



USE OF INTRA-OPERATIVE INDOCYANINE GREEN DYE TO ENHANCE SAFETY IN LAPAROSCOPIC HELLERS CARDIOMYOTOMY

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ABSTRACT

Laparoscopic Heller's cardiomyotomy is safe, effective and the procedure of choice for management of achalasia cardia. In this case series we are trying to evaluate the effectiveness of Indocyanine Green dye in identifying mucosal perforations and completeness of myotomy while performing Heller's Cardiomyotomy. We have utilised this technique in five patients with different types of Achalasia and have detailed the advantages. ICG may be a useful adjuvant to confirm completeness of myotomy and absence of perforations independent of upper Gastrointestinal endoscopy and can be helpful when endoscopy facilities are unavailable

KEYWORDS :

INTRODUCTION

Laparoscopic Heller's cardio myotomy is safe, effective and the procedure of choice for the management of achalasia cardia. We present here a case series of 5 patients, where intraoperative use of per oral ICG was used to evaluate the completion of myotomy and to check for mucosal perforation as an alternative to intraoperative endoscopy or methylene blue instillation.

Five patients were included in this case study, three of whom had type 2 achalasia, one had type 1 achalasia and one had Type 3 Achalasia. All the patients underwent a pre operative upper gastrointestinal endoscopy and an oesophageal manometry. Laparoscopic Heller's cardio myotomy with a Dor's fundoplication was performed and ICG was used per orally to evaluate the completion of myotomy and to identify mucosal perforations.

Surgical Technique

Pre operatively, Patients were kept on clear liquids for 24 hours and naso-gastric tube was inserted. The patient was kept in split-leg position with the surgeon standing in between the legs and the monitor at the head end of the patient. Port placement was done as shown in (Fig 1). Pars flaccida was opened and the dissection of phreno-oesophageal ligaments done, the right crus was identified. The anterior vagus was identified by crossing from left to right at the gastro-oesophageal junction and preserved. Belsey's pad of fat was dissected off the gastro-oesophageal junction. By using blunt traction, the longitudinal and the circular muscle fibers of the esophagus were separated by using 2 Maryland forceps, 5 cms above onto the esophagus and 3 cms onto the stomach side. This was done till a long mucosal tube was visualized (Fig 2). Naso-gastric tube was withdrawn to 20cm. Indocyanine Green (4 mg ICG in 100 ml Normal Saline) was injected through nasogastric tube in the esophagus and the camera was switched to near infra-red fluorescence mode. ICG was visualized, uniformly across the whole mucosal tube immediately after instillation. Residual muscle fibers were visualized in a patient at the gastro-oesophageal junction, as black bands on ICG mode (Fig 3). These bands of muscle fibers were divided to complete the myotomy. No leak of ICG was seen, confirming the absence of perforation (Fig 4 and Fig 5).

The completeness of myotomy and absence of mucosal perforation were also confirmed by Upper Gastrointestinal Endoscopy (Fig 6). Dor's fundoplication was done. No drains were placed. Contrast study done on post op day 1 showed no

leak. Patients were started on clear liquids on post operative day 1 and discharged on day 2.

DISCUSSION

Indocyanine Green has been utilized in Laparoscopic and Robotic Surgery to improve the view and to have a detailed understanding of the biliary anatomy. Indocyanine green is a sterile, anionic, water-soluble but relatively hydrophobic, tricarboyanine molecule with a molecular mass of 776 Daltons.[2]

Following intravenous injection, ICG rapidly binds to plasma proteins, especially lipoproteins. There are no known metabolites. ICG is rapidly extracted by the liver without modifications and nearly exclusively excreted by the liver appearing unconjugated in the bile about 8 min after injection, depending on liver vascularization and function [2]. We have previously published our experience with ICG to enhance the safety in lap cholecystectomy which enabled identification of cystic duct, common hepatic and common bile duct, the junction between common hepatic and bile duct, right and left hepatic duct.[3]

Intra-operative endoscopy is the gold standard to evaluate the completeness of myotomy and to look for any mucosal discontinuity in Laparoscopic hellers cardio myotomy. [4,5]. However logistical issues and non-availability of intra-operative endoscopy may limit utility of intra-operative endoscopy.

ICG injection combined with Infrared Imaging, is a simple and feasible method to avoid incomplete myotomy and limit myotomy towards the gastric side in POEM [6]

Our concept of using intra-luminal ICG is similar to that of instilling ICG by doing intra op cystoscopy through ureteral catheters for identification of ureters in laparoscopic and robotic surgery. [7,8,9] Fluorescence-imaging helps in the identification of residual muscle fibers and verify the integrity of the mucosa without the use of intra-operative endoscopy. Ease of use makes ICG the preferred molecule, as it doesn't stain the oral cavity or surrounding tissues in cases of a leak unlike methylene blue, thus making closure of any perforation easier.

CONCLUSION

ICG may be a useful adjuvant to confirm completeness of myotomy and absence of perforation, independent of upper Gastrointestinal endoscopy and can be helpful when endoscopy facilities are unavailable. Non inferiority trials are

yet to be done to compare the efficacy of intra-operative use of ICG to intra-operative endoscopy in determining the extent of myotomy and identification of mucosal perforation.

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Statement Of Ethics: Ethical approval is not applicable for this article.

Data Availability Statement :

The data that support the findings of this study are available from the corresponding author upon reasonable request.

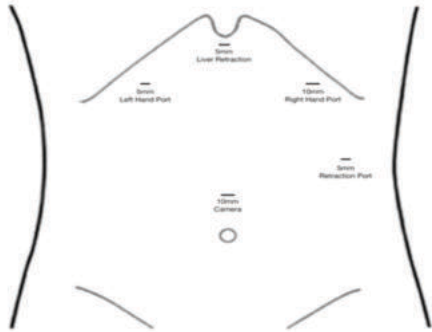


Fig 1-Port Placement for Laparoscopic Heller's Cardiomyotomy

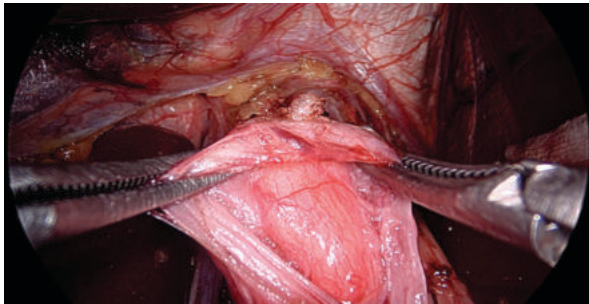


Fig 2- Stretching the Longitudinal Fibers of esophagus causing outpouching of the mucosa

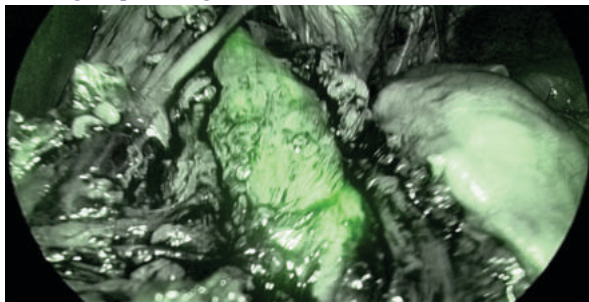


Fig 3- Use of ICG mode showing remnant muscle fibers over the mucosa

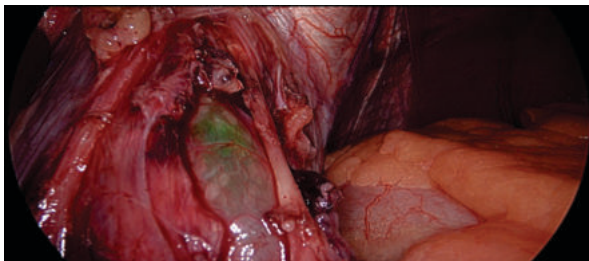


Figure 4 - Oesophageal instillation of ICG showing no breach in mucosa.

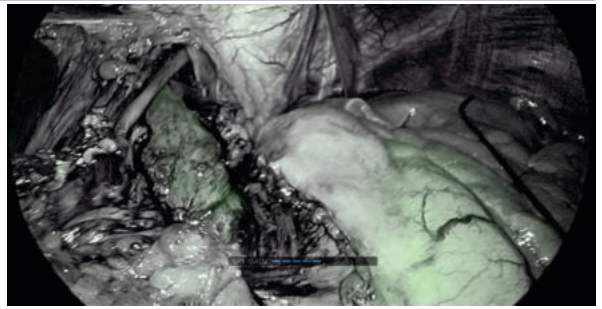


Figure 5 -Use of ICG mode showing no remnant muscle fibres

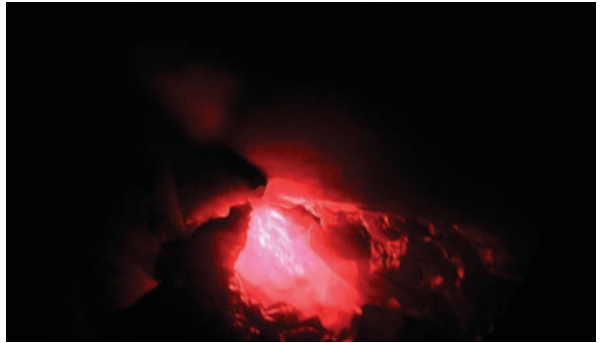


Fig 6 -Intra-Operative endoscopy showing completeness of Myotomy and absence of any mucosal breach, thus confirming the findings of ICG

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