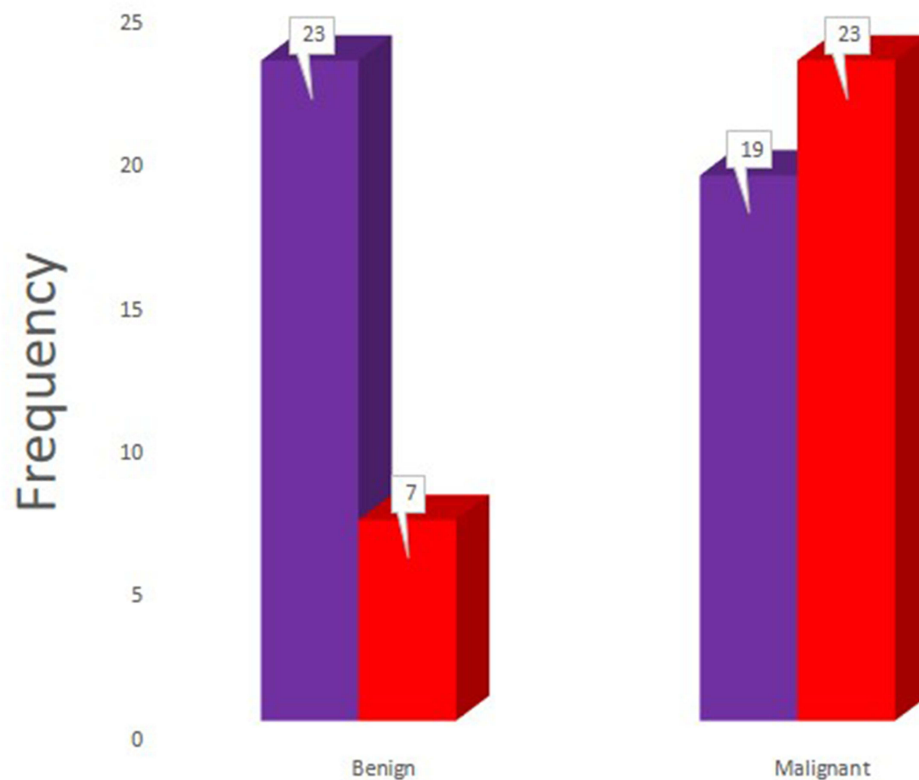


Figure 3 Treatment modalities.

2016¹¹ from this study could be due to the study design of prospective with a retrospective component, which is subject to selection bias.

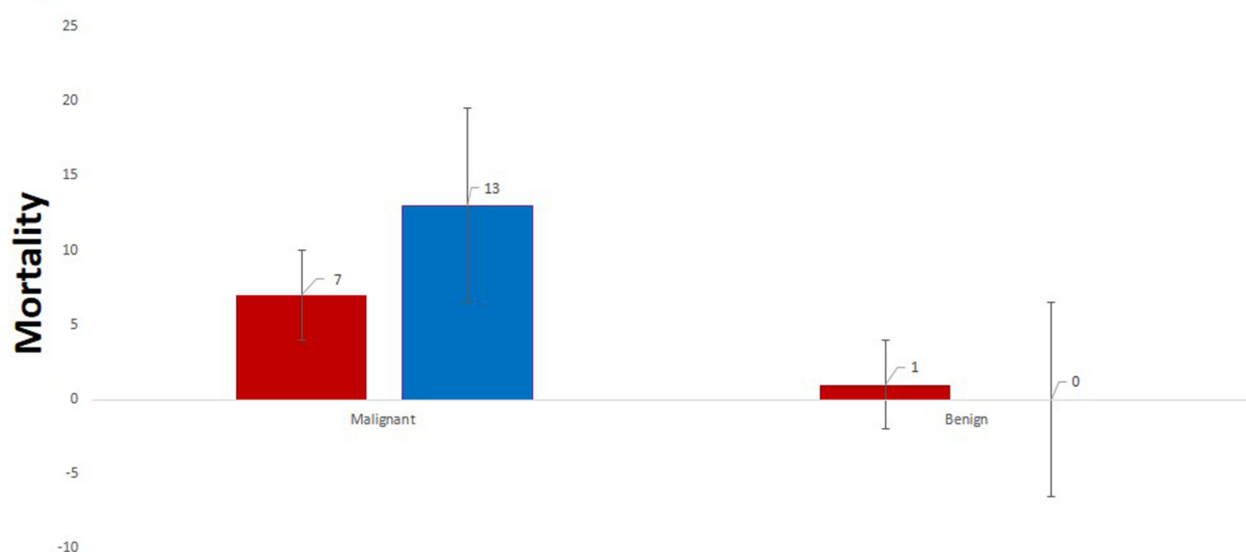
Among the age group of 1–14 years, stones formed 2 (50%) cases of obstructive jaundice. Similar findings were documented by Tuna Kirsaclioglu et al, 2016,¹⁵ and Frybova et al, 2018.¹⁶ The possible cause of gallstones in this age group is hemolysis resulting in increased excretion of unconjugated bilirubin. Unconjugated bilirubin complexes with calcium and nucleating factors (glycoproteins) to form pigment stones.

Table 5 Surgical Procedures

Procedures	Benign	Malignant	Total (%)
Cholecystectomy	8	3	11 (25.6)
Cholecystojejunostomy + jejunoejunostomy	0	8	8 (18.6)
Choledochoduodenostomy	6	1	7 (16.3)
Roux-en-Y hepaticojejunostomy+ jejunoejunostomy	1	3	4 (9.3)
Roux-en-Y cystojejunostomy	3	0	3 (7.0)
Choledochotomy + cholecystectomy +T-Tube	3	0	3 (7.0)
Cystogastrostomy	2	0	2 (4.7)
Cholecystojejunostomy + gastrojejunostomy + jejunoejunostomy	0	2	2 (4.7)
Laparotomy +biopsy	0	2	2 (4.7)
Kasai portoenterostomy	1	0	1 (2.3)
Total	24	19	43 (100)

Biliary stones were the most common cause of biliary obstruction among the age group of 36–50 years with predilection for male gender in this study. However the prevalence was more in females in other studies in Ethiopia, Tanzania, Italy, and the USA ^{7,17–19}. Estrogen causes super-saturation of biliary cholesterol due to hepatic hypersecretion, potentiating nucleation of cholesterol monohydrate crystals. Progesterone inhibits gallbladder contraction, encourages bile stasis, and decreases the gallbladder's response to cholecystokinin. The difference in findings could have resulted from a small sample size to give a conclusive epidemiological gender distribution of biliary stones.

Malignancy was the most common cause of surgical jaundice among age group of >50 years, accounting for 58.33% compared with benign (41.67%). Similar observations were made by Singh et al, 2019²⁰ and Shukla et al, 2018.¹⁷ However in Sweden and India, bile duct obstruction was due to choledocholithiasis.^{21,22} Pancreatic head tumors and cholangiocarcinoma were the predominant malignant causes of surgical jaundice, accounting for 27.8% and 18.1% respectively. Males were more affected than females in both pancreatic head tumors and cholangiocarcinoma. This was also observed in Sweden, Tanzania, and Nigeria by Borkman et al, 2008²³ Mabula et al, 2013⁷ and Olatoke et al, 2018,¹ respectively. The preponderance of pancreatic head tumors and cholangiocarcinoma among males are most likely due to high rates of smoking and primary sclerosing cholangitis, respectively. Carcinoma of the gallbladder was only found among females, similar to a study done in China.²⁴ This was contrary to a study by Singh et al,²⁰ who reported

**Figure 4** Mortality stratified by diagnosis and treatment modality.

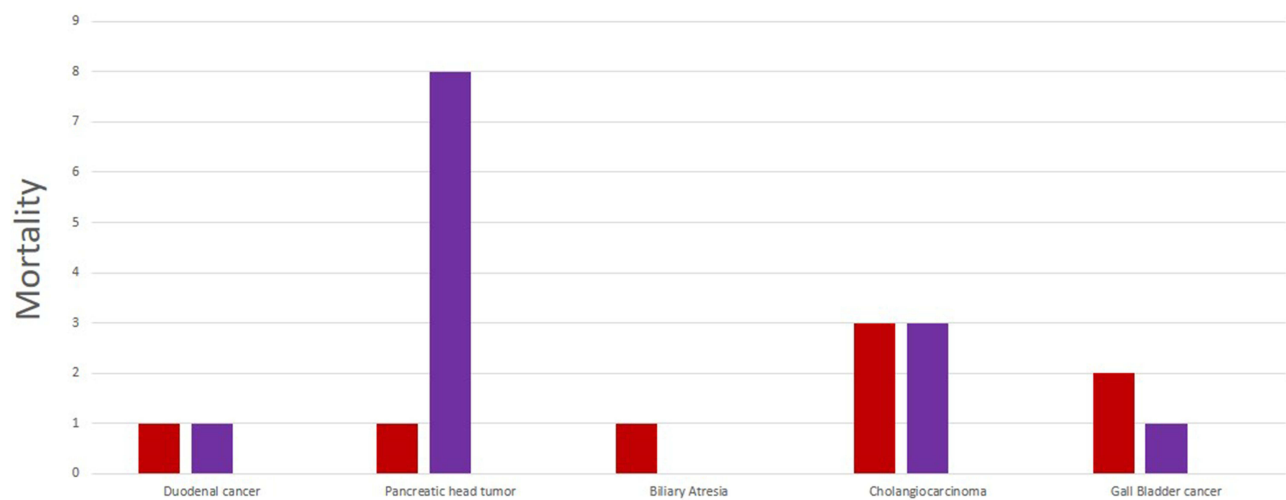


Figure 5 Mortality of extrahepatic obstructive jaundice.

predominance among males. Female predominance for gallbladder cancer is due to high prevalence of gallstones which is a precursor for gallbladder cancer.

Abdominal pain, RUQ pain, dark urine, and vomiting were the most common presentations of patients with EHOJ. This tallied with findings from other studies [Mabula et al, 2013⁷ and Engida Abebe et al,]. The RUQ pain is most likely due to tonic spasm around the cystic duct secondary to temporal obstruction by gallstones. Malignant conditions presented with pain possibly due to retroperitoneal spread of cancer [Engida Abebe et al,]. Findings in this study differed from findings by Shukla et al, 2018,¹⁷ who reported that jaundice and abdominal pain were the only clinical presentations. The latter study was retrospective therefore there could have been missing data and selection bias. Courvoisier's sign was elicited in malignant cases. The association between palpable gall bladder and malignancy is consistent with other studies.^{22,25} Courvoisier's sign is typically from biliary obstruction below the level of the cystic duct.

The study also found that the majority of patients presented with persistent, progressive, and continuous nature of jaundice, accompanied by significant weight loss predominantly among the malignant group. Similar findings were also reported elsewhere in sub-Saharan Africa.^{1,7,23} In the USA, UK, Sweden, and India, the majority of patients presented with intermittent jaundice, possibly because the predominant cause of EHOJ was choledocholithiasis.^{7,17} The observations reflect differences in etiological spectrum from one geographic area to another and different exposure.

Table 6 Morbidities Associated with Extrahepatic Obstructive Jaundice

	Benign		Malignant		Total (%)
	With Surgery	Without Surgery	With Surgery	Without Surgery	
Anemia	1	4	5	4	14 (26.4)
Ascending cholangitis		1	5	3	9 (17.0)
Wound dehiscence	3	0	5	0	8 (15.1)
Hepatic encephalopathy	0	0	0	5	5 (9.4)
Surgical site infection	3	0	2	0	5 (9.4)
Coagulopathy	0	1	0	2	3 (5.7)
Bile leak	0	0	2	0	2 (3.8)
Deep vein thrombosis	0	0	2	0	2 (3.8)
Cirrhosis/portal hypertension	0	2	0	0	2 (3.8)
Failure to thrive	0	2	0	0	2 (3.8)
Sepsis	1	0	0	0	1 (1.9)

Over 41.7% did not received any surgical treatment be it temporary bile diversion/drainage or definitive treatment. This was because 43% of the patients presented late with complications, therefore they would only benefit from temporary drainage of bile using percutaneous transhepatic cholangiography before definitive treatment, which is not available in our setting. This was not the case for other studies,^{14,26} where many cases received either temporary drainage of bile or definitive surgery. The delay to access health care in our centre explains late presentation with complications at admissions. Only one case of biliary atresia, for example, presented in time for a Kasai procedure. This delay can be explained by the long distance travelled by attendants to access the only center with specialized pediatric surgical services in south-western Uganda, but also coupled with delayed referrals by health-care workers at peripheral health facilities.

For pancreatic head tumors, cholecystojejunostomy with Braun anastomosis for palliation was the preferred surgery. This was consistent with a study done in Nigeria by Engida Abebe et al, possibly because the procedure is technically easier to perform. However, other studies demonstrated Whipple's procedure, ERCP guided stenting and percutaneous transhepatic biliary drainage (PTBD) [Engida Abebe et al]. The differences in treatment modality can be explained by late presentation of patients, lack of resources such as ERCP and stents, and shortage of human resources in the study setting. For patients with cholangiocarcinoma, palliative hepaticojejunostomy, choledochoduodenostomy, cholecystojejunostomy and cholecystectomy plus biopsy were performed. However one study²⁷ first did a combination of tumor resection, bilioenteric diversions and then adjuvant radiotherapy and chemotherapy. But for two other studies,^{28,29} pancreaticoduodenectomy plus adjuvant therapy was the main surgical modality for distal cholangiocarcinoma. The difference was late admission of patients with cholangiocarcinoma for respectability coupled with poor capacity for other treatment modalities in the study setting.

Overall mortality rate was 29.17% in this study. Malignancy recorded the highest mortality rate, 15% dying without surgical intervention. However, Mabula et al, 2013⁷ reported overall mortality of 15.5% . The difference is that the former did a retrospective follow up, which is heavily linked with selection bias and the study concentrated on patients who underwent surgery as the only treatment modality while the latter researcher was following patients who underwent ERCP. In Sweden Borkman et al, 2008²³ surprisingly reported a mortality of 68.5%. The follow up was for 5 years compared with this study. Pancreatic head tumors contributed to 9 (45%) of the 20 cases admitted. The author extracted information from the national database, therefore with retrospective study design; chances are high that the findings were influenced by selection bias.

The mortality of gallbladder cancer was 3 (75%) of the total cases admitted. This was consistent with a Japanese study.³⁰ The bad prognosis can be explained by the age of the participants at admission, dispersal of tumor cells into the liver bed through the ducts of Luschka and peritoneal cavity, and recurrence from the cystic duct stump. However, another study showed a better prognosis as their treatment modality constituted aggressive curative resection including radical cholecystectomy together with right hepatectomy and bile duct reconstruction.²⁴

Overall complication rate was 53 (73.6%). Complication rate was higher in patients with malignancy than benign (50.0% vs 23.6%). This is similar to other studies in Ethiopia and Tanzania [Engida Abebe et al,⁷] but different from developed countries.^{31–33} Anemia and ascending cholangitis were the commonest complications in this study. Cholangitis following surgery can be explained by loss of sphincter of Oddi, which prevents bacterial transition from the duodenum into the bile duct. This results in consecutive ascension of bacteria into the bile system causing ascending cholangitis.^{33,34} In patients who develop cholangitis before surgery, persistent obstruction causes bacterial overgrowth and increase of ductal pressure, which then leads to reflux of bacteria and toxins in the close-by veins and lymphatics, resulting in cholangiosepsis. Long-standing jaundice leads to formation of pseudo-transmitters, which predispose to hepatic encephalopathy and hepatic coma. This study was limited by short duration of follow up, that probably left out some of the important aspects of study participants, such as overall survival of those who were inoperable and those who had palliative surgery.

Conclusion

The most common cause of biliary obstruction in MRRH is pancreatic head tumors, followed by cholangiocarcinoma. Biliary atresia accounts for obstructive jaundice among infants. The commonest clinical presentations of patients were right upper quadrant tenderness, abdominal pain, and clay-colored stool. Cholecystectomy and cholecystojejunostomy + jejunojunctionostomy

were the commonest procedures performed in this resource-constrained center. Mortality rate was 29.17%. Interventions aimed at early recognition and appropriate referral and/or investigations are key in this population to improve outcomes. Sensitization through focus groups and radio talk shows should be performed to improve the knowledge on surgical jaundice in this setting.

Data Sharing Statement

The information used and/or analysed during this case report is available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

Ethical clearance was obtained from Mbarara University Faculty of Medicine Research Committee, MUST-REC09/07-19. Consent to publish this case report was obtained from the next of kin of the deceased patients. In addition, informed consent was obtained from the legal guardian/parents of participants younger than 18 years of age.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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