

# Prospects of Reconstructive and Restorative Surgery of Extrahepatic Biliary Tracts

Feruz G. Nazirov<sup>1</sup>, Mirshavkat M. Akbarov<sup>1</sup>, Rustam R. Saatov<sup>2</sup>, Uktam N. Turakulov<sup>1,2</sup>✉

<sup>1</sup>Republican specialized center of surgery named after academician V. Vakhidov. Tashkent. Uzbekistan.

<sup>2</sup>Tashkent Institute of Postgraduate Medical Education. Tashkent. Uzbekistan.

✉Corresponding author's Email: tun\_71@mail.ru

## ABSTRACT

Gallstone disease morbidity, as well as improving biliary tract surgery have led to a significant increase in the amount of surgical interventions in patients with biliary disorders. Since operations on biliary tract today are performed in almost all hospitals by differently-skilled surgeons, this leads to an increased frequency of various complications, including iatrogenic injuries, which are responsible for the formation of cicatricial strictures of extrahepatic bile ducts. The leading hepatology centers continue to accumulate the new clinical data on the treatment of patients with bile duct strictures, continuously and critically reinterpreting views on key issues of this problem. Restoring the adequate bile secretion is a great difficulty. We used classifications proposed by some researchers such as Bismuth, Ratchik and Galperin to review and discuss six key surgical problems of hepatobiliary tract. The main causes of the difficulty are gross violations of topographic and anatomical relationships and commissural processes at the gates of the liver, severe general condition of patients caused by prolonged mechanical jaundice and recurrent purulent cholangitis. A growing interest is arisen by non-invasive methods of restoration by endoscopic interventions. Application of endoscopic methods allows preparing patients for the upcoming scheduled or deferred surgical interventions. In most cases the above endoscopic interventions may be an alternative to surgical interventions. Despite the introduction of high-tech, minimum-invasive diagnostic and treatment methods, the progress in reconstructive surgery of the biliary tract, only long-term results analyses can provide an objective assessment of the correctness of the chosen direction.

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## INTRODUCTION

Increased frequency of gallstone disease morbidity as well as improving biliary tract surgery in recent decades have led to a significant increase in the number of surgical interventions. In Uzbekistan around 7-8 thousand operations are performed each year on the organs of bile-excreting system, about 400 thousand operations are performed in the commonwealth of independent states (CIS) countries and, according to the world health organization (WHO), about 2.5 million-worldwide. Recently operations on biliary tract are performed in almost all hospitals by differently-skilled surgeons, with following increased frequency of various complications, including iatrogenic injuries which are responsible for the formation of cicatricial strictures of extrahepatic bile ducts [1-4].

In addition, treatment of patients with injuries and cicatricial strictures of the bile ducts is one of the most difficult problems of biliary tract surgery. According to a number of authors, the frequency of bile duct injury is 0.2-2.8% of the total number of operations on the biliary system, and mortality at reconstructive and restorative interventions reaches 15-50%, post-operative stricture recurrences occur between 5.8% and 35% of cases [1, 4-6].

In 95-97% of cases with the cicatricial stricture formation is a consequence of iatrogenic bile duct injury, inaccurate surgical manipulations on the duct during the execution of cholecystectomy. The same problem can be caused by stricture development at the choledochotomy hole at application of rough suture material and non-traumatic needles. In addition, cicatrices choledoch may occur in case of the wrong choice of the diameter of drainage, injury at its removal, at fixation of the drainage with non-absorbable sutures or rough suturing of choledoch wall to drainage pipe. Rarely strictures are congenital in nature or occur as a result of primary sclerosing cholangitis [2, 3, 7-11].

One of the reasons for damage of bile ducts is the misperception of their anatomical structure because of edema or infiltration hepatoduodenal zone, anomalies of cystic or hepatic ducts, lack of experience of the surgeon. In recent years cicatricial strictures of hepaticocholedoch occur in connection with the widespread technique of laparoscopic removal of gall bladder, especially at the stage of learning of this technique. The frequency of iatrogenic bile duct injuries has been stable in recent decades at 0.05-0.2% rate, and application of laparoscopic cholecystectomy increased this number to 0.3 - 3% rate [4, 5]. As a result of thermal burn during an allocation of the cystic duct from cervix or hepaticocholedoch wall injury during postoperative period a bile efflux may occur and, subsequently, develop into cicatricial stricture of the bile ducts. In addition, careless imposition of a clips on the cystic duct or cystic artery may lead to partial or complete compression of the bile duct, especially in congenital anomalies of the bile ducts.

Until recently among the leading hepatologist surgeons believed that the greatest difficulty of surgical interventions are observed at the treatment of patients with cicatricial strictures of the bile ducts [1, 12, 13]. However, recent decades show that together with the significant development in medical science and surgical technology, including in hepatobiliary surgery, the most complex interference have occurred in liver and extrahepatic bile ducts in a wide variety of their diseases. The development of such techniques as liver transplantation, surgery of tumors and cysts of the liver, and endovisual and x-ray endovascular surgery, application of new surgical materials, along with the undoubted success and renewed hopes also poses a number of challenges related to eliminating the inevitable complications.

Paying tribute to the thorough study and development of reconstructive hepatobiliary surgery it must be noted that many issues in this direction are far from being resolved, and some of them are in their infancy. This is especially true for iatrogenic cicatricial injuries of bile ducts [13-16].

The frequency of bile duct injury during open cholecystectomy is approximately 1:400 [17]. Similar frequency was observed at laparoscopic cholecystectomy (1: 200 - 1: 400) [16, 18]. According to various authors mortality at reconstructive and restorative interventions reaches 15-50% [14, 16, 19]. Leading hepatologist surgeons insist that using the principle of prevention of liver and biliary tract diseases and prevention of development of severe consequences of surgical interventions in this anatomically sensitive area, it is possible to achieve the lowest mortality [20, 21]. However, unfortunately, the leading hepatology centers continue to accumulate the new clinical data on the treatment of patients with bile duct strictures, continuously and critically reinterpreting views on key issues of this problem.

Restoring the adequate bile secretion is a great difficulty. The main causes of the difficulty are gross violations of topographic and anatomical relationships and commissural processes at the gates of the liver, severe general condition of patients caused by prolonged mechanical jaundice and recurrent purulent cholangitis [10, 22].

## DISCUSSION

The issues of tactics of surgical treatment of this most severe group of patients have repeatedly been the subject of discussion at numerous conferences and symposia. As a result, a significant progress has been achieved in reconstructive surgery of biliary tract associated primarily with active introduction of modern methods and radio endovascular endoscopic surgery, application of precision technology and biomaterials [23, 24]. However, despite this fact, reconstructive operations on bile ducts in 4.5-25% of cases are accompanied by the development of constrictions of the biliary-enteric and bilio-biliary anastomoses [10], repudiating the results of reconstructive surgery and exacerbating the severity of the condition of patients. In the long-term periods the primary reason of

unsatisfactory results of reconstructive operations on bile-excreting system is reflux - cholangitis, leading to restenosis and cholangiolitic abscesses [7, 14, 25]. Frequency of cholangiolitis restrictions in the long-term period of observation is 8.4-28.3% [20]. Smaller percent in the structure of complications is occupied by relapse cholelithiasis, cholangiogenic abscesses of the liver, biliary sepsis. In this regard, the issues such as the choice of optimal technology of reconstructive restorative interventions, indications for transhepatic bile duct draining, defining the role and place for endoscopic methods of correction remain disputable.

Thus we must recognize that only the study of long-term results of treatment of this category of patients can provide an objective assessment of the correctness of the chosen direction. Diagnostic activities at patients with cicatricial strictures of the bile ducts are aimed at establishing a causal factor, the level of the stricture, the length of the affected area, the definition of the bile duct condition above and below the level of destruction.

To streamline the terminology describing the level of bile duct strictures many classifications have been suggested. So far, the most attractive and easy to use is the classification by Bismuth [26] whereby cicatricial strictures are divided into five types: type 1-2 - low strictures and type 3-4-5 - high strictures. However, the author does not address the subtle details of the location of the site of narrowing in the proximal segments in the gate area of the liver, which drastically reduces the possibility of using this classification in selecting the optimal method of reconstruction of the bile ducts above the bifurcation. The most feasible and practical is the classification by Galperin and Kuzovlev [27], which divides cicatricial strictures into:

A) Strictures of type 0 (the free segment of the common hepatic duct less than 1 cm or stricture confluent): 1. Bifurcational; 2. Sub-bifurcational (subconfluent); 3. Monoductal; 4. Biductal

B) Strictures of type 1 (the free segment of the common hepatic duct is of the length of 1 to 2 cm)

C) Strictures of type 2 (the free segment of the common hepatic duct is of the length of not less than 2 cm).

Besides consideration of the levels of layout and extension of choledoch strictures some authors propose to add to the classification the clinical factors. Ratchik [28] propose a modified classification by Shalimov et al. [29] taking into account the clinical and anatomical features. The authors divide iatrogenic strictures by surgical history, inflammatory strictures (cholelithiasis, chronic pancreatitis, peptic ulcer, etc.).

By localization: low (supraduodenal part of the choledoch), medium (hepaticocholedoch area), high (lobar hepatic ducts - the gate area of the liver). By prevalence of duct lesion: 1<sup>st</sup> degree - less than 2 cm, 2<sup>nd</sup> degree - less than 3 cm, 3<sup>rd</sup> degree - more than 3 cm. By cholestasis intensity: partial (transitory bilirubinemia of up to 50 micromole/l, moderately increased alkaline phosphatase), total (refractory bilirubinemia of more than 50 micromole/l). By clinical course: stage of formation of cicatricial stricture (narrowing of the ducts from 1/3 to 2/3 of the diameter) - is characterized by cholangitis occurrences, intermittent jaundice, stage of evident signs (narrowing of ducts over 2/3 of the diameter) - characterized by jaundice, skin itching, cholangitis, multiple organ failure [8]. To date, Endoscopic Retrograde Cholangiopancreatogram (ERCP) is considered the optimum method of investigation of extrahepatic bile duct. This method allows to fully investigating all segments of bile-excreting system. If in some cases ERCP is impossible, then it is complemented by percutaneous transhepatic cholangiography (PTC) which significantly supplements the information on the status of the bile ducts.

Great value in the study of bile duct strictures is also contributed by magnetic resonance imaging, multislice computer tomography with biliary tract contrasting. Magnetic resonance cholangiopancreatography, being a non-invasive technique of visualizing the bile ducts, has gained popularity in recent years as an accurate method of assessing biliary anomalies [12, 30].

Thus, it is assumed that the successful solution of the issues of reconstructive surgery of biliary tract is directly dependent on the quality of preoperative diagnostics, detailed study of the nature, mechanisms of development of pathological processes. Along with this, in many cases the results of a diagnostic method are studied beyond their pathogenetic connection and interdependence. This raises a number of discussions and creates certain difficulties in formulating an optimal solution.

Currently hepatologist surgeons are mentioning several problems associated with surgical correction of cicatricial stricture of the bile ducts:

1. Possibility of recovery operations through the implementation of bilio-biliary anastomoses or surgical intervention using autovenous inserts or allogeneic materials;
2. The need of application of a frame drainage for the imposition of biliary-digestive anastomosis (BDA);
3. Types of frame drainages, duration of their presence in the biliary tract, the diameter of the tube and the material for its production;
4. The advantages of using for BDA jejunum or duodenum;

5. Choice of the optimal method of reconstructive and restorative operations at duct injury and the timing and phasing of these operations;

6. The role and place of radiological and endoscopic techniques in correction of cicatricial stricture of the bile ducts [5, 6, 20, 31].

Each case faced by a surgeon in such situations during the operation is strictly individual, forcing to choose the optimal way out of a number of variants of surgical interventions [8, 9]. In recent years for improving immediate and long-term results of the operations and prevention of digestive-biliary reflux various operations are offered with the formation of the valves in the area of anastomosis between the bile ducts and various segments of the gastrointestinal tract.

This idea still attracts the attention of many surgeons and requires new experimental clinical studies. This, apparently, reasons the attempts of anti-reflux surgery and the development of so-called "a reflux" BDA with the formation of valves between the bile ducts and small intestine.

At the same time, the role of pathologic reflux is still under discussion [21, 32]. One of the promising directions in reconstructive surgery of cicatricial strictures is application of different materials and allogenic biotransplantants. Surgical interventions, often performed at elderly patients with severe concomitant pathology under emergency indications, are accompanied by a large number of complications, and the mortality reaches 15-30%.

## CONCLUSION

In this connection in recent years a growing interest is arisen by non-invasive methods of restoration of bile secretion and, primarily, endoscopic interventions. At present endoscopic methods of diagnostics and treatment play an important role at hepatopancreobiliary system diseases. With regard to therapeutic possibilities of endoscopic methods, along with the traditional methods sanitation of hepaticocholedoch and restoration of an adequate passage of bile, such as Endoscopic papillosphincterotomy (EPST), nasobiliary drainage, clinical practice widely uses new endoscopic interventions: mechanical lithotripsy, duodenobiliary drainage of hepaticocholedoch using transpapillar endoprosthesis, diathermic widening of a narrowed BDA and cicatricial strictures of the bile ducts [33, 34].

Application of these methods allows to easily and quickly prepare the patients with symptoms of mechanical jaundice, purulent cholangitis, for the upcoming scheduled or deferred surgical interventions. In most cases the above endoscopic interventions may be an alternative to surgical interventions [33, 35].

To date it became apparent that despite the introduction of high-tech, minimum-invasive diagnostic and treatment methods into surgical hepatology, the progress in reconstructive surgery of biliary tract, only the study of long-term results of treatment of this category of patients can provide an objective assessment of the correctness of the chosen direction.

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### Authors' Contributions

All authors contributed equally to this work, observing literature, forming text and data.

### Competing interests

The authors declare that they have no competing interests.

## REFERENCES

1. Agayev BA, Atayev RM, Navruzov ShA. 2003. The new directions in a reconstructive and restorative surgery of bile ducts. Materials 10 of the Anniversary international conference of surgeons of hepatologists. Moscow. Pp. 76. [Article in Russian]
2. Altiyev BK. 1999. Diagnostics and treatment posttraumatic strictures and external fistulas of bile ducts. Tashkent. Dissertation. Pp. 266. [Article in Russian]
3. Vakhidov VV, Altiyev BK. 1994. Repeated surgical interventions at iatrogenic damages of extrahepatic bile ducts. Questions of reconstructive and restorative surgery. Report in Conf. (12-13 October 1994) Tashkent. Pp. 154-155. [Article in Russian]

4. Vakhidov AV, Altiyev BK, Akbarov MM, Ikramov AI. Tactics of surgical treatment of patients with postoperative strictures of extrahepatic bile ducts. *Topical Issues of a Reconstructive and restorative Surgery*. Tashkent. 1996. P. 141-142. [Article in Russian]
5. Vishnevsky VA, Kubishkin VA. 2003. Features of surgical tactics for lesions of the bile duct during Lap cholecystectomy. *Materials of the 10th anniversary International Conference of Hepatic Surgeons, 2003, Moscow*, Pp. 86-86. [Article in Russian]
6. Galperin EI. 1999. Choice of drainage with high stricture of the hepatic ducts. *Actual problems of pathology and surgery of the bile duct Sverdlovsk*. Pp. 144-145. [Article in Russian]
7. Atanasov D, Atanasova D. 1989. The modified techniques applying of GEA. *Surgery*, 7: 28-31. [Article in Russian]
8. Dadvani SA, Lotov AN, Musayev GH, Mashinsky AA. 2000. Minimum-invasive technologies in treatment of the cholangitis at patients with a syndrome of a mechanical jaundice. Scientific book «Modern invasive and non-invasive diagnostic methods». Moscow. Pp. 290. [Article in Russian]
9. Jitnikova KS, Zyubina EN. 1991. Restorative and reconstructive operations on bile ducts. *J Surgery*, 11: 24-28. [Article in Russian]
10. Malyarchuk VI, Klimov AE, Pautkin YuF, Ivanov VA. 2003. To the question of surgical treatment of iatrogenic lesions of extrahepatic bile ducts. *Materials 10 Anniversary international conference of HPBS surgeons, 2003 Moscow*, Pp. 102. [Article in Russian]
11. Movchun AA, Timoshin AD, Ratnikova NP, Movchun VA. 2000. Treatment of cicatricial strictures and fistulas of the bile ducts. *Annals of surgical hepatology*. Vol 5. №2. Moscow. Pp. 126-127. [Article in Russian]
12. Galperin EI, Kuzovlev NF, Sharov AV. 1986. Benign strictures of the bile ducts. *Surgery*. 10: 21-26. [Article in Russian]
13. Nazirov FG, Asabayev ASh, Muzaffarov FU. 2004. Questions of diagnosis and treatment in patients with reflux-cholangitis after reconstructive interventions on the biliary tract. *J Surger Uzbek*. 1: 75-78. [Article in Russian]
14. Shalimov AA, Kopchak VM, Serdyuk VP, Homyak NV. 2000. Surgical treatment of cicatricial strictures of the bile ducts. *The Annals Surg Hepatol*, 5: 151-152. [Article in Russian]
15. Tocchi A, Maoni G, et al. 2000. Management of benign biliary strictures: biliary enteric anastomosis vs endoscopic stenting. *Arch Surg*, 135: 153.
16. Wada S, Tamada K, Tomiyama T, Ohashi A, Utsunomiya K, Higashizawa T, et al. 2000. Intraductal ultrasonographic assessment of coagulation depth during endoscopic microwave coagulation therapy in a canine model. *J Gastroenterologist*, Pp. 35.
17. McSherry CK. 1989. Percutaneous Dilatation in primary sclerosing cholangitis two experiences. *Amer. J. Roentgenologist*. 137: 603-605.
18. Mc Mahon AJ et al. 1995. Hepatico-Jejuno-Duodenoplasty for Biliary Stricture. *Int. Surg*. 69: 331-334.
19. Kopchak VM, Kopchak SK. 1996. Surgical treatment and non conservative rehabilitation of patients with strictures of the bile duct. *Topical issues of reconstructive and reconstructive surgery*. Kiev. Pp. 177-179 [Article in Russian]
20. Nazirov FG, Akilov HA, Altiyev BK, Karimov ME. 1999. Damage of extrahepatic bile ducts during resection of the stomach. *Conference materials*. In Kharkov. Pp. 69-70. [Article in Russian]
21. Sherlock SH, Duli D. 2002. *Diseases of the liver and biliary tract*. Moscow. Geotar –med product.
22. Galperin EI, Chevokin AYu, Dyuzheva TG. 2003. Cicatricial strictures of bile ducts. *Materials 10 Anniversary international conference of hepatologists*. Moscow, Pp. 86. [Article in Russian]
23. Kuzovlev NF. 1996. Cicatricial stricture of the hepatic ducts. Precision biliary-enteric anastomosis without drainage-frame. *The annals of surgical Hepatology*. 1: 108-114. [Article in Russian]
24. Padillo FJ, Gallardo JM, Naranjo A, et al. 1999. Changes in the pattern of visceral proteins after internal biliary drainage in patients with obstructive jaundice. *Eur J Surgeons*, 165: 550-555.
25. Gulikyan ShB. 2001. *Prophylaxis Prevention and treatment of reflux cholangitis*. Tomsk. [Article in Russian]
26. Bismuth H, Majno PE. 2001. Biliary strictures: classification based on the principles of surgical treatment. *World J Surg*, 25: 1241-1244.
27. Galperin EI, Kuzovlev NF. 1995. Cicatricial strictures of the hepatic ducts in the region of their fusion (a stricture 0). *Surgery*, 1: 26-31. [Article in Russian]
28. Ratchik VM. 2003. Closed lesions of the gallbladder and extrahepatic bile ducts. *Surgery*, 7: 55-59. [Article in Russian]
29. Shalimov AA, Shalimov SA, Nichitaylo ME, Konchak VM. 1988. Principles of diagnostics and surgical treatment of cicatricial strictures of bile ducts. *Materials of the symposium with international participation*. Moscow. Pp. 84-87. [Article in Russian]
30. Bret PM, Reinhold C. 1997. Magnetic resonance cholangio-pancreatography. *Endoscopy*, 29: 72-86.
31. Beburishvili AG. 2003. Restorative and reconstructive operations on bile ducts. *Annals of surgical hepatology*. 8(2): 80. [Article in Russian]
32. Kotelnikova LP, Cherkasov VA. Traumatic damages of HC. *Materials 10 of the Anniversary international conference of the HPBS surgeons. 2003 Moscow* p. 97. [Article in Russian]

33. Timoshin AD, Zavenyan ZS, Ratnikova NP. Endoscopic method of replacing submerged of bile ducts. *Surgery*, 3: 110-112. [Article in Russian]
34. Jeng KS. 1997. Treatment of intrahepatic biliary strictures associated with hepatolithiasis. *Hepatogastroenterology*. 44: 342-51.
35. Sodikov HT. 1996. Endoscopic diagnosis and correction of postoperative pathology of the biliary tract. Dissertation, Tashkent. P. 131. [Article in Russian]