

CLOSURE OF THE CYSTIC DUCT DURING LAPAROSCOPIC CHOLECYSTECTOMY BY THE LIGASURE VESSEL SEALING SYSTEM

By

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Abstract

Laparoscopic cholecystectomy is the “gold standard” in the treatment of symptomatic gallbladder lithiasis. Nevertheless, some pitfalls are associated with the use of the monopolar hook, such as the risk of thermal injuries and biliary complications. The present study assessed the efficacy of the Liga-Sure Vessel Sealing System (LVSS) when used for cystic duct closure during laparoscopic cholecystectomy.

The laparoscopic cholecystectomy was done beginning with visualization of Calot’s triangle, and dissection of Calot’s triangle was achieved using a monopolar cautery device. Once the cystic duct was exposed, sealing was performed and divided using the LVSS. The records were compared with those of patients undergoing laparoscopic cholecystectomy with closure of the cystic duct with clips during the same period.

The results showed that during the study period, 218 laparoscopic cholecystectomies were performed; 82 of these were performed with the Liga-Sure. The work was experienced a single case of bile leakage from the cystic duct due to missed stone in the common bile duct that was managed using ERCP.

Key Words: Cholecystectomy, Gall bladder, Complications, Cystic duct leakage, Liga-Sure, LVSS.

Introduction

Initially, the LigaSure vessel sealing system (LVSS) was intended for sealing vessels up to 7 mm in breadth as another option to the utilization of clips or ligature (Yao *et al*, 2009). Relative ponders have been demonstrated that it is as protected, attainable, and indeed, even valuable as other vessel closure procedures, for example, the plasma trisector, Ultracision, surgical clip application, symphonious surgical tool, and customary hemostasis (Cakabay *et al*, 2009).

In late years, there has been an expanding number of reports on the utilization of the LVSS not just for sealing vessels yet additionally for the dismemberment/transection of different delicate and parenchymatous tissues (Nouri *et al*, 2009). In liver resection, pancreatotomy, pneumonic resections, hysterectomy, LigaSure-assisted laparoscopic appendectomy, also, even hemorrhoidectomy (Kovács *et al*, 2009; Aydogan *et al*, 2009; Sucullu *et al*, 2009; Lambert *et al*, 2010; Elemen L, *et al*, 2010; Hartwig *et al*, 2010; Cakan *et al*, 2010).

Additionally, the utilization of the LVSS for the transection of major Glisson bundles and major bile ducts, also for the closure of the cystic duct during cholecystectomy, has been accounted for in animal display trials and in the *ex vivo* setting (Matthews *et al*, 2001;; Shamiyeh, *et al*, 2002; Schulze *et al*, 2002; Shamiyeh *et al*, 2004; Nii *et al*, 2008; Fong *et al*, 2018). The closure of the cystic duct during laparoscopic cholecystectomy was utilized the LVSS system.

The present study aimed to evaluate the efficacy of the Liga-Sure Vessel Sealing System (LVSS) for cystic duct closure during laparoscopic cholecystectomy of patients.

Materials and Methods

This study dealt with 82 patients of both sexes from Theodor Bilhariz Research Institute Hospital scheduled for elective laparoscopic cholecystectomies were consecutively included in the study. The results were compared with those of a control group of 136 patients undergoing elective laparoscopic cholecystectomy with a normal closure of the cystic duct with titanium clips during the

same period in the same department. The patients in the control group were operated on in the stationary ward. The surgery in both groups was performed by the same team of surgeons. The 10-mm & 5-mm Liga-Sure ForceTriad system (Valleylab, Boulder, Colorado, USA) were applied perpendicularly to cystic duct at least 3mm from the common bile duct, and the duct was measured using the device blade (Figs. 1 & 2), sealed with sufficient energy and divided with the instrument knife (Figs. 3 & 4).

The cystic duct was closed with 3 clips in the control group, 2 of these were applied below where it was transected. Patients with a cystic duct wider than 1cm or shorter than 1 cm, or both were excluded from the study. The dimensions of the cystic duct were measured using the tip of the LigaSure. As the bile duct is a low-pressure system compared with the arterial system, we decided to include patients with the mentioned dimensions in the study, although the system according to the literature only supports sealing of vessels up to 7mm.

A concept statement was obtained from each patient after clarifying the study design. The study was approved by the local Ethics Committee and conducted in accordance to the Helsinki II Declaration (World Medical Association, 2013).

Statistical analysis: A comparison between qualitative variables was made using the X2 test or Fisher's exact test where appropriate, while the student t test was chosen for non-normally and normally distributed variables, respectively. $P < 0.05$ was significant (McDonald, 2001).

Results

During the study period, March 4, 2016 through April 5, 2017, two hundred and eighteen patients were enrolled in this study.

They were divided into two groups: group A (82 patients) underwent Laparoscopic Cholecystectomy with LigaSure Sealing System, and group B (136 patients) underwent laparoscopic cholecystectomy with titanium clip control group. Both groups were similar in age, sex, and BMI (Tab. 1). Furthermore, both groups were similar in the presenting symptoms and number of stones (Tab. 2).

The mean time for closure of the cystic duct, conversion rates, postoperative hospital stay, CD length, CD diameter and morbidity for each group were analyzed and compared with each other (Tab. 3). Laparoscopic cholecystectomy was successfully completed in 216 patients (99%). Conversion was necessary in 2 patients (0.91%) in group B due to diffuse peritoneal adhesions. Intraoperative cholangiography was performed in 10 cases (2 in group A and 6 in group B). The median time for closure of the cystic duct was 0.92 ± 0.54 in group A vs. 2.42 ± 1.85 min in group B with significant difference $P = 0.031$

The mean postoperative hospital stay, pain score, analgesia score and postoperative complications were analyzed and compared with each other of all patients without significant difference between groups (Tab. 4).

In this study, a single case of cystic duct leakage in the study group. The patient developed pain the day after surgery, and a collection was noticed in the operative bed. ERCP was done and showed missed stone in the common bile duct and bile leakage from the cystic duct (Fig. 5), the stone was removed and a stent was inserted. A pig tail was inserted in the site of the collection. This patient recovered and was discharged after 4 days. The stent was removed after 3 months without complications.

Table 1: Demographic data of patients and control.

Variables	Control group (N= 136)		Study group (N=82)	P value
Age (Mean +SD)	36.20±2.389		43.00±2.910	0.0788
Sex	Male	22 (16%)	11 (13%)	0.374
	Female	114 (84%)	71 (87%)	
BMI (Mean +SD)	33.8±6.41		33.6±4.34	0.9110

Table2: Laparoscopic cholecystectomy (LigaSure sealing system) in patients compared to titanium clip controls.

Variables		Control group (N = 136)	Study group (N=82)	P value
Symptom	Pain in Rt. hypochondrium	98 (72%)	70 (85%)	0.4506
	Fatty dyspepsia	38 (28%)	12 (15%)	
History of biliary colics		111 (82%)	54 (65%)	0.526
History of acute attack		22 (16%)	9 (11%)	0.374
History of obstructive jaundice		0.0	0.0	--
Number of stones	Single	33 (24%)	18 (22%)	0.9110
	Multiple	103 (76%)	64 (78%)	

Table 3: Laparoscopic cholecystectomy (LigaSure sealing system) patients compared to titanium clip controls.

Variables	Control group (N=136)	Patients group (N=82)	P value
Mean operative time needed for closure of the cystic duct \pm SD	2.425 \pm 1.854 min	0.925 \pm 0.54 min	0.031
Conversion rate	2 cases	0.0	0.528
Mean CD length \pm SD	2.200 \pm 0.1328 cm	2.450 \pm 0.1491 cm	0.218
Mean CD width \pm SD	0.725 \pm 0.0228 cm	0.665 \pm 0.0264 cm	0.093
Intraoperative cholangiography	6 cases	2 cases	0.7131
Mean intraoperative blood loss	9.250 \pm 5.121	1.750 \pm 1.105	0.1604

Table \$: Laparoscopic cholecystectomy (LigaSure sealing system) patients compared to titanium clip controls (postoperative variables)

Variables		Control group (N=136)	Patients group (N=82)	P value
Pain score	First day	8	7.59	0.9804
	Second day	6.65	6.35	
	Third day	5.85	5.4	
Analgesia score	First day	3.5	3.5	0.8813
	Second day	3.2	2.9	
	Third day	2.35	1.85	
Bleeding		0.0	0.0	
Bile leakage		0.0	1 (5%)	0.9998
Jaundice		0.0	0.0	
Hospital stay		2.200 \pm 0.1170	1.350 \pm 0.254	0.5950
Wound infection		5	3	0.6948

Discussion

Generally speaking, Cholecystectomy is indicated in the presence of gallbladder trauma, gallbladder cancer, acute cholecystitis, and other complications of gallstones. More controversial are the indications for elective cholecystectomy (Potts, 1990). Epidemiological studies showed gall bladder carcinoma to be the 6th common cancer involving gastrointestinal system (Goodman and Wagman, 2010). Also, many parasites encountered in Egypt cause acute cholecystitis, as malignant malaria (Abreu *et al*, 2013) ascariasis (Azhar *et al*, 2015), toxocariasis (Strickler *et al*, 2016) and giardiasis (Araki *et al*, 2017) as well as *Staphylococcus saprophyticus*, *Corynebacterium urinapleomorphum*, and *Helicobacter pylori* (Backert *et al*, 2018).

The principal finding in the study was that

the 5-mm and the 10-mm LigaSure Force-Triad system provided sufficient sealing of the cystic duct and the cystic artery in patients undergoing laparoscopic cholecystectomy. The 5-mm laparoscopic LigaSure system has been shown to be effective in liver surgery when transection of the liver is performed, including division of the small bile ducts (Saiura *et al*, 2008; Slakey 2008).

The LigaSure system proved to be effective for blood vessel sealing in many studies comparing it with monopolar electrocoagulation, bipolar coagulation, or ultrasonic techniques (Diamantis *et al*, 2006; Newcomb *et al*, 2009; Singal *et al*, 2018). However the LigaSure system has no previously been reported for sealing of the cystic duct in human studies, but in an animal study we found the method to be safe. This has re-

cently been confirmed by closure of the major bile ducts in pigs (Nii *et al*, 2008).

One potential advantage of the LigaSure is that it leaves no metallic objects in the body and that the risk of damage of the surrounding structures is minimal due to the bipolar cautery. However, the cost of the instrument is higher than the cost of the clip applier. The present results with a single case of leakage suggest that the use of the new 5-mm LigaSure is safe and may be used for division of a cystic duct in patients undergoing laparoscopic cholecystectomy.

Conclusion

Generally speaking, there are so many microbiol and parasitic diseases condition indicating the laparoscopic cholecystectomy.

The LigaSure Vessel Sealing System (LVSS) is not only a safe and effective instrument but also a reliable substitute for clips because it provides complete hemobiliary stasis. Even if the study revealed no differences with regard to postoperative complications, the LVSS represents a viable alternative because of the shorter operation time and cost savings that are inherent in a procedure using it as a single instrument. The instrument proved to be suitable for dissection, sealing, and division of the cystic duct and the tissue anchoring the gallbladder to the gallbladder bed in the liver. Whether this might lead to shortening of operation time and a reduction of the total cost needs to be elucidated.

Conflict of Interest: The authors declare that they neither have conflict of interest nor received funds

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Explanation of figures

Fig 1: Measurement of cystic duct size using LigaSure 5mm; dimensions (5 mm×18mm).

Fig 2: Measurement of t cystic duct size using LigaSure 10mm; dimensions (10mm × 20mm).

Fig 3: Closure of t cystic duct using LigaSure 10-mm.

Fig 4: Closure of cystic duct using LigaSure 5-mm.

Fig 5: ERCP showing missed stone in CBD and Cystic.

