

## ORIGINAL ARTICLE

# Ligature Technique: A Safe Outcome in Laparoscopic Cholecystectomy

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## ABSTRACT

**Objective:** To compare Extracorporeal Sliding knot (ECK) and clip ligation to ligation of the cystic duct in laparoscopic cholecystectomy.

**Patients and Methods:** This study was conducted as prospective randomized study in Jeddah National Hospital in Jeddah Saudi Arabia, in surgical department carried out from June 2018 to June 2019. In the study 100 patients were selected and divided into two groups, in which we compared outcomes of patients in whom Cystic Duct Occlusion was done by clips (Group I n=60) and other group Ligatures endoloop knotting (Group II n=40). During laparoscopic cholecystectomy (LC), cystic duct occlusion can be done with titanium clips or ligature permanently in order to prevent leakage of bile into the peritoneal cavity.

**Results:** Average age of the patients of clipping group was 43.68 years and the average age of the patients of knot group was 42.64 years, with male to female ratio as 1:4.5. 1:2.3 of clipping and knot group respectively. Regarding operating time from initial incision to closure of wound is 61 to 65 minutes in clip group and 69 to 70 minutes in knot group. Longer operating times in knot group is due to learning curve effect for most surgeons as is evident from the fact that first twenty surgeries took longer time as compared to subsequent surgeries. The port site infection was in 03 cases of the clip group 01 in the knot group, drain was kept in 12 cases in knot group and 06 in clip group, bile leak requiring ERCP 02 cases in clip group and 01 in knot group, retained CBD Stones 01 was in clip group, obstructive Jaundice was seen in one cases of clip group, while no mortality was seen in both groups. Although the hospital stay after surgery in clip group was 1-2 days and in knot group also 1-2 days and in ERCP patients' Hospital stay was 2 to 3 days.

**Conclusion:** Cystic duct occlusion with knots/ligatures is a safe, cost effective, less post operative pain alternative to clips as various studies showed clips complications. It also showed less post-operative pain, less bile leak and port site wound infection. Safety of using knots/ligatures is even better than clips as is evident from this study comparing these two methods of cystic duct occlusion.

**Key words:** cholecystectomy, surgical clips, surgical knots, surgical ligature, cystic duct occlusion, bile leakage

## INTRODUCTION

Cholecystectomy is the most common elective procedures throughout the world performed by the general surgeons.<sup>1</sup> The German Prof. Dr. Erich Muhe performed the first lap chole procedure in 1985. Since then, this procedure has considered the "gold standard" for treating symptomatic gallbladder disease. Due to its advantages of reduced cost and hospital duration, as well as greater patient satisfaction, laparoscopic cholecystectomy has been the standard of treatment since its initiation and subsequent adoption.<sup>2,3</sup> Usually, laparoscopic cholecystectomy is considered a safe surgery, although complications such as bile leak, bleeding, wound infection, abscess, bowel/vascular injury and bile duct injury might occur in 6 to 8% of the cases.<sup>2,4</sup> The invention of laparoscopic cholecystectomy was a significant step forward in the evolution of minimally invasive surgical procedures. It is the commonest operation performed throughout the world. Surgical clips are used to occlude the cystic duct and artery at the time of laparoscopic cholecystectomy, but they can become dislodged and end up lying inside the abdomen during or after the procedure.<sup>5</sup> Common bile duct (CBD) damage and the bile leakage, which are estimated

to occurred in 0.6 percent and 0.3 percent of cases, respectively, are in the commonest complications.<sup>5</sup> Gallstones may also be spilled from the gallbladder in between 3.8 percent and 9% of cases undergoing laparoscopic cholecystectomy, which might result in an abscess if not removed.<sup>5,6</sup> To prevent CDL, the cystic duct must be properly closed, especially in individuals with severe gallstone disease who are at a higher risk of bile leaking. Despite the fact that CDL is classed as a mild bile duct injury, it is linked to a high rate of re-intervention, raised morbidity, and even death.<sup>7,8</sup> During laparoscopic cholecystectomy, different methods of suture closure of the cystic duct, both intracorporeal and extracorporeal, have recently been described. Although there have been many advancements in cystic duct and artery closure (suture ligation, clip ligation), the effectiveness, safety, and postoperative problems of employing non-absorbable suture material or Liga clip for the operating surgeon in LC remain controversial.<sup>9</sup> Surgical clips are used to bind the cystic duct, however they have the potential to move into the main bile duct over time.<sup>10</sup> The migrating surgical clip is thought to act as a nidus for choledocholithiasis and biliary blockage.<sup>10</sup> Knot tying in open surgery is simple to

learn and execute. When knot tying is done laparoscopically, however, it becomes difficult and frustrating.<sup>10</sup> Via more experience in advanced laparoscopic methods, it is now possible to safely occlude the cystic duct with ligature as an alternative to clipping.<sup>10,11</sup> Hence this study has been done to compare Extracorporeal Sliding knot (ECK) and clip ligation to ligation of the cystic duct in laparoscopic cholecystectomy.

**MATERIAL AND METHODS**

This study was conducted as prospective randomized study in Jeddah National Hospital in Jeddah Saudi Arabia, in surgical department carried out from June 2018 to June 2019. In the study 100 patients were selected and divided into two groups, in which we compared outcomes of patients in whom Cystic Duct Occlusion was done by clips (Group I n=60) and other group Ligatures endoloop knotting (Group II n=40). During laparoscopic cholecystectomy (LC), the cystic duct can be permanently occluded using titanium clips or ligature to prevent bile leakage into the peritoneal cavity. Ligature technique was used for any continuous tubular structure up to 22mm. For extra corporeal knotting with Vicryl 1-0 thread, it was passed through epigastric port with help of Maryland grasper. The thread was wrapped around cystic duct and was brought out through the same port using the same Maryland grasper. Extracorporeal knot was then made. The duct was ligated twice, once near the CBD and the other near the gall bladder. The operative time, intraoperative predictors, postoperative recovery, morbidity, and mortality linked with laparoscopic cholecystectomy for cystic duct stump ligations were all compared. All the information was collected via self-made proforma and SPSS version 26 was used for the purpose of data analysis.

**RESULTS**

The average age of the patients of clipping group was 43.68 years and of knot group's patients was 42.64 years, with male to female ration as 1:4.5. 1:2.3 of clipping and knot group respectively. Table.1

As per intraoperative findings the multiple adhesions of GB and Omentum were found in 10 cases of knot group and 04 cases in clip group. Short a Wide Cystic Duct was in 10 cases of knot group and 01 in clip group, mucocele empyema of GB was found in 6 cases of knot group and 02 cases of clip group, GB distended Cystic Duct Short was among 6 cases of knot group and 04 in clip group, GB thick walled was 8 in knot group and 07 in clip group, Calot's difficult to identify was seen in 10 cases in knot group and 04 in clip group, while there was no any case of biliary peritonitis following laparoscopic cholecystectomy in either group. Table.1

No bile duct injury was detected intra-operatively in either of the two groups. Difficulty in dissecting gall bladder was in 10 cases of knot group and 4 cases of clipping group, Adhesions to surrounding were in 7 cases of knot group and 4 in clipping group, Misperception of biliary tree was in 3 cases of knot group and 1 case of clipping group, Over hanging liver was in only 1 cases of knot group. Regarding the time taken from initial incision to wound closure was 61 to 65 minutes in the clip group and 69 to 70 minutes in the knot group. Longer operating times in knot

group is due to learning curve effect for most surgeons as is evident from the fact that first twenty surgeries took longer time as compared to subsequent surgeries. Table.1

The port site infection was in 03 cases of the clip group 01 in the knot group, drain was kept in 12 cases in knot group and 06 in clip group, bile leak requiring ERCP 02 cases in clip group and 01 in knot group, retained CBD Stones 01 was in clip group, obstructive Jaundice was seen in one cases of clip group, while no mortality was seen in both groups. Although the hospital stay after surgery in clip group was 1-2 days and in knot group also 1-2 days and in ERCP patients' hospital stay was 2 to 3 days. Table.2

Table.1 Demographic characteristics of the patients n=100

Variables		Extra corporeal knotting	Clipping
Age (years)	Mean+SD	42.64+5.23	43.68+7.21
Gender	Male to female ration	1:2.3	1:4.5
Pre-operative findings	CBC > 15000	20	10
	Gall bladder wall thickness >5mm	08	04
	Duration of symptoms >72 hrs	12	03
	ERCP attended already	01	0
	H/O previous surgery	02	01
	H/O cholecystitis/ pancreatitis	07	02
Intraoperative findings	Difficulty in dissecting gall bladder	10	04
	Contracted gallbladder	05	03
	Adhesions to surrounding	07	04
	Intrahepatic gall bladder	02	0
	Misperception of biliary tree	03	01
	Delayed lap. Cholecystectomy	03	02
	Over hanging liver	01	0
Operative time (from initial incision to closure of wound) (minutes)		61- 65	69-70

Table.2 Outcome of the patients n=100

Outcome	Knot group	Clip group	p-value
Bile leak	01	02	0.720
Port site infection	01	03	0.448
Retained CBD Stones	00	01	0.378
Obstructive Jaundice	00	01	0.378
Mortality	00	00	1.00

**DISCUSSION**

Across all fields, laparoscopic surgery is a well-established alternative to open surgery. To prevent bile leakage and haemorrhage during laparoscopic cholecystectomy, the cystic duct and cystic artery must be blocked prior to division. In this study mean age of the patients was 43.68 years in group knots clip group and 42.64 years in knots group with male to female ration as 1:4.5. 1:2.3 of group a and B respectively. These findings regarding age and gender were almost similar to the study of Mufti TS et al<sup>12</sup> as out of 60 patients, females were in majority 85% and males were 15%, with an average age of 40.30 years with age range of 17 to 65 years. In another study of Almahjoub A et al<sup>1</sup> also reported that the average age of the patients was 37 years and females were most common 88.84%.

In this study, the time taken from initial incision to wound closure was 61 to 65 minutes in the clip group and 69 to 70 minutes in the knot group. Longer operating times in knot group is due to learning curve effect for most surgeons as is evident from the fact that first twenty surgeries took longer time as compared to subsequent surgeries. Similar observations were made in study by the Marane AT et al<sup>13</sup> and Seenu V et al<sup>14</sup> where procedure using knots took a longer time. The operating time decreased in the last 15 patients as the experience of the surgeons increased in the latter study. Consistently Gurusamy et al<sup>16</sup> reported that in the group of absorbable suture ligature, the operative duration was 12 minutes longer than the group of clip ligation. Kumar H et al<sup>10</sup> also conduct similar line study and reported that, the duration of operation did not differ significantly between the two groups (clipping Group A=40.4±4.63 minutes, knot Group B=43.32±4.44 minutes).

In this study as per intraoperative findings the multiple adhesions of GB and Omentum were found in 10 cases of knot group and 04 cases in clip group. Short a Wide Cystic Duct was in 10 cases of knot group and 01 in clip group, mucocele empyema of GB was found in 6 cases of knot group and 02 cases of clip group, GB distended Cystic Duct Short was among 6 cases of knot group and 04 in clip group, GB thick walled was 8 in knot group and 07 in clip group, Calot's difficult to identify was seen in 10 cases in knot group and 04 in clip group, while there was no any case of biliary peritonitis following laparoscopic cholecystectomy in either group. In this study, no bile duct injury was detected intra-operatively in either of the two groups. Regarding bile leak requiring ERCP, in our study 02 patients in clip group required ERCP for persistent bile leakage and 01 patient of knot group. In all these three patients, abdominal drains were kept luckily as in more adhesive cases we always put drain routinely, and bile was draining persistently into drains and all these patients were managed by ERCP. In the study by Hawasli A et al<sup>15</sup> which reported similar outcome none of patient in either group had bile leak which required ERCP.

In this study the port site infection was in 03 cases of the clip group 01 in the knot group, drain was kept in 12 cases in knot group and 06 in clip group, bile leak requiring ERCP 02 cases in clip group and 01 in knot group, retained CBD Stones 01 was in clip group, obstructive Jaundice was seen in one cases of clip group, while no mortality was seen in both groups and the hospital stay was almost similar in both groups. Consistently Kumar H et al<sup>10</sup> conducted the study to see how clip occlusion compared to extracorporeal suture ligation (Roeder knot) of the cystic duct during laparoscopic cholecystectomy and they observed that the cystic duct occlusion using knots/ligatures is a safe and cost-effective substitute to clip ligations, with such a lower risk of problems such as bile leakage and unintentional ligation of the common bile duct, and at a lower cost to the patient. On other hand Murad F et al<sup>17</sup> conducted study over the last three years, Roeder's knot has been used in 771 procedures out of a total of 1883 and the knot's safety is determined not just by its configuration, but also by the suturing substance used. It

has been demonstrated that material that expands when exposed to water or after being injected into the body theoretically boosts knot tying and tightening capabilities.<sup>17</sup>

## CONCLUSION

As per study conclusion the cystic duct occlusion with knots/ligatures was observed to be the effective, cost effective, less post operative pain alternative to clips as various studies showed clips complications. It also showed less post-operative pain, less bile leak and port site wound infection. Safety of using knots/ligatures is even better than clips as is evident from our study comparing these two methods of cystic duct occlusion. The knot must be properly constructed to prevent the suture from slipping or cutting through, and it must also be easily tightened for optimal strength. Further large-scale studies are suggested on this subject.

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