Journal of the Egyptian Society of Parasitology, Vol. 53, No.1, April 2023
J. Egypt. Soc. Parasitol. (JESP), 53(1), 2023: 83 – 92
Online: 2090-2549

BILIARY HELMINTHIASIS: ENDOSCOPIC DIAGNOSIS AND TREATMENT

By

TOSSON A. MORSY[1], HANAN TAHER HAMZA[2] and AYMAN T. A. MORSY[3]

[1]Department of Parasitology, Faculty of Medicine, Ain Shams University, Cairo 11566 [2]Department of Biology, College of Science, Jouf University, Sakaka 72341, Saudi Arabia and Department of Zoology, Faculty of Science, Al-Azhar University (Girls), Nasr City, and [3]Consultant of Tropical Medicine and Fever, Must (Correspondence: tossonmorsy@ med.asu.edu.eg or morsyegypt 2014@gmail.com, Orcid.org/0000-0003-2799 2049, [2]httaher@ju.edu.sa; [3]ayman.morsy@must.edu.eg)

Abstract

Helminthes are a common cause of biliary obstruction in tropical countries and lead to complications as cholangitis and cholangiocarcinoma. This may require surgical or endoscopic intervention. Hepatic and extra-hepatic biliary tree infections occur most commonly by *Ascaris lumbricoides, Clonorchis sinensis, Opisthorchis felineus,* and *Fasciola hepatica*. Other hepatobiliary parasites include *O. viverrini, Fasciola gigantica*, and *Dicrocoelium dendriticum.*

Keywords: Biliary Helminthiasis, Epidemiology, Diagnosis, Treatment, An overview

Introduction

Parasitic infections of the biliary tract are a major concern in the tropical and subtropical countries with significant morbidity and mortality (Garcia, 2013). Clinicians must be aware of these infections in view of increasing travel and migration (Rana *et al,* 2007).

Worms of hepatic and extra-hepatic biliary tree were mainly fascioliasis, clonorchiasis, opisthorchiasis, and ascariasis, other hepatobiliary ones as *O. viverrini, Fasciola gigantica*, and *Dicrocoelium dendriticum* (Davenport, 2012). Deslyper *et al.* (2019) reported that helminthes affect the liver and the biliary tract either during life-cycle to be adult worms or these organs serve as natural habitats. Liver cysts and abscesses may occur by ascariasis or liver flukes (Schulman, 1987), and hepatic hydatidosis can rupture in biliary tract, causing cholangitis. Endoscopic retrograde cholangiopancreatography (ERCP) is now the specific diagnostic and therapeutic tool.

Ascariasis *lumbricoides*: This roundworm is one of the most highly prevalent helminthes; infecting more than 1.2 billion people worldwide (Leung *et al,* 2020). It developed normally reside in the jejunum but are actively motile and invade the papilla, migrating into bile duct and causing complications as cholangitis and pancreatitis; even bile duct perforation biliary obstruction with many Hepatobiliary complications (Iscan *et al,* 1991). Heggers *et al.* (1995) in USA found fatal *Ascaris* pneu-monitis in three children. Javid *et al.* (1999) in India found that 74/510 of liver abscess in children and youth were due to dead or living ascariasis. Wani *et al.* (2000) in India found that ascariasis caused persistence post-cholecystectomy syndrome. Shad and Lee (2001) in USA reported a patient with two episodes of pancreatitis due to *A. lumbricoides* with 2 years apart. Jung *et al.* (2004) reported an acute interstitial nephritis associated with *A. lumbricoides* of a 48-year-old patient. Jang *et al.* (2007) in Korea reported that *A. lumbricoides* was incriminated in biliary stone formation and development. Lastra *et al.* (2010) reported that pulmonary *Ascaris* was generally asymptomatic, but when larvae enter pulmonary cycle caused fever, dyspnea, chest pain, cough with hemotoxic expectoration, eosinophilia and alveolar infiltrates on chest radiography. Hedya *et al.* (2012) in Egypt reported *Ascaris*- in 2/11 patients with obstructive lesions in appendectomy samples. WHO (2013) declared that ascariasis caused annual 60.000 death mainly in children. Gan *et al.* (2014) in UK reported a 14-month-old child with an airway obstruction caused by ascariasis. Kobayashi and Tsuyuzaki (2018) in Japan reported *Ascaris* worm discharged from mouth of an old patient. Sarici *et al.* (2020) in Tur-

key reported *Ascaris*-infested appendix with its head at base and its tail at appendix tip.

Diagnosis: Khuroo *et al.* (1990) reported that in endemic areas biliary symptomatology patient must be diagnosed for egg and/or adult worm in bile or feces and confirmed by ultrasound or ERCP. Two ultrasound results (radiographic imaging) were strongly suggested biliary ascariasis by: 1- Long, linear, parallel echogenic structures with- out acoustic shadowing, and 2- Four lines signnon-shadowing echogenic strips with a central anechoic tube represented parasite digestive tract, worm and intestines (Khuroo *et al,* 1987). MR Cholangiogram showed intraductal worms as a linear low intensity filling defect in bile ducts (Lim *et al,* 2007).

ERCP role: Endoscopic Retrograde Cholangiopancreatography provides a therapeutic option for ascariasis, fascioliasis, and some hydatidosis forms. So, the ERCP can change preoperative management and treatment strategies for biliary system parasites (Yilmaz *et al,* 2018). Worms can be seen in the duodenum and very often across the ampulla of Vater during endoscopy (Mijandrusi-Sinci *et al,* 2008). Cholangiographic finds *Ascaris* worm during ERCP include: 1- Long, smooth, linear filling defects with tapering ends, 2- Parallel, smooth filling defects, curves, and loops crossing the hepatic ducts transversely, and 3- Dilatation of bile ducts (usually the common bile duct).

Ascaris extraction is easiest if it is protruding out of the papilla where a grasping forceps can be used to hold it, while both worm and endoscope are withdrawn from patient (Sonthalia *et al,* 2021). Main pathologies caused by *A. lumricoides* were cholangitis, obstructive jaundice, pancreatitis, and bile calculus, which may lead to the liver apses in endemic regions (Bari *et al,* 2007). *Ascaris* rarely causes pathological effect on urinary system (Tay and Teo, 2012). Among < 300 patients suggested that pancreatobiliary ascariasis was commonest in patients with prior cholecystectomy or sphincterotomy (Sandouk *et al,* 1997). But, a wide sphincterotomy was required for worm removal in 73/77 patients with pancreatic-biliary ascariasis, without major complications reported during or after procedure and recurrence post sphincterotomy occurred. Also, Alam *et al.* (2007) didn't report any biliary ascariasis recurrence in patients after a papillotomy. Papillary balloon dilation facilitated extraction in some patients (Sakai *et al,* 2012).

Extraction of worm was associated with rapid symptoms relief in more than 80% of patients (Magistrelli *et al,* 1989). Infection may be associated with calculi or strictures and can usually be dealt with endoscopic (al-Karawi *et al,* 1999). Patients must be given anthelminthic to eradicate remaining ones. A single oral dose of albendazole® (400mg) or mebendazole® (500mg) was usually given (Albonico *et al,* 1994). Anthelmintic medications are the drugs of choice for *Ascaris* treatment, regardless its species. Infections are generally treated for 1-3 days, and with few side effects (CDC, 2020a)

Echinococcus granulosus: Definitive hosts are canines (dogs, wolves, & foxes) adult resides in intestines. There are 2 types of medical and economic values cystic echinococcosis (CE) & alveolar echinococcosis (AE).

CE is caused by infection with larval stage of *E. granulosus*, mainly in found in Africa, Europe, Asia, the Middle East, Central and South America, but rare in North America. Parasite is transmitted to dogs when they ingest organs with hydatid cysts in other animals. Cysts develop into adult tapeworms in dog, which shed eggs in their feces contaminating the soil (Haridy *et al,* 2000). Sheep, cattle, goats, and pigs ingest eggs in contaminated vegetation; eggs hatch and develop into cysts in internal organs. Transmission to man is by accidental consumption of soil, water, or food contaminated by fecal matter from infected dog. Eggs in soil can stay viable for up to one year. Disease is commonly in people involved in raising sheep, due to their role as an intermediate host and presence of dogs that are allowed to eat the offal of infected sheep (Brik *et al,* 2018).

Alveolar echinococcosis (AE) is caused by *E. multilocularis* larval stage. AE is found across the globe, especially prevalent in the northern latitudes of Europe, Asia, and North America. Adult is normally found in foxes, coyotes, and dogs. Infection with larval stages to people via ingestion of food or water contaminated with eggs (CDC, 2020b).

Symptoms: Human infection with *E. granulosus* leads to development of one or more hydatid cysts located most often in liver and then lungs, and less frequently in bones, kidneys, spleen, muscles and central nervous system. Incubation period can last many years until hydatid cysts grow to an extent that triggers clinical signs, but about half of the patients that receive medical treatment for infection do so within a few years of their initial infection. Abdominal pain, nausea and vomiting are commonly seen when liver hydatids. If lung is affected, clinical signs include chronic cough, chest pain and shortness of breath. Other signs depend on hydatid cysts site and pressure exerted on the surrounding tissues. Non-specific signs include anorexia, weight loss and weakness.

Alveolar echinococcosis is characterized by an asymptomatic incubation period of 5-15 years and slow development of a primary tumor-like lesion usually in liver. Clinically are weight loss, abdominal pain, general malaise and hepatic failure. Larval metastases may spread to organs adjacent to liver (spleen) or distant locations (lungs, or brain) after dissemination via blood and lymphatic system, alveolar echinococcosis is fatal.

Diagnosis: Ultrasonography imaging is the technique of choice for zoonotic cystic echinococcosis and alveolar echinococcosis. Technique is usually complemented or validated by CT and/or MRI (Mazyad *et al,* 1999). Cysts can be incidentally discovered by radiography. Specific antibodies by serological tests and can support diagnosis. Early *E. granulosus* and *E. multilocularis* detection, especially in low-resource areas, is still indicated to aid in selecting treatment options. But, in about one-fourth of hepatic hydatidosis ruptures in biliary tree, due to higher pressure in cyst, often up to 80cm H_2O, causing obstructive jaundice (Bekta *et al,* 2010). Of 16 patients, biliary rupture cyst was in eight, less commonly; cysts ruptured into peritoneal cavity or other organs, led to anaphylaxis and organs failure (Dadoukis *et al,* 1984).

There are 2 types of communications with the biliary tree; frank intrabiliary rupture and simple communication. Patients with simple communications may be asymptomatic, with the communications identified only during surgery. But, patients with frank intrabiliary ruptures are usually symptomatic. Cyst contents (scolices & daughter cysts) drain into biliary ducts and cause intermittent or complete obstruction of bile duct causing obstructive jaundice, cholangitis, and sometimes cholangitic abscesses (Pavlidis and Pavlidis, 2018). Most patients present with jaundice, which can be progressive or fluctuating. The only physical sign may be tender hepatomegaly. Intrabiliary rupture must be suspected when the ultrasound reveals a cystic space occupying lesion in the liver and a dilated common bile duct in a patient from an endemic area (Akel *et al,* 2013). ERCP is indicated when sero-diagnosis are uncertain, and in patients with recurrent biliary colic, especially if associated with icterus or cholangitis. Biliary hydatidosis were diagnosed by ERCP in 60% of cases compared to 25% by CT or ultrasound (Spiliadis *et al,* 1996).

Cholangiography often reveals minor communications, particularly with peripheral ducts, which are of unclear clinical significances. 99mTc-labeled albumin aggregate injection into cysts can assist in the detection of leakage into the systemic circulation. Duodenoscopy sometimes shows whitish, glistening membranes lying in the duodenum, or impacted in the papilla of Vater.

Three patterns of intraductal filling defects on ERCP have been described: 1- Filiform, linear, wavy material in the common bile duct due to laminated hydatid membranes or ill-defined, irregular leaf-like filling defects due to fragmented membranes, 2- Round or

oval lucent filling defects, floating in the common bile duct due to daughter cysts, and 3-Brown, thick, amorphous debris.

Treatment: Hydatidosis is usually by anthelminthic therapy combined with either surgical resection of cyst or percutaneous aspiration and instillation of scolicidal agents. Endoscopic therapy should be reserved for patients with suspected biliary complications occurred before or after surgery (Dumas *et al,* 1999). Surgical treatment technique for liver hydatid cyst cannot be standardized, and surgical technique must be tailored according to cyst extent and any adjunct complications of hydatidosis and patients were treated with albendazole (10mg/kg/day) for 15 days preoperatively (Ezer *et al,* 2006)

Chemotherapy, cyst puncture, and PAIR (percutaneous aspiration, injection of chemicals & respiration) was used to replace surgery as cystic echinococcosis treatment (Ibrahim and Moray, 2020). However, surgery remains the most effective treatment to cyst removal particularly in the lung and can lead to a complete cure (El-Saied *et al,* 2020).

Preoperative ERCP: A sphincterotomy is often needed in patients with obstructive jaundice or cholangitis. Cysts and membranes can then be removed with help of a basket or an occlusion balloon (Tracing, 2006). Saline irrigation of bile duct may be indicated to flush out hydatid sand and daughter cysts. Life-threatening episodes of acute cholangitis can be managed by initially placing a nasal-biliary drain, followed by extraction of hydatidosisand membranes with or without sphincterotomy. Drained bile (by NBD) can be examined for hydatid hooklets or membranes (Al Karawi *et al,* 1987).

Sterilization of other daughter cysts and germinal layers is a must to complete treatment, done during surgery when completely removed cyst by instillation of a cysticidal agent (hypertonic saline, iodophor or ethanol) that is left to dwell in the cyst cavity for 30 minutes prior to excision. Also, it can be done endoscopically if a catheter passes into a communicating cyst, permitting irrigation of main cyst with hypertonic saline (30%). However, it should not be attempted in settings where cysts communicate with other parts of biliary tree or branches. There have been only a handful of case reports of successful non-surgical treatment of complicated hydatid disease with ERCP and medical therapy (Khoshbaten *et al*, 2009).

Post-operative ERCP: Complications also can develop after surgery for hydatid disease. Early complications include development of jaundice (due to echinococcal remnants) or an external biliary fistula, occurred in up to 2% of patients typically within two to four weeks of surgery (de Aretxabala and Perez, 1999). Endoscopic biliary stenting for about four to six weeks was sufficient to achieve fistula closure, and sphincterotomy was also effective (Tekant *et al,* 1996).

Late complications, including sphincter of Oddi stenosis and sclerosing cholangitis, are most commonly seen in patients in whom formalin was used to sterilize the cysts during surgery; minor or major communications with the bile duct permit the formalin to enter the biliary system, causing inflammatory changes. Most of these complications can be treated with ERCP (Bilsel *et al,* 2003). Patients who develop sphincter of Oddi stenosis can be treated with sphincterotomy (Rodriguez *et al,* 1998). Endoscopic treatment methods were successful in addressing other complications of biliary hydatidosis such as clearing the biliary tree, closing fistulas and biliary leaks (Eickhoff *et al,* 2003).

Clonorchisasis *sinensis: Clonorchis sinensis*, or Chinese liver fluke or Oriental liver fluke, is a trematode commonly found in the Far East, mainly China, Japan, Korea, Taiwan, and Vietnam (Liu and Harinasuta, 1996), Jordan among Palestinian refugees (Morsy and El Maridi, 1978), France among Cambodian refugees (Duong *et al.* (1979) as well as in Saudi Arabia (Al Karawi *et al,* 1993) and Egypt (Morsy and Al-Mathal, 2011). It lives in the biliary tract of humans for up to 30 years with delayed pathogenicity (Lim,

1990). Also, dogs, cats, birds, pigs and several other fish-eating mammals are also susceptible for infection and are able to maintain *C. sinensis* as the commonest reservoirs (Doughty, 1996). Man is infected by eating raw or undercooked freshwater fish as dishes of filet, *sashimi*, or congee containing *C. sinensis* metacercariae. Na *et al.* (2020) reported that clonorchiasis caused obstructive jaundice, intrahepatic stones, re-current bile duct stones, cholangitis, cirrhosis, pancreatitis, and cholangiocarcinoma.

Opisthorchis felineus and *Opisthorchis viverrini* are closely related, have similar life cycles, pathophysiology, and with similar clinical manifestations. *O. viverrini* is endemic in Laos and Thailand, but *O. felineus* in Eastern Europe (Sithithaworn *et al,* 2011).

Pathogenesis of biliary injury: Metacercariae (infective stage) attach to the common bile duct, migrate along the epithelial lining of the duct, and stay in the intrahepatic ducts where they mature into adult worms, which are flat, elongated and 10 to 23mm in length. As a general rule, they seek the smaller branches of the left lobe of liver, attain maturity in about one-month and begin to pass eggs. The migration of the immature worm causes trauma to the bile duct epithelium leading to ulceration and desquamation. Adenomatous hyperplasia and goblet cell metaplasia may develop as a result of epithelial injury, which can lead to fibrous tissue formation, resulting in extensive thickening of bile duct or duct encapsulating fibrosis.

Single parasite is of little clinical significance. But, repeated infection may provoke a diffuse involvement of biliary tree, including the large bile ducts and gallbladder. Average infection involves 20 to 200 adult worms; in heavy infections 20,000 flukes may be present in liver. Dilated sub-capsular bile ducts, adenomatous hyperplasia of bile duct epithelium with or without per-ductal fibrosis, and clonorchiasis an eosinophilic infiltration that may be seen in early infections. Also, cirrhosis can develop in the late infection and in re-infected patients.

Clinical manifestations: About 35 million patients are infected with liver flukes worldwide and the exceptionally high incidence of cholangiocarcinoma in some endemic areas is closely related to a liver flukes high prevalence (Lim, 2011). Majority are asymptomatic, symptomatic ones present with cholangitis, intrahepatic calculi, or cholangiohepatitis. Chronicity is associated with cholangiocarcinoma development.

Liver flukes *Opisthorchis viverrini, O. felineus*, and *Clonorchis sinensis* are group 1 carcinogen by the International Agency for Research on Cancer (Saltykova *et al,* 2018).

Brindley *et al.* (2021) reported that cholangiocarcinoma (CCA) is a highly fatal adenocarcinoma of hepatobiliary system, classified as intrahepatic, perihilar and distal. They added in endemic regions, liver fluke is associated with CCA, owing to oncogenic effect of associated chronic biliary tract inflammation, in others; CCA may be associated with chronic biliary tract inflammation due to choledocholithiasis, cholelithiasis, or primary sclerosing cholangitis, but most CCAs with unknown cause. Worm blocks bile flow, predisposing to cholangitis causes worm death. Paroxysms of colicky upper abdominal pain may be confused with calculous biliary disease. But, calculous disease may coexist with eggs act as a nidus for stone formation (Wilkins *et al,* 2017).

Cholangiography characteristics: Many cholangiography findings depended upon infective stage, including elongated filling defects (few mm to 10mm in length) and intrahepatic biliary dilatation that was predominantly peripheral. Defects are of variable size and shape, occurring mostly within smaller tertiary or quaternary intrahepatic bile ducts (Golse *et al,* 2017). These include: a- A mulberry appearance: multiple saccular or cystic dilatations of intrahepatic bile ducts, b- An arrowhead sign: rapid tapering of the intrahepatic bile ducts to periphery, and c- A decrease of intrahepatic radicles number due to portal and periportal fibrosis.

Duct wall irregularities are due to adenoma

hyperplasia, and vary from small indentations to hemispherical filling defects, if these indentations or defects occur in series, they can give rise to a scalloped appearance. *Clonorchis* worms may be visible as filamentous, wavy, and elliptical shaped filling defects (Iscan and Düren, 1991).

Clonorchis worms within bile ducts may be recognized on ultrasound. On CT, appear as non-shadowing echogenic foci/casts within bile ducts. Flukes within gall-bladder move reacted to a light blow above gall-bladder with the transducer (Lim, 1991).

Treatment: Urgent biliary decompression is required for patients with acute cholangitis. Aspirated bile may show adult worms and ova. Endoscopic biopsies are indicated when cholangiocarcinoma is suspected. Surgical intervention may be required in patients who have developed abscesses, extensive fibrosis, or biliary lithiasis (Juttijudata *et al,* 1984). Drug of choice was praziquantel (75mg/kg/ day in three divided doses). But, it was virtually 100% effective, biliary ductal abnormalities may persist even after successful drug therapy (Leung *et al,* 1999).

Fascioliasis is a trematode flat worm caused by *Fasciola hepatica* or *F. gigantica*.

Fasciola hepatica has a worldwide distribution; *F. gigantica* occurs predominantly in the tropics, but both have similar life cycles, and cause similar clinical manifestations in humans (Mas-Coma, 2005). *F. hepatica* occurs mainly in sheep-rearing areas of temperate climates, particularly in parts of Central and South America, Europe, China, Africa, and the Middle East (Mas-Coma *et al,* 1999) Total estimated number of patients was 2.5 million of 61 countries and more than 180 million were at risk (Hasseeb *et al*, 2002).

Human infection usually occurs after eating raw vegetables that are infested with metacercariae (infective form). Humans are an accidental final host in the life cycle of the parasite. Diagnosis should be suspected when eosinophilia and right upper quadrant pain are seen in a patient with the history of eating watercress (El Shazly *et al,* 2005).

Many infections are mild; morbidity increases with fluke burden. Infection forms include acute (liver) phase, chronic (biliary) phase, ectopic fascioliasis, and pharyngeal fascioliasis, penetrate the duodenal wall, migrate across peritoneal cavity, and enter biliary passages through the capsule and parenchyma of liver (Rashed *et al,* 2010). Larvae in bile ducts elicit inflammatory reactions due to toxic metabolites and mechanical effects, leading to necrosis and adenomatous changes of the epithelium, and biliary fibrosis. Biliary tract by locating to biliary tree, mostly causes common bile duct obstruction and obstructive jaundice (Triest *et al,* 2014)

Chronic phase of fascioliasis develops after invading the bile duct and/or gallbladder with the adult worm, which has a life span of approximately 9 to 13 years. This develops three to four months after contaminated meal. Patients were typically presented with jaundice, fever, right upper quadrant pain, and rarely with calculous cholecystitis, severe hemobilia, and acute pancreatitis (Badalov *et al,* 2009). As *Clonorchis* infection, eggs or the dead parasites can act as a nidus for calculous formation, potentially leading to intra or extra-hepatic biliary lithiasis. Extra-hepatic involvement may occur, but not known whether the parasites migrate to ectopic sites hematogenously or via soft tissues. Ectopic fascioliasis results in eosinophilia and mononuclear infiltration with secondary tissue damage. The commonest ectopic site is the subcutaneous tissue of the abdominal wall. Lungs, heart, brain, muscle, genitourinary tract, skin, and eye may also be affected (Dalimi and Jabarvand, 2005) Tender, migrating, erythematous, itchy nodules (1 to 6 cm in diameter) can develop; in some cases, may result in localized abscesses.

Role of ERCP/endoscopic ultrasonography: Flukes may appear as small, radiolucent linear, elliptical, or crescent-like shadows, with jagged, irregular margins in the gallbladder or dilated bile ducts (Cheung *et al,* 2005).

Biliary fascioliasis by endoscopic ultrasonography showed a dilated common bile duct

with a floating, linear structure within (Haseeb *et al,* 2003). Worms were extracted after creation of a small sphincterotomy. Adequate drainage must be done with acute cholangitis (Gandhi *et al,* 2010).

Chloroquine, mebendazole, albendazole, and praziquantel were used with variable success. Bithionol, a dichlorophenol, is recommended in a dose of 30 to 50mg/kg on alternate days for 10 to 15 doses (Dowidar *et al,* 1999). Chronic infection is more difficult to treat than acute disease. A case report suggested that washing the biliary system with povidone iodine during ERCP may be effective for resistant cases. Some of the ductal changes are reversible following successful treatment (Dias *et al,* 1996).

Conclusion and Recommendations

Ascaris normal reside in jejunum, but are actively motile to papilla, and migrating into bile duct, causing biliary obstruction. Endoscopic retrograde cholangiopancreatography is a highly sensitive to demonstrate worm in biliary and pancreatic ducts. Worms can be seen in duodenum, very often across an ampulla of vater during endoscopy. Worm extraction is usually associated with rapid relief of symptoms and is successful in more than 80% of patients. Patients must be treated to eradicate remaining worms. A single oral dose of albendazole (400mg) or mebendazole (500mg) is usually successful.

Echinococcus in humans as intermediate hosts with a hydatid cyst, commonest site is liver, followed by lung others organs could be infected. Diagnosis is by radiologic tests and serology. ERCP is indicated when these tests results were uncertain and in patients with recurrent biliary colic, especially if associated with icterus or cholangitis.

Hydatidosis usually treated by anthelmintic drug combined with either surgical resection of cyst or percutaneous aspiration & instillation of scolicidal agents. Albendazole must start prior to endoscopic or surgical therapy. Endoscopic therapy must be reserved for patients with suspected biliary complications before or after surgery.

Clonorchis lives in biliary tract of man and fish-eating animals and cause obstructive jaundice. Infection is acquired by eating raw fresh-water fish (carp & salmon). Complicaations include intrahepatic or recurrent bile duct stones, cholangitis, cirrhosis, pancreatitis, and cholangiocarcinoma. Many cholangiographic types (depends infection on site), including elongated filling defects (few to 10mm in length) and intrahepatic biliary dilatation, which is predominantly peripheral. Defects are of variable size and shape, occurr mostly within the smaller tertiary or quaternary intrahepatic bile ducts. Urgent biliary decompression is a must for acute cholangitis patients, Aspirated bile shows adults & ova, endoscopic biopsies in suspected cholangiocarcinoma. Surgery is needed in patients developed abscesses, extensive fibrosis, or biliary lithiasis, Praziquantel (75mg/kg/day in 3 divided doses).

Fasciola hepatica is more frequent in sheep raising areas. In acute infection, immature worms penetrate duodenal wall, migrate across peritoneal cavity, and enter biliary passages via capsule and liver parenchyma. Larvae in bile ducts cause inflammatory reactions, lead to necrosis and adenomatous changes of epithelium, and biliary fibrosis. Changes ultimately evolve into cystic dilatation, total or partial obstruction of bile ducts, and periportal cirrhosis. Chronic fascioliasis develops after bile duct and/or gallbladder infection. Patients present with jaundice, fever, right upper quadrant pain, and rarely with calculous cholecystitis, severe hemobilia, and acute pancreatitis. On ERCP, flukes may appear as small, radiolucent linear, elliptical, or crescent-like shadows, with jagged, irregular margins in gallbladder or dilated bile ducts. Biliary fascioliasis on endoscopic ultrasonography showed a dilated common bile duct with a floating, linear structure. Worms can be extracted by a small sphincterotomy. Adequate drainage must be in acute cholangitis, Bithionol 30-50mg/kg on alternate days for 10 to 15 doses.

References

Akel, R, Faraj, W, Haydar, A, Masri, O, El-Majzoub, N, *et al,* 2013: Diagnosis of hydatid cyto-biliary disease by intraductal ultrasound (with video).Endosc. Ultrasound 2, 4:225-7.

Al Karawi, M, Sanai, FM, Yasawy, MI, Mohammed, AE, 1999: Biliary strictures and cholangitis secondary to ascariasis: Endoscopic management. Gastrointest. Endosc. 50:695-99.

Al Karawi, MA, el Sheikh Mohamed, AR, al Shahri, MG, Yasawy, MI, 1993: Endoscopic sphincterotomy in acute gallstone pancreatitis & cholangitis: A Saudi Hospital experience. Hepatogastroenterol. 40, 4:396-401.

Al Karawi, MA, Mohamed, AR, Yasawy, I, Haleem, A, 1987: Non-surgical endoscopic trans-papillary treatment of ruptured echinococcus liver cyst obstructing the biliary tree. Endoscopy 19:81-6.

Alam, S, Mustafa, G, Ahmad, N, Khan, M, 2007: Presentation and endoscopic management of biliary ascariasis. Southeast Asian J. Trop. Med. Publ. Hlth. 38:631-6.

Albonico, M, Smith, P, Hall, A, *et al*, 1994: A randomized controlled trial comparing mebendazole and albendazole against *Ascaris, Trichuris* and hookworm infections. Trans. R. Soc. Trop. Med. Hyg. 88:585-90.

Badalov, NL, Anklesaria, A, Torok, A, *et al,* 2009: *Fasciola hepatica* causing acute pancreatitis complicated by biliary sepsis. Gastrointest. Endosc. 70:386-9.

Bari, S, Sheikh, K, Ashraf, M, *et al,* 2007: *Ascaris* liver abscess in children. J. Gastroenterol. 42, 3:236-40

Beckingham, IJ, Cullis, SN, Krige, JE, *et al,* 1998: Management of hepatobiliary and pancreatic *Ascaris* infestation in adults after failed medical treatment. Br. J. Surg. 85:907-12.

Bekta, M, Dökmeci, A, Cinar, K, *et al,* 2010: Endoscopic management of biliary parasitic diseases. Dig. Dis. Sci. 55:1472-8.

Bilsel, Y, Bulut, T, Yamaner, S, *et al,* 2003: ERCP in the diagnosis and management of complications after surgery for hepatic echinococcosis. Gastrointest. Endosc. 57:210-8.

Brik, K, Hassouni, T, Youssir, S, Baroud, S, *et al,* 2018: Epidemiological study of *Echinococcus granulosus* in sheep in Gharb plain (North-West, Morocco). J. Parasit. Dis. 42, 4:505-10.

Brindley, PJ, Bachini, M, Ilyas, SI, Khan, SA, Loukas, A, *et al,* 2021: Cholangiocarcinoma. Nat. Rev. Dis. Primers. 2021 Sep 9;7(1):65. doi: 10.1038/s41572-021-00300-2.

CDC, 2020a: Parasites-Ascariasis: https://www.cdc.gov › parasites › ascariasis › treatment.

CDC, 2020b: Parasites -Echinococcosis: https://www.cdc.gov/parasites/echinococcosis/index.ht

Cheung, J, Enns, R, Romney, M, *et al,* 2005: Biliary fascioliasis. Gastrointest. Endosc. 61: 596-08.

Dadoukis, J, Gamvros, O, Aletras, H, 1984: Intrabiliary rupture of the hydatid cyst of the liver. World J. Surg. 8:786-90.

Dalimi, A, Jabarvand, M, 2005: *Fasciola hepatica* in the human eye. Trans. R. Soc. Trop. Med. Hyg. 99:798-804.

Davenport, M, 2012: Biliary atresia: Clinical aspects. Semin. Pediatr. Surg. 21, 3:175-84.

De Aretxabala, X, Perez, OL, 1999: Use of endoprostheses in biliary fistula of hydatid cyst. Gastrointest. Endosc. 49:797-802.

Deslyper, G, Doherty, DG, Carolan, JC, Holland, CV, 2019: The role of the liver in the migration of parasites of global significance. Parasit. Vectors 12, 1:531-8.

Dias, LM, Silva, R, Viana, HL, *et al,* 1996: Biliary fascioliasis: diagnosis, treatment & follow-up by ERCP. Gastrointest. Endosc. 43:616-9.

Doughty, BL, 1996: Schistosomes and other trematodes. In: Medical Microbiology. By Baron, S, (ed). 4th Ed. Galveston (TX): University of Texas Medical Branch at Galveston

Dowidar, N, El Sayad, M, Osman, M, Salem, A, 1999: Endoscopic therapy of fascioliasis resistant to oral therapy. Gastrointest. Endosc. 50: 345-9.

Dumas, R, Le Gall, P, Hastier, P, *et al,* 1999: Role of endoscopic retrograde-cholangiopancreatography in the management of hepatic hydatid disease. Endoscopy 131:242-5.

Duong, TH, **de Closets, F, Dupin, M, Rigal, J, Barrabes, A,** *et al,* **1979:** A parasitologic survey conducted in Touraine (France) in a group of South East Asia refugees. Med. Trop. (Mars). 39, 6:659-63.

Eickhoff, A, Schilling, D, Benz, CA, Riemann, JF, 2003: Endoscopic stenting for postoperative biliary strictures due to hepatic hydatid disease: Effectiveness and long-term outcome. J. Clin. Gastroenterol. 37:74-8.

El-Sayed, YA, Ibrahim, EA, Morsy, TA, 2020: Peri-cystectomy versus cystotomy and enucleation of germinal layer by tissue spearing technique for lung hydatid in Egypt. JESP 50, 3: 494-503

El-Shazly, AM, Abdel-Magied, AA, El-Nahas, HA, El-Metwaly, MS, Morsy, TA, *et al,* 2005: The main reservoir host of *Fasciola* in Dakahlia Governorate, Egypt. JESP 35, 1:243-52.

Ezer, A, Nursal, TZ, Moray, G, Yildirim, S, Karakayali, F, *et al,* 2006: Surgical treatment of liver hydatid cysts. HPB (Oxford), 81:38-42.

Gan, RW, Gohil, R, Belfield, K, Davies, P, Daniel, M, 2014: Acute airway obstruction by *Ascaris lumbricoides* in a 14-month-old boy. Int. J. Pediatr. Otorhinolaryngol. 78, 10:1795-8.

Gandhi, V, Jain, P, Rathod, V, Nagral, S, 2010: Endoscopic ultrasound in biliary fasciolosis. Indian J. Gastroenterol. 29:128-32.

Garcia, L, 2013: Hepatobiliary parasites. Pathology 45, 1:S50

Golse, N, Lewin, M, Rode, A, Sebagh, M, Mabrut, JY, 2017: Gallbladder adenomyomatosis: Diagnosis and management. J. Visc. Surg. 154, 5:345-53.

Haridy, FM, Ibrahim, BB, Morsy, TA, 2000: Sheep-dog-man: The risk zoonotic cycle in hydatidosis. J. Egypt. Soc. Parasitol.30, 2:423-9.

Haseeb, AN, El Shazly, AM, Arafa, MAS, Morsy, ATA, 2002: A review on fascioliasis in Egypt. J. Egypt. Soc. Parasitol. 32, 2:397-412.

Haseeb, AN, El Shazly, AM, Arafa, MAS, Morsy, ATA, 2003: Clinic-al, laboratory and ultrasonography features of proven human fascioliasis. J. Egypt. Soc. Parasitol.33, 2:397-412

Hedya, MS, Nasr, MM, Ezzat, H, Hamdy, H M, Hassan, AMA, *et al,* 2012: Histopathological findings in appendectomy specimens: a retrospective clinicopathological analysis. J. Egypt. Soc. Parasitol. 42, 1:157-64.

Heggers, JP, Muller, MJ, Elwood, E, Herndon, DN, 1995: Ascariasis pneumonitis: A potentially fatal complication in smoke inhalation injury. Burns 21:149-51

Ibrahim, EA, Morsy, TA, 2020: Tissue sparing technique in liver hydatid diseases: Three-way technique versus hydatid cone technique. JESP 50, 2:378-89.

Iscan, M, Düren, M, 1991: Endoscopic sphincterotomy in the management of postoperative complications of hepatic hydatid disease. Endoscopy 23:282-8.

Iscan, M, Düren, M, Tayyareci, A, 1991: Ascariasis pancreatitis: Endoscopic diagnosis and therapy. Fortschr. Med. 109, 12:251-2.

Jang, JS, Kim, KH, Yu, JR, Lee, S, 2007: Identification of parasite DNA in common bile duct stones by PCR and DNA sequencing. Korean J. Parasitol. 45, 4:301-6.

Javid, G, Wani, NA, Gulzar, GM, Khan, BA, Shah, AH, *et al,* 1999: *Ascaris*-induced liver abscess. World J. Surg. 23, 11:1191-4.

Jung, O, Diting, T, Gröne, HS, Geiger, H, Hauser, IA, 2004: Acute interstitial nephritis in a case of *Ascaris lumbricoides* infection. Nephrol. Dial. Transplant.19, 6:1625-8

Juttijudata, P, Chiemchaisri, C, Palavatanan, C, Churnratanakul, S, 1984: Biliary tract disease in Thailand. Surg. Gynecol. Obstet. 158, 1: 13-6.

Khoshbaten, M, Farhang, S, Hajavi, N, 2009: Endoscopic retrograde cholangiography for intrabiliary rupture of hydatid cyst. Dig. Endosc. 21: 277-82.

Khuroo, MS, Zargar, SA, Mahajan, R, 1990: Hepatobiliary and pancreatic ascariasis in India. Lancet 335:1503-7.

Khuroo, MS, Zargar, SA, Mahajan, R, *et al,* 1987: Sonographic appearances in biliary ascariasis. Gastroenterology 93:267-70.

Kobayashi, Y, Tsuyuzaki, J, 2018: *Ascaris lumbricoides* discharge from the mouth. Case Rep. Gastroenterol. 12, 1:153-7.

Lastra, G, Sandoval, J, Diaz Sandos, J, 2010: *Ascaris* pulmonar en paciente politraumatizado (pulmonary ascariasis in a polytraumatized patient) Rev. Colomb. Neumol. 22:22-5.

Leung, AKC, Leung, AAM, Wong, AH, Hon, KL, 2020: Human ascariasis: An updated review. Rec. Pat. Inflamm. Aller. Drug Discov. 14: 133-45

Leung, JW, Sung, JY, Banez, VP, *et al,* 1990: Endoscopic cholangiopancreatography in hepatic clonorchiasis, a follow-up study. Gastrointest. Endosc. 36:360-6.

Lim, JH, 1990: Radiologic findings of clonorchiasis. Am. J. Roentgenol. 155:1001-8.

Lim, JH, 1991: Oriental cholangiohepatitis: Pathologic, clinical, and radiologic features. AJR. 157:1-8.

Lim, JH, 2011: Liver flukes: The malady neglected. Korean J. Radiol. 12, 3:269-79

Lim, JH, Kim, SY, Park, CM, 2007: Parasitic diseases of the biliary tract: Abdominal imaging pictorial essay. AJR. 88, 6:1596-603.

Liu, LX, Harinasuta, KT, 1996: Liver and intestinal flukes. Gastroenterol. Clin. North Am. 25:627-36.

Magistrelli, P, Masetti, R, Coppola, R, *et al,* 1989: Value of ERCP in the diagnosis and management of pre- and postoperative biliary compl-

ications in hydatid disease of the liver. Gastrointest. Radiol. 14:315-8.
Mas-Coma, S, 2005: Epidemiology of fascioliasis in human endemic areas. J. Helminthol. 79: 207-9.
Mas-Coma, S, Esteban, J, Bargues, M, 1999: Epidemiology of human fascioliasis: A review and proposed new classification. Bull. WHO, 77, 4:340-6.
Mijandrusi-Sinci, B, Stimac, D, Kezele, B, *et al,* 2008: Acute pancreatitis caused by *Ascaris lumbricoides*: A case report. Gastrointest. Endosc. 67:541-6.
Mazyad, MAM, Morsy, TA, Habib, KhSM, 1999: Vertebral unilocular hydatidosis in a shepherd and his wife. J. Egypt. Soc. Parasitol. 29, 2:547-50
Morsy, ATA, Al-Mathal, EM, 2011: *Clonorchis sinensis*: A new report in Egyptian employees returning back from Saudi Arabia. J. Egypt. Soc. Parasitol. 41, 1:219-222.
Morsy, TA, El Maridi, NA, 1978: Incidence of parasitic infection in Al-Baqaa, Jordan. J. Egypt. Soc. Parasitol. 8, 2:347-51.
Na, BK, Pak, J, Hong, S, 2020: *Clonorchis sinensis* and clonorchiasis. Acta Trop. 203:1053-9.
Pavlidis, ET, Pavlidis, TE, 2018: Pathophysiological consequences of obstructive jaundice and perioperative management. Hepatobiliary Pancreat. Dis. Int. 17, 1:17-21.
Rana, SS, Bhasin, DK, Nanda, M, Singh, K, 2007: Parasitic infestations of the biliary tract. Curr. Gastroenterol. Rep. 9, 2:156-64.
Rashed, AA, Khalil, HM, Morsy, ATA, 2010: Zoonotic ectopic fascioliasis: review and discussion. J. Egypt. Soc. Parasitol. 40, 3:591-600
Rodriguez, AN, Sánchez, del, Río AL, Alguacil, LV, *et al,* 1998: Effectiveness of endoscopic sphincterotomy in complicated hepatic hydatid disease. Gastrointest. Endosc. 48:593-8.
Sakai, Y, Tsuyuguchi, T, Sugiyama, H, Nishikawa, T, Tawada, K, *et al,* 2012: Current situation of endoscopic treatment for common bile duct stones. Hepatogastroenterology 59:1712-6**.**
Saltykova, IV, Petrov, VA, Brindley, P, 2018: Opisthorchiasis and the microbiome. Adv. Parasitol. 102:1-23
Sandouk, F, Haffar, S, Zada, MM, *et al,* 1997: Pancreatic-biliary ascariasis: experience of 300 cases. Am. J. Gastroenterol. 92:2264-9.
Sarici, B, Akbulut, S, Ozcan, M, Demyati, K, Samdanci, E, 2020: Unusual infectious agents detected in appendectomy specimens: A retrospective analysis of 42 cases. Turk. J. Surg. 36, 3: 291-6.
Schulman, A, 1987: Non-western patterns of biliary stones and the role of ascariasis. Radiology 162:425-9.
Shad, JA, Lee, YR, 2001: Pancreatitis due to *Ascaris lumbricoides*: Second occurrence after 2 years. South Med. J. 94, 1:78-80.
Sithithaworn, P, Andrews, RH, De, NV, Won-Gsaroj, T, Sinuon, M, *et al,* 2011: The current status of opisthorchiasis and clonorchiasis in the Mekong Basin. Parasitol. Inter. 2 Mar; 61, 1:10. 1016/j.parint.08.014.
Sonthalia, N, Rodge, GA, Shah, BB, Patil, V, Goenka, MK, 2021: Endoscopic ultrasonographyguided rendezvous technique for removal of a long biliary ascariasis: A challenging case. Video-GIE 6, 12:540-2.
Spiliadis, C, Georgopoulos, S, Dailianas, A, *et al,* 1996: The use of ERCP in the study of patients with hepatic echinococcosis before and after surgical intervention. Gastrointest. Endosc. 43: 575-9.
Tarcin, O, 2006: Rupture of hydatid cyst into the biliary tract. Gastrointest. Endosc. 63:325-9.
Tay, KV, Teo, JY, 2012: Education and imaging gastrointestinal: Incidental findings of *Ascaris lumbricoides* in patient presenting with ureteric colic. J. Gastroenterol. Hepatol. 27, 6:112-7.
Tekant, Y, Bilge, O, Acarli, K, *et al,* 1996: Endoscopic sphincterotomy in the treatment of postoperative biliary fistulas of hepatic hydatid disease. Surg. Endosc. 10:909-14.
Triest, L, Mana, F, Willekens, I, *et al,* 2014: Obstructive jaundice at the age of 24: *Fasciola hepatica*. Acta Gastroenterol. Belg. 77, 2:272-3.
Wani, NA, Shah, OJ, Naqash, SH, 2000: Postoperative biliary ascariasis: presentation and management, experience. Wld. J. Surg. 24:1143-8.
WHO, 2013: Water related diseases: ascariasis. Available at: http://www.who.int/water_ sanitation health/diseases/ascariasis/en/
WHO, 2021: sheets/detail/echinococcosis. https: //www.who.int/news-room/fact.
Wilkins, T, Agabin, E, Varghese, J, Talukder, A, 2017: Gallbladder dysfunction: Cholecystitis, choledocholithiasis, cholangitis, and biliary dyskinesia. Prim. Care 44, 4:575-97.
Yilmaz, S, Akıcı, M, Şimşek, M, Okur, N, Erşen, O, *et al,* 2018: Endoscopic retrograde cholangiopancreatography for biliary system parasites. Turk. J. Surg. 34, 4:306-10. Published online 2018 Jan 3