ORIGINAL ARTICLE

UDC: 617.55::616.361-089
https://doi.org/10.2298/VSP1607133373J

Evaluation of choledochoduodenal anastomosis function in benign biliary obstruction

Procena funkcije holedohoduodenalne anastomoze u hirurškom lečenju benignih opstruktivnih oboljenja žučnih puteva

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Abstract

Background/Aim. Choledochoduodenostomy has been reported as an effective treatment of benign biliary obstructions, but associated with a certain percentage of complications, (primarily cholangitis and the "sump" syndrome), as the consequence of duodenobiliary reflux which may occur. The aim of our study was to evaluate the safety, effectiveness and technical feasibility of choledochoduodenostomy for the treatment of distal benign biliary obstruction and to present its minimal postoperative complications. **Methods.** This propective study included 50 operated patients who had choledochoduodenal anastomosis created for benign biliary obstructions. The symptoms, biochemical and echosonographic parameters of cholestasis, operative technique, recovery features and complications were analayzed and compared. Based on the analysis of obtained data, safety, efficacy and competence of choledochoduodenal anastomosis were determined. **Results.** Specific early anastomosis-related complications were observed in 12.0% of patients (mostly minor surgical complications). During the immediate postoperative course, aerobilia as an indirect sign of duodenobiliary reflux, occurred in 91.7% of patients, but it was reduced to 16.7% after 30 days (and was not always associated with symptomatology). Choledochoduodenostomy was associated with a low incidence of cholangitis (2%) and anastomosis dehiscence (2%). Transitory duodenogastric reflux was identified in 6% of patients. The rate of intrahospital mortality was very low, considering patients' very complex conditions (4%). During early postoperative period, the "sump" syndrome was not identified. **Conclusion.** Choledochoduodenostomy is a simple and effective method in the management of certain types of biliary obstruction. Serious complications can be avoided by proper selection of patients and careful surgical technique. This type od anastomosis has to be included in basic skills of every general surgeon.

Key words:
anastomosis, surgical; biliary tract surgical procedures; choledochostomy; duodenum; gallstones.

Apstrakt

Uvod/Cilj. Holedohoduodenalna anastomoza se uspešno primenjuje u hirurškom lečenju benignih bilijarnih opstrukcija. Medutim, smatra se da je povezana sa izvesnim procentom komplikacija, (holangitis i "sump" sindrom), kao posledice duodeno-bilijarnog refluksa, koji može postojati nakon njenog kreiranja. Cilj rada bio je procena efikasnosti, sigurnosti i tehnike izvođenja holedohoduodenalne anastomoze u terapiji distalnih benignih bilijarnih opstrukcija, u cilju utvrđivanja uticaja izbora indikacija i operativne tehnike na pojavu postoperativnih komplikacija. **Metode.** Prospektivnom studijom je obuhvaćeno 50 bolesnika operisanih zbog benignih bilijarnih opstrukcija, primenom holedohoduodenalne anastomoze. Analizom i komparacijom kliničke slike, biohemijskih parametara holestaze, ultrazvuka i parametara operativne tehnike, kao i analizom ranog postoperativnog perioda i detekcijom komplikacija, utvrđivani su efikasnost, sigurnost i kompetentnost holedohoduodenoanastomoze. **Rezultati.** Neposredne specifične postoperativne komplikacije, vezane za anastomozu, zabeležene su kod 12% bolesnika (uglavnom minorne hirurške komplikacije). Neposredno nakon kreiranja anastomoze, aerobilija kao indirektni znak duodenobilijarnog refluksa, registrovana je kod 91,7% bolesnika, ali se taj procenat do tridesetog dana smanjio na 16,70% i nije bio uvek praćen patološkim posledicama.

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Holangitis je potvrđen kod jednog (2%) bolesnika, kao i dehiscencija anastomoze (2%), dok "sump" sindrom nije detektovan u posmatranom periodu. Tranzitorni duodenogastrični refluks je identifikovan kod 6% bolesnika. Stopa intrahospitalnog mortaliteta bila je niska (4%), s obzirom na kompleksno stanje bolesnika podvrgnutih operaciji. **Zaključak.** Holedohoduodenalna anastomoza je jednostavna i efikasna metoda u lečenju benignih bilijarnih opstrukcija. Ozbiljne komplikacije moguće je izbeći pravilnim izborom indikacije i pažljivom operativnom tehnikom, zbog čega njihovo poznavanje mora biti deo osnovne edukacije svakog opšteg hirurga.

Ključne reči:
anastomoza, hirurška; hirurgija žučnih puteva, procedure; holedohostomija; duodenum; žučni kamenci.

Introduction

The number of surgical interventions on bile ducts is constantly increasing and in many surgical units these are the most frequent abdominal operations. Benign biliary obstructions (BBOs) are among the most common biliary diseases, following gall bladder calculosis. Most common causes of BBOs are hepatico-choledocholithiasis (HCHL) (present in 10%–20% of patients with gall bladder calculosis), stenosis of the sphincter of Oddi, stenosis of the papilla (SP), rarely fibrous chronic pancreatitis (CP) and then inflammatory and iatrogenic strictures of the hepaticocholedochus (HCH). Parasitoses (especially echinococcosis), juxtapapillary duodenal diverticulum, congenital HCH cysts, congenital biliary atresia and sclerosing cholangitis are less frequent causes of BBOs [1–3].

BBOs are treated endoscopically or surgically (using laparoscopic or classical "open" approach). One of the methods of treatment is choledochoduodenal anastomosis (CDA) which has been debated about since its introduction in 1888. It is described as a "reflux" procedure due to the risk of reflux of duodenal content into the bile duct after the creation of anastomosis as well as alkaline duodenal content back into the stomach, with possible complications such as recurrent cholangitis (cholangiocarcinoma as well, in the long run), "sump" syndrome (creation of choledochal stump as a remnant of created anastomosis) and alkaline gastritis. In the era of endoscopy, interventional radiology and laparoscopy and with an increasing use of hepaticojejunal anastomosis (HJA), it was almost completely abolished back in the 1980s. However, numerous studies have shown that CDA is an anastomosis that can be easily created, with good long-term results, while the complications can be kept at a minumum rate by a careful selection of indications and meticulous surgical technique. In everyday clinical practice, it is most commonly used in the elderly, those at higher surgical risks with distal (retropancreatic or supraduodenal) stenoses (CP, injuries, inflammations), those with calculi stuck in the papilla as well as in patients with multiple, residual or recurrent calculosis. In addition to the above indications, CDAs can be applied as well after unsuccessful endoscopic procedures [endoscopic papillotomy (EPT), stenting] and in the cases when these are not available [4–9].

The aim of this study was to evaluate the safety, effectiveness and technical feasibility of choledochoduodenostomy for the treatment of distal benign biliary obstruction and to demonstrate that, in properly selected patients with careful surgical technique, postoperative complications of this method may be kept to a minimum.

Methods

The prospective study included 50 patients treated at the General Surgery Clinic, Clinical Center Niš, Serbia, in the period from 2010 to 2014. All the patients underwent surgery and CDA for BBOs.

In all 50 patients preoperative clinical symptoms (icterus, pain, fever) and biochemical parameter of cholestasis [bilirubin, aspartat aminotransferase (AST), alanine aminotransferase (ALT), gama glutamyl transferase (GT), alkaline phosphatase (ALP), lactate dehydrogenase (LDH)] were analyzed and HCH diameters were sonographically measured preoperatively in all 50 patients.

The parameters of the surgical technique were directly monitored (length of surgery, creation and duration of CDA itself, blood losses). Distal longitudinal choledochotomy (25–30 mm), duodenal mobilization and duodenotomy closest to choledochal incision, were a condition of creating anastomosis without any tension. Latero-lateral (L-L) CDA was created using interrupted suture technique with Vicryl 3.0 or 4.0 resorbable sutures in 46 patients. In 4 patients, due to Mirrizi's syndrome type II, III and IV, a part of the HCH was resected and terminolateral (T-L) CDA was created. The length of the whole surgical intervention was measured as well as the duration of a CDA creation from the moment of completion of all the preparations. Also, the total intraoperative blood loss was measured. After the creation of anastomosis, its circumference was measured in order to establish possible interdependence of the bile duct diameter and anastomosis itself.

Biochemical cholestatic parameters were observed on postoperative days 1, 3, 7 and 30. HCH diameters were sonographically measured and possible complications were evaluated on days 7 and 30 as well as the indirect and direct signs of duodenobiliary reflux, assessing thus the efficacy and safety of CDA in resolving the cholestasis. Nineteen patients underwent hepatobiliary Tc^{99m}-hepatobiliary iminodiacetic acid (HIDA) scintigraphy and 4 had esophagogastroduodenoscopy (with biopsies of antral mucosa), if alkaline reflux was suspected according to clinical, labaratory and ultrasonographic (US) findings.

Functional assessment of the liver and bile ducts using hepatobiliary scintigraphy was done in total of 19 patients at the Nuclear Medicine Center, Clinical Center Niš, using

^{99m}Tc-ethyl-hexa-imino diacetic acid (^{99m}Tc-EHIDA). Liver morphology, changes in the bile ducts and the onset of bowel activity were qualitatively analyzed as well as the onset and duration of duodenogastric reflux (DGR). As the semiquantitative indicators of liver function, the following factors were determined: time to maximal activity - T_{max} (in minutes), semielimination time – T/2 (in minutes), and residual activity – R (in %) of a radiopharmaceutical, time to the onset of DGR, detection of biliary-to-bowel transit (BBT), i.e. time of the activity onset in the bowels were established visually and semiquantitatively (the values up to 30 minutes were considered normal).

In all patients, early postoperative complications were recorded and analyzed (those occuring in the first 30 postoperative days), both specific and non-specific, i.e. the complications caused by comorbidities or operation itself, without any direct association with CDA.

Complications in this study were graded according to Clavien-Dindo classification scale [10].

Statistical analysis

SPSS 16.0 statistical software package was used for statistical data processing. We used *t*-test (or Mann-Whitney test), χ^2 test and Fisher's test of exact probability, variance analysis (ANOVA), and as a *post hoc* analysis Tukey's and afterwards Kruskal-Wallis test, Wilcoxon and Friedman test. The statistical hypothesis was tested at the level of significance $\alpha = 0.05$, i.e. the difference between the samples was considered significant if $p < 0.05$.

Results

The mean age of examined patients was 63.08 ± 8.82 years (ranging from 42 to 84, years). There were 52% men and 48% women. All the enrolled patients were divided into three groups based on indications: 56% of the patients with HCHL (3.58% with recurrent; 10.71% with residual; and 85.71% with secondary calculosis); 28% of the patients, with benign stenosis of the HCH or the ampulla of Vater (53.57% with stenosing papillitis; 35.71% with inflammatory stenosis of the HCH; 10.72% with distal bile duct lesions); 14% of patients with chronic fibrous pancreatitis (62.50% with alcoholic origin). There was not any statistically significant difference in age related to the indications ($p = 0.947$), nor a statistically significant difference in gender distribution related to the indications ($p = 0.242$). All patients had preoperative biochemical cholestatic syndrome, with or without clinically evident jaundice. Icterus was observed in 92% of patients and was usually accompanied by upper abdominal pain (67%), nausea and vomiting (63%) and fever (32%). The classical Charcot's cholangitis triad was present in a smaller proportion of cases (21%). All the patients in the prospective group (100%) before the surgery had sonographically confirmed mild or larger dilation of major bile ducts (exceeding 8 mm), with clinically manifested icterus or without it. Average HCH width was 17.57 ± 6.03 mm (range 10.5 to 32). Most patients had values ranging from 10 to 12.5 mm, and from 17.5 to 20 mm.

Surgical technique

In 92% of patients, L-L anastomosis was created, while in 8% of cases T-L CDA was done. Average lenght of operation was 89.30 ± 17.53 minutes (min. 60 minutes, max. 130 minutes). The creation of anastomosis took 14.98 ± 2.54 minutes (min. 11.00, max. 22.00), while the average blood loss during the surgery was 126.28 ± 44.86 mL (min. 78, max. 255 mL).

The average width of HCH, measured preoperatively, was 17.57 ± 6.03 mm (min. 10.50, max. 32 mm). The average width of anastomosis was 19.78 ± 4.29 mm (min. 13, max. 29 mm). A strong statistical correlation was observed between these two parameters (r = 0.949, $p < 0.001$) (Figure 1).

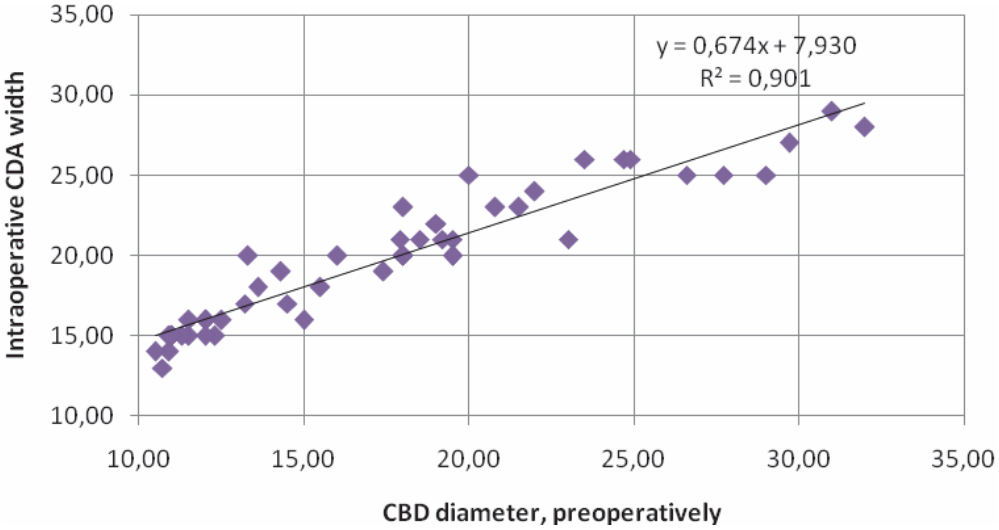

Fig. 1 – Association of hepaticocholedochus (HCH) diameter with intraoperative choledochoduodenal anastomosis (CDA) width.
CBD – common bile duct.

After measuring the biochemical parameters of cholestasis on postoperative days 1, 3, 5 and 7 and comparing them values, it was demonstrated that their regression occurred on the first postoperative day, immediately after the creation of anastomosis and continued to decrease on day 3 and on day 7. Further surveillance of bilirubin, ALT, AST, ALP and LDH revealed that, up to the termination of early postoperative period (the first 30 days), their values were significantly lower than preoperative ones ($p < 0.001$) in most of the cases (94%).

On postoperative day 7, the average HCH diameter decreased to 14.59 ± 4.13 mm (min. 10, max. 25 mm), while on day 30 it was 7.73 ± 1.40 mm, (min. 6, max. 11 mm). HCH diameter statistically diminished during the 30 days compared to the preoperative values ($p < 0.001$) (Figure 2).

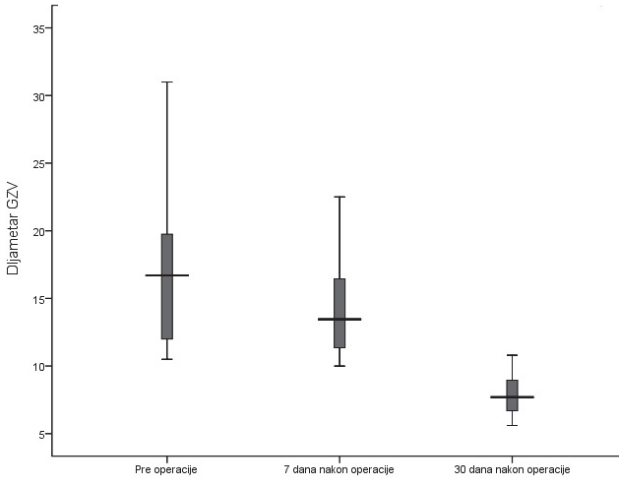

Fig. 2 – Common bile duct (CBD) diameter before surgery, 7 and 30 days after surgery (S).

Aerobilia was present in most of the examined patients (91.7%) 7 days after surgery. The number of patients with aerobilia significantly fell up to postoperative day 30 - 8 (16.7%) patients; ($p < 0.001$).

In 19 patients HIDA scintigraphy was done during the first 30 postoperative days. In 9 of them, abnormal liver morphology was encountered, but the values of semielimination and retention of the radiopharmaceutical were within the physiological ranges (30 minutes and 50%, respectively). In addition to morphological abnormalities of the biliary tree present in almost all examined patients, the mean values of semielimination and retention of the radiopharmaceutical were elevated compared to control values (30 minutes and 50%, respectively) in 15 patients. In all patients, biliary-to-bowel transit (BCT) was visualized within one hour, which indicated the competence of the created CDA and fast transit into the duodenum. In all patients DGR was detected, but only 3 had symptoms of alcaline gastritis.

The overall hospital mortality was 2% and overall morbidity was 28%. Indication for CDA and cause of death were icterus and HCHL and acute myocardial infarction on postoperative day 3 in the first patient and icterus and postcholecystectomy syndrome and cholagitis and hepatorenal syndrome on postoperative day 9 in the second patient, respectively. The total time of postoperative hospital stay for all the enrolled patients was 10.22 ± 44.60 days.

Specific early complications (related to CDA) were present in 12% of patients (Table 1). Non-specific complication were present in 16% of patients (2 wound infection and 6 with cardiovascular, pulmonary and renal complications).

Table 1

Specific early choledochoduodenal anastomosis (CDA)-related complications in operated patients

Complications	Choledocholithiasis	Stenosis	Fibrous pancreatitis	Total
	n (%)	n (%)	n (%)	n (%)
Fistula	1 (3.57)	0 (-)	0 (0)	1 (2.00)
Cholangitis	0 (-)	1 (7.14)	0 (0)	1 (2.00)
Nausea/vomiting	1 (3.57)	1 (7.14)	1 (12.50)	3 (6.00)
Intraabdominal bleeding	0	0 (-)	1 (12.50)	1 (2.00)
Total	2 (7.14)	2 (14.28)	2 (25.00)	6 (12.00)

n (%) – number (%) of operated patients.

Most patients with complications in our study (11/50) had grade I and II complications (minor complications which did not require any serious therapy, without the need for endoscopic, surgical or radiological interventions). One patient (1/50) was classified as grade IIIb (intraabdominal bleeding due to portal hypertension, requiring surgical reintervention). Two deceased patients (2/50) belonged to grade V by this classification (69-years-old patient with chronic coronary disease and 84-years-old patient with prolonged icterus and hepatorenal syndrome).

Discussion

Benign biliary obstructive diseases constitute the group of the most common biliary diseases after gall bladder calculosis. CDA still has its place in the management of certain forms of BBO as a simple, fast, effective and safe alternative, in spite of the development of endoscopic procedures and the trends of minimally invasive approaches to this pathology. Indications for CDA remained almost the same as they were in 1974, when they were established for the first time by Degenshein (except for the malignant ones) [9] and can be termed all together as distal biliary obstructions, comprising the most common bile duct lithiasis, stenosing papillitis and CP. In our series there were 58% of HCHL, 28% of papillary stenosis and 14% of CP.

By surveilling the intraoperative parameters, we were able to confirm that it was a fast to perform and technically relatively simple procedure, taking into account the complexity of the procedure itself and a patient's characteristics (aged mostly 60 to 70 years, usually with comorbid conditions, icterus and coagulation abnormalities). The complete

surgery lasted 89.30 ± 17.53 minutes, creation of an anastomosis took on the average 14.98 ± 2.54 minutes, while the average blood loss during the operation was 126.28 ± 44.86 mL.

In 92% of cases it was a L-L anastomosis, although some authors [11] recommended a T-L type, especially for younger patients, in order to avoid the "sump" syndrome and cholangitis. However, the creation of such an anastomosis prolongs the surgery, it can compromise blood supply to the proximal end of CBD, while the "sump" syndrome is a rare complication; therefore, we believe that T-L CDA should be created only when intraoperative findings mandate it [12].

The decision about the type of biliary drainage was made based on pre- and intraoperative findings. One of the common alternatives in the management of BBO is hepaticojejunal anastomosis (HJA), which, together with endoscopy, almost completely superseded CDA during the 1980s. One of the recent studies [13], comparing these two anastomoses in 121 patients operated for BBOs, demonstrated a higher risk of postoperative cholangitis and "sump" syndrome in CDA (10.41% and 4.17% respectively), compared to a complete absence of these complications with HJA, while HJA was associated with a higher risk of dehiscence and postoperative stenosis (6.67% and 4.44%, respectively) with a complete absence of these complications with CDA. Another group of authors demonstrated with their series of 314 patients surgically treated for lithiasis of intrahepatic bile ducts using HJA or T-draining that this type of anastomosis was not free from risk of postoperative cholangitis (present in 24% in this series) due to disturbed motility of the Roux loop, which, without physiological stimulation by food and with reduced peristalsis, favours bacterial colonization and enterobiliary reflux [14, 15]. HJA is more burdensome in view of a more complicated technique involved, greater losses of blood, longer duration, and its use is reserved for younger patients with lower surgical risks, and primarily those with proximal biliary obstructions. Perhaps its most important use (most commonly as the only one solution) is in biliary tract reconstruction in iatrogenic lesions of the extrahepatic bile ducts [16–18].

Early postoperative complications after CDA creation occur in 9.8% to 28% of patients [16, 19, 20]. Specific complications were present in 12.0% of the patients in our study.

Careful abiding by the surgical technique, valid for all biliodigestive anastomoses, is the sole most important factor of prevention of postoperative complications. CDA is defined as a reflux anastomosis and its characteristic complications can be minimized by the creation of a sufficiently wide, tension-free anastomosis on a dilated, well vascularized bile duct. Some authors suggested that a CBD diameter had to measure >16 mm [5] or > 15 mm [6], but De Almeida et al. [18] thought that a dilation exceeding normal values (i.e. over 10 mm) is sufficient for a wide CDA to be created. According to the literature data, the percentage of cholangitis after a CDA creation ranges from 0% [21], 3% [6], 4.2% [5], to 7% [22]. Almost all of the authors have described cholangitides as the consequence of inappropriate indications and inadequate techniques. During our study, as a CDA complication, cholangitis occurred in the early postoperative period in 1 patient who was conservatively treated until the disease was completely cured, without any recurrent cholangitis episodes in the first 30 days. In the literature, different results were presented regarding cholangitis as a long-term complication of CDA [12, 23]. The most serious complication of this anastomosis is certainly cholangiocarcinoma, which may appear after many years of chronic, recurrent cholagitis. Tocchi et al. [23] found that all biliodigestive dainage operations (HDA, HJA, transduodenal sphincterotomy) were also the risk factors leading to carcinoma. Recurrent cholangitis was identified as the sole independent factor of influence on the incidence of cholangiocarcinoma. Therefore, in order to prevent malignant alteration, regular follow-up of patients with reflux complaints is necessary [utilizing endoscopic retrograde cholangiopancreatography (ERCP) biopsies].

In the early postoperative period, we did not detect any case of "sump" syndrome in the studied patients. In addition to enteral reflux, stenosis of the papilla of Vater, wide distal choledochus, residual calculosis, an insufficently wide anastomosis is also one of the major factors in the onset of the syndrome (adequate draining and irrigation of the blind segment of choledochus are thus hampered). Nevertheless, the syndrome remains a rare complication occurring after CDA in 0%–9.6% of cases [5, 7, 10, 22, 23]. It is generally recommended that in patients with confirmed residual calculosis or stenosis of the papilla of Vater, after the creation of a wide anastomosis, endoscopic papillotomy or calculus extraction should be performed in order to prevent this complication [1].

Aerobilia or the presence of gas in bile ducts is an ultrasound finding that should be expected immediately after the creation of anastomosis, and it differs from the gas present as the consequence of anaerobic infection of the hepatobiliary system (diffusely present throughout the liver parenchyma or within an abscess collection) or the presence of gas in the portal venous system as the consequence of intestinal ischemia or inflammation (predominantly peripheral gas distribution). Aerobilia occurring after the creation of CDA is situated in central portions of the liver, towards the *porta hepatis*, as the result of "hepatofugal" bile flow, which via constant excretion prevents gas and other reflux, enteral contents, to pass into more peripheral parts of the liver. In later postoperative course, it represents an indirect proof of duodenobiliary reflux. In our study, immediately after surgery, aerobilia was present in most patients of the prospective group (91.70%), but up to postoperative day 30 it was confirmed in only 8 (16.70%) patients. Except for the 2 patients of the prospective group with complications (cholangitis and biliary fistula), in whom, in addition to the air CBD dilation was detected, in 6 patients aerobilia was also detected by ultrasonography (US), but with the CBD diameter normalization and without other (clinical and laboratory) signs of reflux. Detected in competent CDAs, with normalized bila duct diameter, it shows that biliary reflux does not always have pathological consequences and can also be a temporary phenomenon. After the CDA creation and switching off the sphincter of Oddi, reflux of duodenal contents is a normal phenomenon, transitory and mostly without any consequences thanks to continued production and excretion of

bile, which, due to a difference in pressures between the choledochus and duodenum, constantly irrigates the bile ducts through a sufficiently wide anastomosis [24].

CDA is associated with a low incidence of dehiscence (from 0% to 3.5%) [20–22, 25]. In one patient in our study, a minimal anastomotic dehiscence with the appearance of a controlled biliary fistula was reported, which was conservatively treated and controlled till it resolved (without any reintervention). It was considered that an error in the surgical technique caused the anastomotic dehiscence (insufficient mobilization of the duodenum, inadequate suture placement, absence of adaptation of bile duct epithelium to duodenal mucosa) [18, 26].

During the early postoperative period, nausea and vomiting of biliary contents were observed in 3 patients in our study after CDA creation. All of them were included in scintigraphic examination and gastroduodenoscopy with biopsy (an acute non-specific inflammation and edema of the gastric mucosa were found). The patients were treated with the appropriate therapies after which their complaints subsided. DGR is a sporadic, physiological phenomenon occurring after meals or during sleep and its consequences have not been elucidated nor studied sufficiently. It is thought that it results from a disturbed antro-pyloro-duodenal antireflux barrier and an inadequate, non-physiological biliary drainage which occur in biliary tract surgery. This pathological reflux was most frequently attributed to sphincterotomy and CDA. However, numerous studies [23, 27 29] have not been able to demonstrate that any of the operations carries a higher risk of the onset of reflux and its consequnces, nor the similar for cholecystectomy, where DGR is also present. Moreover, its presence is not a direct evidence of altered gastric mucosa. Kuran et al. [24] found that there was a significant association between the patient age and onset of reflux, with reflux occurring mostly in the elderly.

By monitoring the dynamics of regression of cholestasis and reduction of the US bile duct diameters after surgery as well as by morpho-functional studies using HIDA scintigraphy, it was established that this type of anastomosis, in addition to its efficacy, was characterized by a rapid resolution of the cholestatic syndrome. CDA is recommended, above all, for patients with evident icterus, altered general status, with abnormal coagulation factors and hepatic and renal function, not only as the final solution for their cholestasis, but also as a lifesaving procedure.

Conclusion

Benign obstructive diseases of the bile ducts are the most common biliary diseases after gallbladder calculosis. Despite the development of endoscopic procedures and trends of minimally invasive approaches to pathology, CDA is still important in the management of certain forms of BBOs. Based on our results (technical fesibility, low incidence of complications, fast postoperative recovery) CDA was show as safe and effective metod in the menagement of certain type of biliary obstruction. It is recommended not only as a definitive, but also as a rapid solution for cholestasis which qualifies the procedure as a "lifesaving" one. Serious complications occur in small percentages and can be avoided by proper selection of patients and meticulous surgical technique each general surgeon should have the thorough knowledge of.

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Received on July 13, 2016.
Revised on October 27, 2016.
Accepted on November 3, 2016.
Online First December, 2016.