

Cystic Duct Closure by Sealing With Bipolar Electrocoagulation

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ABSTRACT

Background: Cystic duct leakage after cholecystectomy is not uncommon and is a potentially serious complication. The aim of this study was to assess a bipolar sealing system (LigaSure[®]) for closure of the cystic duct.

Methods: The records from consecutive laparoscopic cholecystectomies performed in 2 hospitals with closure of the cystic duct with LigaSure after informed consent were recorded and complications and morbidity registered. The records were compared with those of patients undergoing laparoscopic cholecystectomy with closure of the cystic duct with clips during the same period.

Results: During the study period, 218 laparoscopic cholecystectomies were performed; 102 of these were performed with the LigaSure. One patient was excluded due to violation of the protocol. We experienced no cases of cystic duct leakage, but in one patient, bile leakage from the gallbladder bed was observed probably due to a small aberrant duct.

Conclusion: The LigaSure system was safe and effective for closure and division of the cystic duct in laparoscopic cholecystectomy.

Key Words: Cholecystectomy, Complications, Cystic duct leakage, Electrocoagulation.

INTRODUCTION

Postoperative cystic duct leakage is reported in 0.3% to 2.1% of patients undergoing laparoscopic cholecystectomy.¹⁻⁵ It is a potentially serious complication, causing formation of biliary peritonitis, fistula, or biloma. Due to this, different techniques have been proposed for closure of the cystic duct including resorbable clips and ultrasonic dissection.^{6,7} In an earlier animal study, we showed that bipolar electrocoagulation with the LigaSure system is safe for sealing of the cystic duct in pigs.⁸ Thus, the aim of the present study was to evaluate the LigaSure system in laparoscopic cholecystectomy in humans to determine whether the bipolar coagulation system can be used safely for both electrocoagulation of blood vessels, tissue and closure of the cystic duct, thereby simplifying the procedure.

MATERIALS AND METHODS

After informed consent, 102 patients scheduled for elective laparoscopic cholecystectomies in the day surgery units were consecutively included in the study. The results were compared with those of a control group of 113 patients undergoing elective laparoscopic cholecystectomy with a normal closure of the cystic duct with titanium clips during the same period in the 2 departments. 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 in the 2 respective departments (Glostrup and Bispebjerg Hospitals, Copenhagen, Denmark).

The 5-mm LigaSure ForceTriad system (Valleylab, Boulder, Colorado, USA) was applied perpendicularly to the cystic duct at least 3mm from the common bile duct, and the duct was sealed with sufficient energy and divided with the instrument knife. The cystic artery was sealed and divided separately. The setting used on the Ligasure generator was 2 bars, which is automatically set by the generator. As each seal cycle varies from seal to seal due to the variances in arteries and the cystic duct, the effect delivered by the instrument is approximately 75 watts to 150 watts, changing continuously through the seals.

The cystic duct was closed with 3 clips in the control

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group, 2 of these were applied below where it was transected. The clips were all Endo Clip L 10mm (Covidien, Denmark).

Patients undergoing intraoperative cholangiography were excluded, as were patients with a cystic duct wider than 1cm or shorter than 1 cm, or both. Only one patient was excluded because of the dimensions of the cystic duct (details on this patient are provided in the Results). 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 we are aware that the system according to the literature only supports sealing of vessels up to 7mm.

The study was approved by the local Ethics Committee (number KA02756) and conducted in accordance to the Helsinki II Declaration.

RESULTS

During the study period, January 4, 2007 through January 5, 2008, 218 laparoscopic cholecystectomies were performed in the 2 outpatient clinics (Bispebjerg Hospital and Glostrup Hospital, Copenhagen, Denmark). Of the 102 patients included in the study after informed consent, one patient was excluded due to violation of the protocol, because the LigaSure system was used in a patient with chronic cholecystitis and a short broad cystic duct. The surgeon was not aware of the exclusion criteria. The demographic details of the study groups and complications are presented in **Table 1**.

We observed no cystic duct leakage in either the study or

the control group. The only complication encountered in the study group was a patient with a leakage from the gallbladder bed, probably due to a small aberrant duct or too deep a dissection in the gallbladder bed when the gallbladder was removed from the liver. The patient developed pain the day after surgery, and cholangitis was diagnosed by transabdominal ultrasound. This patient recovered completely after percutaneous drainage of the peritoneal cavity and stenting by ERCP, which demonstrated oozing from the gallbladder bed. In the 113 patients undergoing conventional closure of the cystic duct, one patient was readmitted the day after surgery due to abdominal pain. The patient was evaluated by transabdominal ultrasound and liver function tests, both of which were normal. This patient recovered and was discharged after 4 days.

DISCUSSION

The principal finding in the study was that the 5-mm LigaSure ForceTriad 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 small bile ducts.^{9,10} The LigaSure system has been shown to be effective for blood vessel sealing in many studies comparing it with monopolar electrocoagulation, bipolar coagulation, or ultrasonic techniques.^{11,12} However the LigaSure system has not previously been reported for sealing of the cystic duct in human studies, but in an animal study we found the method to be safe.⁸ This has recently been confirmed by a study from Nii et al¹³ of closure of the major bile duct in pigs. 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. Our results with no 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. The implication of this in the future may be that the complete laparoscopic cholecystectomy procedure may be performed with the LigaSure system. The instrument seems suitable for dissection, sealing, and division of the cystic artery 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 in a future study.

Table 1.

Laparoscopic Cholecystectomy With LigaSure Sealing System Study Group Compared With Titanium Clip Control Group

	Study Group* n=101	Control Group† n=113
Male	32	39
Female	69	74
Median Age [years (range)]	32 (19–74)	39 (20–71)
Complications	1	1
Cystic Duct Leakage	0	0

*Started with 102 patients. One patient has been excluded due to violation of study protocol.

†Cystic duct closed with titanium clips.

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