A new T-tube applier in laparoscopic surgery

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Abstract. In the majority of patients undergoing laparoscopic choledochotomy, it is advisable to insert a T-tube into the duct after ductal exploration, as bile sludge or fibrin deposits may obstruct the papilla and cause postoperative cholangitis. Based on our experience in open surgery, a limited transverse choledochotomy is preferred, which reduces the possibility of damaging the common bile duct blood supply. Such a technique can complicate laparoscopic T-tube positioning, however. After experimenting with the method described by Kitano et al. [Surg Endosc 7:104-105 (1993)], which was abandoned because it was difficult to carry out with the type of soft silicone rubber tubes that we normally use, two subsequent techniques were developed and are described. They were employed in 3 and 10 patients, respectively, out of 21 who underwent laparoscopic transverse choledochotomy. The most satisfying results were obtained using a system employing two sets of telescopic cannulae of different diameters. Laparoscopic T-tube introduction through a transverse choledochotomy using two telescopic cannulae was rapid and safe and allowed to precisely guide T-tube positioning inside the common duct.

Key words: Choledocholithiasis — Common bile duct exploration — Laparoscopy

Recently laparoscopic common bile duct (CBD) exploration for stones has been reported more frequently [1, 2, 7]. While prospective randomized studies comparing laparoscopic techniques of common bile duct exploration to endoscopic sphincterotomy (ES) have not yet been published, results concerning transcystic-duct CBD exploration have demonstrated that most patients can be successfully treated with this single-stage procedure, sharing the benefits of laparoscopic surgery [2]. However, when large and multiple CBD stones are present laparoscopic choledochotomy may be a valid alternative to pre/postoperative ES, with the advantage of single-session, minimally invasive treatment of both gallbladder and CBD stones. In patients with long-standing choledocholithiasis, bile sludge and/or fibrin deposits may be discovered inside the CBD at the time of laparoscopic choledochoscopy. In these patients, positioning of a biliary drainage T-tube is generally recommended after CBD exploration, as in open surgery.

If a longitudinal laparoscopic choledochotomy is performed [8] the introduction of the T-limb into the CBD should not be difficult, as the incision may be extended both caudally and cranially. However, as described by several Italian authors [6, 9, 10], a partial transverse choledochotomy may be more appropriate. In the absence of any evidence demonstrating in a prospective randomized manner that one technique of CBD incision is superior to the other, we can reasonably postulate that a two-thirds transverse incision of the anterior wall of the CBD may reduce the risk of postoperative biliary stricture on the basis of the following two expectations:

1. It does not interfere with the CBD blood supply. It is important to remember that two longitudinal arteries, originating from the hepatic and pancreaticoduodenal artery, run along the medial and lateral aspects of the common hepatic and CBD, giving off branches which enter the extrahepatic bile ducts perpendicularly, to provide a transverse pattern of terminal arteries on the anterior and posterior surfaces of the duct. This pattern of terminal arteries is clearly recognized on the anterior CBD wall under laparoscopic vision. The transverse incision, which is limited to the anterior two-thirds of the CBD and is often shorter, is carried in the space between the visible ends of the terminal arteries of the two sides (Fig. 1);

2. It is an established surgical concept that a transverse incision on any hollow viscus of the digestive tract reduces the risk of stricture at the suture line.

However, such a limited incision can make T-tube insertion more difficult, particularly at laparoscopy. As such, we studied different techniques in order to facilitate transverse choledochotomy T-tube insertion.

In the beginning of our experience with laparoscopic CBD exploration (April 1991), we tested an instrument
Fig. 1. The two-thirds (or less) transverse incision is carried in the space between diverging, arborescence-like terminal arteries, running transversely from the sides towards the center of the common bile duct (CBD). This vascular pattern is clearly visible under laparoscopic vision.

Fig. 2. The tailored T-tube is inserted into the cannula. Two long threads exit the cannula via two small lateral holes.

Fig. 3. By pulling on the two ends of the suture, the T-tube is advanced out of the cannula. The illustration demonstrates the effect that takes place when the cannula is introduced into the abdominal cavity and close to the common duct opening (not shown).

identical to that described by Kitano et al. [3]. Results were disappointing, however, as the soft silicone tubes that we use, and that we consider mandatory for proper biliary drainage, made it very difficult to insert the T-limb of the tube into the CBD by pushing the long arm of the soft T-tube through the metal cannula.

Aim of this study is to describe a new instrument that we developed in order to facilitate the positioning of the transverse limbs of a T-tube inside the CBD incision after laparoscopic choledocholithotomy. Our experience with the method described by Kitano and with two further original methods of laparoscopic CBD T-tube insertion is also reported.

Materials and methods

The first method, similar to that described by Kitano et al. [3], has been used in our first five patients and has been subsequently abandoned.

The second method has been in use since September 1991. The midpoint of a long suture is tied around the long arm of the silicone rubber T-tube, approximately 3.0 cm from the T-limb. The two ends of the suture are kept at least 25 cm long. The threaded silicone T-tube is then inserted into a cannula of the appropriate diameter (depending on the size of the T-tube); the two halves of the T-limb are brought together inside the cannula, with the two long threads exiting the cannula via two small lateral holes (Fig. 2). The ends of the suture are placed under tension and the assembly is introduced into the abdominal cavity from the midclavicular port. The long ends of the suture remain outside of the trocar. The distal end of the metal cannula is then introduced into the common duct opening under laparoscopic control and the T-tube is pushed out of the cannula and into the common duct by pulling on the two extracorporeal ends of the suture (Fig. 3). Once the T-tube is in place, the cannula is removed and the long ends of the suture are cut with scissors and withdrawn.

In June 1992, a third method was developed by us and appears to be the most satisfying to date. It employs two sets of telescopic metal cannulae, of different diameters, and soft silicone rubber T-tubes. The method is as follows:

Cannulae

Two sets of cannulae are used, each consisting of two telescopic cannulae (internal and external). The internal cannulae have an outside diameter of 6.4 and 8.4 mm, respectively, and an inside diameter of 6.0 and 8.0 mm. Both are 40 cm in length. The external cannulae have an outside diameter of 7.9 and 9.9 mm, respectively, and an inside diameter of 7.4 and 9.4 mm, so as to allow easy insertion of the corresponding internal cannula. The external cannulae are 28 cm in length. A thin film of silicone paste between the two surfaces enhances sliding and reduces gas loss. The distal end of both the internal and external cannula is modified as seen in Fig. 5, in order