ANNALS OF HEPATOLOGY

Volume 4 *Number* 3 *July-September* 2005

Artículo:

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Annals of Hepatology 2005; 4(3): July-September: 184-187

Annals
of
Hepatology

Original Article

Low serum albumin is not a contraindication for early iatrogenic bile duct injury repair

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Abstract

Most iatrogenic bile duct injuries are recognized in the early postoperative period (first 48 hours). These patients usually have additional complications such as a suboptimal hydroelectrolitic status, subhepatic collections, external biliary fistula and malnutrition. In these circumstances, besides the elevation of bilirrubin and transaminases associated with the injury, hypoalbuminemia is frequently encountered. The timing for repair is decided according to the condition of each patient. We report the impact of preoperative abnormal low serum albumin levels on the results of biliary tract reconstruction after a iatrogenic biliary lesion. ***Method:*** **Patients who underwent biliary reconstruction in our center from 1998 to 2002 were analyzed. Only patients with complex injuries (Strasberg E, Bismuth III-IV, Stewart-Way III) were included. Major postoperative complications were recorded and correlated with preoperative liver function tests.** ***Results:*** **Seventy seven patients were analyzed. In 41 cases, the injury was a consequence of a laparoscopic operation. All patients were treated by a Roux-en-Y hepatojejunostomy. No operative mortality was recorded. The most frequent postoperative complications were postoperative biliary fistula (8/77-9%, $p < 0.017$) and subhepatic collections (9/77-9%, $p < 0.39$). All fistulae closed spontaneously and the subhepatic collections were drained. Overall, complications were more common in the group with hypoalbuminemia ($p < 0.002$).** ***Conclusion:*** **Early repair is indicated if there is no systemic contraindication (sepsis, multiple organic failure, electrolytic imbalance). Abnormalities in the liver function tests, particularly a low serum albumin, should not delay the operation. Although significantly more postoperative complications are observed in an early repair, long-term results are comparable to those of an elective repair.**

Key words: Bile duct injury, bile duct repair.

Introduction

Some bile duct injuries associated to laparoscopic cholecystectomy are expected to happen, with a frequency that ranges between 0.1 and 0.5%, even in the most experienced centers.[1] Most lesions are not recognized at the initial operation, but if they are, a successful repair can usually only be carried out in the hands of an experienced surgeon. On the other hand, in our country lesions recognized in the early and late postoperative period are usually referred to tertiary health care centers for repair. Many patients arrive with an external biliary fistula and others with bile duct stenosis, with or without previous repairing attempts. Additional factors such as abdominal or systemic sepsis, dehydration and in extreme cases malnutrition, can also be found.[2]

The timing for repair is decided according to the condition of each individual patient, but the consensus is that the repair should be postponed until the general health condition of the patient allows a safe operation.[3] The liver function tests (LFT's) results in this patient pool are extremely variable, ranging from normal or near normal, to completely abnormal; most abnormalities such as low serum albumin, normal or high ALT/AST and also altered bilirrubin and alkaline phosphatase levels, are seen in the patients with the most recent injuries. Low serum albumin is not just a marker of malnutrition. Low serum albumin is a marker of an acute phase response and may therefore be depressed following surgery, in acute sepsis and following trauma.

We analyze the impact of abnormal preoperative low serum albumin on the result of biliary tract reconstruction after iatrogenic injury.

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Manuscript received and accepted: 1st March and 12 April, 2005.

Method

A cohort of patients selected between January 1998 and September 2002 were studied. All patients were referred to our hospital for bile duct injuries involving the extrahepatic ducts at different levels; only patients with complete section (Strasberg E,[4] Bismuth III-IV,[5] Stewart-Way III[6]) were included in the study. Patients that arrived with sepsis and/or multiorganic failure were not operated until their general health condition improved, and those with other injuries, such as small leaks suitable for endoscopic treatment were excluded. INR clotting time was corrected with fresh frozen plasma when necessary. Preoperative evaluation included percutaneous cholangiography, magnetic resonance cholangiography and fistulography when possible. An endoscopic retrograde cholangiography was performed in cases when the integrity of the extrahepatic duct was in doubt. We did not place percutaneous transhepatic catheters in any patient during the preoperative period.

The patients medical charts were analyzed and their preoperative serum albumin levels recorded (immediate preoperative level). The impact of low serum albumin levels on the postoperative outcome of the bile duct injury repair was obtained by correlating major post-operative complications with preoperative serum albumin levels. Statistical analysis was done using χ^2.

We define recurrent stricture as the postoperative development of jaundice and/or cholangitis in the presence of elevated LFT's (↑ AP, ↑ total bilirubin) and radiological findings (magnetic resonance cholangiography, percutaneous cholangiography) compatible with obstruction.

Results

Sixty female and 17 male patients were included (n = 77); the mean age was 35 years (range 15-75.) The injury was secondary to a laparoscopic procedure in 41 cases and to an open one in 36.

In the preoperative period, 42 patients had albumin levels above 3 mg/dL, 27 between 2-2.9 mg/dL and 8 had less than 2 mg/dL. The results of the remaining LFT's are shown in *table I*. All patients with low albumin levels (n = 35) had a biliary leak, manifested by an external fistula in 32 patients and massive biliperitoneum in three cases.

In all instances, the endoscopic retrograde cholangiography showed complete occlusion of the bile duct and subsequent leakage to the subhepatic recess. In the cases in which adequate albumin levels were present (n = 42), no leak was documented.

Some of the cases that had failed previous reconstruction attempts (hepatoduodenostomy 25, hepatoyeyunostomy 17) arrived in a stable condition with increased bilirubin, alkaline phosphatase and aminotranspherases levels (16 patients.)

Table I. Preoperative liver function tests.

Albumin	Patients	Preoperative bile leak
> 3 gr/dL	42	0
2.0 – 2.9 gr/dL	27	27
< 2 gr/dL	8	8
Bilirrubin	**Patients**	
Under 1.2 mg/dL	20	
1.2 – 3.0 mg/dL	22	
3.0 – 6.0 mg/dL	12	
6.0 – 9.0 mg/dL	8	
Over 9.0 mg/dL	15	
Alkaline Phosphatase	**Patients**	
Under 150 UI/L	20	
150 - 300 UI/L	26	
300 – 450 UI/L	13	
450 – 600 UI/L	10	
Over 600 UI/L	8	
AST/ALT	**Patients**	
< 35	14	
> 35	64	

Table II. Postoperative complications.

Mean follow up	33 Months (range 2 – 61)	%
Biliary fistula	8/77	10.3 %
Subhepatic collection	9/77	
Biloma	5	6.4%
Abscess	4	5.1 %
Anastomotical dysfunction	3/77	3.8 %
Neoformed lithiasis	2/77	2.5%
Arterio-biliary fistula (resolved with transarterial embolization).	1/77	1.2 %

All patients underwent a hepatoyeyunostomy (Roux-en-Y), 29 with a transhepatic stent (23 transhepatic non transanastomotic, 6 transhepatic transanastomotic.) Postoperatively, the patients were followed every six months on an outpatient basis with LFT's and ultrasound; mean follow up is 33 months (range 2-61.) Eleven cases were lost for follow up, in their last evaluation they were in good clinical condition with normal LFT's.

Transhepatic stents were removed between the 3rd and 6th postoperative months, based on the findings in the postoperative cholangiography. Three patients remained with a stent for up to one year, which was replaced every 3 to 4 months.

Postoperative complications are listed in Table II. The most frequent complication was biliary external fistula (8 of 77) and three cases had postoperative albumin levels below 3 gr/dL (x: 2.01) ($p < 0.017$). No correlation was found between the outcome of the anastomosis and the previous documentation of bile leaks.

All the fistulae closed spontaneously. Subhepatic collections were observed in nine cases (5 bilomas and 4 abscesses), all of which were resolved with percutaneous and/or surgical drainage. The subhepatic collections were also more common in patients with low albumin levels (relative risk 2.2 for subhepatic biloma and relative risk 2.26 for subhepatic abscess) ($p < 0.039$). All subhepatic collections were identified in the early postoperative period, between the 3rd and 12th postoperative day.

No operative mortality was recorded. At long term evaluation, (maximum follow up 61 months) there were only 3 cases (3.8%) of anastomotical stricture and 2 cases (2.5%) of hepatic lithiasis.

Overall, complications were more common in the group with hypoalbuminemia ($p < 0.002$). At long term follow up; one patient developed secondary biliary cirrhosis with portal hypertension, upper gastrointestinal bleeding (managed with transendoscopical banding), hepatic encephalopathy and death in the 44th postoperative month because of terminal liver failure.

Technical aspects of the operation are described elsewhere.[7,8] Briefly, prior identification of the bile ducts, an anterior section (Hepp-Couinaud) with a major extension to the left duct was performed. Hepatojejunostomy was done with interrupted single layer everted stitches (5-0 absorbable monofilament suture) to a 40-60 cm isolated jejunal limb.

Discussion

Most patients with iatrogenic biliary tract injury are referred for repair in the days following surgery and they usually have additional complications such as a suboptimal hydroelectrolitic status, subhepatic collections, external biliary fistula and malnutrition. In these circumstances, besides the elevation of bilirubin and transaminases associated to the injury, hypoalbuminemia is commonly encountered. In many centers, surgeons postpone reconstruction until the patient is in good health conditions;[9] however, our results indicate that impaired preoperative LFT's, particularly low serum albumin levels are not a contraindication for early biliary tract reconstruction after iatrogenic injury.

On the other hand, when lesions are identified at the initial operation, if there was no massive bleeding at the time of injury, the patients usually are in good physical condition. In this setting, early reconstruction by experienced biliary surgeons offers satisfactory results, with a good probability of obtaining a high quality bilioenteric anastomosis (wide, tension-free, in non-ischemic ducts, with adequate suture material in a defunctionalized jejunal loop.) Our group previously proposed that this can be achieved if a high bilioenteric anastomosis is done at the first reconstruction attempt when well preserved bile duct blood supply in non-ischemic ducts is found.[10]

Other groups advocate reconstruction as soon as the patient is stable and the preoperative imaging of the biliary tree is completed.[11] Chapman et al were able to perform reconstruction at a median of 2 days after referral, decreasing the average length of stay. Although they obtained good results with this approach, they emphasize that this strategy of early repair has to be used only in patients without hemodynamic instability or sepsis.[12]

With the results obtained by our group in patients with low preoperative serum albumin levels, we found that hypoalbuminemia is not a contraindication for an early repair. Although it is true that significative differences were found in patients with hypoalbuminemia when complications were analyzed, the type of complications seen were resolved early in the postoperative period without long term consequence. In all instances, a Roux-en-Y loop was constructed and no fatal or severe complications were observed despite low albumin levels.

Serum albumin levels have a prognostic impact in several conditions. It has been shown, by multivariate analysis, that serum albumin level is a factor that correlates with prognosis and surgical outcome. Patients with abnormal serum levels have a more survival than those with normal serum albumin levels. This is particularly true in patients with gastrointestinal cancer.[13]

Another study, showed that for patients undergoing liver resections, blood loss, albumin level and kaolin-kephalin time were independent risk factors predisposing to the development of complications.[14]

This, albumin is an acute phase protein marker that has prognostic significance for surgical outcome. If reflects a complex balance between synthesis and catabolism and together with prothrombin time (INR) and bilirrubin levels are important tools for evaluation of liver function.

It is generally accepted that the bile duct repair has a secondary role in patients with systemic repercussions after the injury (due to sepsis or hydroelectrolytic imbalance.) These patients benefit more from conservative management with percutaneous drainage, and elective repair when the systemic inflammatory response has subsided. In some instances, limited laparotomy for drainage is indicated.

Surgical repair is indicated in patients with abnormal serum albumin levels secondary to the injury but without systemic repercussion and no contraindication to general anesthesia and surgical procedure. Acute bile duct obstruction (due to a clip or ligature) promotes a rapid deterioration of the liver function. The high intraductal pressure produced by the obstruction is usually accompanied by small leaks (usually at the level of the gallbladder bed, the cystic duct stump and even at the obstruction level) that result in subhepatic collections. Adequate external drainage of the ducts and collections allows a better patient recovery.

Percutaneous transhepatic catheters are of great aid in the preoperative period; they demarcate the anatomy of the biliary tree very accurately, allowing decompression and external biliary fistula "control" by diverting the bile flow. Intraoperatively they also allow the identification of the ducts, warranting the drainage of the whole biliary tree. However, we do not use them routinely, since in our experience magnetic resonance cholangiography outlines the anatomy adequately enough to permit planning the operation. On the other hand, their placement is mandatory in patients with acute cholangitis and intrahepatic dilatation of the biliary tree.

Long-term results of the operation were similar to those obtained for elective cases (evaluated weeks to months after the injury, with well established external fistula and/or stenosis).[15-17]

Postoperative anastomotical stricture rate was low, clinical improvement, adequate long-term survival and good quality of life were similar in both groups.

Strasberg has emphasized and obtained superior results with a delayed repair. He recommends waiting an average of 3 months from the time of the injury or the last attempt at repair before performing a definitive repair.[9] This strategy allows time for the inflammation to subside and very importantly, determines the status of the concomitant ischemic injury, allowing a high quality anastomosis in a non-ischemic duct. He emphasizes the value of this waiting policy especially in technically challenging cases (Type E4 injuries in which the confluence is not preserved and healthy ducts are usually found at the level of secondary branches). He states that early repair can be safely performed if the injury is not complex and there is no extensive right upper quadrant, subhepatic or hilar inflammation.

Boerma et al found in their series that the result of reconstruction was dependent on the time of reconstruction. Overall, success of 84% increased to 94% when a delayed hepaticojejunostomy was performed.[18]

Abnormalities in the serum albumin levels alone should not delay the operative repair.

We conclude that an early repair can be safely done if there are no systemic contraindications for general anesthesia and/or surgery. The general condition and physical health condition of each individual patient dictates the timing for a definitive repair.

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