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Laparoscopic liver resection with selective prior vascular control

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Abstract

BACKGROUND: Selective control of vascular inflow can reduce blood loss and transfusion rates and may be particularly efficient in laparoscopic liver resection (LLR). The aim of this study was to evaluate the efficacy of selective prior vascular control (PVC) in patients undergoing laparoscopic or open liver resections (OLR).

METHODS: Between 1999 and 2008, 52 patients underwent LLR with PVC with prospective data collection and were compared with patients undergoing OLR with PVC.

RESULTS: There was no difference in the operative time between the 2 groups. Blood loss and transfusion rates were lower in patients who underwent LLR (367 vs 589 mL, $P = .001$; 3.8% vs 17.3%, $P = .05$, respectively). Morbidity did not differ significantly between the 2 groups. Hospital stay was longer in the OLR group (11.0 vs 7.4 days, $P = .001$).

CONCLUSIONS: PVC during LLR was feasible and improved intraoperative and postoperative results. Selective PVC should be obtained in LLR whenever possible.

Blood loss during liver resections affects perioperative morbidity and mortality.[1] Perioperative blood transfusions are also associated with a higher rate of recurrence and lower survival after the resection of colorectal liver metastases[2] and hepatocellular carcinoma.[3] The following surgical procedures can decrease blood loss and the need for transfusion considerably: the use of low central venous pressure,[4] new hemostatic devices for parenchymal transection,[5,6] and the control of vascular inflow[5,7] and outflow[8] before liver division. Clamping of the hepatic pedicle (the Pringle maneuver) may induce ischemic lesions in the future remnant liver, particularly in cases of underlying liver disease.[9,10] Such ischemic lesions may be prevented to some extent by intermittent portal triad clamping[11] or liver ischemic preconditioning.[12] Selective hemihepatic vascular occlusion of the liver results in similar blood loss and transfusion requirements to clamping of the total portal pedicle.[13] Furthermore, selective clamping causes no ischemic injury in the remnant liver and may be particularly useful in laparoscopy because of the longer duration

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of parenchymal transection. The clamping of the portal pedicle for longer periods may induce larger ischemic liver lesions.

In laparoscopy, selective vascular control is facilitated by image magnification, allowing a very precise dissection of the portal pedicle, sectorial, and even segmental branches. The positive pressure of the pneumoperitoneum may also play an additional hemostatic role. Thus, laparoscopic liver resection (LLR) with inflow vascular ligation before transection may be associated with lower levels of blood loss than laparotomy. The aim of this retrospective comparative study was to evaluate the efficacy of selective prior vascular control (PVC) in patients undergoing laparoscopic or open liver resections.

Methods

Between 1999 and 2008, 52 patients underwent LLR with PVC (right hepatectomy in 50%, left hepatectomy in 3.8%, and left lateral sectionectomy in 46.2%). Segmental and nonanatomic resections were performed without PVC (Table 1). The selection criteria for laparoscopic resection were tumors well clear from the portal pedicle or hepatic veins, an American Society of Anesthesiologists score less than or equal to 3, compensated cirrhosis or noncirrhotic liver, esophageal varices less than or equal to 1, and a platelet count greater than or equal to 80×10^9/L. We compared patients undergoing laparoscopy with PVC with patients undergoing open surgery with PVC selected from our liver resection database. The patients from the laparoscopy and open groups were matched for sex, age, American Society of Anesthesiologists score, type of liver resection, presence and severity of liver disease, and tumor size.

Operative and perioperative management

Surgical technique, postoperative care, clinical data collection, and histologic analysis were performed as previously described.[14–17] Our surgical technique is similar for open liver resection and LLR, particularly for anatomic liver resections. Indeed, in anatomic resections, portal vessels and hepatic veins were controlled and divided before parenchymal transection. In right hepatectomy, the right sectorial branch of the portal vein and the right branch of the hepatic artery were dissected outside the liver parenchyma and divided.[18] For left hepatectomy, the left portal branch and the left branch of the hepatic artery were also controlled extraparenchymally and divided (Fig. 1). Left lateral sectionectomies were performed with prior control of the portal pedicle for segments II and III separately. The hepatic vein concerned was also controlled before parenchymal transection.

For LLR, we used an entirely laparoscopic technique with 5 ports, a 10- to 12-mm Hg pneumoperitoneum, a 0° laparoscope, and a robotic camera holder. Parenchymal transection was performed by ultrasound dissection (Ultracision; Ethicon, Issy les Moulineaux, France) or thermofusion (Ligasure; Covidien, Elancourt, France). Bipolar coagulation was used to treat minor bleeding.

Table 1 Types of liver resection for patients undergoing laparoscopic hepatectomy with and without PVC

	With PVC (n = 52)	Without PVC (n = 36)
Right hepatectomy, n (%)	26 (50.0)	0
Left hepatectomy, n (%)	2 (3.8)	0
Left lateral sectionectomy, n (%)	24 (46.2)	0
Trisegmentectomy V-VI-VII, n (%)	0	1 (2.8)
Bisegmentectomy V-VI, n (%)	0	2 (5.5)
Segmentectomy, n (%)	0	12 (33.3)
Segmentectomy I, n (%)	0	2 (5.5)
Segmentectomy IV, n (%)	0	1 (2.8)
Segmentectomy V, n (%)	0	7 (19.5)
Segmentectomy VI, n (%)	0	2 (5.5)
Atypical, n (%)	0	21 (58.4)

PVC = prior vascular control.

Study criteria

The surgical variables evaluated were the duration of the intervention, blood loss, transfusion rate, conversion rate, and resection margin. The postoperative variables assessed were specific and overall morbidity, perioperative mortality, and length of hospital stay. Postoperative complications were classified as specific liver-related complications (ie, cirrhotic decompensation, hemorrhage, or biliary collection) and general complications. Complication severity was stratified according to the modified Clavien classification.[19]

Statistical analysis

Matching and statistical analyses were performed with NCSS 2007 software (NCSS, LLC, Kaysville, UT). Continuous variables were expressed as means ± standard deviation and were compared by using the Mann-Whitney U test. The Fisher exact test was used for comparisons of categoric variables. Values of $P < .05$ were considered statistically significant.

Results

Demographic parameters

Fifty-two patients underwent laparoscopic liver resection with PVC and were compared in a case-match analysis with 52 patients retrospectively selected from our open surgery database. The 2 groups of patients were also similar in terms of body mass index, preoperative liver blood test results, and histologic type of resected tumor (benign/malignant) (Table 2).