# Near-Infrared fluorescence imaging in open and laparoscopic hepatectomy: improving safety of the extra-glissionian approach?

Published: 23-10-2017 Last updated: 15-04-2024

The main objective of this trial is to investigate the ability to visualize the exact location of left and right confluence of the bile ducts and thereby distinct between right and left hepatic ducts and the common hepatic duct using NIRF imaging....

Ethical review	Approved WMO
Status	Recruiting
Health condition type	Hepatic and hepatobiliary disorders
Study type	Interventional

# Summary

### ID

NL-OMON55781

**Source** ToetsingOnline

**Brief title** FLASH pilot: Fluorescence Assisted Safer Hepatectomy

### Condition

- Hepatic and hepatobiliary disorders
- Hepatobiliary therapeutic procedures

**Synonym** hepatic tumors

**Research involving** Human

1 - Near-Infrared fluorescence imaging in open and laparoscopic hepatectomy: improvi ... 6-05-2025

#### **Sponsors and support**

#### Primary sponsor: Academisch Medisch Centrum Source(s) of monetary or material Support: Ministerie van OC&W

#### Intervention

**Keyword:** bile duct anatomy, Hepatectomy, Indocyanine Green (ICG), Near Infrared Fluorescence Imaging (NIRF)

#### **Outcome measures**

#### **Primary outcome**

The ability to visualize right, left hepatic ducts and the common hepatic duct simultaneously, with localization of the hepatic duct confluence duct using NIRF imaging. This will be scored by the operating surgeon before and after selective portal pedicle clamping using a scale from 1-5. In this scale; 1 means no fluorescent signal visible, 2 some signal visible but very hard to see, up to 5 where there is a very clear fluorescent signal that provides excellent distinction between the biliary structures and the surroundings. Also, the target to background ratio will be calculated to quantify the fluorescence intensity of the cystic ducts compared to the liver. In this, the two arms will be compared (injection of ICG 24h before surgery versus during induction of anaesthesia)

#### Secondary outcome

- Visibility of liver metastasis (also on a scale from 1 to 5);

- Time between cholecystectomy and the surgeon being confident where to transect the hepatic duct;

- Total surgical time, measured from incision until first stitch;

- Bile duct injury;

2 - Near-Infrared fluorescence imaging in open and laparoscopic hepatectomy: improvi ... 6-05-2025

- Postoperative length of hospital stay (number of night admitted after

surgery);

- Complications due to the intravenously injected contrast agent;
- Postoperative complications until 30 days after surgery.

# **Study description**

#### **Background summary**

Liver resection is the accepted treatment for various benign and malignant indications. Several techniques can be applied to resect one or more segments of the liver. In anatomic resections two main techniques to transect the main portal pedicles are generally used. Traditionally the hilar dissection technique is being used most but this technique is time consuming. A faster but potentially more risky technique to damage the remnant bile duct is the (extra)glissonian approach. Takasaki described the glissonian sheet that envelopes the hepatic artery, het biliary duct and the portal vein extra hepatic as well as intrahepatic. Because these structures are all enveloped together, they can be approached and transected together without dissecting Glisson\*s sheet, making this surgery faster and easier when experienced. The en-bloc transection of the hilar structures is called the \*extra glissonian approach\*. This includes the dissection of the whole sheet of the pedicle directly after division of a substantial amount of the hepatic tissue to reach the pedicle, which is surrounded by a sheet derived from Glisson\*s capsule. The use of vascular staplers in this situation allows simultaneous ligation of the entire right or left portal pedicle. Using this approach, the hilary dissection is faster. However, the extra-glissonian approach is being associated with an increased rate of biliary fistula, and described disadvantages of the approach are accidental ligation of the biliary confluence when stapling the right pedicle, presenting postoperatively as obstructive jaundice or portal vein thrombosis. These complications can possibly be prevented easily by a clearer view of enhanced hilar anatomy and visualization of the exact location of the left and right biliary confluence. For minimal invasive liver resections, the Glissonian approach has been further popularized by Machado (5) and Topal (6). They both use intraoperative fluoroscopic (i.e. guided by X-ray) cholangiography to avoid the aforementioned complications. The fluoroscopic cholangiography however is cumbersome, time consuming and costly since it necessitates extra equipment and a radiologic team being present in the OR. Also, the patient is exposed to X-rays.

Several clinical feasibility studies have shown the potential benefit of

near-infrared fluorescence (NIRF) imaging using indocyanine green (ICG) for enhanced (and even earlier) biliary anatomy visualization during laparoscopic cholecystectomy with the aim to reduce the number of vascular and biliary injuries (7-11). The same technique can be used to visualize the central bile ducts when performing a hepatectomy to visualize the biliary anatomy. NIRF is easily applicable and less cumbersome than fluoroscopic intra-operative imaging.

The aim of this study is to investigate the feasibility of the use of NIRF fluorescence imaging for visualizing the biliary anatomy during partial liver-resection using the hilar dissection as well as the glissonian approach. Is the fluorescence imaging helpful for the surgeon? We hypothesize that by visualizing the bile ducts by using near infrared fluorescence imaging, this technique will be easier to perform and the surgeon can be more sure about the exact location of the left and right biliary confluence. where to transect the glissonian envelope.

An additional benefit of using this technique might be that the hepatic metastasis can be visualized according to the study by van der Vorst et al. Therefore, the second hypothesis is that the use of NIRF fluorescence imaging will help identifying liver metastases.

#### **Study objective**

The main objective of this trial is to investigate the ability to visualize the exact location of left and right confluence of the bile ducts and thereby distinct between right and left hepatic ducts and the common hepatic duct using NIRF imaging. This will be scored by the operating surgeon on a scale from 1-5 in which 1 is no visualisation of the structures in fluorescent light, and 4 is excellent visualisation. Also, the target to background ratio will be calculated to quantify the fluorescence intensity of the cystic ducts compared to the liver.

Secondary Objectives:

- To establish when the ICG should be given for optimal visualisation of the bile ducts with minimal background fluorescence.

- To assess whether the use of ICG can help identify the location of the liver metastases.

Also, bile duct injury, total surgical time, postoperative length of hospital stay and complications due to the injected contrast agent will be recorded.

#### Study design

A single center trial with two randomization arms:

- Early administration group: ICG is being administered the day before surgery

(12-24 hours before surgery), in a dose of 0,15mg/kg intravenously

- Late administration group: ICG is being administered just after induction of

anesthesia, in a dose of 0,05mg/kg intravenously.

Planned duration of this project: 1 year

#### Intervention

The included patients will undergo NIRF-assisted liver surgery with the use of ICG. ICG will be administered 12-24 hours before surgery in a dose of 0,15mg/kg or just after induction of anesthesia in a dose of 0,05mg/kg. The fluorescence mode on the (laparoscopic) equipment will be used.

#### Study burden and risks

Compared with standard care, patients participating in this pilot study will receive one intravenous injection of ICG. This is the only additional (minimally) invasive action for the patient. The administration of ICG (FDA approved and used for several clinical diagnostic indications, previously used in related NIRF-LC studies (NL 38521.068.11 en NL 47718.068.14)) and the fluorescence imaging system are not related to additional risk for the patient.

# Contacts

Public Academisch Medisch Centrum

p. debeyelaan 25 Maastricht 6229HX NL **Scientific** Academisch Medisch Centrum

p. debeyelaan 25 Maastricht 6229HX NL

# **Trial sites**

### **Listed location countries**

Netherlands

# **Eligibility criteria**

#### Age

Adults (18-64 years) Elderly (65 years and older)

#### **Inclusion criteria**

- Male or female patients, aged 18 years and above
- Scheduled for elective segment resection or hemi-hepatectomy
- Normal renal function (eGFR>45)
- No known hypersensitivity for iodine or ICG
- No hyperthyroidism
- Able to understand the nature of the study procedures
- Willing to participate and give written informed consent

### **Exclusion criteria**

- Age < 18 years
- Renal insufficiency (eGFR<45)
- Known ICG, iodine, penicillin or sulpha hypersensitivity
- Pregnancy or breastfeeding
- Hyperthyroidism
- Not able to understand the nature of the study procedure
- i.v. heparin injection in the last 24h (LMWH not contraindicated)
- Not willing to participate

# Study design

### Design

Study type: Interventional	
Masking:	Open (masking not used)
Control:	Uncontrolled
Primary purpose:	Diagnostic

### Recruitment

NL

6 - Near-Infrared fluorescence imaging in open and laparoscopic hepatectomy: improvi ... 6-05-2025

Recruitment status:	Recruiting
Start date (anticipated):	14-12-2017
Enrollment:	30
Туре:	Actual

### Medical products/devices used

Generic name:	Olympus Laparoscopic Fluorescence Imaging System en STORZ LED white light source
Registration:	Yes - CE intended use

# **Ethics review**

Approved WMO	
Date:	23-10-2017
Application type:	First submission
Review commission:	METC academisch ziekenhuis Maastricht/Universiteit Maastricht, METC azM/UM (Maastricht)
Approved WMO	
Date:	23-04-2021
Application type:	Amendment
Review commission:	METC academisch ziekenhuis Maastricht/Universiteit Maastricht, METC azM/UM (Maastricht)

# **Study registrations**

### Followed up by the following (possibly more current) registration

No registrations found.

### Other (possibly less up-to-date) registrations in this register

No registrations found.

## In other registers

#### **Register** CCMO

Other

**ID** NL61383.068.17 volgt