ORIGINAL ARTICLE

A Comparative Study of Extracorporeal Knotting vs Clips for Ligating Cystic Duct in Laparoscopic Cholecystectomy

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Abstract

The aims of present study were as following: To compare extracorporeal knotting vs clips for ligating cystic duct in laparoscopic cholecystectomy in terms of feasibility operative time (incision to closer) based on types of cholecystitis postoperative pain, operative cost, and associated morbidities like gallbladder perforation, bile leak, liver bed injury, port site infection, migration of clips, and slipping of knot.

Methodology: All the patients were assigned by randomization into either of two groups: study group—patients in whom extracorporeal knotting was done for ligation of cystic duct, and control group—patients in whom clips were used for clipping of cystic duct. Period of study was from November 2018 to June 2020.

Results: This was a case series analysis conducted from November 2018 to June 2020; i.e., for a period of 20 months, 60 cases were subjected to laparoscopic cholecystectomy. In the control group, 11 patients had intraoperative complications, and no complications in the study group. In the study group, mean time taken for the operation was 67.37 minutes when compared to control group of 61.83 minutes. The cost of the suture material used in study group was 302 rupees, and the average cost of the titanium clips used in control group was 500 rupees.

Conclusion: In laparoscopic cholecystectomy, extracorporeal knotting has the advantages over clipping of cystic duct in operative cost and lesser intraoperative complications with the only limitation being operative time.

Keywords: Clipping, Cystic duct, Extracorporeal knotting, Laparoscopic cholecystectomy.

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Introduction

Cholecystectomy is the common operation of the biliary system.[1] In cholecystectomy, cystic duct is ligated with the sutures or clips. The conception of laparoscopy has revolutionized the art of surgery due to its advantages over open technique. The lately innovated laparoscopic cholecystectomy has been drastically refined over the years by better exploration of ergonomics, new energy sources, and endo suturing.[2] The conventional four-port access technique has been modified to three ports, two ports, and single incision laparoscopic surgery. Cystic duct ligation methods using metallic clips, harmonic scalpel, plasma kinetic, and intracorporeal and extracorporeal suturing techniques have been tried with gratifying results.[3–8] Open cholecystectomy is replaced by the gold standard procedure, i.e., laparoscopic cholecystectomy in the treatment of gallbladder diseases.

Using clips will reduce the intraoperative time which has advantage over the extracorporeal knotting, whereas clips have the drawback of slippage, resulting in leakage or hemorrhage, and there are situations such as wide cystic duct where clipping is difficult; in such cases, using the extracorporeal knotting for occluding the cystic duct is best alternative. Extracorporeal knotting with absorbable suture material is feasible, practical, economic, and safe as well.

In 5–10% of the cases, there are chances of conversion to open cholecystectomy from laparoscopic cholecystectomy.

Aims and Objective of Study

The aims of present study were as following: To compare extracorporeal knotting vs clips for ligating cystic duct in laparoscopic cholecystectomy in terms of feasibility, operative time (incision to closer) based on types of cholecystitis, postoperative pain, operative cost, and associated morbidities like gallbladder perforation, bile leak, liver bed injury, port site infection, migration of clips, and slipping of knot.

Methodology

This was a case series analysis done in patients who underwent laparoscopic cholecystectomy in Department of Surgery at a tertiary hospital in North Karnataka.

All the patients were grouped into study group and control group based on computerized random number tables: Study group—patients in whom extracorporeal knotting was done for ligation of cystic duct. Control group—patients in whom clips were used for clipping of cystic duct. Period of study was from November 2018 to June 2020.

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Sampling (Prospective, Interventional Study)

On the basis of a study done by Kuldip Singh et al. at Patiala,[1] the anticipated mean ± SD of operating time by extracorporeal knotting vs using clips was 60.50 ± 14.93 and 47.83 ± 14.77, respectively. The minimum sample size was 30 per group with 95% level of significance and 80% power.

Formula used was as follows:

$$N = 2\left[\frac{\left(Z_{1-\alpha/2} + Z_{\beta}\right) * S}{d}\right]^2$$

$Z_{1-\alpha/2}$—level of significance = 95%
$Z_{1-\beta}$—power of the study = 80%
d = clinically significant difference between two parameters
SD = common standard deviation

Statistical Analysis

Data were represented using mean ± SD, percentages, and diagrams. Significant difference between quantitative data was found using unpaired *t* test/Wilcoxon signed rank test. Significant difference between qualitative data was found using Chi-square or Fisher's exact test.

Method of Collection of Data

Patients admitted for cholecystectomy were included in the study and allocated to study and control groups alternatively.

Detailed history was taken, and thorough clinical examination and investigations were performed for all the patients in both the study and control groups. A pro forma was used to collect all the relevant data from the patients pre-, intra-, and postoperatively. All cases were followed up to discharge and subsequently for a follow-up of 3 months. After the evaluation, patient was taken for laparoscopic cholecystectomy and time taken from incision to closure, bile/stone spillage and cost of clips/suture was noted. Postoperatively, cases were followed up for any complication.

Inclusion Criteria

Patients with cholecystitis—calculous/acalculous and cholelithiasis were included in the study.

Exclusion Criteria

Patients with cardiac disease, pregnant women, those who were unfit for general anesthesia, and patients with CBD stone were excluded.

Results

This case series analysis was conducted from November 2018 to June 2020, i.e., for a period of 20 months; 60 cases were subjected to laparoscopic cholecystectomy, and the following results were observed.

In the study group, there were no intraoperative complications noted among the 30 patients. In the control group, 11 patients had intraoperative complications, seven patients had clip slippage and stone spilling into the peritoneal cavity from the gallbladder, three patients had clip slippage and bile spillage into the peritoneal cavity from the gallbladder, and 1 patient had clip migration (Table 1). In the study group, mean time taken for the operation was 67.37 minutes when compared to control group of 61.83 minutes. In the study group, maximum time taken was 105 minutes and the minimum time taken was 35 minutes. In the control group, maximum time taken was 80 minutes and the minimum time taken was 38 minutes (Table 2). The average cost of the suture material used in study group was 302 rupees, and the average cost of the titanium clips used in control group was 500 rupees (Table 3).

Table 1: Distribution of subjects according to intraoperative complications

	Study group		*Control group*			
Intraoperative complications	*N*	*%*	*N*	*%*	*Chi-square test*	*Remark*
Bile leak	0	0	0	0	$\chi^2 = 13.469$	$p = 0.0037^*$
Clip migration	0	0	1	3.3		
Clip slippage, bile leak	0	0	3	10		
Clip slippage, stone spillage	0	0	7	23.3		
Nil	30	100	19	63.3		
Total	30	100.0	30	100.0		

*Highly significant

Table 2: Comparison of operation time (minutes) between study and control groups

Operation time (minutes)	*Mean*	*±SD*	*Difference in mean (%)*	*Unpaired t test*	*p value*	*Remarks*
Study	67.37	15.230	4.68 (6.94%)	$t = 1.636$	$p = 0.107$	NS
Control	61.83	10.55				

NS, not significant

Table 3: Comparison of cost of suture/clips (in rupees) between study and control groups

Cost of suture/clips (rupees)	*Mean*	*±SD*	*Difference in mean (%)*	*Mann–Whitney U test*	*p value*	*Remarks*
Study	302.00	0.000	198 (39.6%)	NA		
Control	500.00	0.000				

NA, not applicable (SD = 0)

Follow-up

All patients were followed up for a period of 1 month, and no significant complication was noted.

Discussion

The mankind was affected with gall stones from centuries, and the best treatment for the symptomatic gall stone disease is cholecystectomy. In elective cholecystectomy, laparoscopic cholecystectomy is considered best and feasible. Laparoscopic cholecystectomy yields good results and better prognosis when compared to the open cholecystectomy in terms of early postoperative recovery, pain, shorter hospital stays, and early getting back to routine life style.

In laparoscopic cholecystectomy, preferably titanium clips are used to clip the cystic duct. In recent times, different ways of suturing and knotting are used by either intracorporeal or extracorporeal technique. However, there are only few case series analyzes that compare the cystic duct occlusion with knotting and using titanium clips in laparoscopic cholecystectomy.

In the present study, for extracorporeal knotting, Vicryl No 1 was used for ligating the cystic duct and knots are pushed using a knot pusher. The duct was ligated in two places, once near to the common bile duct and another one distally near the gallbladder (Fig. 1). Cystic duct is cut in between the two knots, and gallbladder is dissected from the liver bed. In 90% of the patients, gallbladder was extracted by using sterile glove and, in few affordable patients, sterile bags were used.

In Obstructive jaundice due to accidental ligation of common bile duct was seen with clip ligation as compared to with suture ligation. This result is further supported by a study by Bali and Singal who concluded that silk suture can be tied near the common bile duct, as risk of involving the common bile duct wall is very little as compared to clips.[9]

In the present study, the maximum percentage of patients who underwent laparoscopic cholecystectomy were under the age-group of 30–49 years of age, i.e., 77%; another study done by Nidoni et al. on predicting difficult laparoscopic cholecystectomy based on clinicoradiological assessment in 180 patients also reported that 30–50 years was the most common age-group to undergo laparoscopic cholecystectomy.[10]

Another study done by Kuldip Singh et al. on extracorporeal knotting with silk vs liga clips for ligating cystic duct in laparoscopic cholecystectomy in 60 patients reported that most common age-group of presentation was between 30 and 50 years.[1]

In this study, the male-to-female ratio is almost 1:1; a study done by Nidoni et al. on predicting difficult laparoscopic cholecystectomy based on clinicoradiological assessment in 180 patients reported that male-to-female ratio was 1:1.76.[10]

Another study done by Kuldip Singh et al. on extracorporeal knotting with silk vs liga clips for ligating cystic duct in laparoscopic cholecystectomy in 60 patients reported that there was a female predominance, i.e., 90%.[1]

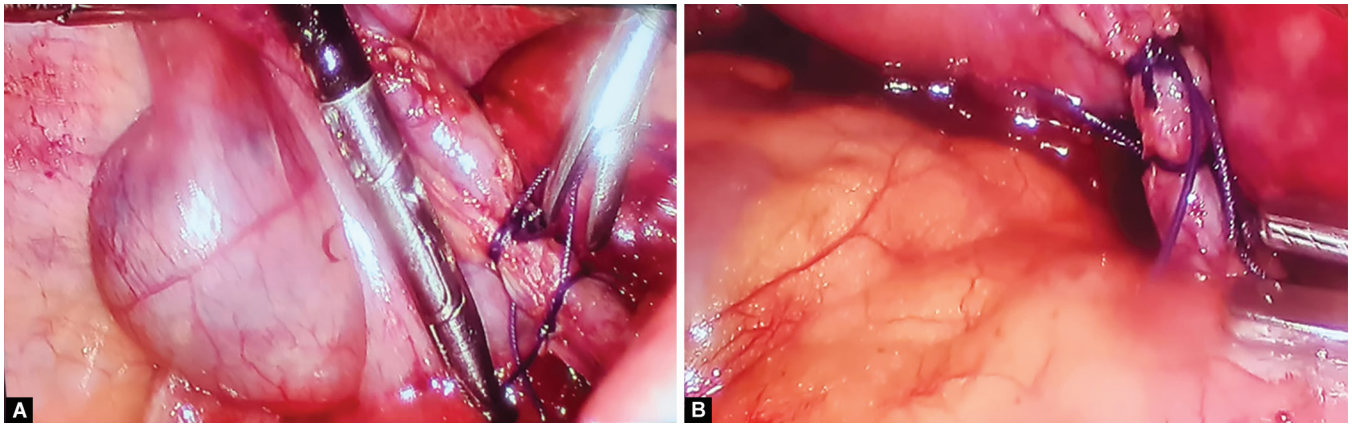
In the present study, the mean operating time for group in which extracorporeal knotting done was 67.37 minutes when compared to control group using clips was 61.83 minutes. However, statistical analysis showed that the difference between the two groups was not significant. Using clips reduce the intraoperative time which has advantage over the extracorporeal knotting, whereas clips have the drawback of slippage resulting in leakage or hemorrhage and there are situations such as wide cystic duct where clipping is difficult, in such cases using the extracorporeal knotting for occluding the cystic duct is best alternative. Extracorporeal knotting with absorbable suture material is feasible, practical, economic, and safe as well.

However, the difference in the operating time between the two groups was mainly because surgeons do not commonly use the extracorporeal knotting when compared to the frequently used clips during laparoscopic cholecystectomy and also there was technical skill associated with extracorporeal knotting. As skill increase with extracorporeal knotting, we have observed that operating time decreased.

Intracorporeal knotting is another method of knotting the cystic duct. There is a need to learn the skill, and it is little difficult while knotting as compared to extracorporeal technique of knotting (Fig. 1).

In the present study, cost of the suture (Vicryl No 1 Round Body) used was 302 rupees when compared to titanium clips that cost 500 rupees.

A study done by Kuldip Singh et al. on extracorporeal knotting with silk vs liga clips for ligating cystic duct in laparoscopic cholecystectomy in 60 patients concluded that though it takes more time for extracorporeal knotting of cystic duct when compared to liga clips, it makes a significant difference with respect to cost without affecting the safety and efficacy in laparoscopic cholecystectomy.[1]



Figs 1A and B: Extracorporeal knotting of cystic duct

In the present study, majority of the control group patients where titanium clips were used had complications such as adhesions, empyema gallbladder, and obese patients due to which dissection of Calot's triangle became difficult which resulted in complications in those patients.

In the present study, using clips had some drawbacks with respect to the intraoperative complications; in seven cases, there was clip slippage and stone spillage seen during the dissection of gallbladder from the liver bed and during extraction. Finding and retrieving the spilled stones in the peritoneum were again a difficult task which extended the operating time.

In three cases, there was clip slippage at the specimen side and bile was spilled into the peritoneal cavity; in all these cases, peritoneal cavity was irrigated with normal saline.

In the present study, in one case, there was clip migration seen during the final inspection, which needed clipping again.

There were two patients from the control group in which clipping was planned, which had to be converted to extracorporeal knotting due to the wider cystic duct.

In the present study, there was no case with cystic duct leak postoperatively in both the groups, i.e., either with extracorporeal knotting or clipping of cystic duct, which indicates that cystic duct was safely secured in both the groups. Gallbladder wall thickness was not considered in our study.

Conclusion

In laparoscopic cholecystectomy, extracorporeal knotting has the advantages over clipping of cystic duct in operative cost and lesser intraoperative complications with the only limitation being operative time.

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