Editorial

Overview of fluorescence imaging focusing on fusion-image for laparoscopic hepatectomy

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A fluorescence imaging using indocyanine green (ICG) as a fluorophore was first reported to be useful for assessing coronary artery bypass graft patency (1). The technique was subsequently used to visualize lymphatic vessels (2) and to identify sentinel lymph nodes during breast (3) and gastric (4) cancer surgeries. ICG is taken into the hepatocyte and solely excreted into the bile (5). The fluorescence imaging technique has been recently used for hepatobiliary surgery to identify hepatic cancers (6,7) the bile duct (8-10), and bile leakage (11,12) and to visualize portal venous and hepatic venous territories (13-16).

Many fluorescence imaging systems are now commercially available for open and laparoscopic surgeries. However, there are limited number of systems that facilitate fusion images made up of pseudocolor fluorescence images and white-light color images. A fusion fluorescence imaging was firstly applied for open liver surgery and liver transplantation on 2011 (17). In the current issue of the journal, Terasawa *et al.* reported their experiences of a laparoscopic imaging system that facilitates fusion images (18). The authors performed laparoscopic hepatectomy by applying the system for 41 patients with 59 hepatic lesions. According to histopathological diagnosis, there were 53 malignant and 6 benign tumors. Of the 53 malignant tumors, 45 (85%) were visualized before performing live resection using the system. The grossly-unidentifiable 22 tumors were visualized only by fluorescence imaging and located more deeply than the other 8 tumors that was not identified by fluorescence imaging {depth from the liver surface to the tumors, 1 [1–10] *vs.* 9 [6–35] mm, P<0.001}. For 12 patients, the technique was used to visualize the hepatic segments. The authors demonstrated that a fusion ICG-fluorescence imaging serves as a simple navigational tool and provides information on tumor location, segmental boundaries, and bile duct anatomy, compared to previous laparoscopic imaging systems that provide only monochromatic fluorescence images. Additionally, they emphasized that laparoscopic surgery is advantageous over open surgery when using fluorescence imaging navigation. That is because surgeons can continue the surgical procedure without shifting their gaze from the surgical site.

The limitation of fluorescence imaging is the low tissue penetration ability. Namely, objects cannot be visualized as a fluorescence when they are located >10 mm deep from the liver surface (7). Nonetheless, fluorescence imaging is expected to complement preoperative and intraoperative imaging modalities which sometimes fail to diagnose subcapsular hepatic malignancies, whereas they were well visualized by fluorescence imaging (19,20). Further technical innovation in this field can help surgeons to perform safe and accurate liver resection.

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Footnote

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