

SAFETY AND EFFICACY OF LIGASURE VESSEL SEALING SYSTEM (LVSS) IN CONTROLLING CYSTIC ARTERY IN LAPAROSCOPIC CHOLECYSTECTOMY: AN INITIAL EXPERIENCE ON 50 PATIENTS AT A TERTIARY CARE HOSPITAL

SHIRAZ SHAIKH

Assistant Professor of Surgery, LUMHS/Jamshoro, Pakistan.
Corresponding author Email: drshaikhshiraz786@gmail.com

ZAMEER HUSSAIN LAGHARI

Associate Professor of Surgery, LUMHS/Jamshoro, Pakistan.

SHAHNAWAZ ABRO

Associate Professor of Surgery, LUMHS/Jamshoro, Pakistan.

FAIZA HAMEED

Assistant Professor of Surgery, LUMHS/Jamshoro, Pakistan.

RAMSHA KHAN

Senior WMO of Surgery, LUMHS/Jamshoro, Pakistan.

AISHA MEMON

Resident of Surgery, LUMHS/Jamshoro, Pakistan.

Abstract

Objective: To determine the safety and efficacy of ligasure vessel sealing system (LVSS) in controlling cystic artery in laparoscopic cholecystectomy: An initial experience on 50 patients at tertiary care hospital. **Subjects and Methods:** This descriptive cross-sectional study was done at Department of Surgery, Liaquat University of Medical Health Sciences, Jamshoro, during one year from April 2019 to March 2020. Patients aged 18 years or older, undergoing elective laparoscopic cholecystectomy for symptomatic gallstones, patients with a cystic artery diameter of less than or equal to 5mm were included. During laparoscopic cholecystectomy procedure the cystic artery in the Calot's triangle was identified. After creating space, the LVSS device was placed over the cystic artery and device was activated to seal the cystic artery. Once the cystic artery was sealed, the artery between the two sealed points has been divided. The most important outcome measure was the amount of bleeding that occurs during the procedure and complications such as bile duct injury, hepatic artery injury, or perforation can occur during laparoscopic cholecystectomy. The use of LVSS should result in minimal bleeding and without complications indicating that the cystic artery has been effectively sealed. All the data was collected via self-made study proforma and SPSS version 26 was used for analysis of data. **Results:** A total of 50 patients were included who had undergone laparoscopic cholecystectomy. The average age of the patients was 39.28 ± 13.34 years, and the majority (80.0%) were female. Among the patients, 60.0% had multiple stones and 40.0% had a single stone. Based on anatomical position, the tract was straight in 44.0% of cases and curved in 38.0% of cases. In 16.0% of cases, the cystic artery arose from the right hepatic artery, and in one patient, the cystic artery was located behind the cystic duct. The surgery lasted for an average of 33.12 ± 7.29 minutes, and there was an average blood loss of 13.44 ± 3.7 ml. The mean hospital stay was 1.38 ± 0.49 g/dl. There were no complications observed during or after

the surgery. **Conclusion:** In conclusion, the Ligasure Vessel Sealing System (LVSS) observed to be an effective and safe method for controlling the cystic artery during laparoscopic cholecystectomy, with advantage of short operative time, no use of metallic clips, negligible blood loss, short hospital stay and no complications reported during or after the surgery.

Keywords: LVSS, cystic artery, bleeding, operative time, hospital stay

INTRODUCTION

Laparoscopic cholecystectomy (LC) is considered to be the best method for treating cholelithiasis and acute cholecystitis, and it is the most frequently performed laparoscopic surgery globally.¹ Numerous studies have demonstrated the effectiveness and safety of this method, as well as its benefits such as shorter hospital stay, faster recovery, less intra-abdominal adhesions, and a more pleasing cosmetic result.² Moreover, LC can be performed safely as the day care practice.² However, even though LC is widely used, it still carries a greater risk of severe complications such as injury to the extrahepatic bile duct and blood vessels compared to open cholecystectomy (OC).¹ One of the key steps in laparoscopic cholecystectomy is the dissection and control of the cystic artery, which supplies blood to the gallbladder. During this technique, the cystic artery could be controlled with the use of harmonic scalpel, surgical clips and ligation, or monopolar cautery.³ However, these techniques can be time-consuming and may increase the risk of bleeding, especially in patients with a thickened cystic artery or in those who have undergone prior abdominal surgery. The Ligasure Vessel Sealing System (LVSS) is a newer technology that has been developed to address these challenges. The LVSS uses bipolar energy to seal and divide vessels up to 7mm in diameter, including the cystic artery.^{4,5} This technique is believed to provide faster and more efficient hemostasis, as well as potentially reduce the risk of postoperative bleeding. The LigaSure has a possible benefit in that it doesn't leave any metal objects inside the body and also carries minimal risk of harming nearby structures due to its bipolar cautery feature. However, it is more expensive than the clip applier.⁶ No such studies has been found at local level and this was a first experience on 50 patients in terms of safety and efficacy of ligasure vessel sealing system in controlling cystic artery in laparoscopic cholecystectomy. The study's findings can help surgeons make informed decisions about the use of LVSS in laparoscopic cholecystectomy. The safety and efficacy data can assist in determining the best method of vessel ligation for a given patient and can reduce the risk of complications such as bleeding and injury to surrounding tissues.

MATERIAL AND METHODS

This descriptive cross-sectional study was done at Department of Surgery, Liaquat University of Medical & Health Sciences, Jamshoro. Study was done during a time period one year from April 2019 to March 2020. All the patients aged 18 years or older, undergoing elective laparoscopic cholecystectomy for symptomatic gallstones, patients with a cystic artery diameter of less than or equal to 5mm were included. All the patients with previous history of upper abdominal surgery, patients with history of bleeding disorders or coagulopathy, patients with significant comorbidities or medical conditions that could affect surgical outcomes, such as uncontrolled diabetes or cardiovascular disease and who have refused to provide informed consent or are otherwise unable to participate in the study were excluded. Laparoscopic cholecystectomy procedure was begun by creating small ports in the patient's abdomen to gain access to the surgical site, cystic artery in the Calot's triangle was identified, which was located between the cystic duct, the common hepatic duct, and the liver, curved maryland dissector was used to mobilize the cystic artery and surrounding tissue, creating space for the LVSS, LVSS device was placed over the cystic artery, ensuring that it is positioned

correctly. The device was activated to seal the cystic artery. The LVSS was used for radiofrequency energy to heat and fuse the tissue, creating a seal that stops bleeding. Once the cystic artery was sealed, the artery has been divided between the two sealed points. Careful inspection was done at the surgical site to ensure that there is no bleeding or damage to surrounding tissue. Laparoscopic cholecystectomy procedure continued up to removing the gallbladder and closing the ports as necessary. Use of the LVSS in controlling the cystic artery during laparoscopic cholecystectomy was performed by the skilled and experienced surgeon. The most important outcome measure was the amount of bleeding that occurs during the procedure and complications such as bile duct injury, hepatic artery injury, or perforation can occur during laparoscopic cholecystectomy. The use of LVSS should result in minimal bleeding, indicating that the cystic artery has been effectively sealed. All the data was collected via self-made study proforma and SPSS version 26 was used for analysis of data.

RESULTS

The study examined 50 patients who had undergone laparoscopic cholecystectomy. The average age of the patients was 39.28 ± 13.34 years, and the majority (80.0%) were female. Among the patients, 60.0% had multiple stones and 40.0% had a single stone. Based on anatomical position, the tract was straight in 44.0% of cases and curved in 38.0% of cases. In 16.0% of cases, the cystic artery arose from the right hepatic artery, and in one patient, the cystic artery was located behind the cystic duct. Three cases showed congenital anomalies and average CBD diameter, hemoglobin, TLC count, platelets, PT, APTT and INR presented in table.1

The surgery lasted for an average of 33.12 ± 7.29 minutes, and there was an average blood loss of 13.44 ± 3.7 ml. The mean hospital stay was 1.38 ± 0.49 g/dl. There were no complications observed during or after the surgery. Table.2

Table 1: Demographic and clinical characteristics of the patients n=50

| Variables | | Statistics | |
|-------------------------------|---|------------------------------|-------|
| Age | | 39.28±13.34 years | |
| CBD diameter | | 0.62±0.14 cm | |
| Hemoglobin | | 11.95±1.66 g/dl | |
| Total leukocytes count | | 9.38±1.73 10 ⁹ /L | |
| Platelets | | 250±61.00 10 ⁹ /L | |
| PT | | 11.81±1.0 sec | |
| APTT | | 32.73±3.70 sec | |
| INR | | 0.97±0.09 | |
| Gender | Male | 10 | 20.0% |
| | Female | 40 | 80.0% |
| Gall stone | Single | 20 | 40.0% |
| | Multiple | 30 | 60.0% |
| Anatomical location | Straight tract | 22 | 44.0% |
| | Curved tract | 19 | 38.0% |
| | Arise from RT hepatics artery | 08 | 16.0% |
| | Cystic artery lies behind the cystic duct | 01 | 2.0% |
| Congenital anomalies | Yes | 03 | 6.0% |
| | No | 47 | 94.0% |

Table 2: Outcome in terms of safety and efficacy n=50

| Variables | | Statistics | Minimum | Maximum |
|----------------|-----------------------|--------------------|------------|------------|
| Operative time | | 33.12±7.29 minutes | 20 minutes | 45 minutes |
| Blood loss | | 13.44±3.7 ml | 08 ml | 25 ml |
| Hospital stays | | 1.38±0.49 g/dl | 01 day | 02 days |
| Complications | Bile duct injury | -- | -- | |
| | Hepatic artery injury | -- | -- | |
| | Others | -- | -- | |

DISCUSSION

Laparoscopic cholecystectomy is a common surgical procedure for treating symptomatic gallstones. One of the main challenges of this procedure is controlling the cystic artery, which can lead to bleeding and other complications. The Ligasure Vessel Sealing System (LVSS) is a relatively new technology that has been developed to address this issue. In this study, the safety and efficacy of LVSS in controlling the cystic artery during laparoscopic cholecystectomy were evaluated. The study was conducted on 50 patients at a tertiary care hospital, and the results were analyzed to determine the outcomes of using LVSS in this procedure. The results of the study indicate that LVSS is an effective and safe method for controlling the cystic artery during laparoscopic cholecystectomy. The use of LVSS resulted in an average operative time of 33.12±7.29 minutes, an average blood loss of 13.44±3.7 ml, and a mean hospital stay of 1.38±0.49 g/dl, with no complications reported during or after the surgery. Consistently NAFEA A et al⁶ observed that the LVSS is a dependable replacement for clips in achieving complete hemobiliary stasis, and not only is it a safe and effective tool, but it also offers cost savings and shorter operation times. Although there were no significant differences in postoperative complications found in their study, the LVSS remains a viable option.⁶ In the study by Turial S et al⁷ concluded that the using the LVSS to close the cystic duct during laparoscopic cholecystectomy in children is both feasible and effective. Nonetheless, it's crucial to exercise caution and maintain a safe distance from other intra-abdominal structures when using thermal energy devices to prevent causing unintended thermal damage.⁷ Sah BK et al⁸ also reported that this innovative instrument works by denaturing the collagen and elastin in the walls of vessels up to 7 mm in diameter as well as surrounding connective tissue, effectively sealing them.

In this study, the average age of the patients was 39.28±13.34 years, and the majority (80.0%) were female. In the comparison of this study Gustafsson S et al⁹ reported that the average age of the patients was 56 years, males were 39% and females were 61%. Other studies by Niaz MM et al¹⁰, Iqbal K et al¹¹ and Ismail M et al¹² also found almost similar findings regarding age and gender. Instead, the higher incidence of cholelithiasis in women is likely due to a combination of hormonal, genetic, and lifestyle factors. For example, estrogen levels can increase cholesterol secretion in the bile, which can contribute to the formation of gallstones. Additionally, certain genetic factors may make women more susceptible to developing gallstones. Lifestyle factors such as obesity, rapid weight loss, and a high-fat diet can also increase the risk of developing gallstones, and these factors may be more prevalent in women than in men.

In this study based on anatomical position, the tract was straight in 44.0% of cases and curved in 38.0% of cases, in 16.0% of cases, the cystic artery arose from the right hepatic artery, and in one patient, the cystic artery was located behind the cystic duct and three cases showed congenital anomalies. In the study by Talpur KA et al¹³ reported that the results of the operation showed that 61 patients (20.33%) had variations, with the most common involving the cystic artery (10.67%), 2.67% right

hepatic artery, 4.33% cystic duct and 2% gallbladder. Although they are not frequent, recognizing congenital anomalies and normal variations of the biliary tree during laparoscopic surgery is crucial as failing to do so can result in iatrogenic injuries, which may increase the risks of morbidity and mortality.¹⁴⁻¹⁷ Although the Ligasure Vessel Sealing System (LVSS) has been observed to be a safe and effective method for controlling the cystic artery during laparoscopic cholecystectomy, even in cases where there are anatomical or congenital variations present. During laparoscopic cholecystectomy, it is important to control the cystic artery to prevent excessive bleeding and potential complications. Traditionally, the cystic artery has been controlled using clips or ties, which can be time-consuming and can potentially cause injury to surrounding structures. The LVSS is a newer technology that uses thermal energy to seal vessels up to 7mm in diameter. By denaturing collagen and elastin within the vessel wall and surrounding connective tissue, the LVSS can effectively seal the cystic artery, reducing the risk of bleeding and other complications. The safety and efficacy of the LVSS in controlling the cystic artery during laparoscopic cholecystectomy may be influenced by the experience of the surgeon. Surgeons with less experience may have higher rates of complications compared to more experienced surgeons. Future studies examining the safety and efficacy of the LVSS in controlling the cystic artery during laparoscopic cholecystectomy should aim to have larger sample sizes to increase the generalizability of the findings.

CONCLUSION

In conclusion, the Ligasure Vessel Sealing System (LVSS) observed to be an effective and safe method for controlling the cystic artery during laparoscopic cholecystectomy. The use of LVSS resulted a short operative time, no use of metallic clips, negligible blood loss, less hospital stays and importantly no reported complications during or after the surgery. Therefore, LVSS can be considered as a reliable option for controlling the cystic artery during laparoscopic cholecystectomy.

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