HPB, 2007; 9: 319–323

informa healthcare

TECHNICAL REPORT

Use of radiofrequency hepatic parenchymal transection device in hepatic hemangioma resection: early experience and lessons learned

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Abstract
Background. Control of intraoperative hemorrhage represents a significant challenge in hepatic surgery, particularly during resection of large, hypervascular hepatic hemangiomata (HH). Various devices to minimize blood loss from hepatic parenchymal transection are currently under investigation. Herein, we present our experience with a radiofrequency (RF)-powered multiarray for resection of HH. *Patients and methods.* From September 2005 to January 2006, we conducted a retrospective review of our hepatobiliary database to identify patients with symptomatic giant cavernous HH undergoing resection with a RF multiarray device. The purpose of this review was to assess the technical aspects of using RF energy to assist in the resection of HH. *Results.* The extent of operation varied depending on the size and location of the tumor. Two patients underwent two atypical subsectionectomies and two underwent trisectionectomies. The Habib™ sealer provided a safe and effective method for hepatic parenchymal transaction. No patients required blood transfusion, and no injuries to major biliary or vascular strictures were observed at 1 year follow-up. A seroma developed in one patient 6 months postoperatively, but was drained percutaneously. *Conclusions.* Hepatic parenchymal transection with the Habib sealer device is a feasible approach to resect HH. Further study is needed to objectively compare the efficacy of RF-assisted parenchymal transection with that of traditional parenchymal transection techniques.

Key Words: *hepatic hemangioma, liver resection, RFA, Habib™ sealer*

Introduction

Hepatic surgery has undergone a dramatic evolution in the past quarter century. Once burdened with prohibitively high morbidity and mortality, hepatic resection is now considered a safe standard of care in appropriately selected patients with hepatic tumors. Advances in surgical technique, anesthesia, and critical care have reduced operative mortality to $<5\%$ in most major academic centers [1]. While several less invasive liver-directed therapies have emerged, hepatic resection is the only potentially curative treatment option in patients with malignant or symptomatic benign hepatic tumors. Nevertheless, liver surgery remains a potentially high-risk procedure requiring a great deal of operative experience and technical expertise.

Of chief concern among hepatic surgeons is the potential for intraoperative blood loss associated with liver resection. According to a recent review, the average estimated blood loss from hepatic resection in high volume centers approached as much as 500 ml [2]. Several strategies – including low CVP anesthesia, the Pringle maneuver, and total hepatic vascular exclusion – are presently employed to minimize hemorrhage during hepatic resection. In addition, specialized hepatic parenchymal transection devices such as the ultrasonic aspirator, jet dissector, ultrasonic shears, bipolar vessel sealer, linear endocutter, and saline-enhanced radiofrequency (RF) dissecting sealer have been developed to promote hemostasis during resection.

Recently, another device called the Habib™ sealer was introduced as a potentially useful tool to minimize blood loss during hepatic resection. This RF sealer employs RF energy to facilitate relatively ‘bloodless’ parenchymal dissection. Habib et al. first described its use in 2001 [3]; they showed that by creating a 2–3 cm wide zone of coagulative necrosis, RF energy provided a charred, avascular bed that could be sharply divided with minimal blood loss during parenchymal dissection. While previous

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(Received 29 March 2007; accepted 14 May 2007)

ISSN 1365-182X print/ISSN 1477-2574 online
DOI: 10.1080/13651820701457984

studies demonstrate the utility of the Habib™ sealer for resection of malignant hepatic tumors, no reports exist on the potential role of the device in resection of benign vascular liver lesions. Herein, we present four patients with symptomatic hepatic hemangioma (HH) who underwent RF-assisted parenchymal transection with an RF-powered parenchymal transection device.

Surgical technique

Initial exposure and mobilization of the liver were performed in standard fashion. Briefly, the abdomen was entered using a right subcostal 'hockey stick' incision. The falciform ligament was divided and ligated. A self-retaining retractor was placed to retract the costal margin to provide optimal exposure. The ligamentous attachments to the right and left liver lobes were divided as needed, and the triangular ligament was released, exposing the ipsilateral hepatic veins.

The gastrohepatic ligament was then incised and the portal region explored. All visible arteries supplying the lobe that contained the hemangioma were ligated with suture, resulting in dermacation and reduction in the size of the hemangioma. A vessel loop was placed around the porta hepatic to facilitate a Pringle maneuver. Further mobilization of the liver was performed posteriorly off the retroperitoneum to expose the vena cava. After exposure, mobilization, and vascular control of the liver were complete, a cholecystectomy was performed in top-down fashion.

While the preceding operative steps were unchanged from our standard approach to hepatectomy, the next stage in the operation – parenchymal transection – differed substantially. After mapping the course of hepatic veins and margins of the hemangioma with intraoperative ultrasound, we used the Habib™ RF device to create a coagulative plane just outside the hemangioma. The RF generator was set to an energy setting of 70 W and the electrode was applied to the hepatic parenchyma, delivering current to the tissue to induce coagulation necrosis. Once the plane of coagulation was created, the parenchyma was cut with a straight scalpel. During the course of transection, careful attention was paid to the hepatic vasculature and biliary ducts encountered in the field of resection. All hepatic veins >3 mm and suspected biliary structures at the plane of transection were suture ligated. Minor bleeding from the cut surface of the parenchyma was coagulated with an argon beam. The transection plane was then closely inspected for biliary leaks. A clean white laparotomy sponge was applied to the cut surface. The cystic duct was cannulated with a catheter and the distal porta hepatic occluded while methylene blue dye was injected to assess for the presence of bile leak. After hemostasis was assured, the abdomen was closed in standard fashion.

Results

Four patients with symptomatic (pain, gastric compression) giant cavernous HH underwent RF parenchymal transection using the Habib™ sealer device. The extent of resection varied among the patients, with two patients undergoing atypical subsectionectomies, one undergoing lobectomy, and one trisectionectomy. Standard mobilization of the liver and control of inflow and outflow vessels were required for the treatment of these large hemangiomas. (See Figures 1–3 and Table I.)

Several technical principles were rigorously adhered to during parenchymal transection with the RF device. Before entering parenchyma feeding arteries were ligated. First, all hepatic veins >3 mm in diameter in the plane of transection were suture ligated. This minimized the 'heat sink' effect of blood flow, resulting in optimal delivery of energy to the tissue. Second, all biliary structures >2 mm in diameter were suture ligated. Strict adherence to this criterion resulted in no observed biliary leaks either intraoperatively or postoperatively. In addition, we performed the majority of our ablations at a power setting of 70 W. Early on in our experience, we used

Figure 1. Giant cavernous hepatic hemangioma in right hepatic lobe.

Figure 2. Parenchymal transection using the Habib™ needle.