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BILIARY COMPLICATIONS FOLLOWING LIVER RESECTION

By

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ABSTRACT

Background: Hepatic resection is needed to manage many types of pathology, either malignant or benign. It offers the only potentially curative treatment for many primary and secondary hepatic malignancies. Planning hepatic resection needs to be considered as the nature of the lesion and its location within the liver, the patient's anatomy, and the quality and volume of the liver tissue that will remain after resection. Perioperative outcomes for hepatic resection have improved due to better surgical techniques that take advantage of the segmental anatomy of the liver, improved techniques for control of bleeding, and improved intensive care.

Objectives: To investigate the morbidity in our center—a tertiary care facility with a multidisciplinary team for hepatobiliary diseases and transplantation where the mortality of liver resection is below 1%— as well as to develop a simple score predicting the risks of complication.

Patients and methods: In this prospective study, 52 patients of both sexes, age above 12 years old, with chronic liver diseases due to benign and malignant tumor, were subjected to hepatic resection and postoperative management of biliary complications at the Department of Surgery, National hepatic institute in Egypt.

Results: Regarding our results, we found that postoperatively, there was no deterioration in renal functions; median urea was at a median of 23.1 (19.4 – 27.2), median creatinine level was 0.8 (0.6 – 0.9). There was a slight elevation of both ALT and AST; 84 (68 – 101.5), 84.5 (60.25 – 131.75), respectively. Otherwise, hepatic functions were normal; Median total bilirubin was 1.12 (0.83 – 1.38), median albumin was 3.4 (3.03 – 3.8). In term of postoperative complications, we detected that bile leakage was the most common complication which was prevalent in 13.5% of patients (7 patients). Renal failure occurred only in one case which represents 1.9% of cases. No risk of pulmonary infection, ascites, subphrenic abscess, pleural effusion, biliary stricture, wound dehiscence, intestinal obstruction, intra-abdominal bleeding were recorded among cases. Regarding the biliary complications, we found that bile leakage as a complication of liver resection operations was mutually present between males and females. 13.8% of males (4 patients) vs. 13 % of females, which represents three patients who suffered from biliary leakage. We also found that age was not a significant predictor of biliary complications (P = 0.069).

Conclusion: Postoperative transaminase levels are independent predictors of postoperative morbidity and mortality and therefore are clinically relevant. Transaminase levels usually peak during the first 24 h after surgery and thus possess early prognostic power in postoperative mortality. Elevated liver enzymes represent a risk factor for biliary complications and leakage after hepatic resection.

Keywords: Biliary Complications, Liver Resection, Transaminase levels.

INTRODUCTION

Hepatic resection is needed to manage many types of pathology, malignant and benign. As it offers the only potentially curative treatment for many primary and secondary hepatic malignancies. Planning hepatic resection needs to take into account the nature of the lesion and its location within the liver, the patient's anatomy, and the quality and volume of the liver tissue that will remain after resection. Perioperative outcomes for hepatic resection have improved due to better surgical techniques that take advantage of the segmental anatomy of the liver, improved techniques for control of bleeding, and improved intensive care. Hepatic resection that is performed in high-volume centers by specially trained hepatobiliary surgeons is associated with better outcomes *(Farges et al., 2012)*.

With ongoing advances, the indications for surgery continue to expand; however perioperative risk remains significant as increasingly complex cases are considered. The overriding principle is to achieve complete resection of disease with preservation of an adequate functional liver remnant. Successful outcomes rely on intricate knowledge of functional anatomy and demand meticulous attention to patient selection, surgical technique and perioperative care *(Steven and Evan, 2017)*.

Recent advances in imaging techniques and their widespread use have led to the more frequent and incidental detection of focal lesions in the liver. It is well known that these lesions have different prognoses based on their characteristics; hemangiomas and focal nodular hyperplasia are typically indolent and uneventful, while hepatic adenomas can be complicated by hemorrhage, spontaneous rupture, or malignant transformation. A surgical approach to treating these tumors is only indicated in approximately 6% of patients and usually involves either resection or enucleation more invasive procedures are being performed on sicker patients with the aid of portal embolization *(Ciria et al., 2016)*.

Precise preoperative computed tomographic volumetry, improved perioperative management, and, in patients with colorectal metastases, effective neoadjuvant chemotherapies and innovative multidisciplinary strategies. Hence, despite decidedly lower mortality rates, liver resections remain complex procedures with important risks of perioperative morbidity and mortality *(Mentha et al., 2012)*.

The most common indications for surgery are presence of symptoms, uncertain diagnosis, and prevention of complications or malignant transformation, Hepatic (liver) resection is performed to manage benign or malignant pathologies of the liver, with the majority undertaken to manage primary or secondary liver tumors. Perioperative outcomes of hepatic resection have improved over time due to the development of surgical techniques that take better advantage of the segmental anatomy of the liver and improved control of bleeding, as well as advances in perioperative care. In addition, more of these procedures are being performed in tertiary centers by specially trained hepatobiliary surgeons who have a higher level of expertise, which is associated

with better outcomes *(Farges et al., 2012)*.

Benign solid liver tumors (BSLT) affect approximately 20% of the population, exceeding the number of malignant tumors by a 2 to 1 ratio and cystic lesions of the liver represent a heterogeneous group of disorders, which differ in etiology, prevalence, and clinical manifestations. Most liver cysts are found incidentally on imaging studies and tend to have a benign course. A minority can cause symptoms and rarely may be associated with serious morbidity and mortality *(Salemis et al., 2011)*.

Larger cysts are more likely to be symptomatic and cause complications such as spontaneous hemorrhage, rupture into the peritoneal cavity or bile duct, infection, and compression of the biliary tree. Specific types of cysts may have unique complications such as malignant transformation in the case of a mucinous cystic neoplasm (cystadenoma), or anaphylactic shock due to a hydatid cyst. Some of these complications may occasionally mandate surgical intervention *(Kobayashi et al., 2016)*.

In some cases, predominantly cystic liver lesions may have solid areas, particularly in the setting of malignancy. Conversely, predominantly solid liver lesions may have cystic components, as may be seen with hemangiomas or tumors thahave areas that are necrotic. Considerable controversy still exists regarding the definition and classification of cystic lesions of the liver. Furthermore, consensus has not been achieved on the optimal treatment of patients with symptomatic cysts, although a number of therapeutic approaches have been described *(Taylor et al., 2010)*.

Early symptoms of biliary complications are often unspecific or missing, Biliary leaks typically occur early and are diagnosed by routine cholangiography or bilious secretion. Increased inflammatory parameters or fever might occur in the case of undrained bilious collections. Anastomotic or non-anastomotic stenoses are often affiliated with jaundice, increased cholestatic enzymes and fever. Also, recurrent cholangitis is a common symptom and should entail additional diagnostic measures *(Kochhar et al., 2013)*.

The aim of the present study was to investigate the morbidity in our center—a tertiary care facility with a multidisciplinary team for hepatobiliary diseases and transplantation where the mortality of liver resection is below 1%—as well as to develop a simple score predicting the risks of complication.

PATIENTS AND METHODS

In this prospective study, fifty two (52) patients of both sexes, age above 12 years old, with chronic liver diseases due to benign and malignant tumor, were subjected to hepatic resection and postoperative management of biliary complications at the Department of Surgery, National hepatic institute in Egypt.

All patients were given informed consent and information on the procedures and its possible complication. The study protocol was approved by ethical committee, Faculty of Medicine, Al-Azhar University.

Inclusion criteria: Age more than 12 yrs, patients with chronic liver diseases due to due to benign and malignant tumor, biliary complications following liver resection, living donor liver transplantation, and liver resection following liver trauma.

Exclusion criteria: Age less than 12 yrs, non-biliary complication "vascular ", blunt Abdominal trauma to liver with biliary complication treated conservative, unfit hepatic Patient for operation, and end stage liver disease with multiple hepatic focal lesions.

All patients were subjected to:

Preoperative assessment:

- Full history taking: age, gender, BMI, smoking, chronic diseases as hypertension, diabetes and cirrhotic liver diseases.
- Full clinical examination: General and local examinations.
- Routine laboratory investigation: CBC, Complete liver biochemical profile (Alanine transaminase (ALT), Aspartate transaminase (AST), serum albumin, serum bilirubin (Total), prothrombin concentration (PC) and international randomized ratio (INR)), renal function test.
- Radiological investigation: Abdominopelvic ultrasound (U/S), and pelviabdomenal CT.
- Triphasic abdominal CT scan: including (an arterial phase, a portal venous phase, and a late washout phase) has been found to be highly accurate in the diagnosis and characterization of liver tumor specially HCCs.
- Magnetic resonance cholangiopancreatography (MRCP): to visualize the biliary ducts and detect any anatomical variation.

Postoperative assessment:

- The resected specimens were sent to pathology laboratory for a frozen section examination, in order to confirm absence of tumor cells at the liver resection margins.
- Postoperative patient follow up with:

o Liver function test and renal function test: serum bilirubin (Total), international randomized ratio (INR) and creatinine.

o Conservative follow up: general examination in bile leakage showed toxic appearance, tachycardia, fever.

o Local examination (abdominal drain and wound assessment): to detect bile drainage from it. Biliary leakage was diagnosed either when an operatively installed drain contained ≥ 100 mL/day of bile-containing fluid with or without abdominal distention.

o Investigation to detect bile collection and confirm diagnosis:

- Pelvi-abdominal CT.
- MRCP.
- Pelvi-abdominal ultrasound.

When conservative treatment failed Bile collection was treated by U/S guided percutaneous needle aspiration when bile leakage wasn't responded to U/S guided percutaneous needle aspiration endoscopic retrograde cholangiography (ERC) was performed to confirm the diagnosis and as a treatment.

Endoscopic procedure:

- All endoscopic procedures were performed after written informed consent was provided.
- After an overnight fast, ERC was performed using a video duodenoscope.
- The leakage site was confirmed using contrast media. Following insertion of a 0.035-inch guidewire into the intrahepatic bile duct.
- Proximal to the leakage site, an endobiliary plastic stent was introduced over the leakage site, with an endoscopic sphincterotomy (EST).

Statistical analysis:

We used Statistical package for social sciences (SPSS) version 24 software for windows for analyzing the data. Qualitative data was described in terms of frequencies and percentages. Quantitative data was described in terms of mean and standard deviations if parametric and median and interquartile range if nonparametric. Kolmogorov Smirnov test was used to test the normality of numerical variables. Chi Square test was used to test the association between categorical variables. Fissure exact test was used if violation of the assumptions. Independent sample t test was used to test the difference of a numerical variable between 2 groups if parametric and Mann Whitney if nonparametric. P value less than 0.05 was considered statistically significant.

RESULTS

We recruited 52 patients; their median age was 59 (56 – 60) years old. 55.8% of them (29 patients) were males. Their mean BMI was 29.97 ± 5.64 kg/m2. 38.5% of them (20 patients) were diabetic. 44.2% of them (23 patients) were hypertensive. 96.1 % of them (49 patients) were cirrhotic. 38.5% of them (20 patients) were active smokers. 7.7% of them (4 patients) were ex-smokers.

We found that postoperatively, there was no deterioration in renal functions; median urea was 23.1 (19.4 – 27.2), median creatinine level was 0.8 (0.6 – 0.9). For hepatic function, there was a slight elevation of both ALT and AST; 84 (68 – 101.5), 84.5 (60.25 – 131.75) respectively. Otherwise; hepatic functions were normal; Median total bilirubin was 1.12 (0.83 – 1.38), median albumin was 3.4 (3.03 – 3.8) **(Table 1)**.

Table (1): The sociodemographic characteristics and postoperative laboratory investigations of the included patients (n=52)

Variable	N (%)
Age	59 (56 – 60)*
Gender Male Female	 29 (55.8) 23 (44.2)
BMI	29.97 ± 5.64**
DM	20 (38.5)
HTN	23 (44.2)
CLD	49 (96.1)
Smoker	20 (38.5)
Ex-smoker	4 (7.7)
*** Median (Q1 – Q3)** **** mean ± SD**	
	Median (Q1- Q3)
WBCs	7.96 ± 2.17*
Platelets	169 (138.5 – 234.8)
PT	16.85 (15.09 – 18.4)
AST	84.5 (60.25 – 131.75)
ALT	84 (68 – 101.5)
ALK	73.5 (61.75 – 106.75)
Total bilirubin	1.12 (0.83 – 1.38)
Albumin	3.4 (3.03 – 3.8)
Creatinine	0.8 (0.6 – 0.9)
Urea	23.1 (19.4 – 27.2)
*** Mean ± SD**	

Complications:

Postoperatively, we found that bile leakage was the most common complication which was prevalent in 13.5% of patients (7 patients). Renal failure occurred only in one case which represents 1.9% of cases. Neither pulmonary infection, ascites, subphrenic abscess, pleural effusion, biliary stricture, wound dehiscence, intestinal obstruction, intra-abdominal bleeding was recorded among cases **(Table 2)**.

Table (2): Postoperative complications for the included patients (n=52)

Variable	N (%)
Pulmonary infection	0
Ascites	0
Subphrenic abscess	0
Pleural effusion	0
Biliary stricture	0
Wound dehiscence	0
Intestinal obstruction	0
Intra-abdominal bleeding	0
Renal failure	1 (1.9)
Bile leak	7 (13.5)

Biliary complications vs risk factors:

We found that bile leakage as a complication of liver resection operations was mutually present between males and females. 13.8% of males (4 patients) vs 13 % of females which represents 3 patients suffered from biliary leakage. We also found that age was not a significant predictor of biliary complications occurrence (p=0.069). Comorbidities also were not significantly associated with biliary leakage occurrence. 20% of diabetics (4 patients) vs 13% of hypertensive patients (3 patients) got biliary leakage (p=0.408, p=1.00) respectively. Despite that mean BMI was lower among complicated patients compared to the other group (26.72 ± 5.77 vs 30.47 ± 5.51), this was statistically insignificant (p=0.102). On the other hand, Child-Paugh classification was found to be significantly associated with biliary leakage occurrence (p=0.038). 40% of patients classified as Child Paugh C suffered **(Table 3)**.

Table (3): The association between biliary leakage and sociodemographic characteristics

Variable	Biliary leakage		P value
	Complicated (n=7)	Non complicated (n=45)	
Age	59 (56 – 60)	60 (59 – 60)	0.069 M
Gender Male Female	 4 (13.8) 3 (13)	 25 (86.2) 20 (87)	1.00 F
BMI	26.72 ± 5.77	30.47 ± 5.51	0.102 T
DM	4 (20)	16 (80)	0.408 F
HTN	3 (13)	20 (87)	1.000 F
Smoking Yes No Ex-smoker	 2 (10) 4 (14.8) 1 (25)	 18 (90) 23 (85.2) 3 (75.1)	0.572 F
Child Paugh A B C	 0 5 (16.1) 2 (40)	 16 (100) 26 (83.9) 3 (60)	0.038 F
M; Mann Whitney U test F; Fissure exact test T; Independent sample T test			

Relation between bile leakage and hospital parameters:

We found that ICU stay was not significantly different both groups (p=0.929). on the other hand, we found that biliary leakage was associated with significantly more hospital stay compared to the other group (8 (6-9) vs 6 (4-10)) **(Table 4)**.

Table (4): Showing the association between biliary leakage and both ICU stay, and hospital stay for the included patients (n=52)

Variable	Biliary leakage		P value
	Complicated (n=7)	Non complicated (n=45)	
ICU Stay	2 (1-2)*	2 (1-4)*	0.929 M
Hospital stays	8 (6-9)*	6 (4-10)*	0.006 M
*** Median (min-max)** **M; Mann Whitney U test.**			

Management:

For management of cases with biliary leakage, all 7 cases were diagnosed clinically by having bile collected within drains. By US there was collection of bile around the surface area of the liver. They were all treated by inserting pigtail into the site of collection to relieve the biloma. Only 2 cases required ERCP to control the large amount of bile and they were all improved.

DISCUSSION

Regarding the risk factors of biliary complication after hepatic resection, we evaluated the following risk factors, including patients' age, gender, body mass index (BMI), diabetes mellitus (DM), hypertension (HTN), chronic liver disease (CLD), smoking status, and the child-Paugh classifications (A, B, C).

The analysis of the study revealed that a significant results regarding the child-Paugh classification as a risk factor with P value of 0.038. However, no significant difference in terms of patient age (P = 0.069), gender (P = 1.0), BMI (P = 0.102), DM (P = 0.408), HTN (P = 0.1), and smoking status (P = 0.572).

A similar comparative study conducted by *Cho et al. (2011)* also showed no significant difference between age and postoperative live resection. They concluded that liver resection could be performed in patients aged ≥ 70 years as safely as in younger patients. This provides substantial evidence for not considering the patient's age as a risk factor for biliary complications after hepatic resection.

Elderly patients after liver resection have as much benefit as younger participants. Evidence reports equivalent survival benefits for older and younger participants after liver resection of colorectal metastasis and hepatocellular carcinoma *(Adam et al., 2010 and Kondo et al., 2010)*.

We found no significant result regarding the patients' gender and biliary complication with a P-value of 1.0. However, unlike our results, biliary complications were associated with the male gender than females reported by *Erdogan et al. (2012)*. *Erdogan et al. (2012)* reported that postoperative bile

leakage occurred in 6.8% of patients (16/234). In univariate analysis, male gender (P = 0.037). These results can be justified that the predisposition of more biliary leakage in males may result from late presentation in males.

We agree with *Kayaalp et al. (2010)* who reported that gender was not a risk factor for biliary fistula (P = 0.64). The incidence of bile leakage after hepatic resection in our study (7.2%) was consistent with data in previous reports *(Nakai et al. 2010 and Tanaka et al. 2011)*.

We found a significant difference in CP classification as a risk factor for biliary complications after hepatic resection. Some studies *(Garrison et al., 2010 and Mansour et al., 2010)* report that Child class A patients have a 10% mortality rate, Child class B patients have a 30% mortality rate, and Child class C patients have a 70 to 80% mortality rate. We agree with their results. In a meta-analysis of a comparative study conducted by *Peng et al. (2016)*, CP score had a significantly higher specificity than MELD (Model for end-stage liver disease) score.

Regarding the rest of risk factors, including BMI, DM, and HTN. Our result showed no significant difference regarding all of them as risk factors. The current literature agrees with our results. However, in a case-control study on assessing the liver resection in obese patients with high BMI *(Viganò et al. 2011)*, they reported that obese patients have increased postoperative morbidity after liver resection compared to non-obese patients. Obesity may negatively impact surgical outcomes through associated co-morbidities, such as cardiovascular and pulmonary diseases and diabetes *(Berkalp et al., 2010 and Viganò et al., 2011)*.

Bile leakage is one of the most common complications after hepatic surgery. It is associated with an increased sepsis and liver failure rate, higher postoperative mortality, and longer in-hospital stay. Bile leakage was defined as the drainage of 50 mL or more of bile from the surgical drain or the drainage of an abdominal collection across3 days or more *(Strasberg, 2010)*.

We found that bile leakage had an increased risk in hepatic resection patients. Biliary leakage was prevalent among our studied participants in our study (13.5%). However, there was no significant ICU indication after biliary leakage. Co-morbidities were not significantly associated with biliary leakage occurrence, but there were significant results in terms of hospital stay with a significant P-value of 0.006.

A previous retrospective study conducted by *Capussotti et al. (2010)* showed similar results regarding the biliary leakage after hepatic resection. Their results showed that postoperative bile leakage occurred in 22 (3.6%) of 610 patients. *Capussotti et al. (2010)* suggested that the use of fibrin glue on the raw cut surface of the liver after resection had a protective effect on the incidence of bile leakage.

Bile leakage after hepatectomy is still one of the most frequently reported complications after liver resection, with incidences reported in the literature of 3.6% in patients without biliary anastomoses to 33% in patients with

cholangiocellular carcinoma also without biliary reconstruction. The risk factors for bile leakage have been already extensively described in several studies *(Hoekstra et al., 2012)*.

Reported independent factors that were correlated with the occurrence of bile leakage were: (1) exposure of Glisson's sheath on the cut surface (caudate lobectomy, central bisectionectomy, and right anterior retinectomy); (2) resection of segment 4; (3) a cut surface area ≥57.5 cm2; (4) repeated hepatectomy; (5) intraoperative blood loss ≥775 ml; (6) intraoperative bile leakage; (7) prolonged operative time ≥300 min; (8) peripheral cholangiocarcinoma, and (9) preoperative chemoembolization *(Hoekstra et al., 2012)*.

Previous studies on the safety of major liver resections in elderly patients cite morbidity and mortality rates of approximately 30 to 40% and 4 to 5%, respectively *(Menon et al. 2010 and de Liguori Carino et al., 2012)*. The direct consequences of postoperative bile leakage are prolonged hospital stay and increased morbidity and mortality *(Lam et al., 2010)*.

Typically, normal AST ranges between 10 to 40 units per liter and ALT between 7 to 56 units per liter. Mild elevations are generally considered to be 2-3 times higher than the normal range. In some conditions, these enzymes can be severely elevated, in the 1000s range *(Siow et al., 2016)*.

In our study, we found liver enzyme elevation postoperatively. There was a slight elevation of ALT and AST, with values representing 84 (68 – 101.5) and 84.5 (60.25 – 131.75), respectively.

Olthof et al. (2016) Transaminase levels peaked during the first 24 h after surgery and usually receded towards baseline values five days after surgery. Peak ALT and AST levels depended on the type of resection performed. Postoperative peak ALT and AST levels correlated with intraoperative vascular inflow occlusion (VIO) duration. Peak ALT and AST levels were highly predictive for 90-day mortality in several subgroups of patients.

Previous researchers have shown the relationship between peak AST or ALT and postoperative outcomes, but the kinetics of the transaminases changes with lethal Post-hepatectomy Liver Failure (PHLF) have been well studied. *Boleslawski et al. (2014)* reported that postoperative peak-ALT or -AST were not associated with postoperative outcomes, 24 and the authors concluded that peak-ALT or -AST should not be considered as a surrogate of ischemia-reperfusion injury *(Boleslawski et al. 2014 and Olthof et al. 2016)*.

CONCLUSION

Postoperative transaminase levels are independent predictors of postoperative morbidity and mortality and therefore are clinically relevant. Transaminase levels usually peak during the first 24 h after surgery and thus possess early prognostic power in postoperative mortality. Elevated liver enzymes represent a risk factor for biliary complications and leakage after hepatic resection. However, the patients' age, male gender, BMI, DM, HTN, and smoking status do not represent risk factors for biliary complications after hepatic resection. Liver resection can be performed in patients aged ≥ 70 years as

safely as in younger patients as the age does not correlate with postoperative complications.

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المضاعفات الصفراوية التابعة لاستئصال الكبد

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خلفية البحث: الاستئصال الكبدي ضروري لإدارة العديد من أنواع الأمراض، سواء كانت خبيثة أو حميدة. إنه يوفر العلاج العلاجي الوحيد المحتمل للعديد من الأورام الخبيثة الكبدية الأولية والثانوية. يجب مراعاة التخطيط لاستئصال الكبد على أنه طبيعة الآفة وموقعها داخل الكبد، وتشريح المريض، ونوعية وحجم أنسجة الكبد التي ستبقى بعد الاستئصال. تحسنت النتائج المحيطة بالجراحة لاستئصال الكبد بسبب التقنيات الجراحية الأفضل التي تستفيد من التشريح الجزئي للكبد، وتقنيات محسنة للسيطرة على النزيف، وتقليل فترة البقاء في العناية المركزة. يرتبط الاستئصال الكبدي الذي يتم إجراؤه في مراكز كبيرة الحجم من قبل جراحين مدربين تدريباً خاصاً على القنوات الصفراوية بنتائج أفضل.

الهدف من البحث: التحقيق في المخاطر ما بعد العملية – وتم الدراسة مع فريق متعدد التخصصات لأمراض الكبد والزرع حيث تكون نسبة الوفيات الناتجة عن استئصال الكبد أقل من 1 ٪ - بالإضافة إلى تطوير درجة بسيطة تتنبأ بمخاطر حدوث مضاعفات.

المرضى وطرق البحث: كانت هذه دراسة إستباقية، خضع 52 مريضًا من كلا الجنسين، فوق سن 12 عامًا، يعانون من أمراض الكبد المزمنة بسبب ورم حميد أوخبيث، لاستئصال الكبد وإدارة ما بعد الجراحة لمضاعفات القنوات الصفراوية في قسم الجراحة المعهد القومي للكبد - مصر.

نتائج البحث: فيما يتعلق بالنتائج التي توصلنا إليها، وجدنا أنه بعد الجراحة، لم يكن هناك تدهور في وظائف الكلى. بلغ متوسط اليوريا 23.1 (19.4 - 27.2)، وكان متوسط مستوى الكرياتينين 0.8 (0.6 - 0.9). كان هناك ارتفاع طفيف في كل من ALT و AST؛ 84 (68 - 101.5)، 84.5 (60.25 - 131.75)، على

التـــوالي. خـــلاف ذلـــك، كانـــت وظـــائف الكبـــد طبيعيـــة. كـــان متوســـط إجمـــالي البيليـــروبين 1.12 (0.83 - 1.38)، وكان متوسط الألبومين 3.4.(3.8 - 3.03)

فيمـــا يتعلـــق بمضـــاعفات مـــا بعـــد الجراحـــة، اكتشـــفنا أن تســـرب الصـــفراء هـــو أكثـــر المضـــاعفات شـــيوعًا والـــذي كـــان ســـائدًا فـــي 13.5٪ مـــن المرضـــى (7 مرضـــى). حـــدث الفشـــل الكلـــوي فـــي حالـــة واحـــدة فقـــط والتـــي تمثـــل 1.9٪ مـــن الحـــالات. لـــم يـــتم تســـجيل أي خطـــر مـــن العـــدوى الرئويـــة، الاستســـقاء، الخـــراج تحـــت الفرينـــي، الانصـــباب الجنبـــي، التضـــيق الصـــفراوي، تفـــزر الجـــرح، انســـداد الأمعـــاء، نزيـــف داخـــل الـــبطن بـــين الحـــالات. فيمـــا يتعلـــق بمضـــاعفات القنـــوات الصـــفراوية، وجـــدنا أن تســـرب الصـــفراء كمضـــاعفات لعمليـــات استئصـــال الكبـــد كـــان موجـــودًا بشـــكل متبـــادل بـــين الـــذكور والإنـــاث. 13.8٪ مـــن الـــذكور (4 مرضـــى) مقابـــل 13٪ مـــن الإنـــاث وهـــو مـــا يمثـــل ثلاثـــة مرضـــى عـــانوا مـــن تســـرب القنـــوات الصـــفراوية. وجـــدنا أيضًـــا أن العمـــر لـــم يكن مؤشرًا مهمًا للمضاعفات الصفراوية.

الاســـتنتاج: تعـــد إرتفـــاع مســـتويات إنزيمـــات الكبـــد مـــا بعـــد الجراحـــة منبئـــات الـــي مخـــاطر والوفيـــات بعـــد الجراحـــة وبالتـــالي فهـــي ذات صـــلة ســـريريًا. عـــادةً مـــا تصـــل مســـتويات انزيمـــات الكبـــد إلـــى الـــذروة خـــلال الـــ 24 ســـاعة الأولـــى بعـــد الجراحـــة، وبالتـــالي تمتلـــك قـــوة تنبؤيـــة مبكـــرة فـــي معـــدل الوفيـــات بعـــد الجراحـــة. تمثـــل إنزيمـــات الكبـــد المرتفعـــة عامل خطر لمضاعفات القنوات الصفراوية والتسرب بعد إستئصال الكبد.

الكلمات الدالة: المضاعفات الصفراوية، إستئصال الكبد، إنزيمات الكبد.