

The Beneficial Uses of Intraoperative Indocyanine Green

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Abstract

Indocyanine green (ICG) is a sterile, water-soluble, anionic, hydrophobic tricarbo-cyanine molecule developed by Kodak in 1955 for near infra-red photography (1). In 1959, ICG was approved by the FDA for clinical use. The dye is injected into the blood stream where it binds with plasma proteins and has rapid uptake by the liver. In those without compromised liver function, ICG appears in the bile about 8 minutes after injection (2). It fluoresces once exposed to a light source with a wave length of approximately 820nm or laser beam with essentially no adverse effects (1,3,4,5). Standard dose is 0.1-0.5 mg/ml/kg (1). Since its FDA approval, ICG has been used in several applications in medicine.

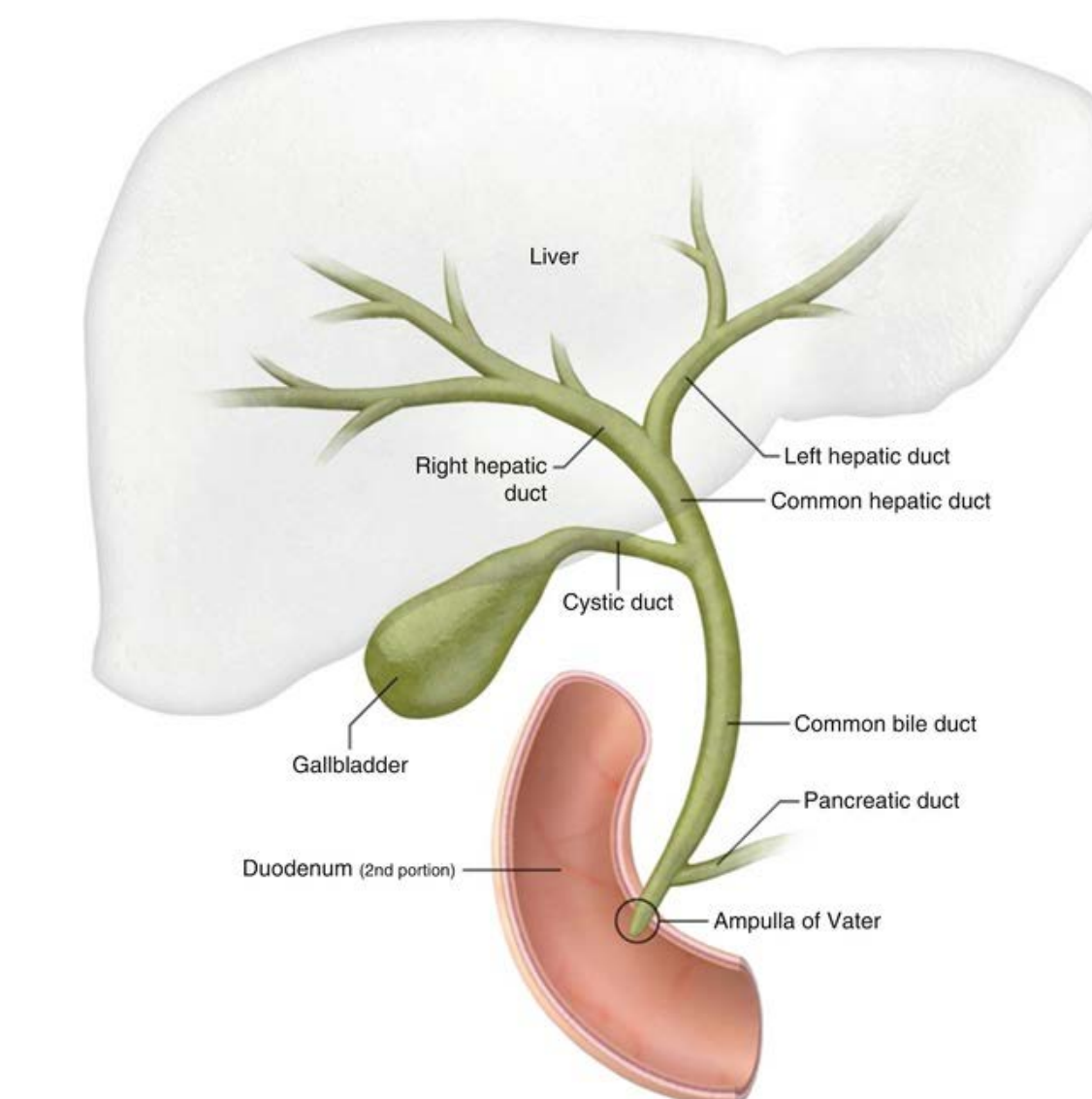
Case

This is a 72 year old male who presented to the outpatient General Surgery Clinic following a visit to the ER with one week of vague, worsening epigastric abdominal pain. He had a CT performed which demonstrated cholelithiasis and laboratory assays revealed a leukocytosis of 12.7, unremarkable liver function tests, and a lipase of 625. He was discharged to home once his pain improved. Since his presentation to the ER, he had been experiencing intermittent upper abdominal pain with early satiety and constipation with flatus for two weeks. He had no fever, nausea, vomiting, scleral icterus or jaundice. It was recommended he begin a bowel regimen, consume a low fat diet and undergo repeat labs with a right upper quadrant ultrasound. He returned one week later. After taking magnesium citrate, he had been having bowel movements and had experienced significant relief. A KUB demonstrated a moderate amount of stool in the colon. His ultrasound revealed a large gallstone and sludge without pericholecystic fluid. Labs were within normal limits. Evidence from investigative assays demonstrated chronic cholecystitis. Two weeks later, he was taken for elective laparoscopic cholecystectomy. Intraoperatively, he was noted to have significant inflammation of the right upper quadrant, a fundus with an extremely thick rind with fat overlying the gallbladder and biliary tree. With administration ICG a single tubular structure was able to be identified coming from the neck of the gallbladder. With the aid of ICG, the common hepatic and common bile ducts were identified. The gallbladder was removed and fluoresces imaging confirmed the absence of bile leak. A JP drain was placed in the gallbladder fossa, and the patient followed up in the office 4 days later. At that time, his drain was removed, and he was noted to feel better than he had in weeks.

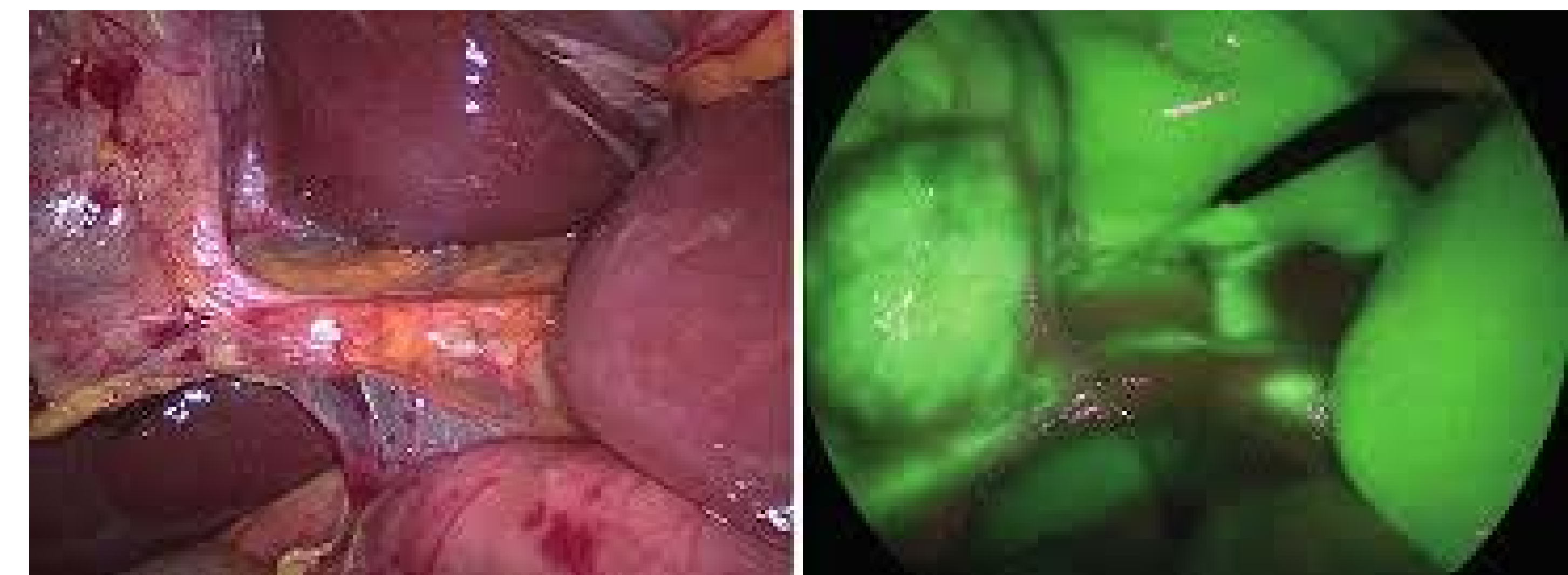
Discussion

In the case presented above, the use of ICG to assist in identification of pertinent anatomy proved essential. Although laparoscopic cholecystectomy is a very commonly performed procedure, it has one of the most dangerous complications in iatrogenic bile duct injury. This is due to complicated dissection, chronic inflammatory states and frequent variation in biliary anatomy. Meticulous dissection is used to obtain the “critical view of safety” in an attempt to keep bile duct injury infrequent. With the use of ICG, normal or aberrant anatomy can be easily identified to allow for safer dissection. Studies have shown that the recognition of cystic and common bile ducts or their confluence was at or near 100% (6). ICG has also been used to assess organ perfusion after transplantation, lymphadenectomy, sentinel lymph node identification, delineation of vascular anatomy in areas of anatomic variance and to assess tissue perfusion prior to anastomosis. ICG also provides a cost benefit. For a 70kg patient the cost would be about \$145.00. This low cost is insignificant compared to the cost of bile duct injury. Most importantly, it is safer for patients and improves outcomes.

Thank you to all who participated in the care of this patient and helped with the creation of this poster



Normal biliary anatomy (7)



Left picture showing cystic duct and common bile ducts. Right with ICG showing confluence of common bile and hepatic duct, cystic duct and bifurcation into the right and left hepatic duct (817098)

Reference

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