

## A Comparative Study between Metal Clip Application and Suture Ligation of Cystic Duct in Laparoscopic Cholecystectomy

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### Abstract

**Introduction:** Laparoscopic cholecystectomy has been performed for decades and is a fairly standardized procedure throughout the world. Occlusion of the cystic duct is popularly done with the help of metal clips. There are many other techniques described in the literature to deal with occlusion of the Cystic Duct. Suture ligation of the duct is one such way. To evaluate the effectiveness in term of cost, safety, and complication in occlusion of cystic duct with suture ligation compared to clip application. **Materials and Methods:** A prospective cross sectional comparative study was carried out From June 2020 to November 2020. Data were collected from 80 patients undergone laparoscopic cholecystectomy for Gall stone diseases. 40 patients were enrolled in each group by consecutive purposive sampling. Complete history was taken. Thorough clinical examination was done. Relevant investigations report was collected. **Results:** Female patients were predominant in both groups and most of the patients were underweight. Mean time for ligation was more in occlusion of cystic duct with clip application. Bile leakage was found and duration of drain in situ was more in occlusion with clip application. Cost was high in occlusion with clip application. **Conclusion:** : Time for ligation, Bile leakage, mean duration of drain in situ (days), and cost of Cystic Duct occlusion and port closure were significantly higher in Laparoscopic Cholecystectomy with conventional Clip application of Cystic Duct group in comparison to Laparoscopic Cholecystectomy with ligation of the Cystic duct with no-Ivicryl by extra corporeal knotting group.

**Keywords:** Laparoscopic cholecystectomy, metal clips application, suture ligation of cystic duct.

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### Introduction:

Laparoscopic cholecystectomy is accepted as the “gold standard” surgical treatment of gall stone diseases due to its optimal postoperative results and enhanced quality of life<sup>1,2</sup>. Cholecystectomy is the second most commonly performed intra-abdominal operation worldwide after appendectomy<sup>3</sup>. It is the commonest performed laparoscopy worldwide<sup>4</sup>. Compared with open cholecystectomy, laparoscopic cholecystectomy has improved surgical outcome in terms of reduce pain, shorter hospital stay, quicker return of normal activity and improved cosmetic outcome<sup>5</sup>. During laparoscopic cholecystectomy it is important to identify the structures of callot’s triangle at the time of cystic duct isolation. Cystic duct occlusion can be done with clips, intra or extra corporeal ligation, harmonic scalpel or ligasure<sup>6</sup>. The main pitfall of metal clips are clip failure (dislodge, slippage or migration), bile leakage and common bile duct injury<sup>7-11</sup>. One reason of bile leakage is laceration of cystic duct by metal clips<sup>12</sup>. This is because of ability of the metal clip to conduct electricity causing a cut in the cystic duct or cause necrosis of clamped tissue<sup>13</sup>. Rarely the metal clips can erode into the cystic duct and migrate in to common bile duct. Such migration of clips can act as a nidus for stone in common bile duct<sup>14</sup>. These disadvantages limited the worldwide use of metal clips in surgical procedures<sup>5</sup>. Alternative techniques have included the use of absorbable clips and harmonic scalpel. These are, however, more expensive, not readily available and used infrequently<sup>15</sup>. In contrast, these complications are not encountered with open cholecystectomy using thread to ligate the duct<sup>5</sup>. It is now possible, with increasing experience in advanced laparoscopic technique, to safely occlude cystic duct with ligature as an alternative to clips<sup>6,16</sup>. Therefore, the

purpose of the present study is to evaluate the effectiveness in terms of intra operative complications, operative time, post-operative complications and cost effectiveness in both groups.

#### Materials and Methods:

This prospective cross sectional comparative study was conducted between June 2020 to November 2020 at Department of Surgery, Cumilla Medical College, Cumilla. Sample were collected by Consecutive purposive sampling method. Patient who undergone laparoscopic cholecystectomy for Gall stone diseases with short and wide cystic duct were selected for study. Exclusion criteria were – choledocholithiasis, previous Upper abdominal surgeries, comorbidities like CLD, ascites & coagulopathy, anaesthetic fitness with ASA grading of 3 and above. All patients received preoperative medication. General anesthesia was applied for all patients. In group A, clip was applied over the cystic duct and artery. In group B, after creating a window extra corporeal meltzer knot was applied for both cystic duct and artery. informed written consent were taken from each patient or from his/her legal guardian. Data collection was done by face-to-face interview using a standard questionnaire by the researchers. Then the patients were examined by the researcher for certain signs and those were recorded in the check-list. Investigations were done for supporting the diagnoses. According to the participants' understanding level, sometimes the questions were described in the native language so that the patients can understand the questions perfectly and answer accurately. Data was process and analyses using SPSS (Statistical Package for Social Sciences) software version 23. The chi-square test and student "t" test was used to analyze the significance level of  $p < 0.05$ . Continuous scale data was presented as mean standard deviation and Categorical data was presented as number percentage. Unpaired t-test was used for continuous variables and Chi square test was used for categorical variables. The summarize data was present in the table and chart. The study was approved by the Institutional Review Board (IRB) of National Institute of Neuroscience (NINS).

#### Results:

In group A majority 10(25.0%) patients belonged to age group 31-40 years and 17(42.5%) in group B. The mean age was  $39.97 \pm 13.50$  years in group A and  $40.12 \pm 9.67$  years in group B (Table-I). Female patients were predominant in both groups. Based on calculated BMI, most of the patients were underweight in both groups that was 15(37.5%) in group A and 16(40.0%) in group B Healthy was 14(35.0%) and 13(32.5%) in group A and group B respectively. The difference was not statistically significant ( $p > 0.05$ ) between two group (Table-II).

Post operative complications shows statistically significant difference in group A and group B. Slippage of clip or ligation was 5(12.5%) in group A and none in group B (Table-III). Spillage of bile was 3(5.0%) in group A and 2(5.0%) in group B. The difference was not statistically significant. Mean time for ligation was significantly more in

group A ( $2.48 \pm 0.30$  minutes) than in group B ( $1.55 \pm 0.25$  minutes) (Table-IV). Bile leakage was found in 4(10.0%) in group A but not found in group B. Duration of drain in situ was  $5.4 \pm 1.2$  days and  $4.1 \pm 1.1$  days in group B. Bile leakage and duration of drain in situ was statistically significant ( $p < 0.05$ ) between two groups (Table-V). Readmission after discharge was found in 3(7.5%) in group A and 2(5.0%) in group B which was not statistically significant (Table-VI). Table 3.9 shows that cost of Cystic Duct occlusion and port closure was  $947.3 \pm 26.2$  taka in group A and 400 taka in group B. The difference was statistically significant ( $p < 0.05$ ) (Table-VII).

**Table I: Distribution of the study patients by age (n=80)**

Age (years)	Group A (n=40)		Group B (n=40)		P value
	n	%	n	%	
≤20	3	7.5	2	5.0	
21-30	8	20.0	7	17.5	
31-40	10	25.0	17	42.5	
41-50	6	15.0	7	17.5	
51-60	9	22.5	5	12.5	
>60	4	10.0	2	5.0	
Mean±SD	39.97±13.50		40.12±9.67		0.954 <sup>ns</sup>

**Table II: Distribution of the study patients by BMI (n=80)**

Body mass index (kg/m <sup>2</sup> )	Group A (n=40)		Group B (n=40)		P value
	n	%	n	%	
Underweight (≤18.4 kg/m <sup>2</sup> )	15	37.5	16	40.0	
Healthy (18.5-22.9 kg/m <sup>2</sup> )	14	35.0	13	32.5	
Overweight (23-24.9 kg/m <sup>2</sup> )	9	22.5	10	25.0	0.928 <sup>ns</sup>
Obese (≥25 kg/m <sup>2</sup> )	2	5.0	1	2.5	

ns=not significant

P value reached from Chi square test

**Table III: Distribution of the study patients by operative complications (n=80)**

Operative complications	Group A (n=40)		Group B (n=40)		P value
	n	%	n	%	
Conversion	0	0.0	0	0.0	-
Spillage of bile	3	7.5	2	5.0	0.644 <sup>ns</sup>
Bleeding from cystic artery	2	5.0	1	2.5	0.556 <sup>ns</sup>
Cystic duct injury	1	2.5	0	0.0	3.15 <sup>ns</sup>
Bile duct injury	1	2.5	0	0.0	0.152 <sup>ns</sup>
Slippage of clip or ligation	5	12.5	0	0.0	0.020 <sup>*</sup>
Drain placement	40	100.0	40	100.0	-

s=significant; ns=not significant; P value reached from Chi square test

**Table IV: Time for ligation of the study patients (n=80)**

	Group A (n=40)	Group B (n=40)	P value
	mean±SD	mean±SD	
Time for ligation (minutes)	2.48±0.30	1.55±0.25	0.001 <sup>s</sup>

s=significant; P value reached from unpaired t-test

**Table V: Distribution of the study patients post operative variables (n=80)**

Post operative variables	Group A (n=40)	Group B (n=40)	P value
Bile leakage (n, %)	4 (10.0)	0 (0.0)	0.040 <sup>s</sup>
Hospital stay (days) mean±SD	2.5 ±0.4	2.4±0.5	0.326 <sup>ns</sup>
Duration of drain in situ (days) mean±SD	5.4±1.2	4.1±1.1	0.001 <sup>s</sup>

s=significant; ns=not significant; P value reached from Chi square test and unpaired t-test

**Table VI: Distribution of the study patient's readmission after discharge**

Readmission after discharge	Group A (n=40)		Group B (n=40)		P value
	n	%	n	%	
Yes	3	7.5	2	5.0	0.644 <sup>ns</sup>
No	37	92.5	38	95.0	

ns=not significant; P value reached from Chi square test

**Table VII: Cost of CD occlusion and port closure**

Cost of CD occlusion and port closure	Clip application (5-8 clips) and suture (used for port closure)	Extra- corporeal ligation + port closure (1 suture is used)	P value
Mean±SD	947.3±26.2	400±0.0	0.001 <sup>s</sup>

s=significant; P value reached from unpaired t-test

#### Discussion:

The present study revealed that the majority 10 (25.0%) patients belonged to age group 31-40 years in group A and 17 (42.5%) in group B. The mean age was 39.97±13.50 years in group A and 40.12±9.67 years in group B. The difference was not statistically significant. Riaz et al.<sup>17</sup> observed that the mean age of the patient was 40.3±11.9 years and 38.3±10.8 years in laparoscopic cholecystectomy with metal clips group and intracorporeal ligation group respectively. Sharma et al.<sup>5</sup> reported the mean age in their study was 44.26 years in clip group and 47.32 years in ligation group. In this study showed that female patients were predominant in both groups, that was 32(80.0%) in group A and 31(77.5%) in group B. The difference was not statistically significant. Prabu et al.<sup>3</sup> reported total of 70 patients were included in the study. 67% of the patients were female and 33% were male. Sharma et al.<sup>5</sup>

reported female predominance in both clip (70%) and ligature groups (74%). Saha et al.<sup>6</sup> observed most of the patients were female (80.0%). This study observed that mean time for ligation was 2.48±0.30 minutes in group A and 1.55±0.25 minutes in group B. The difference was statistically significant (p<0.05) between two group. Riaz et al.<sup>17</sup> reported that the mean operating time in metal clip group was 2.53 ± 0.5 minutes compared to intracorporeal ligation group which was 4.79±1.5 minutes.

However, the study also showed that slippage of clip or ligature was 5(12.5%) in group A and none in group B. The difference was statistically significant (p>0.05) between two groups.

In this study showed that bile leakage was found in 4(10.0%) in group A but not found in group B. Duration of drain in situ was 5.4±1.2 days in group A and 4.1±1.1 days in group B. Bile leakage and duration of drain in situ was statistically significant (p<0.05) between two groups. The result of our study regarding bile leakage was comparable with the study done by Talebpour and Panahi.<sup>18</sup> That study concluded that ligation by suturing is effective in decreasing the risk of bile duct trauma and bile leakage. The result of our study was further supported by Rajra et al.<sup>12</sup> in MMU Hospital India. Bile leakage was 6% in clip group vs 3% in knot group. In a study conducted in Fort Prajaksi lapakoun hospital, Thailand by Jongsiri<sup>7</sup> showed that intracorporeal ligation in laparoscopic cholecystectomy was feasible, economical and safe. Leo et al.<sup>19</sup> reported In the MC group, three patients had post-operative bile leak from the CD stump and two had injury to the common bile duct. Compared to MC, it is observed that the use of absorbable locking clips shows a lesser incidence in bile leak post-operatively. Sharma et al.<sup>5</sup> observed majority of patients in group 1, 46(92%) were discharge on 5th and 7th day while in group 2nd 31(62%) were discharge on beyond 7th day. This difference between two groups was highly significant. In present study showed that cost of CD occlusion and port closure was 947.3±26.2 taka in group A and 400 taka in group B. The difference was statistically significant (p<0.05). In Prabu et al.<sup>3</sup> study, the cost of polyglactin suture was much cheaper than that of titanium clips used for the cystic duct and artery. For the suture material used during the study, the price was only 250-300 rupees (3.51-4.21 \$), whereas for the titanium clips used for clipping it was far higher, reaching 790-1000 rupees (12.28-15.55 \$). This suggests that the use of suture for ligation is a very cost-effective and economic option for ligation. Singal et al.<sup>20</sup> reported that the cost of material for silk suture (40-60 Rupees or 0.62-0.92 \$) is definitely much lower than that for Liga clips (790-1000 Rupees or 12.28-15.55 \$).

#### Conclusion:

Female patients were predominant in both groups and most of the patients were underweight. All patients had drain placement in both groups and slippage of clip or ligature were significantly higher in Laparoscopic Cholecystectomy with conventional Clip application of Cystic Duct. Time for ligation, Bile leakage, mean duration of drain in

situ (days), and cost of CD occlusion and port closure were significantly higher in Laparoscopic Cholecystectomy with conventional Clip application of Cystic Duct group in comparison to Laparoscopic Cholecystectomy with ligation of the Cystic duct with no-1vicryl by extra corporeal knotting group.

**Conflict of Interest:** None.

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