Original Research Article

A Comparative Study between the efficacy of Coagulation and Clip Ligation of the Cystic Artery during Laparoscopic Cholecystectomy

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Abstract

Background: Cholelithiasis is an important disease with common presentation in surgical practice and requires cholecystectomy. The treatment of cystic artery following cholecystectomy is an important which can be achieved by coagulation, clip ligation and the use of ultra devices. This study was mainly undertaken to compare the Coagulation and Clip Ligation of the cystic artery.**Material and Methods:**Between January 2018 and December 2019 a randomized controlled trial was performed in the General Surgery department of a medical college in South India. The patients were divided into two equal groups of 60 patients each where the first group had undergone cystic artery cauterization with bipolar diathermy and the other group had undergone laparoscopic cholecystectomy with cystic artery clip ligation using titanium clips. The operative time, closure time, intra and post operative bleeding, duration of hospital stay and complications were compared between the two groups.**Results:**Most of the patients in this study belonged to the 41 – 50 years age group and most of them were females. The mean operative time, closure time, intra and post operative haemorrhage were lesser in a clip ligation group than coagulation group. There was no statistically significant difference in the duration of hospital stay and complications were observed in the coagulation group only.**Conclusion:**The authors conclude that clip ligation was superior compared to the coagulation of the cystic artery during cholecystectomy.

Keywords: Cholecystectomy, Cholelithiasis, Cystic artery, Coagulation, Clip Ligation.

Introduction

Cholecystectomy is often the second most performed intra abdominal surgery in surgical practice. The advent of minimally invasive surgery (laparoscopic surgery) has maximized the benefits of intra abdominal surgical procedures including cholecystectomy by reducing morbidity and mortality. The estimates show an increasing trend of the cholecystectomy which can be mainly due to either increase the number of cases with gallstones or increased training of surgeons who are getting acquainted with the laparoscopic procedure [1,2].Identification and dissection of Calot's triangle is an important step since the triangle consists of cystic artery which should be either cauterized or ligated subsequently after cholecystectomy[3].Proper control either through clip ligation or electrocauterization of the cystic artery is at most important step since it may lead uncontrollable bleeding obscuring operative field and thus forcing the surgeon to convert the laparoscopic procedure to open laparotomy and thus rising in mortality and morbidity. The anatomical studies available show variations in anatomy in calot's triangle leading to hepatic artery and hepatic duct injury. Congenital anomalies are also common in the hepato - biliary area including the origination of the cystic artery from the common hepatic artery, left hepatic artery, gastroduodenal artery, and celiac plexus instead of its normal origin from a right hepatic artery. Hence, this challenges the surgeon to have proper identification and good control of the cystic artery for the best surgical outcome[4].The literature available had shown that, a number of methods are used to control the cystic artery, including application of the titanium clips, monopolar cautery, bipolar cautery, vessel sealers, ultrasonic devices etc. with variable success and complications[5,6].The clip ligation using the titanium clips which are non absorbable, effective and affordable and do not exhibit ferromagnetic properties enabling the patient for future MRI scans[7]. Monopolar and bipolar diathermy is an age-old procedure of burning and shrivelling the tissues to control the bleeding. The main problem with this procedure is the lateral dissipation of the heat resulting in damage to the adjoining structures, including common bile duct, hepatic artery, portal vein etc. especially in monopolar diathermy[8,9]. The smoke produced during the procedures can also obscure the surgical field and also hails in release of toxic compounds.The literature comparing the efficacy of cystic artery clip ligation and coagulation is scant in this part of the country. Hence, it was decided to compare the two procedures in a tertiary care setting.

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Material and Methods

Between January 2018 and December 2019 a randomized controlled trial was performed in the General Surgery department of a medical college in South India. A total of 120 cases were randomly allocated into cautery and clip ligation groups by using computer generated random numbers. It was a single blinded study. The clearance from the institutional ethics committee was obtained before the study was started. The patients were explained about the procedure of cholecystectomy and cystic artery clip ligation/ cauterization. A written, informed, bilingual consent was obtained before they were included into the study. All the patients with symptoms suggestive of gall stones were included in the study. The patients, denying giving informed consent, not fit for surgery, patients with cholecystitis, choledocholithiasis, elevated liver enzymes, pancreatitis and multiple comorbidities were excluded from the study. All the patients were subjected for a thorough clinical and laboratory examination, including liver function tests and ultrasonography of the abdomen. A contrast enhanced CT was performed in doubtful cases for confirmation of the presence of gallstones.The patients were divided into two equal groups of 60 patients each where the first group had undergone cystic artery cauterization with bipolar diathermy and the other group had undergone laparoscopic cholecystectomy with cystic artery clip ligation using silk suture. The amount of blood loss was noted immediately after the procedure and a blood loss of more than

100 ml was considered as significant blood loss. Any injury to the surrounding structures was also documented. The vital signs including pulse rate, blood pressure and urine output was checked once in four hours. The postoperative hemorrhage (more than 100 ml) was recorded from drain contents. The duration of surgery, hospital stay and any other complications were also recorded by using a pre designed proforma.The data thus obtained was entered into an excel sheet and transferred and analyzed using Statistical Package for Social Services (SPSS vs 20). The categorical variables were presented as frequencies and percentages. The quantitative variables were presented as measures of central tendency and dispersion. Chi square test was used as a test of significance for categorical variables and Independent sample T test/ Mann Whitney U test was used as a test of significance for quantitative variables. A p value of less than 0.05 was considered as statistically significant.

Results

Table 1: Distribution of the study groups according to age group

Age group	Group	
	Coagulation n (%)	Clip Ligation n (%)
21 – 30 years	1 (1.7)	1 (1.7)
31 – 40 years	9 (15.0)	5 (8.3)
41 – 50 years	28 (46.7)	28 (46.7)
51 – 60 years	22 (36.7)	22 (36.7)
More than 60 years	0	4 (6.7)
Total	60 (100)	60 (100)

χ^2 Value=5.143, df=4 , p value=0.273, NS

Majority of the study subjects belonged to 41 – 50 years of age group in both the groups followed by age of 51 – 60 years of age group. This difference was not statistically significant between the coagulation and clip ligation groups.

Table 2: Distribution of the study groups according to sex

Sex	Group	
	Coagulation n (%)	Clip Ligation n (%)
Male	13 (21.7)	13 (21.7)
Female	47 (78.3)	47 (78.3)
Total	60 (100)	60 (100)

χ^2 Value = 0.0, df=1, p value = 1.0, NS

About 78.3% of the study subjects in both the groups were females. This difference in sex was not statistically significant between the coagulation and clip ligation groups.

Table 3: Distribution of the study groups according to operative time and Closure time of cystic duct (in mins)

Mean ± SD	Coagulation	Clip Ligation	T value	P value, Sig
Operative time (in mins)	39.93 ± 5.69	34.6 ± 3.9	5.988	0.000, Sig
Closure time of cystic duct (in mins)	7.2 ± 1.72	5.55 ± 1.32	5.883	0.004, Sig

The mean operative time of coagulation of the cystic artery group was 39.93 (± 5.69) mins and 34.6 (± 3.9) minutes in a clip ligation group. This difference was significantly lower in the clip ligation group than coagulation group. The closure time of the cystic duct in the coagulation group was 7.2 (± 1.72) minutes and 5.55 (± 1.32) minutes in the clip ligation group. This difference was also significantly lower in the clip ligation group than the coagulation group.

Table 4: Distribution of the study groups according to Intra-operative hemorrhage and drain quantity

Mean ± SD	Coagulation	Clip Ligation	T value	P value, Sig
Intraoperative hemorrhage (in ml)	103.62 ± 30.97	78.12 ± 29.08	4.649	0.000, Sig
Drain quantity (in ml)	59.55 ± 23.24	47.62 ± 21.31	2.932	0.004, Sig

The mean intra operative haemorrhage in the coagulation group was 103.62 (± 30.97) ml in the coagulation group and 78.12 (± 29.08) ml in clip ligation group which was significantly lower in a clip ligation group than coagulation group. The mean drain quantity in the coagulation group was 59.55 (± 23.24) ml in the coagulation group and 47.62 (± 21.31) ml in the clip ligation group which was significantly lower in the clip ligation group than coagulation group.

Table 5: Distribution of the study groups according to duration of Hospital stay

Mean ± SD	Coagulation	Clip Ligation	T value	P value, Sig
Duration of hospital stay	1.97 ± 0.55	1.88 ± 0.49	4.649	0.383, NS

The mean duration of hospital stay was 1.97 (± 0.55) days in the coagulation group and 1.88 (± 0.49) days in the clip ligation group which was not statistically significant between the groups.

Table 6: Distribution of the study groups according to complications

Complications	Group	
	Coagulation n (%)	Clip Ligation n (%)
Nil	56 (9.3)	60 (100)
Cystic duct leak	2 (3.3)	0
Port site infection	2 (3.3)	0
Total	60 (100)	60 (100)

χ^2 Value = 4.138, df = 2, p value = 0.126, NS

The complications were mainly found in coagulation where 2 cystic duct leaks and port site infections were present in cases undergoing coagulation. None of the clip ligation group had any complications.

Discussion

Cholelithiasis is one of the common causes of dyspepsia and the burden is increasing with changing dietary patterns. Haemorrhage from the cystic artery is an important surgical complication of the cholecystectomy. A number of methods are available to prevent such hemorrhage, including coagulation with mono and bivalent

diathermy, ligation using silk suture and other types of clips and ultrasonic devices etc.But the electro thermal devices, including monopolar diathermy and are known to produce the lateral dissipating due to heat injury of the bile ducts, hepatic arteries bowel etc. Hence, it is considered as less efficacious than other modes. A number of studies have refuted this[10,11]. Majority of the study subjects belonged to 41 – 50 years of age groups in both the groups. The cholelithiasis is common in this age as shown in the studies available. About 78.3% of the study subjects in both the groups were females. This was in correlation with many other studies which is the common age of occurrence of cholelithiasis. A study by Das et al. had observed that the mean age of the study population was 40.26 years and male: female ratio was 1:4 similar to the results of this study[6].The mean operative time of coagulation of the cystic artery group was 39.93 (± 5.69) mins and 34.6 (± 3.9) minutes in a clip ligation group. This difference was significantly lower in the clip ligation group than coagulation group. A study by Yang et al. also shown similar results where the mean operative time in coagulation group was 58.9 minutes and 41.6 minutes in a clip ligation group[12].The closure time of cystic duct in the coagulation group was 7.2 (± 1.72) minutes and 5.55 (± 1.32) minutes in the clip ligation group. This difference was also significantly lower in the clip group than the coagulation group. The mean intra operative haemorrhage in the coagulation group was 103.62 (± 30.97) ml in the coagulation group and 78.12 (± 29.08) ml in clip ligation group which was significantly lower in a clip ligation group than coagulation group. The mean intra operative blood loss was not significantly different in coagulation and clip ligation groups in a study by Yang et al[12].The mean drain quantity in the coagulation group was 59.55 (± 23.24) ml in the coagulation group and 47.62 (± 21.31) ml in the clip ligation group which was significantly lower in the clip ligation group than coagulation group. In a study by Das et al., the post operative haemorrhage was not noted in any cases[6].The mean duration of hospital stay was 1.97 (± 0.55) days in the coagulation group and 1.88 (± 0.49) days in the clip ligation group which was not statistically significant between the groups. In a study by Das et al., about 86% of the patients in electrocautery and 88% in the clip ligation group were discharged in first postoperative day itself[6]. The duration of hospital stay was not statistically significant in a study by Yang et al[12].The complications were mainly found in coagulation where 2 cystic duct leaks and 2 port site infections were present in cases undergoing coagulation. A study by Das et al. had reported that, 2 of the electrocautery and 1 of the clip ligation patient had a port infection and bile leak was not noticed in any cases[6]. A similar study by Yang et al. had shown that, no leaks in patients undergoing coagulation and 0.96% leaks in patients undergoing ligation in contrary to these results[12].

Conclusion

This study was mainly undertaken to study the efficacy of Coagulation and Clip Ligation of the Cystic Artery during Laparoscopic Cholecystectomy. This study had shown that the clip ligation required less operative time, closure time, intra and postoperative haemorrhage and less number of complications. Hence, the authors conclude that the clip ligation of the cystic artery is more efficacious than coagulation.

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