

Near-infrared fluorescence image-guided surgery for hepatolithiasis

Kunshan He¹, Kun Wang¹, Yamin Mao¹, Chong Zhang¹, Jie Tian¹

¹ Key Laboratory of Molecular Imaging, Chinese Academy of Sciences, Beijing, China;

Introduction: Hepatolithiasis has been defined as the occurrence of stones in any intrahepatic bile duct proximal to the confluence of the right and left hepatic ducts, irrespective of the presence of stones in the main bile duct or the gallbladder. It is prevalent in Japan and Southeast Asia. Because of high rate of remnant and recurrence of stones contributed by the complicating biliary strictures, which lead to inevitable postoperative lithogenesis. Therefore, liver resection (LR), which include the total involved liver parenchymal segments and biliary tract (anatomical hepatectomy or non-anatomical hepatectomy) is the definitive treatment option for intrahepatic duct (IHD) stones because it can remove both the stones and the ductal strictures of biliary tract simultaneously. However, unlike cystic or solid liver tumors, patients with IHD stones have alterations of anatomical structures and perihepatic adhesions because of chronic recurrent inflammation, which makes the identification of the target hepatic segment and locates the biliary strictures difficult. Recently, indocyanine green (ICG) fluorescence image-guided surgery (FIS) has been introduced into hepatectomy, which has been identify as a valuable technique on define the resected margin in tumor patients, yet this technique utilized in patients with IHD stones was rarely reported. Our study describes our initial experience of ICG FIS applied to LR for patients with hepatolithiasis.

Methods: In this study, we used a fluorescent imaging system (PINPOINT, Novadaq, Canada). A total of ten patients were recruited. Preoperatively, triple-phase, contrast-enhanced computed tomography (CT) of the abdomen was conducted to locate stones, biliary strictures and segments of the liver involved. Intraoperatively, after puncture of the target portal branch, 2.5 mg of ICG was injected into the branch under contrast-enhanced IOUS guidance with the hepatic artery clamped. Video-rate color, fluorescence and merged images were displayed for ALR and recorded for data analysis.

Results: The representative merged images collected during surgery were shown in Fig. 1. Of the ten patients, all objectives (100%) achieved valid demarcation with a high signal to background (SBR) of 7.1 ± 0.8 . And, the same result was obtained regardless liver surface states of patients. ALR was conducted referring to 3-dimensional staining of target parenchyma, with no related perioperative adverse events.

Conclusions: FIS using ICG is a safe and valid imaging technique during ALR for patients with IHD that attained valid 3-dimensional parenchymal demarcation with clear demarcation.

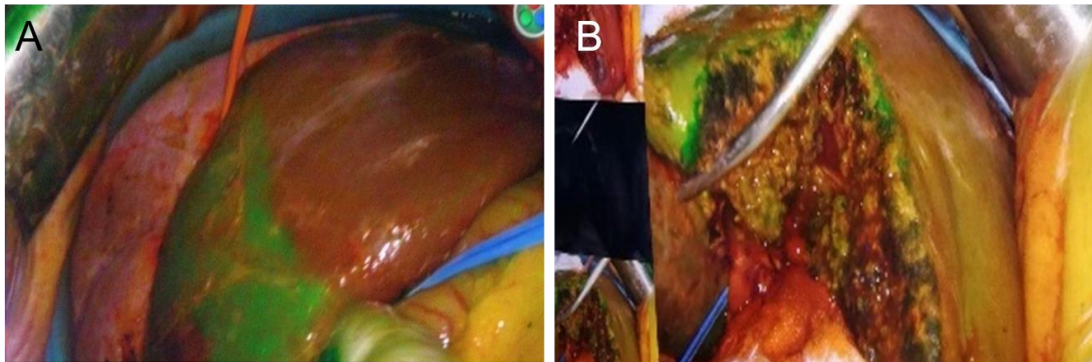


FIG.1 *In vivo* ICG fluorescence imaging of a patient with bile duct stones in the right posterior lobe of the liver. (A)Performance of locating liver segments involved. (B) Performance of resecting the target segments.