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A New Instrument for Intrahepatic Access of Glissonian Pedicles During Anatomical Liver Resections

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Abstract

Background. The knowledge of liver anatomy has led to a rapid evolution based on the intrahepatic distribution of the portal pedicle. One great advance in liver surgery was the used of segment-based liver resections. Techniques based with intrahepatic Glissonian access of portal pedicles were described to safely perform anatomical liver resections. *Methods*. We described a standardized intrahepatic access to right and left liver segments' pedicles without hilar dissection for anatomical hepatectomies. In order to improve the intrahepatic Glissonian technique, the authors designed a new atraumatic instrument for liver pedicle retrieval based on the anatomical liver landmarks. *Results*. This new instrument was successfully employed in 17 consecutive liver resections with minimum blood loss and without any complications related to its use. This new instrument, atraumatic retriever, replaces the right angle dissector or Gray clamp. *Conclusions*. The new instrument can slide easily and smoothly around Glissonian pedicle with a simple movement. This new instrument is a useful adjunct for performing intrahepatic access for liver resections. It can also be used to compass delicate anatomical structures such as esophagus and major abdominal vessels. The retriever can further be used in other common situations, including access for Pringle maneuver, encircling proximal esophagus during total gastrectomies or esophagectomies, and access for total vascular exclusion of the liver. This instrument can also be adapted to be used for laparoscopic liver resections.

Keywords

Liver surgery, Glissonian, Anatomy, Instrument, Liver cancer

Introduction

The technique of liver resection has been object of continuous change towards maximum parenchymal preservation with less traumatic surgery such that many centers throughout the world are now reporting liver surgery with minimal morbidity and mortality.[1,2] The knowledge of liver anatomy has led to a rapid evolution based on the intrahepatic distribution of the portal pedicle. We described a standardized intrahepatic access to right and left liver segments' pedicles without hilar dissection for anatomical hepatectomies.[3,4] These techniques are based upon intrahepatic retrieval of the Glissonian pedicles that can be encircled using right angle dissector or Gray clamp. Later on, we described a novel technique for laparoscopic anatomical liver resections. [5,6] In order to improve the intrahepatic Glissonian technique, the authors designed a new atraumatic instrument for liver pedicle retrieval based on the anatomical liver landmarks.

Technique

Prototype Design

Based on the anatomical landmarks determinations for intrahepatic access of Glissonian pedicles previously reported[3-8] we designed an atraumatic liver pedicle retriever.

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This new instrument is a hook with blunt tip and large curvature that helps retrieval of every Glissonian pedicles even the deep located ones (Figure 1).This prototype is based on the shape of the Gray and right angle dissector, instruments that were normally used by the authors for the intrahepatic access. This novel device has a semi-circle hook format with a 4 cm diameter and olive-shaped tip (Figure 1). Its curvature allows a less traumatic and soft introduction into the liver parenchyma (Figure 1). Its tip prevents rupture of intrahepatic structures as Glissonian pedicles and hepatic veins, as it gets around these structures with the surgeon circular and smooth movement (Figures 2 and 3). The final form of this instrument, i.e. its size and angle was based on its utilization during dissection of 28 fresh livers from cadavers with differences in gender, weight and height. Its final form was such that was the most adequate for the majority of livers. This prototype was built in stainless steel and it is currently evaluated for commercial distribution. Its use was approved by the Hospital. Its sterilization is done in standard way together with other stainless steel instruments.

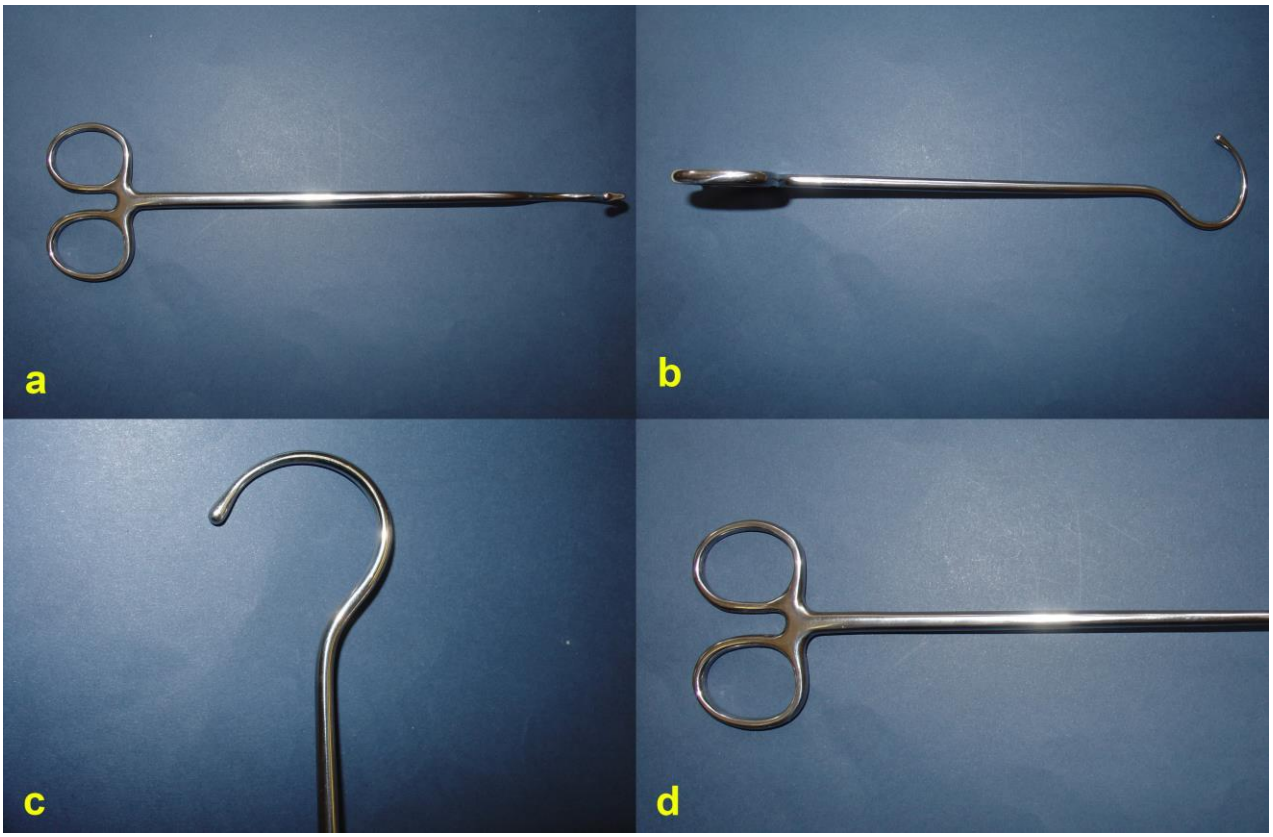

FIGURE 1. Atraumatic retriever for intrahepatic Glissonian approach.

a. Frontal view
b. Lateral view
c. Close-up of the hook
d. Close-up of the handhold

Results

This new instrument was successfully employed in seventeen consecutive liver resections (8 right hepatic pedicle, 4 left hepatic pedicle, one right anterior sectionectomy, two right posterior sectionectomies, two segments 2 and 3 pedicles) with minimum blood loss and without any complications related to its use. After performing the small landmarks incisions in the hepatic surface, the liver pedicle retriever is inserted through the incision sliding around the Glissonian pedicle. The anatomic landmarks for segmental liver resections and hemihepatectomies are described elsewhere. [3,4,9] Once completed the movement, retriever tip is exposed and a rubber tube is attached. Tube is pulled out encircling the pedicle. Glissonian pedicle is then occluded with tourniquet or a cinch, leading to ischemia of the corresponding liver area (Figures 2 and 3). In order to perform segmental resection, the same maneuver is applied but incisions over the hilar plate are differently located. [3,4]

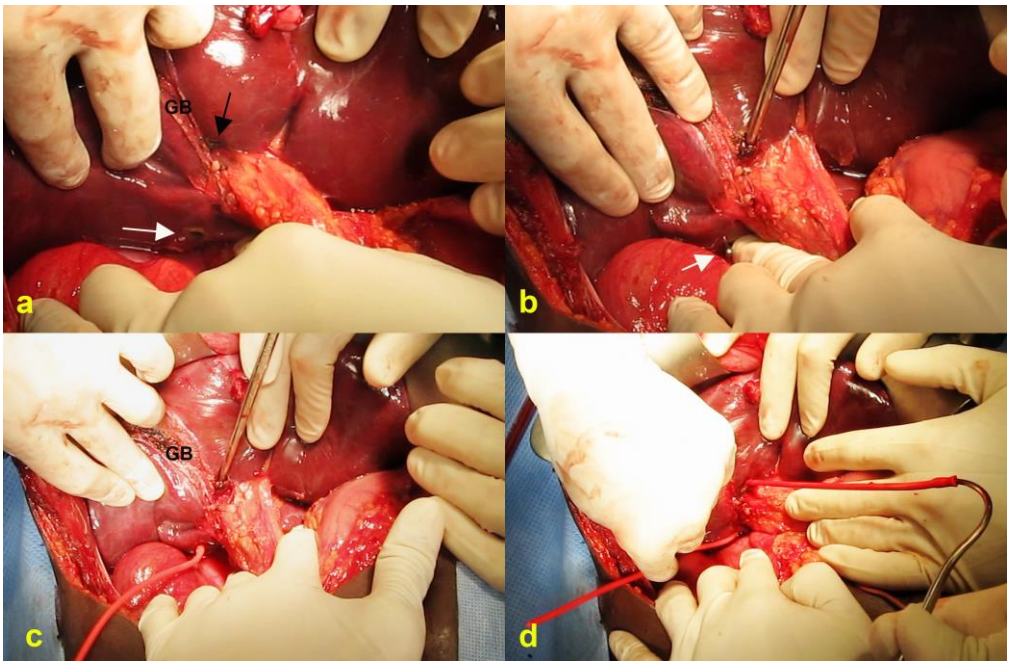

FIGURE 2. Use of the atraumatic retriever during anatomic right hepatectomy.

a. Incisions (white and black arrows) for intrahepatic Glissonian approach of the right main pedicle.
b. Retriever is inserted between these incisions around right main pedicle. Note that there is minimum bleeding and the tip of the instrument is exposed (white arrow)
c. A rubber tube is attached to instrument tip.
d. The retriever is withdrawn and the tape is encircling the right main pedicle. Right pedicle is ready to be occluded and divided.

GB – gallbladder; HP – hilar plate

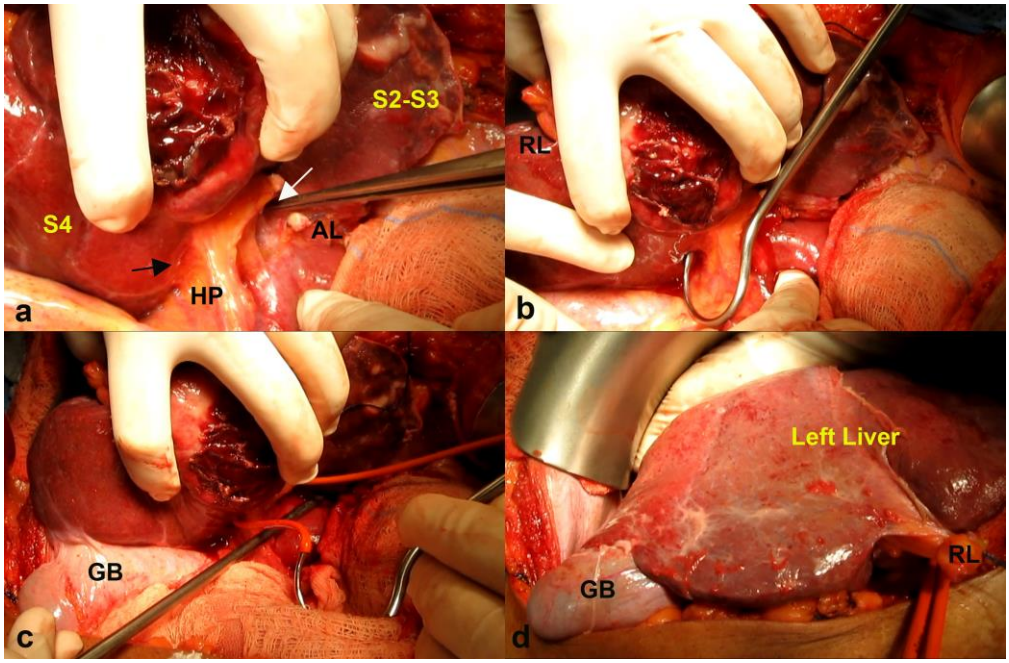

FIGURE 3. Use of the atraumatic retriever during anatomic left hemihepatectomy.

a. Incisions (white and black arrows) for intrahepatic Glissonian approach of the left main pedicle. White arrow shown incision behind Arantius ligament (AL)
b. Retriever is inserted between these incisions around left main pedicle.
c. A rubber tube is attached to instrument tip and retriever is withdrawn. The tape is encircling the left main pedicle.
d. Left pedicle is occluded resulting in ischemic delineation of the left liver (segments 2,3 and 4).

GB – gallbladder; HP – hilar plate; AL – Arantius ligament; RL – round ligament
S4 – segment 4; S2-S3 – left lobe

Discussion

Basis for intrahepatic Glissonian access is retrieval of liver pedicles inside the liver substance. Once encircled, pedicle is occluded and subsequent ischemic demarcation became the limits of planned liver resection. Pedicle is divided between vascular clamps or with vascular stapler. After inflow control of future area of resection, it is possible to proceed with liver transection without Pringle maneuver. Therefore, future remnant remains with continuous arterial and portal flow, reducing ischemic damage to the liver. This technique may result in better liver function after liver resection.

Retrieval of the Glissonian sheaths can be assured by many ways. The first technique was described by Galperin and Karagiulian[7] and posteriorly refined by Launois and Jamieson[8]. It consists in the dissection of the entire hilar plate area with digital maneuvers in order to expose the segmental liver pedicles in the so-called posterior approach technique. Another technique was derived from the latter and described by Machado et al. [3,4] It consists in a systematized way to achieve the same goals without the need of hilar dissection or Pringle maneuver. Specific anatomical landmarks around hilar plate are used and small incisions are performed to disclose segmental Glissonian pedicles. Pedicles are encircled using clamps that were not originally designed for this purpose. Surgical instruments commonly used for this maneuver are a large right angle dissector or a Gray clamp. The main problem with those clamps is that they have a sharp 90° angle that may not encompass the pedicle entirely and also may promote parenchymal rupture that may cause some sort of bleeding. Their curvature does not comprise the complete circumference of the pedicle and therefore the surgeon is required to make an extra effort to

encircle the pedicle. This maneuver is not always easy and comfortable. Another pitfall is that the tip is not blunt and can be hazardous to some small venous branches that may be present. In order to avoid these problems the authors designed a new instrument that may overcome these pitfalls. The goal was to design an instrument that combined high flexibility with ease and safe access to the Glissonian pedicle. This new instrument, atraumatic retriever, replaces the right angle dissector or Gray clamp. The new instrument can slide easily and softly around the Glissonian pedicle with a simple movement. With the increase use of laparoscopy in liver surgery this instrument can be adapted to be used in laparoscopic hepatectomies. The only adaption is to increase the handhold for 35 to 40 cm. It can be inserted through a 5 mm trocar incision without trocar with circular movement. Its laparoscopic use was not done yet.

This new instrument is a useful adjunct for performing intrahepatic access for liver resections. It can also be used to compass delicate anatomical structures such as esophagus and major abdominal vessels. The retriever can further be used in other common situations, including access for Pringle maneuver, encircling proximal esophagus during total gastrectomies or esophagectomies, and access for total vascular exclusion of the liver. This new instrument can easily be adapted for laparoscopic surgery.

Declaration of Conflicting Interests

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