ICG and Robotic Platform in Elective Cholecystectomy: Successful management of an Exceptionally Rare Hisatsugu Type V Biliary Anomaly

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INTRODUCTION

Laparoscopy is the current gold standard for cholecystectomy. Bile duct injuries remain a concern and are often due to unrecognized biliary tree anomalies. Among these, the aberrant right hepatic duct (ARHD) is an uncommon variant, draining primarily into the common hepatic duct, common bile duct, or left hepatic duct [1]. A rare subtype, Hisatsugu Type V ARHD, occurs when the right posterior sectorial duct drains into the cystic duct [2]. While intraoperative cholangiography may reduce the incidence of bile duct injury during laparoscopic cholecystectomies, the utility of near-infrared fluorescent cholangiography (NIFC) remains unclear. Our case highlights the utility of the robotic platform's NIFC in recognizing and managing anomalous biliary anatomy.

CASE

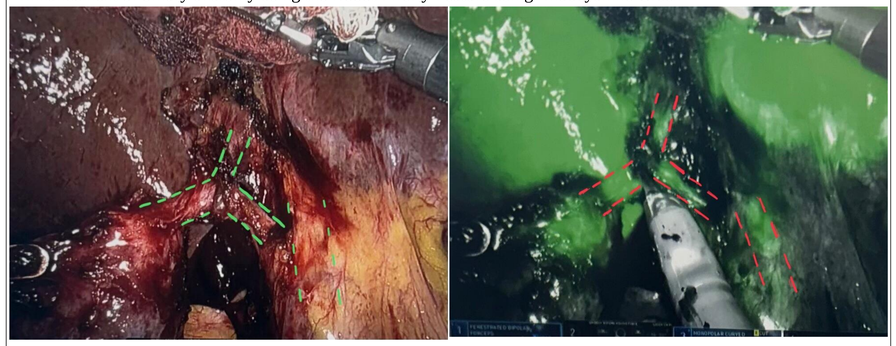
Our patient presented for an elective robotic cholecystectomy without preoperative imaging due to the absence of clinical indications. During dissection of Calot's triangle, the cystic duct and artery were easily identified and isolated. However, during the clearance of the cystic plate, only fibrotic and fatty tissue were visualized, with no additional structures apparent. Before proceeding with the dissection to achieve the one-third clearance required for the Critical View of Safety, the Firefly fluorescence imaging was activated.

Upon activation, a green tubular structure of similar diameter to the cystic duct illuminated immediately parallel and posterior to Hartmann's pouch. At this point, the exact nature of the structure was unclear. A top-down approach was then performed, carefully dissecting the area to fully expose and preserve the structure. Only after the complete dissection were we able to identify it as an aberrant right posterior sectorial duct draining into the cystic duct, confirming it as a Hisatsugu Type V anomaly.

Uniquely, in our case, the junction of this duct with the cystic duct was found to be less than 5 mm from the gallbladder—a location that, to our knowledge, has not been previously described in the literature. Typically, the ARHD in similar cases is depicted joining the cystic duct much closer to the common hepatic duct. This unprecedented proximity to the gallbladder significantly heightened the risk of inadvertent injury, which could have easily gone unnoticed without the use of advanced imaging techniques.

FIGURE 1

Enhancement of biliary anatomy using the Robot Firefly Feature using Indocyanine Green



A) Biliary tree anatomy no ICG

B) Biliary tree anatomy with ICG

FIGURE 2



Figure 2: An artist's rendition of the Hisatsugu Type V anomaly encountered during the robotic cholecystectomy

DISCUSSION

In Hisatsugu Type V cases, the aberrant right hepatic duct (ARHD) typically joins the cystic duct closer to the common hepatic duct. However, in our case, the junction was located less than 5 mm from the gallbladder. This specific location is described in the literature as carrying an extremely high risk of injury[3].

This case underscores both the advantages of the robotic platform in addressing complex biliary anatomy and the critical role of indocyanine green fluorescence in identifying the ARHD. Without the fluorescent imaging capabilities of the robotic system, there was a significant risk of duct injury, potentially leading to serious complications. This emphasizes the necessity of incorporating advanced intraoperative imaging techniques routinely, especially in cases where preoperative imaging may not be indicated.

CONCLUSIONS

Enhanced visualization using the robotic platform, combined with ICG fluorescence imaging, is helpful for preventing bile duct injuries. The findings from this case supports the routine use of these advanced imaging modalities in all cases to ensure optimal surgical outcomes.

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