NIR/ICG Imaging for Fluorescence-guided Surgery
Are you ready for the future?

An OPAL1® technology, based on the IMAGE1 S™ camera platform
The increasing number of publications on the topic of NIR/ICG fluorescence imaging clearly shows that this imaging process is under continuous development. KARL STORZ sees this technology as the standard imaging technology of the future in every operating room thanks to its multifaceted and interdisciplinary functionality.

The Near Infrared (NIR) system using the marker indocyanine green (ICG*) – a non-radioactive and cost-effective dye – enables the visualization of fluorescence up to one centimeter below the tissue surface. For this purpose, KARL STORZ offers the appropriate equipment for open surgery and minimally invasive procedures.

**Key applications of NIR/ICG technology include:**

**Visualization ...**

... of the lymphatic system (e.g. sentinel lymph nodes as well as leakages)**

... of perfusion and vascular structures (e.g., ischemic areas, anastomosis or transplants)

... of lung segments

... of liver segments, bile leakage at the liver and superficial liver metastases/HCC

... of the bile ducts and gallbladder

... of the ureter by means of a catheter

and much more

* Please verify that the fluorescent dye indocyanine green is approved for the respective indication in your country.

** Please inform yourself about the potential for the off-label use of ICG in your hospital / country.
Visualization of SLN in the case of colorectal carcinoma

Courtesy of Prof. Boni, Policlinico di Milano, Milan, Italy

Visualization of the bile ducts and the gallbladder during cholecystectomy

Courtesy of Prof. Boni, Policlinico di Milano, Milan, Italy

Liver segmentectomy during partial liver resection

Courtesy of Niclas Kvanström, M.D., Sahlgrenska University Hospital, Gothenburg, Sweden

Application examples of OPAL1® Technology for NIR/ICG
Sentinel Lymph Node (SLN) Mapping in Early Stage Carcinoma in Gynecology*

The detection rate of affected sentinel lymph nodes using OPAL1® technology for NIR/ICG was significantly higher than that obtained with blue dye and technetium, the current gold standard in Germany.

Source: Buda A. et al., Impact of Indocyanine Green for Sentinel Lymph Node Mapping in Early Stage Endometrial and Cervical Cancer: Comparison with Conventional Radiotracer 99mTc and/or Blue Dye, 2015

Example of the visualization of SLN using the OPAL1® technology for NIR/ICG

White light mode  NIR/ICG mode  NIR/ICG mode with SPECTRA A**

Courtesy of Dr. Puntambekar, Galaxy Care Hospital, Pune, India

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** Pending 510(k) Clearance. Not available for sale in the U.S.
Assessment of perfusion for delineating a resection zone in the case of ischemia and for sufficient circulation in the area around the anastomosis to prevent anastomosis insufficiency

Example of perfusion assessment for planning a resection zone using the OPAL1™ technology for NIR/ICG

White light mode  
NIR/ICG mode

Courtesy of Dr. Skrovina, Nový Jičín Hospital, Czech Republic

Anastomosis insufficiency in patients following resection of an intestinal segment WITHOUT the use of ICG

6.2% with anastomotic leak  
up to 32% mortality

Subsequent leakage was detected in 535 cases. ¹  
Up to 32% of patients die from postoperative complications caused by an anastomotic leak. ²

Mean length of hospital stay was ~8.7 days for patients without an anastomotic leak in comparison with ~23.8 days for patients with an anastomotic leak. ³

¹ Source: Krarup PM, et al., Association of Comorbidity with Anastomotic Leak, 30-day Mortality, and Length of Stay in Elective Surgery for Colonic Cancer: A Nationwide Cohort Study., 2015
³ Source: Krarup PM, et al., Association of Comorbidity with Anastomotic Leak, 30-day Mortality, and Length of Stay in Elective Surgery for Colonic Cancer: A Nationwide Cohort Study., 2015
NIR/ICG Applications for Liver Carcinoma and Metastases

Approx. 9,080 new cases of liver cancer are registered in Germany every year (and still rising).

10%

The 5-year survival rate of liver cancer patients is only 10%!

Liver Metastases

NIR/ICG allows the visualization and demarcation of liver metastases. The healthy tissue around the tumor fluoresces (ring-shaped accumulation) as the tumor cells block elimination of the ICG from the surrounding healthy liver parenchyma.

Compared to preoperative imaging, the intraoperative identification of liver metastases in real time and a higher resolution adds value to the procedure. Our technology detects metastases in the range of 1-2 mm and is a useful complement to conventional techniques for preoperative localization of metastases such as CT and MRT.

Liver Tumors

ICG remains inside the hepatocellular carcinoma for days. Tumor marking with NIR/ICG can therefore be used for the targeted removal of tumor tissue. The ICG system makes it possible to display liver metastases up to one centimeter below the tissue surface.

Furthermore, the technology can be used for the visualization of bile leakage or liver segments.

1 Cancer in Germany 2014, Robert Koch Institut, Berlin, Germany
2 Tummers et al., First experience on laparoscopic near-infrared fluorescence imaging of hepatic uveal melanoma metastases using indocyanine green, 2014
4 Diana M., et al., Superselective intra-arterial hepatic injection of indocyanine green (ICG) for fluorescence image-guided segmental positive staining: experimental proof of the concept., 2018
5 The approval status of the medication may vary. Please inform yourself of its potential use in your hospital or country.
**Visualization of the Gallbladder and Bile Ducts**

The minimally invasive approach has been associated with shortcomings like a significant learning curve, loss of tactile feedback and increased risk of bile duct injury (BDI). The reported incidence is 0.3-0.7% of cases. This translates to approximately 3,000 injuries out of the reported 750,000 laparoscopic cholecystectomies performed in the US in 2008 alone.

**Misidentification**

97% of all bile duct injuries are due to visual perceptual illusion

19% of all patients have anatomic variations in the bile ducts

**Consequences after a bile duct injury**

**Increased Hospital Stay**
BDI adds an average of 32 days inpatient hospitalization and 10 days of outpatient care

**Reduced Quality of Life (QoL)**
BDI decreases QoL by 30-50% in the first year

**Increased Cost**
BDI increases the cost compared to an uncomplicated procedure by 4.5 to 26 times

**Litigation**
BDI is the most frequent injury resulting in litigation. Average payout US$508,341


The OPAL1® technology for NIR/ICG enables the visualization of ICG up to one centimeter below the tissue surface.

Visualization of the cystic duct before dissection under white light – and the NIR/ICG mode

Source: Prof. Walz, Klinikum Essen-Mitte, Germany
Your advantages – with our OPAL1® technology for NIR/ICG

**Image quality**
Most surgery is performed under white light. We deliver razor-sharp FULL HD images for all white light applications as well as our S-Technologies with various visualization modes.

**Safety**
Our technology is Xenon-based. This eliminates the need for additional laser safety precautions such as, for example, laser safety goggles or laser protection officers in the operating room.

**Modularity with our all-in-one solution**
Based on our IMAGE1 S™ camera platform, we provide a modular system that offers forward and backward compatibility and, consequently, sustainability. In accordance with individual needs, the system can be expanded at any time and various modules such as, for example, components for both open and laparoscopic procedures can be used simultaneously in one camera system.

**German quality**
As a system provider, the company combines years of experience in endoscopy with software solutions that ultimately provide brilliant visualization. Furthermore, we have been working very intensively for many years on various fluorescence procedures, e.g., NIR/ICG fluorescence imaging.

**Virtual support thanks to SCENARA®.store**
SCENARA®.STORE provides better orientation for user documentation. With its preview and navigation options, SCENARA®.STORE permits easy retrieval and playback of, for example, fluorescence sequences for consultations with patients or team meetings and thus eliminates tedious searching. In addition, the software offers many other benefits such as, for example, the possibility to edit, cut, compare and export video and image material as well as seamless storage in existing information and archiving systems.

**Service**
KARL STORZ is synonymous with quality products and offers a first-class service. We are always there for you when you need us! As a manufacturer of endoscopes with countless years of experience, we have a global presence and are at your disposal at any time.
The future is now!

Discover OPAL1® technology for NIR/ICG fluorescence imaging:

The future has tradition.
And tradition has a future.
It is recommended to check the suitability of the product for the intended procedure prior to use.
...evolution continues

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