



Surgical Management of Benign Strictures of the Biliary Tract

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Abstract. Benign strictures of the biliary tract are difficult to treat surgical complications. Most biliary strictures result from injuries during cholecystectomies, and their initial management is a major determining factor of the long-term outcome. Only surgeons well trained and experienced in their management should treat this entity. The affected patients present various signs and symptoms depending on the time the lesion is detected, and the treatment modality largely depends on such timing. The success of surgical treatment with its attendant low morbidity and mortality makes it the preferred modality over transhepatic image-guided or endoscopic balloon dilatation, with or without the insertion of stents. Surgical treatment is based on three principles: good exposure for internal drainage of the intrahepatic biliary tract, mucosa-to-mucosa anastomosis, and prevention of the risk of reoperation for recurrent stenosis. Roux-en-Y hepaticojejunostomy with a blind subcutaneous jejunal loop seems to comply with these three principles. Transanastomotic stents are not necessary. We have analyzed our experience from 1988 to 1999 with 65 consecutive patients referred to us for biliary reconstruction. We used the Roux-en-Roux-en-Y hepaticojejunostomy with a blind subcutaneous jejunal loop, performed by the same surgical group in all cases.

Benign strictures of the biliary tract constitute a continuing serious challenge to the hepatobiliary surgeon. Within this surgical specialty there is no other procedure in which the end results are so significantly and directly related to the initial management of the entity. Although there are important technologic developments that have improved our diagnostic and therapeutic methodologies, the high morbidity and mortality rates associated with this entity represent a serious clinical problem. Early recognition of the lesion is not sufficient per se unless immediate proper management is instituted, because what is done at the onset is the determining factor for long-term good results. The aim of surgical management of biliary strictures is to alleviate the obstruction, prevent secondary hepatocellular damage, and prevent restenosis.

Most of the strictures occur as a complication of cholecystectomy [1]. Other surgical procedures, however, such as gastrectomy, hepatic resection, liver transplantation, and operation on or trauma to the pancreas may cause biliary strictures, as may inflammatory lesions such as pancreatitis, choledocholithiasis, primary sclerosing cholangitis, chronic odditis, duodenal ulcer, Crohn's disease, viral infections, and drug toxicity [2].

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Etiopathology

More than 80% of benign strictures of the biliary tract occur as a complication of cholecystectomy; and their incidence has increased since the advent of laparoscopic cholecystectomy [3]. Raute et al. [4] reported a 0.22% incidence of biliary tract lesions in their series of 7057 cholecystectomies performed during 1972–1991. In 14 of the 16 reported cases, the lesion was immediately recognized and repaired with good long-term results.

In their review of 81 patients who sustained biliary tract lesions during cholecystectomy or during exploration of the biliary tract, Moosa et al. [5] concluded that the circumstances contributing to the occurrence of biliary tract lesions were (1) inadequate access, exposure, or surgical assistance; (2) lack of intraoperative cholangiography; (3) obesity; and (4) early dissection of Calot's triangle. The benefit of intraoperative cholangiography has been widely discussed since the publication of this and other reports, with other contributing factors noted: (1) the surgeon's level of training and experience; and (2) the type of center. In Moosa et al.'s series the mortality (15/81 patients) was related to: (1) the level of location of the stricture; (2) the number of failed attempts at reconstruction; and (3) inadequate reconstruction. All this confirms our original impression that with this entity, most particularly, there is a high cost for early diagnostic and treatment errors.

A multicenter analysis of 81 patients presenting with biliary tract lesions that occurred during laparoscopic cholecystectomy, reported by Woods and colleagues [6], concluded that 15 were cystic duct leakage, 27 were common bile duct leakage or strictures, and 39 were transections of the main bile duct. Altogether, 62% of these lesions were recognized after laparoscopic cholecystectomy and 38% during the course of the procedure.

The precise incidence of biliary tract lesions is not known. A Scandinavian study by Bengmark's group [7] reported an incidence of 1 in 1000 cases during the prelaparoscopic era. During the postlaparoscopic era the incidence has increased, as reported by other studies [8].

In our own series consisting of 65 consecutive cases of surgical repair by the Chen Roux-en-Y hepaticojejunostomy with a blind subcutaneous jejunal loop, 45 resulted from cholecystectomy. The incidence of biliary tract injury was 45% for the prelaparoscopic period and 70% for the laparoscopic era (Fig. 1).

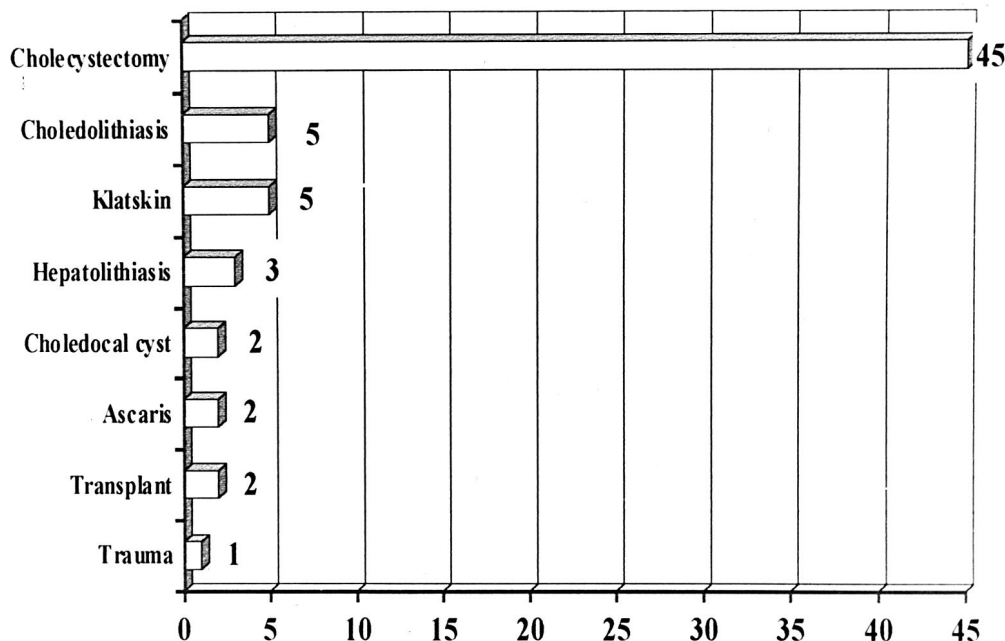


Fig. 1. Causality for the biliary reconstruction in 65 patients managed with Roux-en-Y hepaticojejunostomy with a blind subcutaneous jejunal loop at the Fundación Santa Fe de Bogotá between 1988 and 1999.

More specific factors must be considered in the etiology of biliary tract lesions: intraoperative bleeding and the corresponding attempts to control it through liberal use of clips; operations performed on seriously ill patients with severe inflammation of the gallbladder, as widely reported in the literature [9]; and anatomical anomalies such as an atypical junction of the cystic duct and the main biliary tract, which is the most frequent variant. During the past decade devascularization and ischemia of the biliary tract has attained considerable attention as a cause of postoperative strictures, as reported by Terblanche et al. [10]. Unnecessary dissection of the common bile duct, and even the mere attempt at visualization, may result in section of its vascular supply, which runs in the 3 and 9 o'clock positions.

Experience does not necessarily constitute the main preventive factor. Often skilled and experienced surgeons are more prone to cause injury for reasons of excessive confidence vis-à-vis those who are beginning their surgical careers. Exposure must be adequate. Small incisions may convey large problems, especially in the presence of bleeding during the operation. As discussed above, intraoperative cholangiography may not be of value for preventing biliary tract injury, but its use has clear academic and investigative benefits pertaining to laparoscopic exploration of the biliary tract.

A number of strategies have been described for minimizing the risk of bile duct injury during cholecystectomy: dissection of the peritoneal layer covering Calot's triangle; good exposure of the cystic duct and its junction with the main bile duct; ligation of the cystic duct as close as possible to the gallbladder (and the same for the cystic artery); intraoperative cholangiography when in doubt; aspiration of an acutely inflamed gallbladder prior to starting dissection; and, above all, good judgment about converting a difficult laparoscopic procedure to an open operation before a catastrophe occurs. Some authors recommend routine cholangiography.

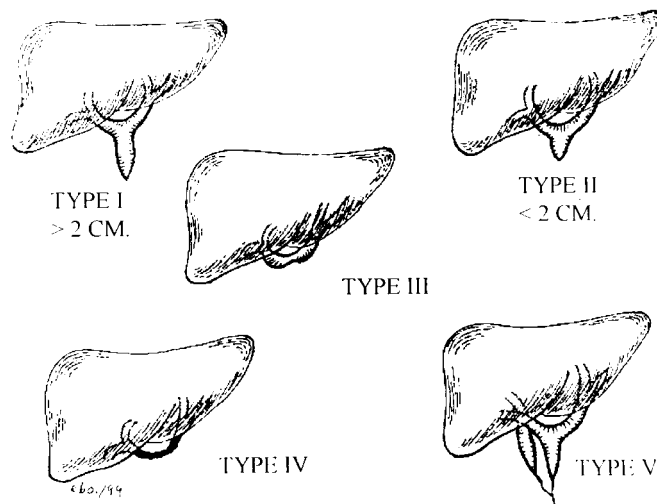


Fig. 2. Classification of the biliary stricture based on the level relative to the hepatic confluence. (From Bismuth [11]).

Classification

Localization of the stenosis is of utmost importance not only for proper management but also to establish the prognosis. Bismuth's classification [11] based on the anatomic patterns of the lesion located at different levels in the biliary tree is quite useful (Fig. 2). Type 2 lesions in Bismuth's classification are the most common, as can be seen in (Fig. 3), which represents our experience with the repair of the 45 lesions of the biliary tree following cholecystectomy referred to above.

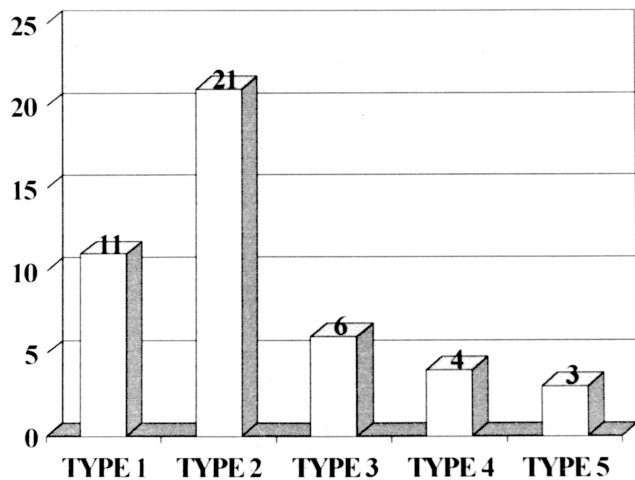


Fig. 3. Distribution of benign bile duct strictures, according to Bismuth's classification, in 45 patients after cholecystectomy.

Diagnosis

Patients with lesions of the biliary tract sustained during cholecystectomy may exhibit early postoperative symptomatology. The diagnosis is suspected during the first week in 10% of the patients, within the first 6 months in 70%, and within the first year in 80%. The clinical presentation varies depending on the time interval between the operation and the onset of symptoms [12].

During the early phases most patients develop altered hepatic function with or without jaundice. Other patients develop a biliary fistula. In 32 of our series the early postcholecystectomy complications were associated with uncontrollable postoperative pain.

Patients diagnosed late after cholecystectomy generally develop episodic cholangitis and jaundice. When the diagnosis is extremely late, patients exhibit significant hepatocellular damage; some of them have come to evaluation for liver transplantation owing to cirrhosis.

Diagnosis requires confirmation of a suspected lesion in the biliary tree. Liver function tests (LFTs) generally are indicative of cholestasis, with the alkaline phosphatase level the most sensitive parameter. Alkaline phosphatase never returns to normal levels, even after a successful repair. Confirmation by diagnostic imaging is essential.

Diagnostic imaging is of ample and rich variety. Ultrasonography and computed tomography (CT) are important during the initial evaluation, especially in patients with early suspicion of biliary tract injury or an intraabdominal fluid collection. They are similarly helpful during the late postoperative phases for demonstrating biliary duct dilatation and ruling out other causes of cholangitis or jaundice.

Radioisotope imaging is also of value for evaluating bile flow and hepatocellular function, but subjects with severe icterus are not candidates for radionuclide imaging. This method is useful in the follow-up of patients who have undergone repair of a bile duct stricture.

The premier diagnostic method is cholangiography, which can be done transhepatically or by endoscopy. Transhepatic cholangiography provides a well defined road map prior to repair, but endoscopic retrograde cholangiopancreatography (ERCP) provides valuable preoperative information.

Lomanto and associates [13], in Rome, Italy, reported the use of magnetic resonance imaging cholangiopancreatography (MRCP) in 136 patients with varied pathology including choledocholithiasis, benign and malignant stenosis of the biliary tree, and bilioenteric anastomoses. This noninvasive method is replacing ERCP in the diagnostic evaluation of biliopancreatic disease. Our own experience with MRCP confirms it as a novel technique that provides computerized images of similar quality to ERCP but devoid of the need for injecting contrast medium. Moreover, Hatano et al. [14] after comparing MRCP and ERCP, concluded that MRCP is better, except for the diagnosis of carcinoma of the pancreas, where ERCP remains superior. We believe MRCP to be a valuable alternative in the noninvasive diagnosis of biliary tract stenosis.

We must stress the importance of administering antibiotic prophylaxis prior to performing transhepatic cholangiography or ERCP with the purpose of preventing cholangitis, which frequently develops following this procedure. We favor a second-generation cephalosporin.

Percutaneous transhepatic cholangioscopy has also been utilized to diagnose focal strictures of the intrahepatic biliary ducts related to stones, as reported by Seo and associates [15].

Preoperative Management

Preoperative management depends on the time of presentation. During the immediate postoperative period the patient may have cholangitis or intraabdominal fluid collections. The first therapeutic step is to control sepsis by administering antibiotics of high biliary concentration and excretion capacity.

Percutaneous and nasobiliary drainage of the biliary tree and ultrasound- or CT-guided drainage of collections are valuable procedures that can effectively improve the initial condition of the patient. Reconstructive surgery takes a secondary therapeutic priority. In cases of biliary fistulas, endoscopic papillotomy is an important therapeutic addendum to external drainage and general support measures.

Patients presenting at later stages usually exhibit cholangitis, which requires urgent management including cholangiography and drainage. Transhepatic cholangiography is the preferred method, as it facilitates management once sepsis has been controlled with antibiotics and the patient can be scheduled for surgery with a complete road map of the biliary tree.

Surgical Management

The aim of surgical management of benign stenosis of the biliary tract is to reestablish the bilioenteric flow in such a manner as to prevent cholangitis, development of calculi or concretions, hepatic damage, and above all restenosis.

Lesions Identified during Surgery

Only 46% of bile duct injuries are recognized at operation [16]. If they are recognized or suspected during operation, cholangiography is done and repair immediately undertaken. A proper repair implies preservation of the full length of the biliary duct without sacrificing tissue, (by means of good mobilization using Kocker's maneuver) and end-to-end anastomosis constructed over a T-tube. Based on the experience acquired with the end-to-end anas-

tomosis during liver transplantation, the T-tube may be omitted [17].

If the lesion is near the confluence or the injured segment is more than 1 cm in length, it appears best to avoid an end-to-end anastomosis in favor of a Roux-en-Y reconstruction. A review of the literature indicates better results and lower stenosis rates with the Roux-en-Y procedure [18].

Lesions Identified during the Immediate Postoperative Period

Presentation may occur in different forms: biliary fistula, biliary peritonitis, or progressive jaundice. We have already described our therapeutic approach in the management of biliary fistula. In the presence of biliary peritonitis internal-external drainage is considered, taking into account the extreme friability of tissues; if direct surgical repair is not feasible, the preferred option is bypass and drainage. The same applies to the jaundiced patient.

Lesions Identified during the Late Postoperative Period

Three basic considerations or precepts determine selection of the method of reconstruction: (1) feasibility of intrahepatic drainage; (2) mucosa-to-mucosa bilioenteric anastomosis; and (3) prevention of reoperation. There is an additional important precept for successful achievement of the first two issues: construction of a jejunal loop that can be brought up, free of tension, to the Roux-en-Y biliary anastomosis. Several techniques have been reported in the literature for this purpose, among which is our favorite method: the Roux-en-Y hepaticojejunostomy with a blind subcutaneous jejunal loop described first by Chen. Our group has utilized this method since 1988 [19].

In 1984 Chen et al. reported a 22-year experience with the diagnosis and management of intrahepatic biliary calculi utilizing, since 1973, bilioenteric bypass with associated enterostomy [20]. The technique was promoted by Barker and Winkler [21] with the innovation of cutaneous access and an antireflux valve. The technique allows radiologic access, as described by Schweizer et al. in 1986 [22] and by Sachse and associates [23]. Steigmann et al. [24] introduced a technical modification but preserved the philosophy of easy accessibility; they described anastomosis of the blind loop of the Roux-en-Y to the duodenum for endoscopic access. In 1998 Hutson and colleagues in Miami [25] reported a series of 30 patients followed for 13 years who underwent balloon dilatation for restenosis through the subcutaneous loop, thereby avoiding reoperations and so complying with the third precept of this type of reconstructive surgery.

In our 11-year experience we have intervened in 65 patients utilizing the Roux-en-Y hepaticojejunostomy with a blind subcutaneous jejunal loop, as described previously [19] (Fig. 4). Six patients developed restenoses; three were managed by percutaneous balloon dilatation and three with radiologically placed stents through the subcutaneous jejunal loop, with successful results in all cases, although two patients developed leakage of the jejunal blind loop that required minor operative repair. We had one fatality at the beginning of our series; an extremely ill patient with many previous operations (Table 1). These figures represent a success rate of 90% for restenosis.

We conclude that this is a rational method of reconstruction that prevents subsequent operations. It also allows percutaneous imaging intervention for balloon dilatation and placement of

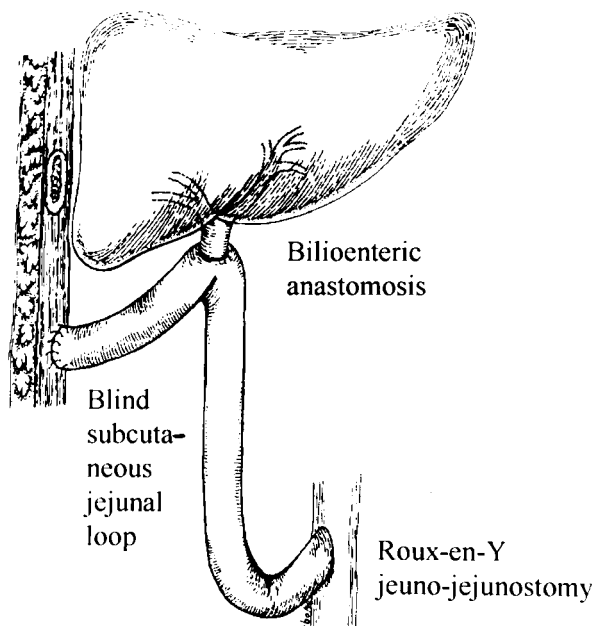


Fig. 4. Roux-en-Y hepaticojejunostomy with a blind subcutaneous jejunal loop, as described by Quintero et al. [19].

Table 1. Restenosis, morbidity, and mortality in 65 consecutive patients managed by Roux-en-Y hepaticojejunostomy with a blind subcutaneous jejunal loop.

Parameter	No. of patients	%
Restenosis	6	9.2
Morbidity (loop leak)	2	3.0
Mortality	1	1.5

intraluminal stents, retrieval of calculi, irrigation of the biliary tree, and diagnostic cholangiography.

Bilioenteric Anastomosis and Stents

In addition to the technique promoted by our group and others, there are a number of alternate methods for repair and management of the stenotic lesions of the biliary tract. The use of stents has advocates and detractors. Bilioenteric reconstruction supported by stents has not been necessary, and we did not utilize stents in any of the 65 patients of our series. Among others, Innes and colleagues [26] suggested, and we concur, that a bilioenteric anastomosis placed for management of benign stenosis of the biliary tract may be undertaken without placing stents. It promises low postoperative morbidity and excellent obstruction-free long-term results.

Other techniques have been described, especially for stenosis of the confluence or one or both hepatic ducts, among them the method described by Hepp and Couinaud [27]. Access to high level strictures of the hepatic duct is gained through an incision in Glisson's capsule overlying the junction of the quadrate lobe (segment IV), with the left lateral segment (segment III), at the level where the falciform ligament enters the liver. The incision exposes the intrahepatic branch of the left hepatic duct, and it can

be extended toward the right side to perform a mucosa-to-mucosa anastomosis, avoiding the use of stents. More recently, Launois et al. [28] proposed a novel modification of the Hepp-Couinaud technique for a better posterior approach to the hepatic hilum for constructing the hepaticojejunostomy.

Postoperative Management

HIDA radionuclide scans are done for most of our patients 48 hours after the reconstruction. If no biliary leak is detected, the abdominal drainage catheter is withdrawn. Liver function tests during the postoperative period serve to define the baseline value once the problem has been corrected. HIDA scans and LFTs are the main parameters in the long-term follow-up. It appears that the manometric perfusion test is of value for long-term prediction of success after treatment of bile duct stricture [29], but have no experience with it.

Nonsurgical Management

Advances in interventional imaging technologies and endoscopy provides alternate methods for the management of patients with benign strictures of the biliary tract. However, these methods in no way surpass surgical treatment, although some series report beneficial results with percutaneous transhepatic balloon dilatation, with success rates ranging between 55% and 85% for follow-up periods of 24 and 59 months [30]. These results appear clearly inferior to those achieved with surgical treatment, as discussed above. Neither endoscopic dilatation nor placement of stents have led to long-term successful results, and these techniques demand considerable experience [31].

Conclusions

Surgical repair of benign strictures of the biliary tract using the Roux-en-Y hepaticojejunostomy with a blind subcutaneous jejunal loop is associated with few complications and a high rate of successful outcomes, even though it requires hospital admission and is more expensive than the percutaneous or endoscopic procedure.

Résumé

Les sténoses bénignes des voies biliaires en rapport avec une complication chirurgicale sont parmi les plus difficiles à traiter. La vaste majorité de ces lésions sont secondaires aux cholécystectomies, et leur traitement initial est un facteur déterminant dans l'évolution à long terme. Seuls les chirurgiens rompus à ce type de chirurgie devraient les traiter. Le patient victime d'une telle sténose se présente de façon variable avec des signes et symptômes dépendant du moment de la détection de la lésion. Le type de traitement est largement en rapport avec ce délai. Les taux de mortalité et de morbidité après traitement chirurgical sont bas par rapport aux dilatations endoscopiques ou transhépatiques avec ou sans insertion de stent. Le traitement chirurgical est basé sur trois principes fondamentaux: une bonne exposition pour assurer le drainage interne de l'arbre biliaire intrahépatique, une anastomose muqueuse à muqueuse et la prévention de la récurrence de la sténose susceptible de nécessiter une réopération. Une anastomose hépaticojéjunale sur anse-en-Y

avec mise à la peau du cul-de-sac semble bien remplir ces trois conditions. La mise en place d'un stent transanastomotique n'est pas nécessaire. Nous avons analysé notre expérience entre 1988 et 1999 concernant 65 patients consécutifs, adressés pour reconstruction biliaire, traités par anastomose hépaticojéjunale sur anse-en-Y avec mise sous la peau de l'anse jéjunale borgne, par une même équipe chirurgicale.

Resumen

Las estenosis de la vía biliar son complicaciones quirúrgicas de muy difícil tratamiento. La mayoría de ellas es consecuencia de lesiones producidas en el curso de una colecistectomía, y su manejo inicial es un factor determinante principal del resultado a largo plazo. Sólo los cirujanos bien entrenados y con experiencia en su manejo deben ser quienes traten esta entidad. Los pacientes afectados presentan una variedad de signos y síntomas según el tiempo en que se detecte la lesión, y la modalidad de tratamiento depende principalmente de este factor. El éxito del tratamiento operatorio, con su correspondiente baja morbilidad y mortalidad, hace que éste sea el método de preferencia, con ventajas sobre la dilatación endoscópica con balón, o transhepática bajo guía de imágenes, con o sin inserción de "stents". El tratamiento quirúrgico se basa en principios de buena exposición para el drenaje interno del tracto biliar intrahepático, anastomosis de mucosa a mucosa y prevención del riesgo de reoperación por estenosis recurrente. La hepatico-yeyunostomía de Roux-en-Y, con una asa yeyunal ciega subcutánea, parece cumplir estos tres principios. En el presente artículo se analiza nuestra experiencia en el periodo 1988 a 1999 con 65 pacientes consecutivos referidos a nuestro grupo para manejo con hepático-yeyunostomía de Roux-en-Y y asa yeyunal ciega subcutánea.

References

1. Lillemoe, K.D., Pitt, H.A., Cameron, J.L.: Current management of benign bile duct strictures. *Adv. Surg.* 25:119, 1992
2. Blumgart, L.H.: Estricturas biliares benignas. In *Cirugía del Hígado y de las Vías Biliares*, Buenos Aires, Editorial Médica Panamericana, 1990 pp. 839–875
3. Lillemoe, K.D.: Benign post-operative bile duct strictures. *Baillieres Clin. Gastroenterol.* 11:749, 1997
4. Raute, M., Podlech, P., Jaschke, W., Manegold, B.C., Trede, M., Chir, B.: Management of bile duct injuries and strictures following cholecystectomy. *World J. Surg.* 17:553, 1993
5. Moosa, A.R., Mayer, A.D., Stabile, B.: Iatrogenic injury to the bile duct: who, how, where? *Arch. Surg.* 125:1028, 1990
6. Woods, M.S., Traverso, L.W., Kozarek, R.A., Tsao, J., Rossi, R.L., Gough, D., Donohue, J.H.: Characteristics of biliary tract complications during laparoscopic cholecystectomy: a multi-institutional study. *Am. J. Surg.* 167:27, 1994
7. Andrén-Sandberg, A., Alinder, G., Bengmark, S.: Accidental lesions of the common bile duct at cholecystectomy: pre and perioperative factors of importance. *Ann. Surg.* 201:328, 1985
8. Zucker, K.A., Bailey, R.W., Gadacz, T.R., Imbembo, A.L.: Laparoscopic guided cholecystectomy: a plea for cautious enthusiasm. *Am. J. Surg.* 161:36, 1991
9. Pitt, H.A., Miyamoto, T., Parapatis, S.K., Tompkins, R.K., Longmire, Jr., W.P.: Factors influencing outcome in patients with postoperative biliary strictures. *Am. J. Surg.* 144:14, 1982
10. Terblanche, J., Allison, H.F., Northover, J.M.A.: An ischemic basis for biliary strictures. *Surgery* 94:52, 1983
11. Bismuth H.: Postoperative strictures of the bile duct. In *The Biliary Tract*, Blumgart, L.H., editor, Edinburgh, Churchill Livingstone, 1982, pp. 209–218

12. Blumgart, L.H., Kelley, C.J., Benjamin, I.S.: Benign bile duct stricture following cholecystectomy: critical factors in management. *Br. J. Surg.* 71:836, 1984
13. Lomanto, D., Pavone, P., Laghi, A., Panebianco, V., Mazzocchi, P., Fiocca, F., Lezoche, E., Passariello, R., Speranza, V.: Magnetic resonance-cholangiopancreatography in the diagnosis of biliopancreatic diseases. *Am. J. Surg.* 174:33, 1997
14. Hatano, S., Kondoh, S., Akiyama, T., Okita, K.: Evaluation of MRCP compared to ERCP in the diagnosis of biliary and pancreatic duct. *Nippon Rinsho* 56:2874, 1998
15. Seo, D.W., Kim, M.H., Lee, S.K., Mying, S.J., Kang, G.H., Ha, H.K., Suh, D.J., Min, Y.I.: Usefulness of cholangioscopy in patients with focal stricture of the intrahepatic duct unrelated to intrahepatic stones. *Gastrointest. Endosc.* 19:204, 1999
16. Browder, I.W., Dowling, J.B., Koontz, K., Litwin, M.S.: Early management of operative injuries of the extrahepatic biliary tract. *Ann. Surg.* 205:649, 1987
17. Randall, H.B., Wachs, M.E., Somberg, K.A., Lake, J.R., Emond, J.C., Ascher, N.L., Roberts, J.P.: The use of the T tube after orthotopic liver transplantation. *Transplantation* 27:258, 1996
18. Csendes, A., Diaz, J.C., Budiles, P., Maluenda, F., Jorn, O.: Late results of immediate primary end to end repair in accidental section of the common bile duct. *Surg. Gynecol. Obstet* 68:125, 1989
19. Quintero, G.A., Espinosa, H., Piñeres, G., Ariza, A., Zundel, N., Botero, R., Cuervo, H., Ucros, G., Patiño, J.F.: Roux-en-Y hepaticojejunostomy with subcutaneous access and the use of Gianturco stents for the management of biliary tract strictures. *World J. Surg.* 16:1178, 1992
20. Chen, H.H., Zhang, W.H., Wang, S.S., Caruana, J.A.: Twenty-two years experience with the diagnosis and treatment of intrahepatic calculi. *Surg. Gynecol. Obstet.* 159:512, 1984
21. Barker, E.M., Winkler, M.: Permanent-access hepaticojejunostomy. *Br. J. Surg.* 71:188, 1984
22. Schweizer, W., Baer, H.U., Nudelmann, L.I., Matthews, J., Thomas, P., Triller, J., Blumgart, L.H.: A combined surgical and interventional-radiologic procedure in bile duct obstructions. *Helv. Chir Acta* 55:583, 1989
23. Sachse, R.E., Hutson, D.G., Russell, E., Levi, J.J., Schiff, E.: Hepaticojejunostomy with a subcutaneous blind jejunum segment: an alternative in the treatment of stenosing duct disease. *Chirurg* 61:402, 1990
24. Stregmann, G.V., Mansour, M.A., Goff, J.S., Pearlman, N.W.: Roux-en-Y jejunoduodenostomy for endoscopic access to hepaticojejunostomy. *Surg. Gynecol. Obstet.* 173:153, 1991
25. Hutson, D.G., Russell, E., Yrizarry, J.: Percutaneous dilatation of biliary strictures through the afferent limb of a modified Roux-en-Y choledochojejunostomy or hepaticojejunostomy. *Am. J. Surg.* 175:108, 1998
26. Innes, J.T., Ferrara, J.J., Carey, L.C.: Biliary reconstruction without trans anastomotic stent. *Am. J. Surg.* 54:27, 1988
27. Hepp, J., Couinaud, C.: L'abord et l'utilisation du canal hepatic gauche dans le reparation de la voie biliare principal. *Presse Med.* 64:947, 1956
28. Launois, B., Sutherland, F.R., Harissis, H.: A new technique of Hepp-Couinaud hepaticojejunostomy using the posterior approach of the hepatic hilum. *J. Am. Coll. Surg.* 188:59, 1999
29. Savader, S.J., Cameron, J.L., Lillemoe, K.D., Lund, G.B., Mitchell, S.E., Venbrux, A.C.: The biliary manometric perfusion test and clinical trial: long term predictive value of success after treatment of the bile duct strictures: ten years experience. *J. Vasc. Interv. Radiol.* 9:976, 1998
30. Lillemoe, K.D., Pitt, H.A., Cameron, J.L.: Results of transhepatic balloon dilatation of bile duct strictures. *Surg. Clin. North Am.* 70:1355, 1990
31. Foutsch, P.G., Sivak, Jr., M.V.: Therapeutic endoscopic balloon dilatation of the extrahepatic biliary ducts. *Am. J. Gastroenterol.* 80:575, 1985