

ORIGINAL ARTICLE

A new technique for hepatic parenchymal transection using an articulating bipolar 5 cm radiofrequency device: results from the first 100 procedures

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Abstract

Background: Parenchymal transection (PT) still remains a challenge in liver resection. The outcomes of the first experience of a novel vessel-sealer for hepatic transection were assessed.

Methods: A bipolar articulating vessel-sealer (Caiman[®], Aesculap Inc., Center Valley, PA) was used in 100 liver resections through both open (OLR) and laparoscopic (LLR) approaches. All data were prospectively collected into an IRB-approved department database, and clinical, surgical and perioperative parameters were analyzed.

Results: Fifty patients underwent OLR and 50 patients underwent LLR. Eighty hepatectomies were performed for malignancy. Median number of tumors was 1, with the largest focus measuring an average of 5.1 cm. Forty-nine of the procedures were major liver resections. Parenchymal transection time was 29.9 ± 3.1 min in OLR and 29.9 ± 3.6 min in LLR. Median estimated blood loss was 300 cc (Inter-quartile range (IQR) 100–575 cc). Median hospital stay was 6 days for open and 3 days for laparoscopic procedures. Ninety-day complication rate was 8% without any mortality. Bile leak rate was 4%. Staplers were used for parenchymal transection in 16 cases.

Conclusion: This study introduces a new multifunctional device into the armamentarium of the liver surgeon. In our experience, this device facilitated the parenchymal transection by adding speed and consolidating the amount of instrumentation used in liver resection without increasing complications.

Received 23 December 2017; accepted 18 March 2018

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Introduction

Liver resection (LR) remains the gold standard for the treatment of malignant liver tumors, despite the emergence of other locoregional therapies.^{1,2} Over the past decades, perioperative morbidity and mortality have been significantly reduced owing to advances in anesthesia, better understanding of the liver

anatomy, refined surgical techniques in controlling hemorrhage, and improved patient selection in terms of underlying liver function.^{1–4} Parenchymal transection (PT), however, still remains a challenge where the majority of blood loss occurs. For open hepatectomy, in addition to the clamp and crush technique, various different techniques for PT have been described relying on a combination of vessel sealers, ultrasonic aspirators, advanced tissue coagulators, ablative technologies, staplers, and tissue sealants.^{5–17} Due to the limitations of exposure, the number of different techniques used in laparoscopic liver resection is even more diverse, leading to the lack of standardization, inefficiency and increased costs. Acknowledging these challenges, we have been assessing a new articulating radiofrequency device for liver resection with the aim to simplify and

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Aesculap is not involved in any part of this study.

This research was presented as a poster presentation at AHPBA annual meeting 2017.

Dr. Berber is a consultant for Ethicon and Aesculap and he has received honoraria for consulting work.



Figure 1 Photo showing the Caiman bipolar articulating vessel sealer. The device is activated by pushing a round button at the back of the handle. Once the cauterization cycle is over, by pulling the trigger at the handle, the tissue is divided by a knife that is incorporated at the tip

facilitate parenchymal transection over the past 5 years. The aim of this study is to report the perioperative outcomes obtained with this new technique. Our hypothesis was that this device would facilitate parenchymal transection without increasing the complication rate, especially the bile leak rate.

Patients and methods

Between November 2012 and May 2014, a new articulating bipolar radiofrequency device (Caiman, Aesculap Inc., Center Valley, PA) was used in 100 hepatectomies at the Department of

General Surgery, Cleveland Clinic as part of a prospective study and institutional evaluation. All cases were consecutive, except for tumors close to portal pedicles or hepatic veins that required a finer dissection with Cavitron ultrasound surgical aspirator (CUSA). Clinical, operative and postoperative data were prospectively collected into an IRB-approved database.

Operative technique

The technique for LLR in our centre has been previously described.^{18,19} Briefly, in laparoscopic cases, the Caiman device was inserted through a 12 mm trocar. Both laparoscopic and open procedures, after the transection line was marked on the liver capsule, the parenchyma was divided using this device similar to the stapling technique (Figs 1–3). This device uses bipolar radiofrequency energy and was activated as the liver parenchyma was slowly crushed between the jaws. Then, by pulling the trigger at the handle, the tissue was divided. Intra-parenchymal segmental vascular and biliary structures were divided using this device, with staplers and suture ligation reserved for extra-hepatic division of hepatic veins and hilar division of portal vein and hepatic duct branches. The Caiman device was not used to divide the hilar pedicles or main hepatic veins. During the parenchymal transection, the central venous pressure (CVP) was maintained at a low level (1–3 mmHg) to minimize the bleeding from hepatic veins. For both laparoscopic and open resections, inflow occlusion was performed based on the discretion of the surgeon. Resections removing 3 or more

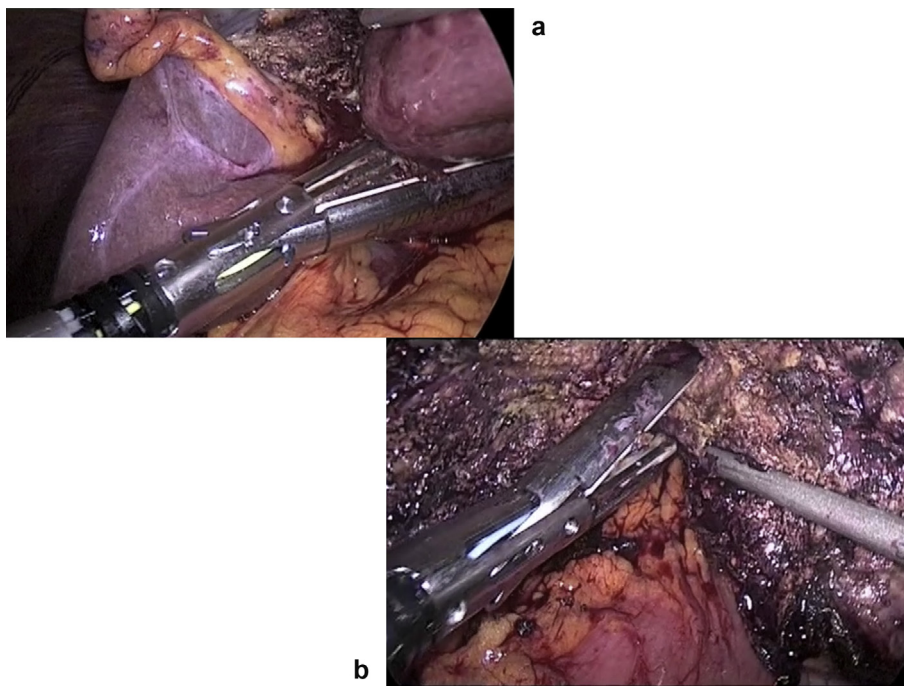


Figure 2 a-b, Intraoperative photo demonstrating the use of the Caiman device in a laparoscopic hepatectomy procedure. After the liver capsule is incised, the device is gently introduced into the liver parenchyma (a). It is activated as the jaws are slowly closed, and when the cycle is over, the parenchyma is divided (b)

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