Laparoscopic Radiofrequency-Assisted Liver Resection (LRR): A New Technique for Minimally Invasive Liver Resection

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INTRODUCTION

The widespread adoption of minimally invasive techniques for liver resection has been slow due to a number of technical hurdles. Among these challenges, hemostatic parenchymal transection remains a major barrier to routine laparoscopic liver resection, particularly in cirrhotic patients.

Recently, radiofrequency energy has been employed in conventional liver surgery to ablate tissues at the hepatic resection line prior to parenchymal transection (*Stella et al., 2003, Weber et al., 2002*). After ablating a line of resection, coagulated tissue may be divided with a scalpel or cautery with minimal blood loss. While radiofrequency energy does not effectively coagulate high-flow arterial and venous branches, intraoperative ultrasound may be used to place RFA probes away from major pedicles.

InLineTM radiofrequency coagulation (ILRFC) (Resect Medical, Fremont CA) is a new technique in which multiple RFA electrodes may be simultaneously employed to rapidly coagulate a resection plane (*Haghichi et al, 2004*). We have used this technology to facilitate hemostatic laparoscopic-assisted liver resection.

CASE REPORTS

Patient A is a 35 yo man with Hepatitis B and Childs A cirrhosis who was found to have elevated serum alphafetoprotein (ADP) on routine screening. An MRI demonstrated a multilobular lesion in the left lateral segment with cirrhotic changes in the remaining liver (Figure 1)

Patient B is a 56 year-old man with a history of alcohol abuse and an incidental 4cm left liver mass. MRI characterized a 4.4 cm T1 hypointense lesion in segment 2 of the liver, with irregularities in the remaining liver suggesting cirrhosis.

Figure 1: MRI, T1-weighted image, showing 4cm hypointense lesion in left lateral segment (arrow), cirrhotic changes of liver.

TECHNIQUE

Resection was accomplished using a laparoscopic-assisted technique, utilizing the InLineTM radiofrequency coagulation device. A right subcostal hand port was used as well as an infraumbilical 12mm port and a left upper quadrant 10mm port. Nonanatomic resection planes were identified around the mass to achieve a greater than 1cm margin. The hand-assisted technique facilitated proper localization and deployment of electrodes in the ILRFC device (Figure 2).

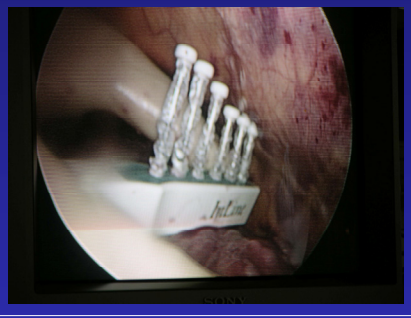

Figure 2: Intraoperative photo of laparoscopic-assisted radiofrequency resection (LRR). Radiofrequency probes are sequentially deployed along the resection line as guided by the surgeon's hand.

Probes were placed full-thickness through the liver along the intended resection line. Ultrasound and palpation were used to guide electrode placement. Radiofrequency energy was applied via a standard RFA generator (RITA, Sunnyvale CA) for three minutes in an amount proportional to the volume of tissue to be coagulated (as estimated by depth of probes). Sequential 3-minute coagulation cycles were used to coagulate the full length of the resection plane. A coagulation plane of approximately 1cm wide by 5cm long by 1-6 cm deep results. Parenchymal division was accomplished with a combination of blunt dissection, cautery, and harmonic scalpel.

Figure 3: Resected specimen. Parenchymal margin demonstrates coagulative necrosis from radiofrequency energy. Parenchymal transection was achieved with cautery (cautery artifact at right, arrow) or a combination of blunt dissection and harmonic scalpel.

OUTCOMES

No transfusions were required. Both patients tolerated a regular diet 24 hours postoperatively. A resected specimen is shown in Figure 3. Both specimens demonstrated hepatocellular carcinoma with negative margins.

DISCUSSION

We have utilized InLineTM Radiofrequency Coagulation (ILRFC) via a subcostal hand port to perform laparoscopic-assisted liver resection in cirrhotic patients. This technique is applicable to both anatomic resection and nonanatomic wedge resection. Potential limitations include difficulty with probe placement at the cephalad resection margin under the diaphragm. There are several potential advantages to this procedure:

- Minimizes blood loss and physiologic insult of surgery in cirrhotic patients
- Right subcostal hand port facilitates mobilization and exposure of liver, allows digital compression, and is adequately situated to allow conversion to an open technique if necessary.
- Utilizes readily available RFA technology with minimal start-up costs
- May be combined with radiofrequency ablation of synchronous liver lesions.

CONCLUSION

By allowing hemostatic parenchymal transection, LRR facilitates the application of minimally-invasive techniques to liver resection.

REFERENCES

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