

Application of temporary inflow control of the Glissonian pedicle method provides a safe and easy technique for totally laparoscopic hemihepatectomy by Glissonian approach

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The Glissonian approach, due to its simplicity of procedure, is a technical procedure widely used in open hepatectomy. However, it is not easily applicable in the setting of the total laparoscopic approach because of movement restriction. We herein propose a new and simple method of performing hemihepatectomy by Glissonian approach called temporary inflow control of the Glissonian pedicle (TICGL) technique. Dissection of the Glisson pedicle from the liver parenchyma is done until the posterior margin of the pedicle is visualized, and is clamped with bulldog clamps. Encircling the pedicle is not necessary. Resection of the liver parenchyma is performed under inflow control of the resected side liver providing less bleeding. After sufficient resection is done so that the whole Glissonian pedicle structures are visualized, the pedicle is encircled, often very easily without the fear of bleeding from the posterior side of the pedicle, which is a common problem when encircling is done before parenchymal resection. The staplers may then be applied safely without injuring the major hepatic veins since they have been already exposed. Stapling is done while the tape is retracted toward the contralateral side. This retraction prevents injury or stricture of the contralateral Glissonian pedicle branch. The remnant liver parenchyma is resected and hepatectomy finalized. The TICGL technique provides a safe and easy way of performing major hemihepatectomies, not only by expert laparoscopic surgeons but by less experienced surgeons. It can therefore become a standard method of performing hemihepatectomy by Glissonian approach.

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Key Words: Laparoscopic surgical procedures, Hepatectomy, Hepatocellular carcinoma, Glissonian approach

INTRODUCTION

With the recent advances in laparoscopic procedures, laparoscopic liver resection has been performed more widely during the last decade [1]. However, major hepatectomies, such as right or left hemihepatectomy, still remain a challenge to many, due to its technical difficulty. The Glissonian approach, due to its simplicity of procedure, is a technical procedure widely used among liver surgeons performing open hepatectomies [2,3].

However, because of movement limitations of the instruments during laparoscopic procedures, the Glissonian approach still remains a surgical challenge. Cho et al. [4] proposed the method of an extrahepatic Glissonian approach using Endo Retract Maxi (Covidien Japan, Tokyo, Japan) to encircle the Glisson pedicle and concluded that it is a feasible method. However, despite the aid of the Endo Retract Maxi, many surgeons, especially those with less experience, find it difficult due to the fear of bleeding at the posterior side of the Glissonian pedicle since

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the dissection has to be done blindly. Machado et al. [5] proposed another method of Glissonian approach by adding 2 small incisions on both sides of the Glissonian pedicle in which to insert the stapler. Although feasible in many circumstances, this approach has 2 potential dangers. First, all major hepatic veins lie between the major Glissonian pedicles and an incision at this area may injure the hepatic vein causing troublesome bleeding. Secondly, applying the stapler before parenchymal dissection and exposure of the Glissonian structures may result in injury of the remnant pedicle due to the restriction of vision and motion.

We herein propose a new method of liver resection by Glissonian approach called temporary inflow control of the Glissonian pedicle (TICGL) technique. This technique provides easy Glissonian approach, allows inflow control during parenchymal dissection thus reducing bleeding, and offers maximal safety during stapling. Due to its technical simplicity, it may be performed quickly, easily and safely even by less experienced surgeons.

SURGICAL TECHNIQUE

Right hepatectomy

After the cystic duct and arteries are ligated and divided, the liver is retracted cephalad using the gall bladder by the assistant to obtain good vision of the hilar plate. The Glissonian pedicle is gently dissected away from the liver parenchyma using blunt tip 5-mm suction and bipolar forceps (MicroFrance Medtronics, Minneapolis, MN, USA) until the posterior side of the pedicle is visualized (Fig. 1A). The same dissection is repeated at the inferior side of the pedicle (Fig. 1B).

A gentle leftward traction of the hepatoduodenal ligament by the assistant may offer a better surgical view. Full dissec-

tion or encircling of the Glisson is not necessary and the dissection is done only until the posterior side is visualized since dissection at the posterior part has to be done blindly and may result in troublesome bleeding from injury of the liver parenchyma or Glissonian pedicle. Minor bleeding during the dissection procedure may easily be controlled with bipolar electrocauterization and/or hemostatic agents such as Surgicel (Ethicon Inc., Somerville, NJ, USA). Thereafter, an arterial bulldog clamp (Aesculap Inc., Center Valley, PA, USA) (Fig. 2A) is applied to control the inflow of the pedicle. In cirrhotic patients with a thick Glissonian pedicle, applying an additional bulldog clamp over the first one may afford better inflow control (Fig. 2B). The demarcation between the right and left liver is identified and parenchymal resection is carried out under inflow control [6,7]. After sufficient parenchymal resection is done so that the whole bifurcating Glissonian pedicle is exposed, a nylon tape can be encircled easily and safely using a Goldfinger (Johnson and Johnson, New Brunswick, NJ, USA) around the pedicle without fear of injury to the parenchyma or middle hepatic vein (Fig. 3). The bulldog clamp is now removed and stapling of the whole Glissonian pedicle is done (Fig. 4). A leftward traction of the nylon tape during stapling enables the stapling line to be positioned sufficiently to the right side so that the left-side portal vein or bile duct is not compromised making the stapling very safe.

Left hepatectomy

The same surgical procedures as with right hepatectomy may be taken during left hepatectomy. During left hepatectomy, there may be anatomic variations where the anterior or posterior Glissonian pedicle joins the left main pedicle separately so it is imperative that the Glissonian structures are fully exposed before stapling of the main left pedicle. The TICGL

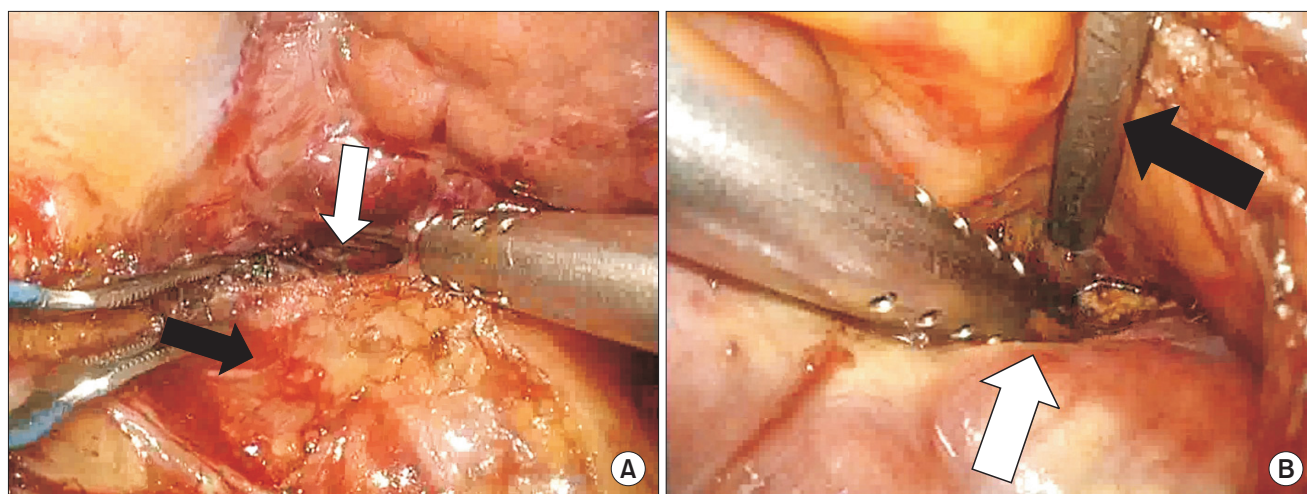


Fig. 1. The right Glissonian pedicle (black arrow) is detached from the liver surface (white arrow) by blunt dissection using bipolar clamp and suction at the superior (A) and inferior plane (B).

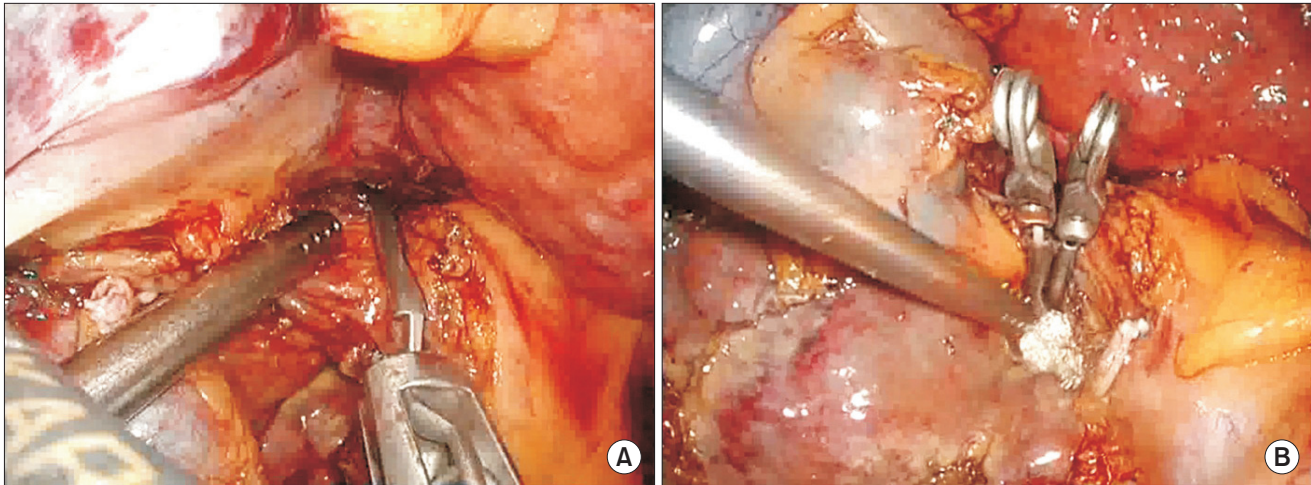


Fig. 2. (A) Arterial bulldog is applied on the Glissonian pedicle. (B) Additional bulldog may be applied for maximal inflow control especially in cirrhotic livers with thick pedicle. Hemostasis of minor bleeding is easily achieved with hemostatic agents.

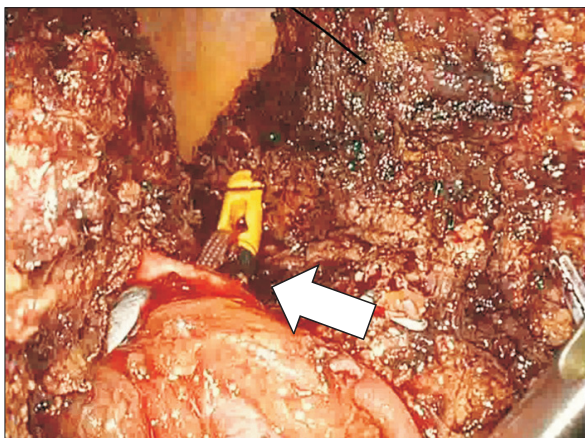


Fig. 3. After sufficient parenchymal resection is done, bifurcation of Glissonian pedicle is well exposed. A nylon tape is easily and safely encircled around the pedicle using the Goldfinger without fear of injury to the parenchyma or middle hepatic vein (white arrow).

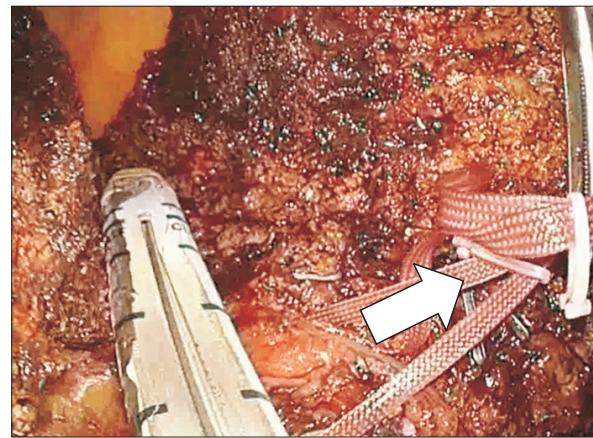


Fig. 4. The stapling of the whole Glissonian pedicle is done. A leftward traction of the nylon tape (white arrow) during stapling enables the stapling line to be positioned sufficiently to the right side so that the left side portal vein or bile duct is not compromised making the stapling very safe.

method, in this aspect, provides a very safe way of controlling the left-sided branches since the stapling is done only after parenchymal resection and full exposure of the whole Glissonian structures.

DISCUSSION

Controlled hepatectomy, proposed by Lortat-Jacob and Robert [6] and Honjo and Araki [7] in the 1950s, consisted of division of hepatic inflow first followed by parenchymal resection. This method allows for less blood loss during parenchymal resection because the inflow is controlled before parenchymal resection, and has been a preferred method compared to parenchymal resection first, followed by inflow control proposed Lin et

al. [8]. Complete inflow control before parenchymal division requires either individual ligation of hepatic artery and portal vein or complete encircling of the Glissonian pedicle as proposed by Cho et al. [4], but both procedures necessitate technical expertise and are not easy to perform for relatively less experienced surgeons. The TICGL method not only allows inflow control before parenchymal division providing less bleeding, but also incorporates the Glissonian approach, which is less time consuming than individual ligation. Moreover, since the dissection of the posterior part of the Glisson pedicle, often done blindly, is not done before full exposure of the Glissonian structure, it is less technically demanding with less chance of troublesome bleeding. Another advantage of the TICGL method is that the stapling is done after full view of the

Glissonian structure providing for safe stapling. It is important to retract the tape leftward during right hepatectomy and rightward during left hepatectomy to not injure the pedicle of the remnant liver.

We believe that the TICGL method, due to its technical simplicity and safety, and ease of reproduction, will provide a way for less experienced surgeons to be able to perform

hemihepatectomies with reduced operative time.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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