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**RESEARCH ARTICLE **

**Laparoscopic Cholecystectomy Without Clips : Our Experience at a Teaching Hospital in Eastern India.**

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Abstract

Introduction:-In laparoscopic cholecystectomy (LC) ,the gold standard for gallstone disease , cystic duct and artery are conventionaly secured with titanium clips. Intracorporeal knotting and ligation is thought to be superior to extra corporeal knotting22. Most of the laparoscopic surgeons using knotting for securing cystic duct and cystic artery per- form separate individual ligations of duct and artery.This is technically demanding and time consuming. On the other hand harmonic scalpel and ‘LigaSure’ are expensive and hence prohibitory for resource limited country like India16*,*18. Methods:-We performed intracorporeal “single ligation of cystic artery and duct” with free silk sutures. From January 2016 to December 2018, we employed successfully performed single ligation of cystic artery and duct (SLAD) with silk 1/0 in symptomatic cholelithiasis patients undergoing LC.The various parameters of SLAD were compared with another group of 100 cases of LC in which duct and artery were ligated individually. Out of 108 cases included in this study undergoing elective laparoscopic cholecystectomy 80 (74.1%) were females16 .Average age of patients was 36 yr (12- 65yrs). We had bile leak in 2 cases and no other complications related to ligature. The average time taken for knotting was 7 minutes (varied from 3 to 11 minutes). In 7 cases, 5th port was needed to grasp and secure the bleeding vessels. There were 12 (11.1%) acute calculus cholecystitis, 6(5.5%) mucocele,2(1.8%) empyema.We had no gangrenous cholecys- titis. Bile leak was encountered I 2 cases in both groups ,3 patients (2.7%) had inflammation of umbilical port which healed in due course of convalescence3*,*5*,*7*,*8. All these parameters were compared with another group of LC with individual ligation of ducts and artery in tabulated form and overall results were similar. Conclusion:- intracorporeal single ligation of cystic artery and duct (SLAD) in LC is simple, safe and economical and can easily be practised. SLAD marginally increases operative time that improves with practice as only single tie is used. Thus no clip laparoscopic cholecystectomy (NCLC) by either method of ligation eliminates the clip related complications of LC6*,*9*,*10.

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

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# INTRODUCTION

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aparoscopic cholecystectomy (LC) led to sig- nificant change in the management of gall- bladder disease and now a days it is the

most frequently performed operation of the digestive tract. Presently, it is considered as the gold stan- dard treatment for cholelithiasis and has replaced open cholecystectomy as the first choice of treat-

ment for gallstones and inflammatory diseases of the gallbladder13*,*17. Despite several modified methods (natural orifice transluminal endoscopic surgery – NOTES -, single-incision laparoscopic surgery-SILS), LC continues to be the gold standard for symptomatic gallstone disease.The main risk associated with the LC appears to be a higher incidence of bile duct injuries3. There are several techniques of securing cystic duct and artery in laparoscopic cholecystectomy (LC), like clips, intra or extra corporeal ligation, harmonic scalpel or Liga Sure11*,*13*,*16*,*19. Intracorporeal ligation is thought to be superior to extracorporeal knotting in assessing appropriate tension without the risk of cutting through the tissue. Most surgeons perform separate and multiple ligations of cystic duct and artery15*,*21. But this process is technically demanding and time consuming. On the other hand harmonic scalpel and Liga Sure are expensive and not affordable for developing country like India13*,*17. Laparoscopic cholecystectomy (LC) started at our hospital in 2001. We exclusively used titanium clips to secure cystic duct and artery separately till 20151*,*13. After viewing reports of intracorporeal knotting in the literature for securing cystic duct and artery in laparoscopic surgery, we started intracorporeal ‘single ligation of cystic artery and duct (SLAD)’ as no clip LC (NCLC)21. With improving learning curve, time taken for intracor- poreal knotting went on shortening. SLAD saves time, as only single ligature is used to secure both artery and duct. Moreover, with increasing expertise in intracorporeal knotting, it will further broaden the scope of laparoscopic surgery beyond routine LC.In this prospective observational study, after several modifications, we used SLAD with quite encouraging results as technique of intracorporeal ligature of cystic artery and duct. Technique of SLAD with its outcome is discussed in detail.

# MATERIALS AND METHODS:

Since January2016 to December 2018, we success- fully performed intracorporeal single ligation of cys- tic artery and duct (SLAD) in 108 patients with symptomatic gall bladder disease with stones under- going laparoscopic cholecystectomy (LC). 4 ports were used - two 5 mm lateral ports, one 10 mm working epigastric port and a 10 mm umbilicus port for camera. We used ‘Safety Trocar’ technique to create pneumoperitoneum. 108 cases included in the study that underwent SLAD, were compared to 100 cases in whom cystic artery and duct were ligated separately. The results of two groups were compared with reference to operative time, postoperative com- plications and final outcome. We performed ligation of cystic artery and duct, separately or together with 2 proximal and one distal tie before dividing them in both groups. We applied inverted ‘C’ technique for SLAD with 1/0 free silk tie, the same silk tie we normally use in open cholecystectomy (OC). In SLAD, we modified manipulation method of gall- bladder (GB). The GB was grasped halfway through its body (unlike grasping fundus) on a grasper passed through the most lateral port to form substantial amount of tension on the Hartmann’s pouch and cystic duct to facilitate tying.Through 5 mm 3rd port another grasper held in left hand was used to hold Hartmann’s pouch. Easy dissection of cystic duct and artery by shearing peritoneum just below the Hartman’s pouch and away from its junction to common bile duct. A 30 cm 1/0 free silk tie was held in needle holder in such a manner that about 2 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 protrud- ing end of the tie was grasped with the help of a dissector passed through the 3rd port. The long arm

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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 1.5 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 .At this stage the grasper on the body of GB was moved to the fundus. Another long jaw grasper through 3rd port was used to hold and occlude cystic duct and artery together, just below the Hartmann’s pouch. Cystic duct artery complex was divided be- low 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 from liver GB fossa. After freeing GB from the bed, it was extracted out under vision, through the epigastric port by withdrawing the GB extractor gently.Calculi lager than 10 mm or exceesive num- ber of calculi necessitated prior removal of stones before delivering gallbladder out of epigastric port. Umbilical port and epigastric port fascial defect was closed by port closing suture. Postoperative manage- ment was similar to conventional LC, starting oral liquid after 6 hours of surgery, and discharged on next day. Patients were followed up in surgical outpatient department (OPD) on next nearest appointment, usually on 10th day of surgery. Patients were called back for 2nd OPD visit by 4 weeks for the observation of final outcome .

# RESULTS:

From January 2016 to December 2018, we per- formed SLAD in 108 patients with symptomatic GB stones. 80 (74.1%) were females. Average age of patients was 36 yr ranging from 12- 65yrs (Table no.1) . We had bile leak in 2 cases each in SLAD as well as in other group , but no other complications related to ligature. The time taken for tie on average was 7 minutes (varied from 3 to 11 minutes). We were able to tie the cystic duct and artery in sin- gle ligature after some modifications in initial few cases. In the beginning, during first 25 cases, we

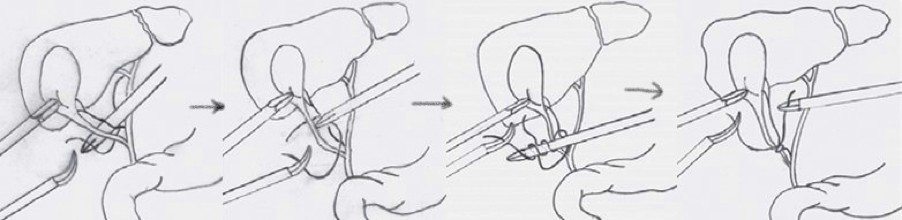
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used clip to secure bleeding from aberrant vessel in one case. Later, in another 3 cases, a 5th port was made to grasp the bleeding vessels, seen after the division of cystic duct/artery complex. These bleeders were ligated successfully with intracorpo- real knotting, after gaining adequate experience and confidence. Among various pathological types ,there were 12 (11.1%) acute calculus cholecystitis, 6 mucocele(5.5%),2(1.8%)empyema and no gangrenous gallbladder in the cases of SLAD. Drains were given in cases of acute cholecystitis and empyema.The corresponding fIgures in other group was by and large similar (Table no.2). 3 patients (2.7%) had inflammation at umbilical port which healed spontaneously (Fig 3) . We had no mortality in either group.

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**FIGURE 1:** Showing Diagramatic steps of ontracorporeal knotting

## TABLE 1: Age incidence of operated cases

Sl No.

AGE

(yrs)

SLAD INDIVIDUALLY LIGATED

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | Number | % | Number | % |
| 1 | 12-20 | 9 | 8.3% | 12 | 12.0% |
| 2 | 21-30 | 27 | 25.0% | 21 | 21.0% |
| 3 | 31-40 | 32 | 29.7% | 26 | 26.0% |
| 4 | 41-50 | 20 | 18.6% | 20 | 20.0% |
| 5 | 51-60 | 17 | 15.7% | 19 | 19.0% |
| 6 | 61-70 | 3 | 2.7% | 2 | 2.0% |
|  | Total | 108 | 100 | 100 | 100 |

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# DISCUSSION:

Although rare, use of titanium clips in LC are met sometimes with complications like ulcerating through the duodenum that may result in severe hemorrhage and even clip induced biliary stone6*,*7*,*9*,*10. Apart from the common use of clips, various other techniques of securing cystic duct and arteries have also been introduced. Harmonic scalpel and ‘Liga Sure’ in LC has been used recently17*,*18*,*19. But cost of equipment is the main prohibitory factor in developing country like India. Moreover, these appli- ances are not recommended for dividing cystic duct greater than 6 mm in diameter for safety reasons13*,*17. Other associated risks of these energy sources are inadvertent injury to bowel and bile ducts20 .With increasing experience and further advancement in the field of laparoscopic surgery, intracorporeal su- ture/knotting has its role to play. We have performed good numbers of LC at our hospital since 2001. We are of the opinion that intracorporeal knot tying will be useful in advancement of laparoscopic procedures in future. Cutting the cost of clips without com- promising efficiency and safety, economic benefit is also an added advantage , as reported by other authors too20*,*21*,*22. We recommend that intracorpo- real knot ligation should be recommended during training programmes in basic laparoscopic surgery. Although most of the reports of suture ligation uses separate and multiple ligatures for cystic duct and artery, which requires more time compared to clip- ping. Single ligation of artery and duct (SLAD)

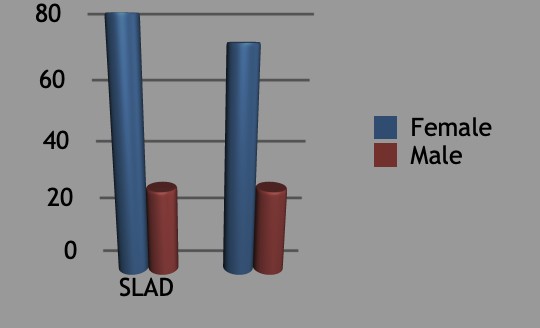
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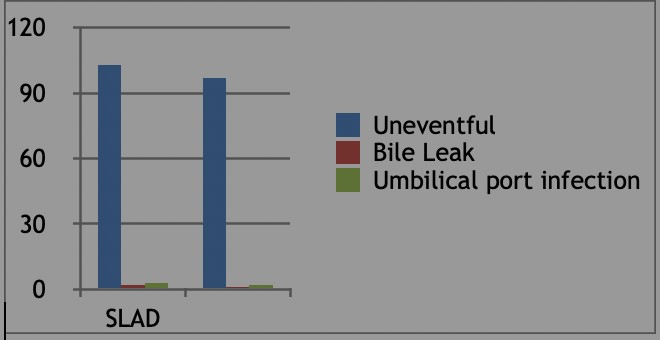


**FIGURE 2:** Sex Distribution of cases

## TABLE 2: Operative Findings

OPERATIVE PATHOLOGIES SLAD INDIVIDUALLY LIGATED

|  |  |  |
| --- | --- | --- |
|  | Number % | Number % |
| Chronic Cholecystitis | 88 81.5% | 73 73.0% |
| Acute Cholecystitis | 12 11.1% | 15 15.0% |
| Mucocele | 6 5.6% | 8 8.0% |
| Empyema | 2 1.8% | 3 3.0% |
| Gangrenous Cholecystitis | 0 0 | 1 1.0% |
| Total | 108 100 | 100 100 |



## FIGURE 3: Complications

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is therefore a feasible, safe and secure method for securing cystic artery and duct. Similar views have been recommended by other authours22*.*23 .We had no complication attributable to single ligature method in our study. In fact, we had 8 cases (out of 12 cases of acute cholecystitis), with thick,adherent and edematous, friable duct/artery complex which would have been normally converted to OC because of difficulty or unsecure clipping. Ligature is also much useful in some unusual circumstances. In 3 cases (this was after experience with over 35 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 torn duct end(together with artery) and successfully completed the SLAD.Similar protocol was followed by few other researchers22.We had 3 cases of mi- nor infection (2%), cellulitis with serous discharge at umbilical port which healed spontaneously.There was bile leak in 2 cases in both groups in this study.

Patient had no complaints of pain abdomen, fever, nausea, vomiting which are usually seen in case of bile leak. Only mild upper abdominal discomfort was felt by them. This was managed conservatively by observing the drain output and for signs and symp- toms of peritonitis. The leak gradually decreased and stopped by spontaneously postoperatively. All our cases of leak settled spontaneously within 10 days. However, like in clips, bile leak following ligature may occur in up to 3.8% as reported by other workers1*,*7. Leak from cystic duct when using clips may be due to many reasons, like incomplete closure of the duct due to mismatch of the clip arms,smaller size of clips, necrosis of the duct at the site of clipping, or slippage of the clips and migration into the biliary tract3*,*4*,*5. SLAD avoids these clip related complications.

# CONCLUSION:

Single ligation of artery and duct is feasible and safe and easy to learn alternative method to secure cystic artery and duct in laparoscopic cholecystectomy It can be used routinely and not only offers an added advantage over clips in cases with thick oedema- tous cystic artery / duct complex but also avoids

clip related complications. There is no significant elevation in operating time as only one ligature is used.Thus this method of SLAD should be practiced atleast in selected cases when dissection and separa- tion of cystic artery and duct is not only difficult but increases the likelihood of inadvertent injury to these structures with resultant catastrophe.

CONFLICT OF INTEREST : None

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