International Surgery Journal
Venkatapuram MR et al. Int Surg J. 2017 Dec;4(12):3844-3848
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20175152

Original Research Article

Control of cystic artery during laparoscopic cholecystectomy: clips versus ultrasonic energy devices which is better?

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Received: 10 November 2017
Accepted: 16 November 2017

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ABSTRACT

Background: This study was undertaken to know whether clip usage or ultrasonic energy application, obtains better haemostasis of cystic artery during laparoscopic cholecystectomy.
Methods: About 80 patients undergoing laparoscopic cholecystectomy were selected on a prospective basis and divided into two equal groups- A and B. a comparative study was done between the two group. Clips were used to control cystic artery in group A patients and ultrasonic energy device was used for the same in group B.
Results: In group A, 2 patients had clip slippage intraoperatively which was dealt by reapplication of clips.in group B,1 patient had intraoperative bleeding from cystic artery few minutes after application of ultrasonic energy which was dealt by bipolar cauterization. In both the groups no, postoperative bleeding was encountered.
Conclusions: During laparoscopic cholecystectomy, clip usage and ultrasonic energy application are equally competent in achieving haemostasis of cystic artery.

Keywords: Clips, Cystic artery, Laparoscopic cholecystectomy, Ultrasonic energy device

INTRODUCTION

With the advent of minimally invasive surgery (laparoscopic surgery), undoubtedly, it's the cholecystectomy procedure which reaped maximum advantage by avoiding a subcostal incision thus bringing down morbidity remarkably. Statistics show that laparoscopic cholecystectomy is one of the commonly done elective surgeries probably due to increasing incidence of gallstone disease and more and more surgeons getting trained and acquainted with laparoscopy.[1] During laparoscopic cholecystectomy after gaining access to abdomen either through Hasson's cannula technique or veress needle technique, pneumoperitoneum is created, gall bladder identified and retracted at fundus then dissection of Calot's triangle started. One of the major step in dissection of calots triangle is to identify cystic artery, which is cauterized or clipped subsequently.[2]

Improper control of cystic artery leads to uncontrollable bleed which obscures the operative field and thus surgeon is forced to convert the laparoscopic procedure into open cholecystectomy bringing lot of morbidity to the patient.one more problem encountered is the variable anatomy in calots triangle leading to injury of hepatic artery and common bile duct. Hepato-biliary area is known for its congenital anomalies. Cystic artery which normally should arise from right hepatic artery, sometimes abnormally arises from common hepatic artery, left hepatic artery, gastroduodenal artery, coeliac plexus etc. so proper identification of cystic artery and its good control is a vital step for successful outcome. Several methods are followed for control of cystic artery

like application of titanium clips, monopolar cautery, bipolar cautery, vessel sealers, ultrasonic devices etc.[3-5] Among these clip application is a popular one in laparoscopic cholecystectomy.

Titanium clips are used, which when applied by a clip applicator, compresses and hold the applied structure-duct, vessel etc. They are nonabsorbable, effective and affordable.[6] Though the clips are made of metals, they don't have any ferromagnetic properties thus enabling the patient fit for any scans like MRI, if necessary, to be done in future. The other one, electro-thermal cauterization is also commonly used. Here tissues are burnt and shrivelled by means of electric current generating heat at the tip. Two types of them are in practice- monopolar and bipolar diathermy. Though these effectively cauterize the tissues the main problem is of lateral dissipation of heat leading to injury of adjacent structures like common bile duct, hepatic artery, portal vein etc, which is more common with monopolar diathermy.[7,8] Sometimes even adjacent bowel is injured when heat dissipation is more.[9]

The other problem with electrothermal devices is production of lot of smoke during the process which obscures the vision and also lot of toxic products are released.[10] Off late ultrasonic energy devices are becoming more popular.in an ultrasonic device the tip of the instrument vibrates with a high frequency (more than 20000 hertz, hence called ultrasonic, here 20000 hertz is the upper limit of human audible range), when activated, thus sheering and shrivelling the tissues. As ultrasonic don't operate by heat and they accurately control vessels, chances of injury to nearby structures is very less. So, clips and ultrasonic energy devices are considered to be safe by majority of surgeons. Hence, we decided to do a comparative study between clip application and ultrasonic usage with the intention of identifying a safe and accurate method for cystic artery control during laparoscopic cholecystectomy.[11-14]

METHODS

A prospective study was planned by selecting 80 consecutive patients getting admitted for laparoscopic cholecystectomy at general surgery department, Narayana medical college and hospital Nellore, during the period July 2016 to June 2017.informed consent was taken from all patients. Approval was taken from hospital ethics committee. All patients presenting with symptomatic gall stone disease were included in this study. After clinical examination, liver function test and ultrasound scan of abdomen was done for every patient to confirm presence of gallstones.in doubtful cases contrast enhanced CT scan of abdomen was done to confirm the disease.

Some patients had stone like appearance in gallbladder on ultrasound scan but on CT scan they turned out to be having either sludge or polyps in gallbladder. These patients were excluded from the study. patients undergoing cholecystectomy on emergency basis and patients with cholecystitis, choledocholithiasis, elevated liver enzymes, pancreatitis and multiple comorbidities were excluded from the study. Patients were equally divided between two groups- group A and group B, with 40 patients in each group. Surgeons with an experience of at least 7years in laparoscopic surgery and who regularly do cholecystectomy were selected. The selected surgeons were well versed with usage of ultrasonic device and clip application.

In group A patient's cystic artery control was achieved by means of clip application.in group B patients the same was achieved by means of ultrasonic cauterization (harmonic scalpel was used).[15-17] any event of inappropriate control of cystic artery was documented soon after the procedure and amount of blood loss was also measured and noted.[18] A blood loss of more than 100ml was considered significant. Also, any event of inadvertent injury to surrounding structures was documented. Patients were followed for 2 days after the procedure, their vital data (pulse rate, blood-pressure, urine output) checked every fourth hourly and any event of postoperative haemorrhage (more than 100ml) documented by observing the drains and ultrasound scan reports. With all the available details a comparative study was done between the two groups.

Statistical analysis

All the statistical analysis was performed as per protocol. Statistical data was computed and analysed with SPSS latest version (SPSS inc., Chicago, Illinois, USA) and they were quantized as Mean±Standard deviation. P value less than 0.05 was considered significant statistically. Intraoperative bleed and injury to surrounding structures during cystic artery control, operative time, difficulty in performing the procedure requiring placement of additional ports, conversion to open cholecystectomy and postoperative vomiting, fever, significant blood loss were the considered factors.

RESULTS

In group A-clip application, among 40 patients 25% were males and 75% were females.in group B-ultrasonic cauterization 27.5% were males and 72.5% were female patients.[19,20] It was female patients who commonly got affected in our study in the ratio of 1:3 and 1:2.63 in both the groups respectively. In group A the median age of male and female patients was 48.7yrs and 43.5yrs respectively.in group B it was 47.9% and 44.8% respectively. Cystic artery was abnormal in 7.5% and 5% of cases of group A and B respectively.

Cystic artery normally arises from right hepatic artery.in our study any abnormal origin of cystic artery from common hepatic artery, left hepatic artery, coeliac plexus etc. was considered anomalous. Intraoperatively cystic artery bleed was encountered in 2 cases of group A due to loosening of clips which was later dealt with

reapplication of clips successfully. In group B one patient had cystic artery bleed preoperatively even after application of ultrasonic energy which was successfully controlled by clip application.[21-23] Surgery related factors like operative time, requirement for any additional laparoscopic ports, conversion to open cholecystectomy were studied to assess any difficulty in surgery in both the groups.[24]

Table 1: Clinical data and outcomes between clip application versus ultrasonic energy usage.

	Group A (clips)		Group B (ultrasonic device)	
Parameters	**Total no. of cases**	**Percentage**	**Total no. of cases**	**Percentage**
Sex predilection	40		40	
Males	10	25%	11	27.5%
Females	30	75%	29	72.5%
Median age				
Males	48.7yrs		47.9yrs	
Females	43.5yrs		44.8yrs	
Cystic artery				
Normal	37	92.5%	38	95%
Anomalous	3	7.5%	2	5%
Cystic artery bleed during surgery in milli litres, mean±SD	2	5%	1	2.5%
Need for any additional ports	1	2.5%	2	5%
Operative time in minutes, mean±SD	72.4±6.5		75.3±7.2	
Conversion to open surgery	1	2.5%	1	2.5%
Nausea/vomiting in postoperative period	6	15%	8	20%
Fever in postoperative period	3	7.5%	4	10%
Postoperative bleed	0		0	

The mean operative time stood between 70 to 80 minutes. in only few cases there was need for additional port and need for conversion to open cholecystectomy. In group A one case needed placement of an additional port for retraction of liver (a fan retractor was used), as there was hepatomegaly.in group B 2 cases needed additional port placement, for release of adhesions in one case and for control of port site bleed in the other case. Conversion to open cholecystectomy was done in one case of group A, as there was a suspected injury to common bile duct, and in one case of group B as there was a need to repair an incidentally found thin walled diverticulum of duodenum. in the postoperative period factors like nausea, vomiting, fever and postoperative bleed were studied. more than 100ml of fresh blood in drain or a collection of similar quantity in ultrasound scan was considered as significant bleed but postoperatively no significant bleed was encountered in both the groups. The results are tabulated below.

DISCUSSION

Cholelithiasis is one of the common causes of dyspepsia and its incidence is increasing due to changed dietary habits of less fibre intake and consumption of more fatty diet. Sedentary lifestyle, obesity, increasing usage of oral contraceptive pills are other factors contributing to the same. with increase in minimally invasive procedures on the other side, as more and more surgeons are getting trained, laparoscopic cholecystectomy has become the commonest hepatobiliary surgery performed.[25] During the said procedure control of cystic artery is a vital step which is being done by varied types of methods like clip application, monopolar and bipolar cautery, vessel sealers and ultrasonic devices.[26]

Electro-thermal devices like monopolar dithery produces lateral dissipation of heat injuring bile ducts, hepatic arteries, bowel etc. hence it is considered less efficient with respect to safety.[27] The same was expressed by Humes DJ, Ahmed I, Lobo DN et al in their study of the pedicle effect and direct coupling: delayed thermal injuries to the bile duct after laparoscopic cholecystectomy. In other study small bowel injury due to effects of heat was described by Ho AC, Horton KM, Fishman EK et al. We considered clip application and ultrasonic cauterization as safe procedures.so we conducted a prospective comparative study between two groups of patients undergoing laparoscopic cholecystectomy by usage of clips in one group and usage of ultrasonic device in other group for control of cystic artery. Female preponderance was noticed in both the groups in the ratio of 1:3 and 1:2.63 respectively nearly matching the demographic data presented by Hugh TB, Kelly MD, Li B et al in their study of laparoscopic anatomy of the cystic artery.

The median age of presentation in both group was in mid-forties. In both groups females presented at early age than males. Age demographics were on par with those described in Khan S, Oonwala ZG et al. Abnormal origin of cystic artery was noticed in about 7.5% and 5% of cases of both groups slightly lower than the figures published by Suzuki M, Akaishi S, Rikiyama T, Naitoh T, Rahman MM, Matsuno S. et al in their study of Laparoscopic variations in cystic arterial supply. There was not much difference in effectiveness of clip usage and ultrasonic device usage in control of intraoperative bleed.[28] Both showed promising results and there was no postoperative bleed in both method usage. These results concurred with study done by Huscher CG, Lirici MM, Di Paola M, Crafa F, Napolitano C, Mereu A, et al in their study of Laparoscopic cholecystectomy by ultrasonic dissection. Our results showed that there was no significant difference statistically between clip and ultrasonic energy application for cystic artery control.[28]

CONCLUSION

Clip application and ultrasonic energy application are equally safe and efficacious methods in the hemostatic control of cystic artery during laparoscopic cholecystectomy.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Venkatapuram MR, Sateesh S. Control of cystic artery during laparoscopic cholecystectomy: clips versus ultrasonic energy devices which is better?. Int Surg J 2017;4:3844-8.