Indocyanine Green Fluorescent Cholangiography During Laparoscopic Cholecystectomy, Ain-Shams University and Egypt's Initial Experience - A Case Report

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A laparoscopic cholecystectomy is the procedure of choice for the patients with gall bladder diseases requiring a cholecystectomy. The addition of intra-operative cholangiography was suggested to decrease the risk of the complications associated with this procedure, especially the extra-hepatic biliary tract injuries.

This work is to report the successful use of the indocyanine green enhanced fluorescence-guided laparoscopic cholecystectomy for the first time in Ain-Shams University Hospitals, on the 2nd of July 2018. This procedure was done for a 28 years old female patient suffering of chronic calcular cholecystitis. The technique facilitated easier identification of the extrahepatic biliary system and assessment for bile leakage, if present, at the end of the procedure. The patient had no intraoperative or postoperative complications, with good recovery.

Key words: ICG Florescent Cholangiography, laparoscopic cholecystectomy, parallel cystic duct, case report.

Introduction

Laparoscopy is the standard of care for patients needing cholycystectomy. Indocyanine green enhanced fluorescence-guided laparoscopic cholecystectomy has been described years ago. The Indocyanine Green (ICG) is a water-soluble dye, which has many uses in the medical practice due to its high profile of safety. It has a fluorescence activity when subjected to a near infra-red light. The indocyanine green enhanced fluorescence-guided laparoscopic cholecystectomy has been described years ago and it is gaining more popularity with time.[1]

This report documents the use of ICG enhanced fluorescence for the first time in Ain-Shams University during a cholycystectomy for a female patient suffering from chronic calcular cholecystitis.

Case Presentation

A female patient, 28 years old, weighing 75kg, presented with repeated episodes of dyspepsia. An abdominal ultrasound revealed a chronic calcular cholecystitis. She had normal liver functions and bilirubin levels. She was scheduled to have an indocyanine green enhanced fluorescence-guided laparoscopic cholecystectomy on the 2nd of July 2018, in Ain-Shams University Specialized Hospital. The whole procedure was explained thoroughly to the patient, and a written informed consent was obtained from her for the procedure and the publication of this case report and the accompanying images.

The usual preoperative assessment and preparation were done. The ICG solution was prepared by adding 10 ml of water for injection to a vial of 25 mg ICG powder. The solution was injected to the patient intravenously, in the dose of 0.15 mg/kg, 10 hours before the surgery. The patient was closely observed after the injection with frequent assessment of her vital data, and no reactions were recorded from the dye.

Under general anesthesia, the scope port was inserted in the umbilical area using a modified Hasson's technique; three other ports were inserted under vision. A near-infrared light source and a special camera were used.

On activating the near-infrared light, the liver appeared in a light blue color. The gall bladder was more intense blue. The common hepatic duct was identified easily before any dissection **(Figure 1).** Blunt and sharp dissections for controlling the cystic duct and artery were done. During the dissection, both the usual and the near-infrared light modes were used. The cystic duct was seen descending parallel to the common hepatic duct, down to the duodenum **(Figure 2)**, so the common bile duct wasn't identified. The cystic duct and artery were controlled by titanium clips, and the gall bladder was dissected from the liver. In the near-infrared light mode, assessment was done for any leaking bile from the cystic duct stump or from the gall bladder bed. None was detected.

The patient was discharged after 24 hours, and she had a smooth post-operative course during the follow up period.

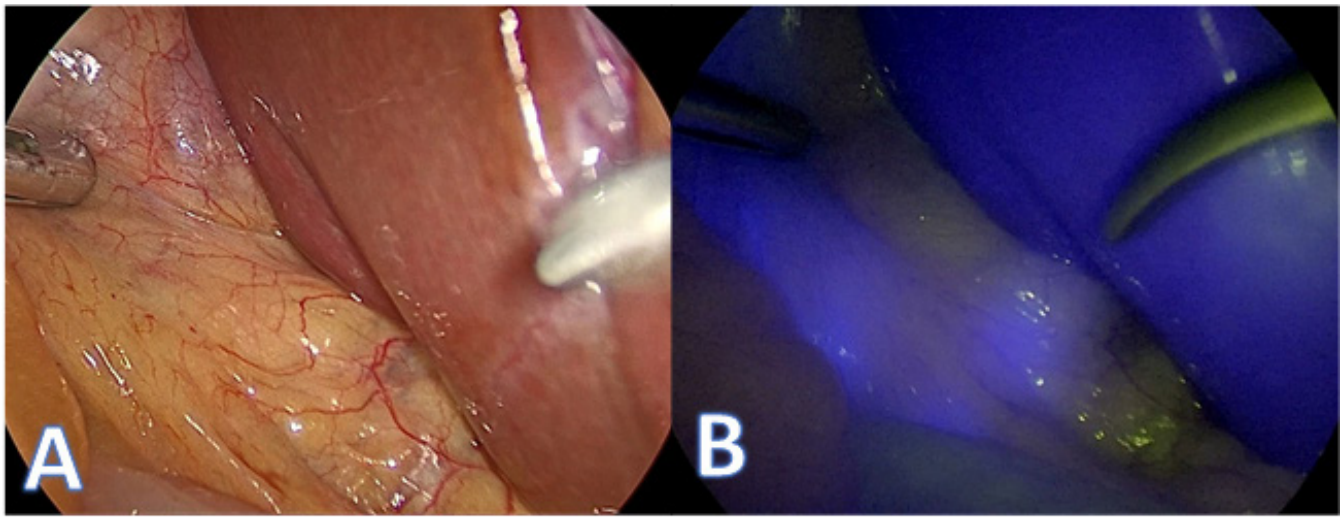

Fig 1: The view before dissection. A under usual light, B under near infra red light.

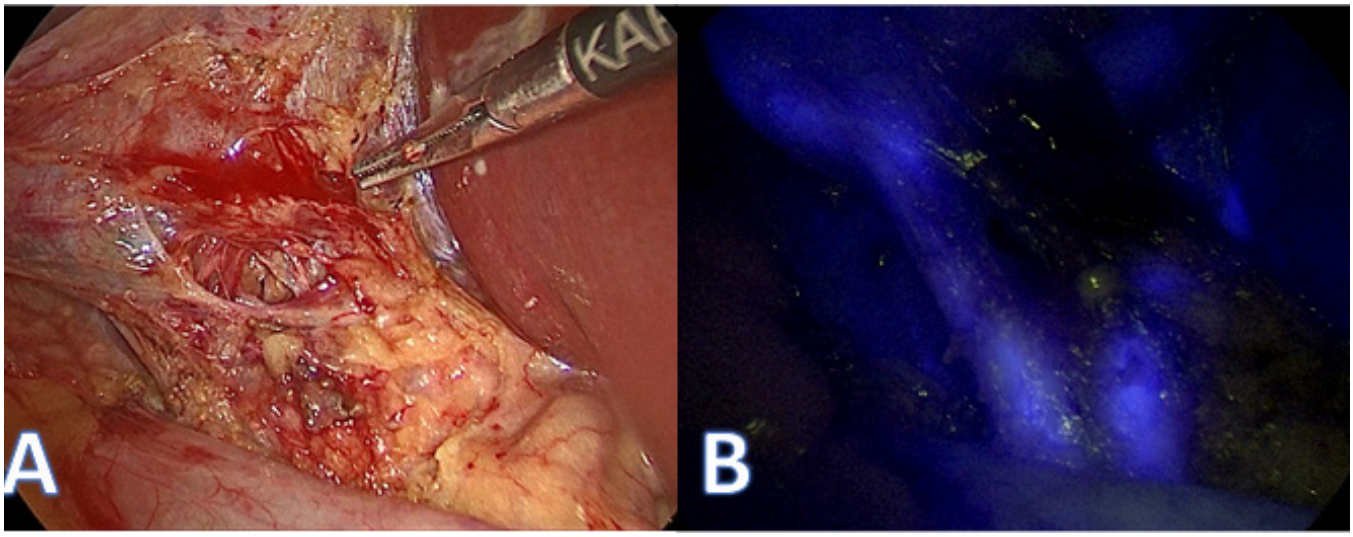

Fig 2: Parallel cystic duct. A under usual light, B under near infra red light.

Discussion

Laparoscopic cholecystectomy is the standard of care for removing diseased gall bladder. But since its introduction in September 1985,[2] it was reported to be associated with an increase in major biliary tree injuries.[3] Efforts were done to standardize safe techniques for the procedure, but till now, there is no strong evidence supporting any of these techniques. This can be attributed to the difficulty to perform a randomized controlled trial (RCT), with the right sample size to test the techniques and compare them. The event rate of biliary injury during the procedure is 3 in 1000, so an RTC should have 4500 patients in each arm. The suggested techniques include; Critical View of Safety (CVS), infundibular technique, fundus-first cholecystectomy, visualization of the CBD and CHD and routine cholangiography.[4]

Indocyanine Green is a water-soluble, tri-carbocyanine dye, formulated by Kodak Laboratories in 1955 to be used in photography.[5] A few years later, ICG was approved to be used in the medical field. Each vial of ICG contains 25 mg of ICG as a sterile lyophilized powder with no more than 5% sodium iodide.[5] It undergoes no significant extrahepatic or enterohepatic circulation; negligible renal, peripheral, lung or cerebrospinal fluid uptake. It is taken up exclusively by the hepatic parenchymal cells from the plasma and is secreted entirely into the bile. Its peak spectral absorption is at 800 nm; this specific wavelength lays in the near-infra-red spectrum of light. When reconstituted in water for injection, ICG has a pH of approximately 6.5. Only a few cases of allergy or toxicity to the ICG dye were

reported, lower than any clinically employed dye.[7]

The use of ICG fluorescence cholangiography in cholecystectomies to achieve a better assessment for the extrahepatic biliary tree was described more than a decade ago; in both open and laparoscopic cholecystectomies.[8]

By reviewing literature there was no reports for using ICG fluorescence cholangiography during cholecystectomies before that date in Egypt.

The encountered arrangement of extra hepatic biliary system in this case was the parallel cystic duct, which by definition means that the cystic duct runs parallel to the common hepatic duct for at least 1.5-2 cm before entering it. It is considered to be one of the rare arrangements, it is encountered only in 5–7% of patients.[9,10]

Conclusion

The ICG cholangiography during the laparoscopic cholecystectomy makes the procedure easier and safer, without adding any risk to the patient.

References

1. Hackethal A, Hirschburger M, Eicker S, et al: Role of indocyanine green in fluorescence imaging with near-infrared light to identify sentinel lymph nodes, lymphatic vessels and pathways prior to surgery- A critical evaluation of iptions.***Geburtshile Frauenheilkd.*** 2018; 78(01): 54-62. Doi:10.1055/s-0043-123937.
2. Reynolds W: The first laparoscopic cholecystectomy. ***JSLS J Soc Laparoendosc Surg.*** 5(1): 89-94.
3. Strasberg SM, Hertl M, Soper NJ: An analysis of the problem of biliary injury during laparoscopic cholecystectomy. ***J Am Coll Surg.*** 1995; 180(1): 101-125.
4. Strasberg SM, Brunt LM: The critical view of safety. ***Ann Surg.*** 2017; 265(3): 464-465. doi:10.1097/SLA.0000000000002054.
5. Xiao Q, Chen T, Chen S: Fluorescent contrast agents for tumor surgery (review). ***Exp Ther Med.*** 2018; 16(3): 1577-1585. doi:10.3892/etm.2018.6401.
6. Akorn, Inc. IC-Green [package insert]. U.S: Food and Drug Administration website URL ***www.accessdata.fda.gov/drugsatfda_docs/label/2015/011525s027lbl.pdf Revised March 2015. Accessed August.*** 2018.
7. Hope-Ross M, Yannuzzi LA, Gragoudas ES, et al: Adverse Reactions due to Indocyanine Green. ***Ophthalmology.*** 1994; 101(3): 529-533. doi:10.1016/S0161-6420(94)31303-0.
8. Tagaya N, Shimoda M, Kato M: Intraoperative exploration of biliary anatomy using fluorescence imaging of indocyanine green in experimental and clinical cholecystectomies. ***J Hepatobiliary Pancreat Sci.*** 2010:595-600. doi:10.1007/s00534-009-0195-2.
9. Ishizawa T, Bandai Y, Ijichi M, et al: Fluorescent cholangiography illuminating the biliary tree during laparoscopic cholecystectomy. ***J Am Coll Surg.*** 2010:1369-1377. doi:10.1002/bjs.7125.
10. Cuschieri A, Hanna G: Essential Surgical Practice. 5th ed. ***CRC press.*** 2015; 671- 676.
11. Sarawagi R, Sundar S, Gupta SK, et al: Anatomical Variations of Cystic Ducts in Magnetic Resonance Cholangiopancreatography and Clinical Implications. ***Radiol Res Pract.*** 2016; 2016: 1-6. doi:10.1155/2016/3021484.