Risk factors for postoperative bile leakage: a retrospective single-center analysis of 411 hepatectomies

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BACKGROUND: The primary focus of the study was to analyze the risk factors for bile leakage after hepatectomy for benign or malignant tumors.

METHODS: A total of 411 patients who had undergone hepatectomy between December 2006 and December 2011 were retrospectively analyzed. The severity of bile leakage was graded according to the ISGLS classification. Twenty-eight pre- and postoperative parameters were analyzed.

RESULTS: The overall bile leakage incidence was 10.2% (42/411). The severity of the leakage was classified according to the ISGLS classification. Bile leakage was detected early in case of abdominal drainage (11.4% vs 1.9%, *P*=0.034). It prolonged the time of hospitalization (16 vs 9 days, *P*=0.001). In all patients, wedge resection was associated with a higher incidence of bile leakage in contrast to anatomical resections (25.6% vs 4.1%, *P*<0.0001) regardless of the underlying liver disease. Furthermore, total vascular exclusion increased risk of bile leakage (*P*=0.008).

CONCLUSIONS: Bile leakage as a major issue after hepatic resection is related to the postoperative morbidity and the hospitalization time. It is associated with non-anatomical resection and a total vascular exclusion.

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KEY WORDS: liver resection; bile leakage; wedge; total vascular exclusion

Introduction

Bile leakage is a common complication of liver resection.[1-3] Despite recent technological advances in hepatobiliary surgery, the constant incidence of bile leakage ranges from 2.6% to 15%.[1-5] There are many factors relating to the increased risk of bile leakage such as preoperative bile leakage, type of resection (anatomical/non-anatomical), segmentectomy of the posterior liver segments (VII-VIII) or segment I, duration of hepatic pedicle clamping, blood loss, types of surgical instruments, parenchyma texture, and chemotherapy toxicity.[5-10] Moreover, with an increased survival rate of patients undergoing hepatic resection for cancer because of the use of new chemotherapy agents, the patients often undergo a repeat hepatectomy, that increases the risk of bile leakage. The aim of the present study was to identify the risk factors relating to the occurrence of bile leakage in patients undergoing hepatectomy.

Methods

Definitions

Bile leakage was defined as the bilirubin concentration in the drain fluid being at least 3 times higher than the serum bilirubin concentration on or after postoperative day 3 or as the need for radiologic or operative intervention resulting from biliary collections or bile peritonitis. Using this criterion, we classified the severity of bile leakage according to its impact on patients' clinical manage-

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ment. Grade A bile leakage causes no change in patients' clinical management. Grade B bile leakage requires active therapeutic intervention but is manageable without re-laparotomy, whereas in grade C, bile leakage re-laparotomy is required.[1]

Surgical resection

Anatomic hepatectomy: if the line of resection follows the limits of one or more functional segments of the liver as defined by the Couinaud classification.[4, 8] Non-anatomic (wedge) hepatectomy: if the line of resection does not follow the limits of one or more functional segments of the liver as defined by the Couinaud classification.[4, 8] Major hepatectomy is defined as the resection of at least three segments of the liver.[4, 8-10]

Patient selection

After approval from the Institutional Review Board of Montpellier University Hospital, retrospectively collected clinico-pathological data of 411 liver resections performed in our institution between December 2006 and December 2011 were reviewed.

All the consecutive patients who had undergone hepatectomy were included, except for those who had undergone liver biopsy, biliary surgery, fenestration or resection of benign cyst, hepatic resection associated with hepatico-jejunostomy and liver transplantation.

The demographic characteristics of the patients were identified. The operative indications were collected and classified as benign tumor, hepatocellular carcinoma (HCC), intrahepatic cholangiocarcinoma, colorectal and non-colorectal liver metastasis, and other primary malignant tumors. The surgical technique, the type of hepatectomy (minor, major, anatomical, non-anatomical), the surgical devices utilized for liver transection, the type and duration of vascular clamping, the hemostatic agent used, and the type and length of drainage were also recorded. The medical records of these patients were retrospectively analyzed for bile leakage-related factors [presentation, length, quantity, quality, management (medical, surgical, endoscopic and/or radiological), complications (fever, pain, abscess, sepsis, pleural effusion) and recurrence]. The length of hospitalization and the mortality rate were collected.

Surgical technique

Routinely, we did not perform magnetic resonance imaging (MRI) preoperatively for the biliary tree. However, in case of cholestasis (increase of gamma glutamyl transpeptidase, alkaline phosphatase, and total bilirubin serum level) or biliary abnormalities (dilated biliary tree at ultrasound or computed tomography), an MRI was performed.

Intraoperative ultrasound was routinely performed in order to detect the lesions described in the preoperative imaging and analyze their contiguity with the vascular structures. During the resection, the hepatic pedicle control was routinely performed. The pedicle clamping was complete in 27.3% of the patients, and selective (right/left) in 4.9%. In only 2.7% of the patients, we performed a complete vascular exclusion of the liver (segment I hypertrophy, giant lesions). The pedicle clamping was intermittent in all patients. The clamping time ranged from 10 to 60 minutes according to the type of resection, the state of underlying liver parenchyma and the instrument utilized for the resection.

During the study period, four senior surgeons performed 411 liver resections (excluding resection of Klatskin tumors and hepatectomy associated with biliary or pancreatic resection). The devices used for liver resection were different according to the practice of surgeons. Hemostasis and bile control were performed by ligation with no absorbable suture (polypropylene 4/0 and 5/0), and/or metal clips. The trans-cystic methylene blue test and/or a trans-cystic cholangiography after surgery were not systematically performed except in case of doubt about a bile duct injury or anatomic abnormalities. A withe lap test was applied for a few minutes on the cut surface of liver resection, to detect biliary leakage in all patients. The hemostatic agents were not applied routinely on the liver transection surface after surgery. A passive drainage is placed close to the cut surface of the liver at the end of the operation. This drain was left in place, on average, 3 to 5 days except in case of complication.

Statistical analysis

Parametric and nonparametric data were expressed as mean±standard deviation and median (range), respectively. Primary endpoints included patient survival. Statistical analysis was performed according to the Kaplan-Meier method and resulting curves were compared using the log-rank test. Univariate analysis was performed to identify factors associated with the incidence of bile leakage. A multivariate logistic regression analysis was performed, including variables associated with the occurrence of bile leakage with a P value less than 0.20. A difference was considered statistically significant when a P value less than 0.05. All statistical analyses were performed using the SPSS® statistical package (SAS Institute, Cary, NC, USA).

Results

Study population

The cohort consisted of 411 patients including 240 (58.4%) males and 171 (41.6%) females. The median age was 60