

## True and False Incomplete Duplications of the Common Bile Duct and Their Impact on Therapy

E. Brătucu<sup>1</sup>, A. Stănescu<sup>1</sup>, D.N. Straja<sup>1</sup>, C. Cirimbei<sup>1</sup>, M. Marincea<sup>1</sup>, S. Rădoi<sup>2</sup>, D. Fătoi<sup>3</sup>,  
Abdul Kariem H. Huwood Al Jabouri<sup>1</sup>, I. Ștefan<sup>1</sup>, S. Ionescu<sup>1</sup>

<sup>1</sup>Surgery Department No.1, Oncologic Institute, Bucharest, Romania

<sup>2</sup>Department of Anaesthesiology and Intensive Care, Oncologic Institute, Bucharest, Romania

<sup>3</sup>Euromedic, Bucharest, Romania

### Rezumat

#### *Duplicații reale și false ale căii biliare principale cu implicații terapeutice*

Anomaliile de constituire a căii biliare principale reprezintă o reală problemă pentru chirurg, nerecunoașterea acestora putând genera soluții terapeutice incomplete sau incorecte și mai grav, conducând la patologie iatrogenă. Asocierea anomaliilor CBP cu litiaza biliară, cu neoplasmul căilor biliare sau cu altă patologie hepato-bilio-pancreatică, poate conduce la depistarea pre sau peroperatorie a acestor anomalii. Deseori incertitudinea persistă. Prezentăm 2 cazuri, unul dintre ele cu duplicație incompletă a CBP, iar celălalt cu o falsă duplicație, în dorința de a sublinia valoarea superioară a colangio-RMN-ului cu reconstrucție 3 D, în clarificarea anatomiei căilor biliare, superioară în unele cazuri explorărilor colangiografice intraoperatorii sau colangiografiei retrograde endoscopice.

**Cuvinte cheie:** duplicația căii biliare principale, colangio-RMN cu reconstrucție 3D, colangiografie retrogradă endoscopică

### Abstract

The congenital anomalies of the common bile duct (CBD) represent a real challenge for the surgeon, and not recognizing them may have two consequences: either generate incomplete or incorrect surgical solutions, or, even worse, lead to iatrogenic pathology. The association between the anomalies of the CBD and biliary lithiasis, biliary cancer or other hepatobiliopancreatic pathology may lead to a pre/perioperative diagnosis; frequently, the uncertainty persists. We present 2 cases: one with an incomplete duplication of the CBD and the other with a false duplication. We wish to underline the sovereign value of cholangio-MRI with 3 D reconstructions in the diagnosis and description of the anatomy of the biliary ducts, superior, in some cases, to the intraoperative cholangiography or ERCP.

**Key words:** duplication of the CBD, cholangio-MRI with 3 D reconstructions, endoscopic retrograde cholangiopancreatography (ERCP)

---

#### Corresponding author:

Ciprian Cirimbei, M.D.  
1<sup>st</sup> Surgical Clinic  
The Oncological Institute of Bucharest  
Carol Davila University School of Medicine  
Bucharest, Romania  
Tel. +42212271590, Fax +42212271011  
E-mail: cirimbei@yahoo.com

### Introduction

There is a wide diversity in the formation of the main biliary duct (1,2) from the hepatic pedicle - a higher or lower convergence of the hepatic ducts (incomplete duplication) or lack of convergence (complete duplication). Exceptional situations, where the common bile duct is formed very low in the retroduodenopancreatic area, may be encountered. In

such cases the cystic duct usually opens in the right hepatic duct.

The discovery of these anomalies comes as a surprise occasioned by a pre, intra- or even postoperative imaging exploration. (3-6) Nowadays, the clinician can choose from an entire arsenal of valuable techniques of investigation (7-9) which can suggest or confirm the existence of an extrahepatic biliary anomaly: ultrasound scan, CT with contrast media, spiral CT, cholangio-MRI, ERCP, intra and postoperative cholangiography.

Despite this remarkable progress, the imaging information brought by the above mentioned techniques may lead to a false interpretation because of the images overlapping and due to the 1 D visualisation – possible causes of error. We are convinced that only the images obtained in a 3D system are able to offer the unquestionable certainty of a presumed anomaly.

Further on, we would like to present two cases from our practice. In one of the cases there was an incontestable incomplete duplication. The other case proved, to be a false duplication eventually, a diagnosis that was possible only after a 3D re-interpretation of a cholangio-MRI.

#### Case 1

In 1968, a 68-year old patient was admitted to the hospital with obstructive jaundice. The paraclinical tests revealed a biliary retention syndrome: total bilirubin (TBIL) of 12,5 mg%, direct bilirubin (DBIL) 8,7 mg%, alkaline phosphatase (ALP) 388 IU. Discretely elevated cytolysis tests: AST=100 IU, ALT=182 IU. At that time, the current modern imaging techniques of invasive and non-invasive exploration of cholestatic jaundice did not exist. Therefore, the patient was operated on by a right subcostal laparotomy. Multiple stones, of 3-8 mm in diameters, occupied the gallbladder. An open cholecystectomy was performed, followed by a choledocotomy and the extraction of 2 calculi migrated from the gallbladder. No suspicion regarding a possible anomaly of the biliary ducts had arisen. After the insertion of an „à la D. Burlui” axial drainage (10), a cholangiography was performed. At that

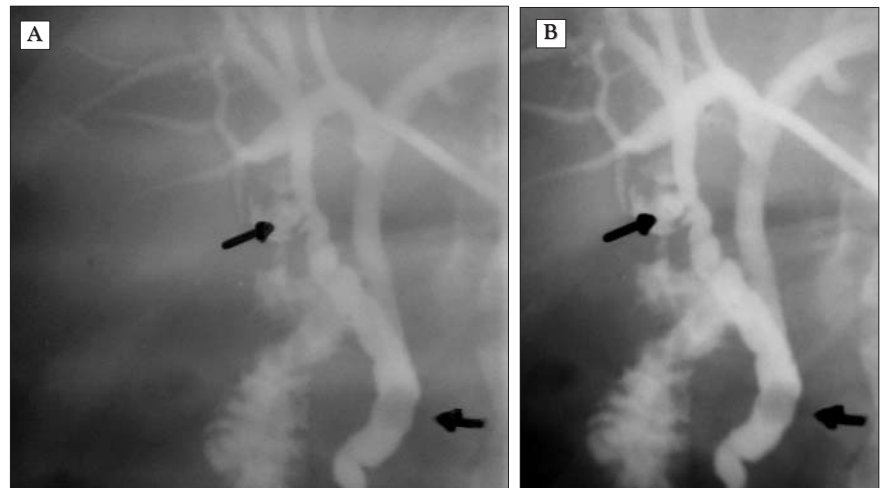
moment, a very low convergence of the hepatic ducts, which were converging behind the pancreas, at 4 cm from the “duodenal window” was discovered. Primary, an incomplete duplication of the common bile duct in its pedicle segment was recorded. The cystic stump was placed in the right hepatic duct. The hepatic ducts were converging very low, near the duodenum, and were disposed in a “sandwich” conformation at the place of their convergence. From a frontal plane view, the opening of the right hepatic duct was situated cranially to that of the left hepatic duct (Fig. 1 A, B).

Underneath their convergence, in the conjoint part, a calculus was discovered. That discovery imposed reopening of the right hepatic duct and the extraction of the lithiasic obstacle. The postoperative evolution was uneventful.

#### Case 2

A 33-years old patient was admitted to our clinic by transfer from another hospital, in January 2011. In 2008 she had an operation for gallbladder lithiasis-cholecystectomy. Three years after the operation she suffered from a painful and febrile episode of biliary colic accompanied by jaundice. TBIL = 10 mg%, AP = 292 IU, AST-120 IU, ALT-155 IU, gamma GT = 520 IU. She was initially admitted to a gastroenterology department in another hospital. The diagnostic of acute lithiasic angiocholitis was established and an ERCP was performed. The catheterisation of the papilla was impossible. She was transferred to the surgical unit of the same hospital. She was operated by a right subcostal approach. The CBD was isolated; a choledocotomy followed by the extraction of purulent bile and of lithiasic debris were performed. A Kehr tube was inserted and the intraoperative cholangiography revealed a non-dilated choledocus, and rapid progression of contrast media into the duodenum. However, a vicious placement of the Kehr tube was noticed, with its superior limb sitting on the cystic stump. Initially, the postoperative condition of the patient was favourable, with complete remission of the jaundice at an external biliary drainage of 600 ml/24 hours. In the 24-th postoperative day, a cholangiographic control was performed, with images suggesting microcalculi in the CBD (Fig. 2).

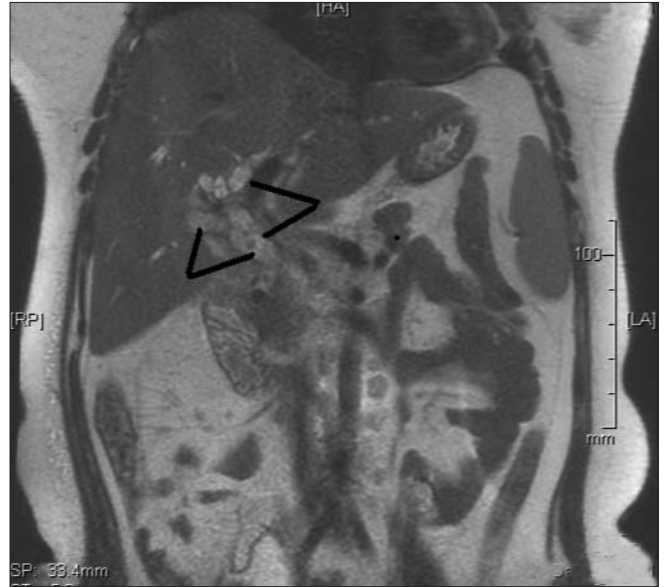
**Figure 1.** An axial drainage intraoperative cholangiography - a very low convergence of hepatic ducts, at 3-4 cm from Vater's region. A calculus in the common bile duct and in the cystic stump (A,B)





**Figure 2.** Postoperative cholangiography on Kehr drain after choledocolitotomy. Free Oddi passage, defective placement of the Kehr tube, with its superior arm engaged into the cystic stump. Lithiasis of the distal choledocus

Nevertheless, the Kehr tube was removed and the patient discharged home, apparently being surgically cured. 10 days later the jaundice reappeared and the patient became febrile.  $BT = 12 \text{ mg\%}$ ,  $GGT = 264 \text{ ui}$  with signs of hepatic cytolysis. In those circumstances, a cholangio-MRI was performed which revealed the existence of calculi in the main biliary tree (Fig. 3).

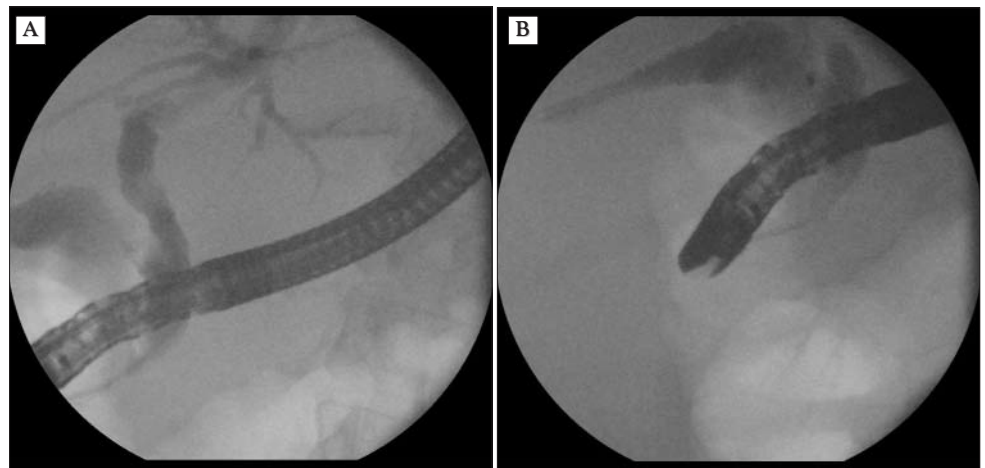


**Figure 3.** Cholangio-MRI done 10 days postoperatively. Dilatation of the intrahepatic biliary ducts and calculi in the terminal segment of the choledocus. Image suggesting an incomplete duplication of the CBD (indicated by arrows)

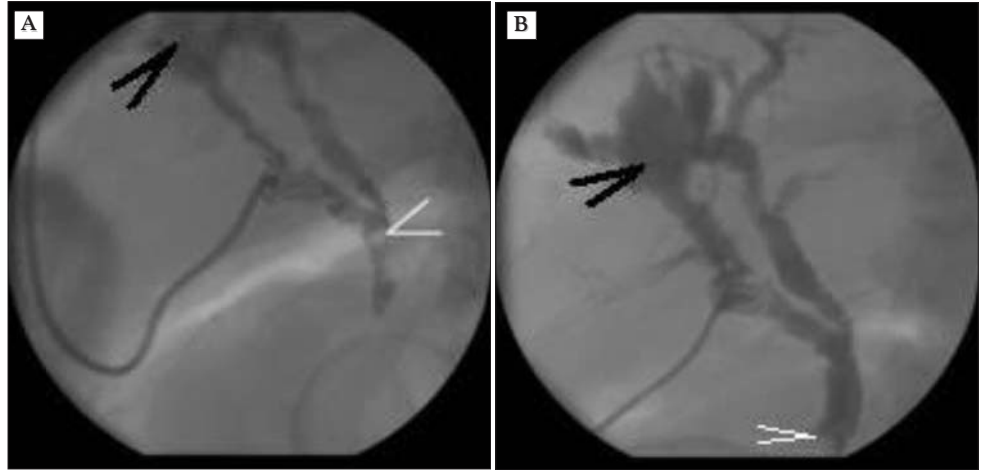
The patient was transferred to our surgical department for an endoscopic approach of the main biliary duct lithiasis. An ERCP was performed, which revealed a non-dilated CBD with a fistula at the site where the previous Kehr tube was positioned. Through the biliary fistula, the contrast media was draining into the peritoneal cavity (Fig. 4 A,B).

In that case the endoscopic desobstruction was abandoned, and the intervention was continued by a right subcostal laparotomy. A choleperitoneum in the supra- and inframesocolic spaces was noticed; peritoneal lavage. The CBD was approached, the fistulous orifice was identified, being enlarged by choledocotomy and 2 approx. 6 mm calculi were extracted. Control with a 24 Benique and cholangiography after the reinsertion of the Kehr tube. The cholangiography revealed a suggestive image for a CBD

**Figure 4.** (A) A biliary fistula with choleperitoneum after extraction of the Kehr tube. (B) Collection of bile in the right subphrenic space



**Figure 5.** (A,B) Intraoperative cholangiography on the Kehr tube after desobstruction. An aspect of incomplete biliary duplication, with a very low convergence of the hepatic ducts. Remaining calculus in the terminal segment of the choledocus (white arrow). Cystic mass in the right hepatic area (black arrow)



duplication: the two main hepatic ducts were converging at 4 cm above the papilla (Fig. 5 A,B). A calculus was blocking the ampulla.

In the right retrohepatic area a 3-cm in diameter cystic mass was observed. The Kehr tube appeared to be installed in the right duct of the duplication. The dislocation of the calculus from the ampullary zone was impossible. Therefore, we proceeded to transverse duodenotomy of the DII, the papilla being directly visualized and a 10 mm Oddi sphincterotomy centered on the calculus was performed, with further extraction of a 8 mm stone. The Kehr tube was reinstalled and a cholangiographic control on the tube was performed. Two images of stones in the terminal part of the common duct could be seen (Fig. 6).

A decision of leaving the calculi in place was taken, in order to extract them endoscopically at a later stage, having a guaranty of a facilitated approach after the surgical sphincterotomy. Ten days after the operation a new cholangiographic control was performed and the image of a left hepatic duct with its afferent intrahepatic area and partially of the right hepatic duct with the Kehr tube was obtained (Fig. 7). Concomitantly, the remaining calculi in the common duct could be seen.

Twenty days postoperatively, with the guaranty of a healed duodenal duodenorrhaphy, an endoscopic intervention was done with the extraction of the 2 remaining calculi. However, the ERCP was able to opacify only the supposed right hepatic channelled territory (Fig. 8 A,B).

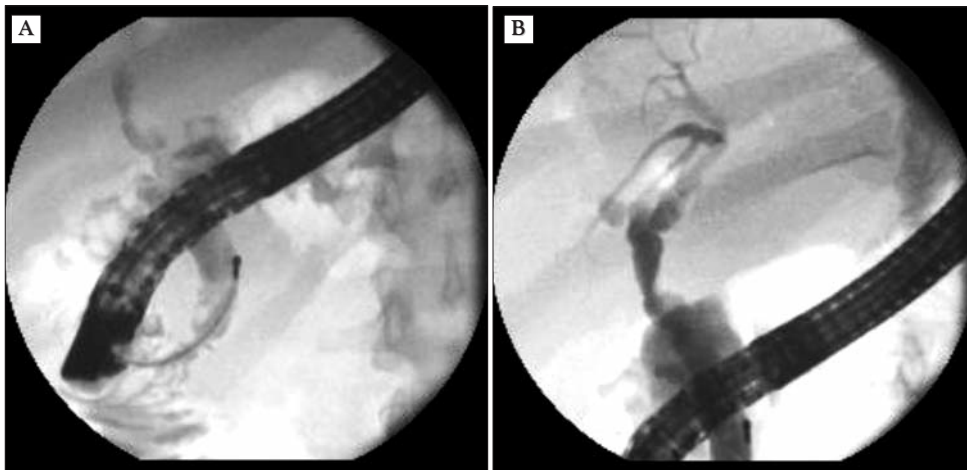


**Figure 6.** Intraoperative cholangiography after lithotomy done through transduodenal sphincterotomy. 2 remaining calculi can be seen (black arrow). The Kehr tube appears to be inserted in the "right hepatic duct"



**Figure 7.** Cholangiography on the Kehr tube made 10 days postoperatively: the left hepatic duct and the Kehr tube inserted in the "right hepatic duct"

**Figure 8.** (A,B) ERCP done before the endoscopical desobstruction, with calculi in the terminal CBD. "Right hepatic system" opacified



The evolution of the patient was uneventful with discharge on the 24th postoperative day, with a closed Kehr drain. Control at 14 days – asymptomatic, no jaundice. Kehr cholangiography apparently opacified only the right territory, which was free with a rapid passage of the contrast into the duodenum. The presumed left territory did not opacify (Fig. 9).

The Kehr tube was extracted, without any consequences.

Under these circumstances and to avoid any errors of interpretation, we requested the re-evaluation of the first cholangio-MRI; all MRCP imaging were performed using a 1,5 T SIGNA Excite HDxT, with respiratory triggering, in the following sequences: 3D MRCP FRFSE-XL with FOV 32X32 thick 1,6 matrix 256X192, MRCP with TE LONG: 6600 matrix 384X356 SSFSE pulse sequence, slice thickness 20



**Figure 9.** Cholangiography on the Kehr tube done 14 days after patient discharge. The left area is opacified, visible only partially; the right area with the Kehr tube

and spacing 0, MRCP THIN with matrix 256X224 TR, minim slice thickness 5 mm and spacing 0 SSFSE pulse sequence. 3D reconstructions and reformations were obtained using GE application FAST VOLUME VIEWER.

We obtained 3D images that were able to clarify the situation and cancel the idea of a biliary duplication (Fig. 10 A,B).

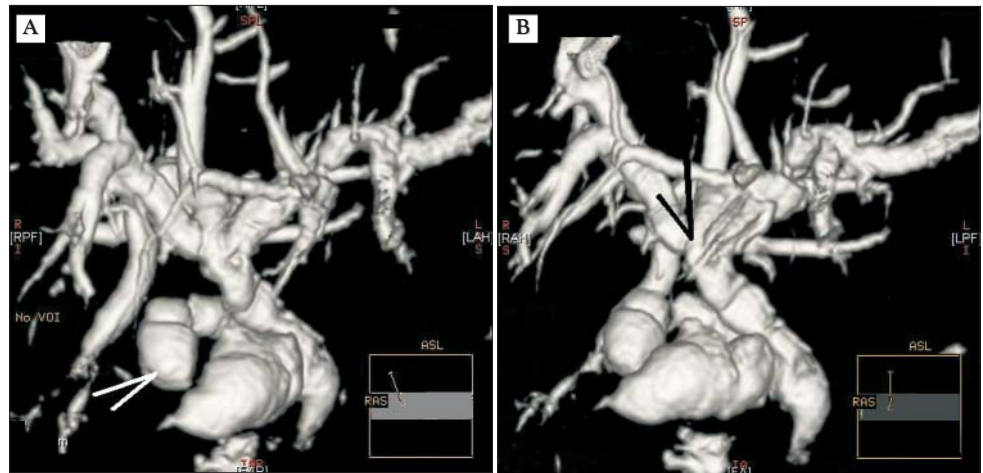
In reality, the errors of cholangiographic interpretation were due to the fact that there was a long and rather wide cystic stump (diameter = 1 cm) remaining after cholecystectomy. This long cystic stump with a length of almost 5 cm was initially considered to be the right hepatic duct. The visualization of a biliary duct to the left of this cystic stump was regarded as being a left hepatic duct. Therefore, a duplication of type-V in the Saito-Choi (1) classification resulted. The false cystic dilation was due to the extravasation of the contrast media into the sub-hepatic area. The Kehr tube was misplaced in the cystic stump, a stump that was parallel to the CBD and had a very low opening, at 4 cm from the papilla. It is therefore obvious that the common bile duct lithiasis 3 years post-cholecystectomy represented, in fact, the migration of the calculi from the remaining cystic stump, where they had lodged all that time. Due to its large caliber and within the surgical maneuvers of desobstruction the cystic duct was initially regarded as CBD, and again erroneously, as being the right hepatic duct of the duplication.

We had the curiosity to repeat the cholangio-MRI at 5 months from the correcting intervention - desobstruction of the main biliary duct (Fig. 11 A,B).

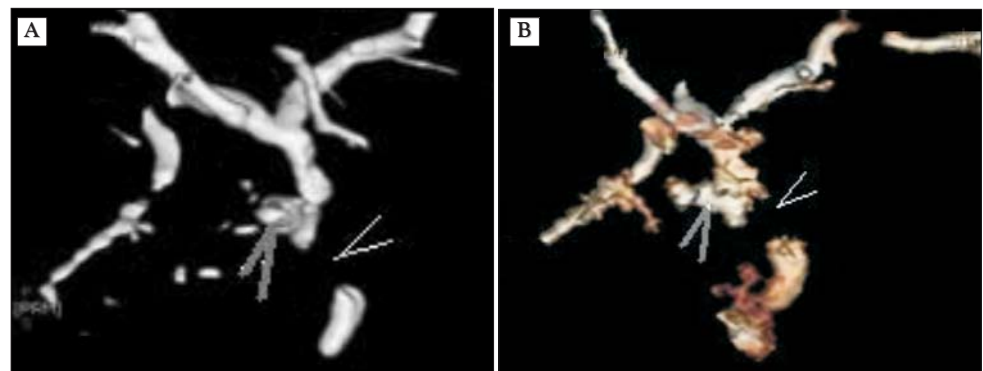
From the analysis of these two cases, we can draw the following conclusions:

1. Real anomalies of the main biliary tree, very rare though, may cause therapeutic errors, including the involvement of iatrogeny. Cholangiography on drain or by endoscopy may offer incomplete, often misleading, images of the extrahepatic bile ducts.
2. Cholangio-MRI appears to be the most faithful method in the identification of the anomalies of the main biliary tree, and its value increases further when

**Figure 10.** (A) Long cystic stump (white arrow); (B) Visualisation of the true convergence of the hepatic ducts (black arrow)



**Figure 11.** (A,B) There were no dilations of the intrahepatic ducts, with a partial interruption of the signal in the 2 cm long middle third of the choledochus (white arrow). There were no images of calculi. The existence of the excessively large cystic stump is recorded again (grey arrow).



reconstruction techniques are used, offering 3 D images in different views. Both the surgeon and the MRI specialist, as a team, have to specifically request this investigation.

- When recording postoperative biliary complications, involving the main biliary duct, the request for a cholangio-MRI with reconstructions is fully justified if the cholangiography offers unclear or inconclusive images. In this way, possible erroneous therapeutic solutions are avoided, and additional assurance in the choice of the right treatment option is obtained.

## References

- Choi E, Byun JH, Park BJ, Lee MG. Duplication of the extrahepatic bile duct with anomalous union of the pancreaticobiliary ductal system revealed by MR cholangiopancreatography. *Br J Radiol.* 2007;80(955):e150-4.
- Saito N, Nakano A, Arase M, Hiraoka T. A case of duplication of the common bile duct with anomaly of the intrahepatic bile duct. *Nihon Geka Gakkai Zasshi.* 1988;89(8):1296-301. Japanese
- Turcu F, Dragomirescu C, Pletea, Bănescu B. The problem of iatrogenic common bile duct injury, or the picture of an iceberg peak. *Chirurgia (Bucur).* 2011 ;106(2):187-94. Romanian
- Beuran M, Păun S, Negoii I, Gănescu R, Runcanu A, Avram M, et al. Laparoscopic approach in gallbladder agenesis - an intra-operative surprise. *Chirurgia (Bucur).* 2010;105(4):531-6. Romanian
- Paraskevas G, Papaziogas B, Natsis K, Spanidou S, Kitsoulis P, Atmatzidis K, et al. An accessory double cystic duct with single gallbladder. *Chirurgia (Bucur).* 2007;102(2):223-5.
- Oprea D, Maier A, Costea P. Double gall bladder - surprise during operation. *Chirurgia (Bucur).* 2010;105(2):267-9. Romanian
- Djuranovic SP, Ugljesic MB, Mijalkovic NS, Korneti VA, Kovacevic NV, Alempijevic TM, et al. Double common bile duct: a case report. *World J Gastroenterol.* 2007;13(27):3770-2.
- Taourel P, Bret PM, Reinhold C, Barkun AN, Atri M. Anatomic variants of the biliary tree: diagnosis with MR cholangiopancreatography. *Radiology.* 1996;199(2):521-7.
- Dohke M, Watanabe Y, Okumura A, Amoh Y, Oda K, Ishimori T, et al. Anomalies and anatomic variants of the biliary tree revealed by MR cholangiopancreatography. *AJR Am J Roentgenol.* 1999;173(5):1251-4.
- Bratucu E, Ungureanu FD, Ungurianu L. Drainage of common bile duct by axial transomphalic extraperitoneal route. *Dig Surg.* 2000;17(4):348-53.