Clipless laparoscopic cholecystectomy- a prospective observational study

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ABSTRACT

In laparoscopic cholecystectomy (LC), cystic duct and artery are normally secured with titanium clips. Intracorporeal ligation is normally superior to extra corporeal knotting. Most studies report of separate and multiple ligations of cystic duct and artery, which are viewed as technically demanding and time consuming. Similarly the harmonic scalpel and 'LigaSure' are prohibitory expensive for resource limited country like Nepal. After several modifications, we observed the success of intracorporeal "single ligation of cystic artery and duct" with free silk tie. From Jul to Oct 2009, after a pilot study and several modifications of intracorporeal ligation, we successfully used single ligation of cystic artery and duct (SLAD) with free silk 2/0 in symptomatic cholelithiasis patients.80 cases undergoing elective laparoscopic cholecystectomy. There were 80 patients, females 71.0% (n=57). Average age of patients was 39 yr (14-65). We had no bile leak or other complications related to ligature. The time taken for tie varied from 2 to 7 minutes (average 3 min). In 3 cases, a 5th port was made to grasp and ligate the bleeding vessels. There were 19 (25.0%) acute calculus cholecystitis, including mucocele, empyema, gangrenous cholecystitis. Two patients (2.0%) had inflammation of umbilical port which healed spontaneously. This technique of intracorporeal single ligation of cystic artery and duct (SLAD) in LC is simple, safe and economical. SLAD do not increase operative time as only single tie is used. This no clip laparoscopic cholecystectomy (NCLC) eliminates the clip related complications.

Keywords: Clips, cystic duct, laparoscopic cholecystectomy, ligation.

INTRODUCTION

There are several techniques of securing cystic duct and artery in laparoscopic cholecystectomy (LC), like clips, intra or extra corporeal ligation, harmonic scalpel or LigaSure.[1-3]

Intracorporeal ligation is superior to extra corporeal knotting in assessing appropriate tension without the risk of cutting through the tissue. Most studies report of separate and multiple ligations of cystic duct and artery, which are viewed as technically demanding and time consuming. Similarly the more advanced harmonic scalpel and LigaSure are expensive for developing country like Nepal.

We started laparoscopic cholecystectomy (LC) at our institute in 1998, with average of 500 LC a year. We use titanium clips to secure cystic duct and artery. In view to expand laparoscopic surgery, we have started intracorporeal 'single ligation of cystic artery and duct (SLAD)' as no clip LC (NCLC). SLAD saves time, as only single ligature is used to secure both artery and duct. Furthermore, by gaining expertise in intracorporeal knotting, we believe that it will further broaden the scope of laparoscopic surgery beyond routine LC.

In this prospective observational study, after several modifications, we successfully used SLAD as technique of intracorporeal ligature of cystic artery and duct. Technique of SLAD with its outcome is discussed in detail.

MATERIALS AND METHODS

Since July to Oct 2009, we successfully used intracorporeal single ligation of cystic artery and duct (SLAD) in 80 patients with symptomatic GB stones undergoing laparoscopic cholecystectomy (LC). We used 4 ports; two 5-mm lateral ports, one 10 mm working epigastric port and a 10 mm umbilicus port for camera. We used open technique to create pneumoperitoneum. A purse string suture with #1 polyglycolic acid on 25 mm strong round body needle was used to anchor and prevent leak of gas from umbilical port. In the beginning we used several different methods of ligation of cystic artery and duct, separately or together with 2 proximal and one distal tie before dividing them and finally adopted SLAD. We applied inverted 'C' technique for SLAD with 12-15 cm 2/0 free silk tie, the same silk tie we normally use in open cholecystectomy (OC).

In SLAD, we made some modifications in manipulating gallbladder (GB). The GB was grasped halfway through its body (unlike grasping fundus) on a grasper passed through the most lateral port to create right amount of tension on the Hartmann's pouch and cystic duct.

Through 5 mm 3rd port another grasper held in left hand was used to hold Hartmann's pouch. This facilitated easy dissection of cystic duct and artery by clearing peritoneum just below the Hartman's pouch and away from the junction to common bile duct. A 12-15 cm 2/0 free silk tie was held in needle holder in such a way that about 1 cm of the end of tie was protruding from the jaw. The tie was introduced on needle holder through the epigastric port, and pushed through window created behind cystic duct and artery complex. The protruding end of the tie was grasped with the help of a dissector passed through the 3rd port. The long arm of inverted C-loop was held by grasper and 2 over-wrap created over tip of the needle holder. The short-free end of the suture was grasped by the needle holder and pulled in opposite directions to grasper to make a square knot at 0.5 to 1 cm from the junction to the common bile duct. The long arm of the suture was looped on the needle holder to create 2nd and 3rd square knots completing the SLAD (Fig. 1-5).

Now the grasper on the body of GB was moved to the fundus. Another long jaw grasper through 3rd port (mid-clavicle line) was used to hold and occlude cystic duct and artery together, just below the Hartmann's pouch. Cystic duct artery complex was divided below the locked grasper at a safe distance approximately 1 cm away from the ligature. This locked grasper is used to create appropriate tension moving in different angles required during dissection of the GB. After freeing GB from the bed, it was pushed out under vision, by withdrawing camera and pushing the GB through the umbilical port with the help of grasper locked at Harman's pouch. Umbilical port fascial defect was closed by tightening the purse string suture.

Postoperative management was similar to conventional LC, starting oral liquid after 4-6 hr of surgery, and discharged on 1st day. Patients were followed in surgical outpatient department (OPD) on next nearest appointment, usually on 4th or 5th day of surgery. Patients were called back for 2nd opd visit by two weeks for the histopathology report. This also served as post operative follow up.

RESULTS

From Jul to Dec 2009, we performed SLAD in 80 patients with symptomatic GB stones. Females were 71.0% (n=57). Average age was 39 yr (14-65). We had no bile leak or other complications related to ligature. The time taken for tie varied from 2 to 7 minutes (average 3 min). We were able to tie the cystic duct and artery in single ligature after some modifications in initial few cases. This was in the beginning, during first 10 cases, that we used clip to secure bleeding from aberrant vessel in one case. Later, in another 4 cases, a 5th port was made to grasp the bleeding vessels, 2 noticed after the division of cystic duct/artery complex. These bleeders were ligated successfully with intracorporeal knotting, after we had gained considerable experience and developed confidence. There were 19 (25.0%) acute calculus cholecystitis, including mucocele, empyema and gangrenous.

We had no death. Two patients (2.0%) had inflammation at umbilical port which healed spontaneously.

DISCUSSION

Though rare, clips in LC have complications like ulcerating through the duodenum causing sever hemorrhage, embolism of clips, internalization into the common bile duct, bile leak secondary to displacement, and clip-induced biliary stone.[4-7]

Besides the common use of clips, various other techniques of securing cystic duct and arteries have been introduced.

Harmonic scalpel and 'LigaSure' in LC has come up recently.[8,9] Cost of equipment is the main prohibitory factor in developing country like Nepal. Also, these appliances are not recommended for division of the

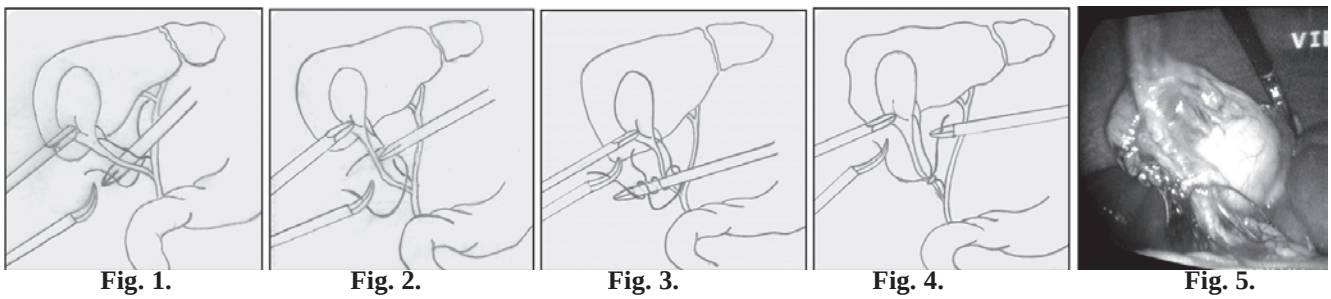

Fig. 1. **Fig. 2.** **Fig. 3.** **Fig. 4.** **Fig. 5.**

Fig. 1. A 12-15 cm 2/0 free silk tie on needle holder through epigastric port being pushed into the window created behind cystic duct and artery complex. **Fig. 2.** The protruding end of the silk tie was grasped with dissector passed through the 3rd port. **Fig. 3.** The long arm of inverted C-loop was held by grasper and 2 over-wrap created over tip of needle holder. **Fig. 4.** The short-free end of the suture was grasped by the needle holder and pulled in opposite directions to make a square knot; similarly 2nd and 3rd knot was placed. **Fig. 5.** Intraoperative photo of completed intracorporeal single ligation of cystic duct and artery (SLAD).

cystic duct greater than 6 mm in diameter for safety reason.[10] Other associated risks are injury to bowel and bile ducts.[11]

With increasing experience and at the same time with aim to further advance the field of laparoscopic surgery, intracorporeal suture/knotting is necessary. We perform good numbers of LC at our institute, an average of 500 per year since 1998. We believe that intracorporeal knot tying will be useful in advancing laparoscopic procedures. Economic benefit is also an added advantage by cutting the cost of clips without compromising efficiency and safety, as reported by other authors.[12]

We believe that intracorporeal knot ligation should be the recommended training in basic laparoscopic surgery. Most of the reports of suture ligation uses separate and multiple ligatures for cystic duct and artery, requiring more time compared to clipping. To overcome this drawback we have successfully shown in over 80 cases (and now the favorite technique in author's unit) that single ligation of artery and duct (SLAD) is feasible, safe and secure. We had no complication related to single ligature. On the contrary, we had 9 cases (out of 15 cases of acute cholecystitis), with thick, edematous, friable duct/artery complex which would have been normally converted to OC because of difficulty or unsecure clipping.

Ligature is also suitable in some unusual circumstances. In 4 cases (this was after experience with over 30 SLADs), we encountered bleeders which were successfully ligated by creating 5th port. In one case of friable acute cholecystitis, the duct was torn due to traction on GB. Here also, we used 5th port to hold the severed duct (together with artery) and successfully completed the SLAD.

We had 2 cases of minor infection (2%), cellulitis with serous discharge at umbilical port which healed spontaneously.

There was no bile leak in this series. However, like in clips, bile leak following ligature may occur in up to 3.8%.[13] Leak from cystic duct when using clips may be because of a variety of reasons, like inadequate closure of the duct due to mismatch of the clip arms, necrosis of the duct at the site of clipping, or slippage of the clips and migration into the biliary tract.[14-19] SLAD avoids these clip related complications.

In conclusion, intracorporeal 'single ligation of artery and duct (SLAD)' is easy to learn and do not increase operating time as only one ligature is needed to secure both cystic duct and artery. SLAD is feasible, cost effective and safe alternative method to secure cystic artery and duct in LC.

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