

Hepatectomy guided by indocyanine green fluorescent imaging for visualizing bile leakage (with video)

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Abstract

Using indocyanine green(ICG), a standard reagent used in liver function tests, bile leaks from exfoliated liver sections can be detected with higher sensitivity than observation with the naked eye. This presentation will introduce the technique of using ICG to detect bile leaks that cannot be detected by the naked eye.

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Authors have no conflicts of interest or financial ties to disclose.

Ethics approval statement

Not applicable.

Patient consent statement

Written consent for this presentation was obtained from the patients who appeared in the figure and supplementary video.

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Not applicable

Abstract and key clinical message

Using indocyanine green (ICG), a standard reagent used in liver function tests, bile leaks from exfoliated liver sections can be detected with higher sensitivity than observation with the naked eye. This presentation will introduce the technique of using ICG to detect bile leaks that cannot be detected by the naked eye.

Key words: indocyanine green, biliary fistula, hepatectomy, fluorescence imaging, navigation surgery

Main text

Biliary fistulas (BFs) after hepatectomy are a challenging complication and are occasionally accompanied by serious conditions such as liver failure or severe infection despite recent improvements in perioperative care and surgical techniques. The bile leak test has been reported to be efficient in detecting bile leakage during surgery¹; however, it is not valid for identifying bile leaks that do not involve the common bile duct (e.g., Nagano Type D bile leakage²).

In our institution, indocyanine green (ICG) (10 mg/body) is administered intravenously to determine the hepatic resection area, and the liver is observed with an ICG camera system (Stryker AIM1588, Kalamazoo, MI) after the completion of hepatectomy. Since intravenous ICG is taken up by the hepatocytes and then in bile, this property can be used to identify the bile ducts. In the section plane after hepatectomy, bile leakage could be observed more clearly, compared to naked-eye observation, as an ICG-fluorescence contamination of the gauze (Fig. 1, Supplementary video 1). This allows for the appropriate treatment of intraoperative subclinical bile leakage, thus preventing BF. Further, the method seems useful for the detection of Nagano Type D bile leakage², which cannot be detected via conventional bile leak tests.

List of abbreviations

ICG, indocyanine green; BF, biliary fistula

Authors' contributions

TaH: collected the patient data, performed surgery and a literature review, and wrote the manuscript. NT and TS: revised the manuscript. YF: were involved in overall supervision of the study. All authors have read and approved the final version of the manuscript.

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Figure legend

Figure 1.

Observation of the liver section plane. On naked-eye observation, the gauze that was pressed against the section plane of the liver was not stained yellow with bile (a). Near-infrared observation showed an indocyanine green fluorescent spot (arrowhead) from the parenchyma of the liver section (arrow) (b). A Z-shaped suture was added to the site of contamination (arrow) in the liver section plane, and it can be seen that the fluorescent spot of gauze disappeared (c).

Supplementary Video 1.

Fluorescence imaging with systemically administered indocyanine green for the prevention of bile leak in hepatectomy.

Fig. 1

