PROTOCOL TITLE COLOFLOW: Quantified ICG fluorescence versus LSCI for perfusion assessment

Protocol ID	***<include protocol ID given by sponsor or investigator>***
Short title	**COLOFLOW**
Version	**1**
Date	**01-06-2026**
-Coordinating investigator/project leader	***I Planting*** ***L.E. van der Aa***
Principal investigator(s) (in Dutch: hoofdonderzoeker/ uitvoerder)	***Joost van der Vorst***
Applicant (in Dutch: indiener)	***I Planting***
Sponsor (in Dutch: verrichter/opdrachtgever)	***Leiden University Medical Centre***

TABLE OF CONTENTS

1. OBJECTIVES 6
2. STUDY DESIGN 6
3. STUDY POPULATION 6
3.1 Population (base) 6
3.2 Inclusion criteria 6
3.3 Exclusion criteria 6
3.4 Sample size calculation 7
4. TREATMENT OF SUBJECTS ..... **Error! Bookmark not defined.**
5. INVESTIGATIONAL PRODUCT 7
6. NON-INVESTIGATIONAL PRODUCT 7
7. METHODS 9
7.1 Study parameters/endpoints 9
7.1.1 Main study parameter/endpoint 9
7.1.2 Secondary study parameters/endpoints (if applicable) 9
7.1.3 Other study parameters ..... **Error! Bookmark not defined.**
7.2 Randomisation, blinding and treatment allocation ..... **Error! Bookmark not defined.**
7.3 Study procedures 10
7.4 Withdrawal of individual subjects 11
7.5 Replacement of individual subjects after withdrawal 11
7.6 Follow-up of subjects withdrawn from treatment 11
7.7 Premature termination of the study ..... **Error! Bookmark not defined.**
8. STATISTICAL ANALYSIS 11
8.1 Primary study parameter(s) ..... **Error! Bookmark not defined.**
8.2 Secondary study parameter(s) ..... **Error! Bookmark not defined.**
8.3 Other study parameters ..... **Error! Bookmark not defined.**
9. ETHICAL CONSIDERATIONS 12
9.1 Regulation statement 12
9.2 Recruitment and consent 12
9.3 Benefits and risks assessment 13
9.4 Incentives (if applicable) ..... **Error! Bookmark not defined.**
10. ADMINISTRATIVE ASPECTS, MONITORING AND PUBLICATION 13
10.1 Handling and storage of data and documents 13
10.2 Monitoring and Quality Assurance 13
10.3 Amendments 13
11. REFERENCES 14

LIST OF ABBREVIATIONS AND RELEVANT DEFINITIONS

GCP	**Good Clinical Practice**
GDPR	**General Data Protection Regulation; in Dutch: Algemene Verordening Gegevensbescherming (AVG)**
IB	**Investigator's Brochure**
IC	**Informed Consent**
IMP	**Investigational Medicinal Product**
IMPD	**Investigational Medicinal Product Dossier**
IMD	**Investigation with Medical Device**
IMDD	**Investigational Medical Device Dossier**
METC	**Medical research ethics committee (MREC); in Dutch: medisch-ethische toetsingscommissie (METC)**
(S)AE	**(Serious) Adverse Event**
SPC	**Summary of Product Characteristics; in Dutch: officiële productinformatie IB1-tekst**
Sponsor	**The sponsor is the party that commissions the organisation or performance of the research, for example a pharmaceuticalcompany, academic hospital, scientific organisation or investigator. A party that provides funding for a study but does not commission it is not regarded as the sponsor, but referred to as a subsidising party.**
UAVG	**Dutch Act on Implementation of the General Data Protection Regulation; in Dutch: Uitvoeringswet AVG**
WMO	**Medical Research Involving Human Subjects Act; in Dutch: Wet Medisch-wetenschappelijk Onderzoek met Mensen**

SUMMARY

Rationale: Anastomotic leakage remains a major cause of morbidity and mortality after colorectal surgery, with rates of approximately 10–15%. Although near-infrared fluorescence (NIRF) imaging with indocyanine green (ICG) is increasingly used to guide intraoperative perfusion assessment, its clinical effectiveness remains inconsistent, and interpretation is still largely subjective. Moreover, ICG fluorescence has inherent limitations, including dye dependency, residual fluorescence, and the inability to perform repeated measurements reliably. Laser Speckle Contrast Imaging (LSCI) offers a dye-free, real-time, and objective alternative capable of delineating well-perfused and ischemic bowel regions. This study evaluates intraoperative agreement between subjective ICG assessment and LSCI and investigates whether postoperative quantitative ICG analysis further improves concordance.

Objective: The primary objective of this study is to evaluate the concordance between subjective indocyanine green (ICG) fluorescence interpretation and Laser Speckle Contrast Imaging (LSCI) for assessing perfusion at the anastomotic site during colon and rectal surgery.
Secondary objectives are to determine the postoperative spatial agreement between the quantified ICG line of demarcation and the LSCI perfusion boundary, and to evaluate the feasibility of applying the PerfusiX-IGS LSCI system in the open surgical field.

Study design: This study is designed as a prospective, single-centre, observational investigation. No intervention, randomization, or blinding is performed. LSCI imaging does not influence surgical decision-making and serves solely as an additional, non-contact imaging modality.

Study population: The study population consists of adult patients undergoing elective colon or rectal resection requiring the creation of a primary anastomosis. This population mirrors that of the previously approved non-WMO study ‘’QUANTICOLON’’. Patients are enrolled preoperatively in the outpatient clinic during routine surgical planning. No additional burden is introduced other than consent for postoperative analysis of intraoperative imaging.

Main study parameters/endpoints: The primary endpoint is the degree of agreement between subjective ICG interpretation and LSCI perfusion mapping at the anastomotic site, including both categorical (adequate vs. inadequate perfusion) and spatial agreement.

Nature and extent of the burden and risks associated with participation: The study introduces no additional physical burden. LSCI is a non-contact, dye-free optical technique that requires approximately 30 seconds of intraoperative acquisition and does not interfere with surgical workflow. Standard-of-care ICG administration is performed independently of the study. There is no direct benefit to participants, and the risks are limited to the storage and handling of anonymized imaging data.

INTRODUCTION AND RATIONALE

Colorectal cancer remains one of the most prevalent malignancies worldwide and is associated with substantial morbidity and mortality. (1, 2) Anastomotic leakage is a major contributor to this morbidity and mortality, and it occurs in approximately 10-15 % of the cases. (3)
Despite advances in surgical techniques and perioperative care, the incidence of AL has remained largely unchanged. Surgeons routinely evaluate perfusion subjectively based on color, pulsation and bleeding, which are unreliable predictors.(4) Imaging modalities such as Near-Infrared Fluorescence (NIRF) using indocyanine green (ICG) have become an increasingly established tool for intraoperative perfusion assessment. By providing rapid, real-time visualization of tissue vascularization, NIRF imaging may enable surgeons to optimize anastomotic site perfusion and thereby reduce leakage rates. Several prospective studies suggest potential benefits of NIRF imaging, particularly in left-sided colonic and rectal resections. However, superiority over conventional white-light assessment and clinical judgment has not been consistently demonstrated. (5-8) Beyond these variable clinical outcomes, the use of ICG is associated with several intrinsic limitations. These include the reliance on subjective interpretation of the fluorescence signal by the surgeon, the need for intravenous dye administration, and the potential for residual dye to interfere with or prevent repeated, immediate perfusion assessments. In addition, the technique depends on specialized and expensive near-infrared imaging systems, which may limit its broader implementation in clinical practice. (9, 10) Laser Speckle Contrast Imaging (LSCI) overcomes these limitations by providing real-time, objective perfusion mapping without the need for dye. Prior studies demonstrate its ability to delineate well-perfused versus ischemic bowel regions. (11-14)

In the development of more objective perfusion assessment strategies, it is essential to determine how subjective ICG fluorescence interpretation relates to these objective, dye-free LSCI perfusion maps. As intraoperative decision-making currently continues to rely largely on the surgeon’s subjective assessment of ICG signals, establishing the level of agreement between both modalities represents a critical first step. Such a comparison forms the foundation for a transition toward fully quantitative, standardized, and objective perfusion assessment in colorectal surgery.
Therefore, the aim of this study is to evaluate the intraoperative agreement between subjective ICG fluorescence assessment and LSCI perfusion imaging at the anastomotic site, and to further assess whether postoperative quantitative analysis of ICG fluorescence improves concordance with LSCI-derived perfusion measurements.

1. OBJECTIVES

Primary Objective:
To evaluate the concordance between subjective ICG fluorescence interpretation and LSCI perfusion imaging for assessing colon perfusion at the anastomotic site.

Secondary Objective(s):

- To assess postoperative spatial agreement between the quantified ICG “line of demarcation” and the LSCI perfusion boundary.
- To evaluate feasibility of LSCI application in the open surgical field.
- Clinical outcomes and the incidence of AL

2. STUDY DESIGN

Prospective, single-center, observational study. No intervention, no randomization, no blinding.
No clinical decisions are altered based on the LSCI.

3. STUDY POPULATION

3.1 Population (base)

The population for this study consists of adult patients undergoing elective colon or rectal resection with the creation of a primary anastomosis, identical to the population described in the previously approved LUMC non-WMO protocol named ‘’QUANTICOLON’’. Consistent with this previous protocol, the population will be identified through scheduled elective surgical planning, and there is no additional burden placed on patients other than consenting to the use of intraoperative imaging material collected as part of this study. Since LSCI imaging is non-contact and passive, no deviation from routine care is required. Postoperative follow-up follows standard clinical practice.

3.2 Inclusion criteria

To be eligible to participate in this study, a subject must meet all the following criteria:

- Adults ≥18 years.
- Undergoing elective colon resection with primary anastomosis.
- Able to provide consent for postoperative analysis of intraoperative imaging.

3.3 Exclusion criteria

A potential subject who meets any of the following criteria will be excluded from participation in this study:

- Palliative surgery.
- Factors that severely limit intraoperative visualization (per investigator judgement).

- Conditions interfering with perfusion assessment (e.g., severe peripheral vascular compromise).

3.4 Sample size calculation

No official sample size calculation was needed since this is an exploratory observational study. The sample size was predicted on 30 patients since this is the remaining number of patients in the QUANTICOLON study that is performed simultaneously.

4. INVESTIGATIONAL PRODUCT

The investigational product in this study is the PerfusiX-IGS Laser Speckle Contrast Imaging (LSCI) system, a non-CE-marked investigational medical device intended exclusively for clinical research. The device is described in detail in the Investigational Medical Device Dossier (IMDD). PerfusiX-IGS is intended for visualization of tissue perfusion during surgical procedures, generating perfusion heatmaps in real time. The intended users are trained healthcare professionals. The device provides additional imaging information but does not replace clinical judgement.

Name of product	**Manufacturer**	**Model**	**CE conform 93/42/EEG of EU/2017/745 (Medical devices) OR 98/79/EEG of EU/2017/746 (in-vitro diagnostics)**	**Conform intended use as described in the instruction manual?**
PerfusiX-IGS	LIMIS	1.0	No	Yes

5. NON-INVESTIGATIONAL PRODUCT

In this study, ICG will be administered intravenously or intra-arterially depending on the indication (i.e. only intra-arterially during endovascular procedure where a sheath is being placed for the procedure). Administration of a bolus of 0.01 – 0.1 mg/kg ICG will be performed. ICG is used within its intended use for perfusion assessment.

To perform the near-infrared fluorescence imaging of the colon, a near-infrared camera system readily in place will be used. These include the following:

Quest Spectrum Platform ® and Arthrex Synergy HD3

The Quest Spectrum platform® (Quest Medical Imaging, Middenmeer, the Netherlands) and the Arthrex Synergy HD3 (Arthrex, Naples, Florida) are CE certified imaging systems for assessment of perfusion. The camera system contains three wavelength-isolated light sources, including a "white" light source and two separate NIR light sources. Colour video and fluorescence images are acquired simultaneously by separate sensors and are displayed in real time using custom-built optics and software, thereby displaying colour video and NIRF images separately. The camera is attached to a freely moveable arm. During surgery, the camera and moveable arm can be enclosed in a sterile shield and drape (Medical Technique Inc., Tucson, AZ, U.S.A.).

Postoperatively data will be analysed using the Quest Research Framework or any other validated research tool. These curves included:

- T0 (time of fluorescence onset)
- Tmax (time to peak intensity)
- Imax (maximum fluorescence intensity)
- MaxNormSlope (maximum normalized slope)
- Outflow in AUC 30/60/120

These quantitative parameters will be used postoperatively during this study to determine whether quantified ICG fluorescence correlates with LSCI perfusion maps.

Name of product	**Manufacturer**	**Model**	**CE conform 93/42/EEG of EU/2017/745 (Medical devices) OR 98/79/EEG of EU/2017/746 (in-vitro diagnostics)**	**Conform intended use as described in the instruction manual?**
Quest Spectrum Platform ®	*Quest Medical Imaging B.V.*	*2.0/3.0*	*Yes, conform 93/42/EEG*	*Yes*
Arthrex Imaging systems	*Arthrex*	*Synergy HD3*	*Yes, conform 93/42/EEG*	*Yes*

ICG (Verdye®)	*Diagnostic Green*	-	-	*Yes*

5.1 Escape medication

In case of severe adverse reaction to ICG, i.e. anaphylactic shock, patients will be treated according to the local protocol concerning anaphylaxis of the participating centres.

6. METHODS

6.1 Study parameters/endpoints

6.1.1 Main study parameter/endpoint

The primary endpoint of this study is the degree of agreement between subjective ICG fluorescence interpretation and LSCI perfusion mapping at the anastomotic site. This includes both categorical concordance (adequate vs. inadequate perfusion) and spatial agreement between the visually estimated ICG boundary and the perfusion boundary identified by LSCI.

6.1.2 Secondary study parameters/endpoints (if applicable)

- Spatial distance (mm) between quantified ICG and LSCI demarcation.
- Feasibility and user-friendliness of the PerfusiX-IGS in open colon procedures
- Successful acquisition of calibrated photo documentation of LSCI.
- Postoperative clinical outcomes within 30 days, including overall complications and the occurrence of anastomotic leakage. Complications will be classified according to the Clavien–Dindo classification. Anastomotic leakage will be defined according to standard clinical and/or radiological criteria as applied in routine practice

6.2 Study procedures

During each operation, a standardized workflow is followed to ensure consistency across all imaging modalities. This does not differ from the original workflow so only a minimal additional surgery time is required. Initial laparoscopic assessment

a. After mobilization of the bowel and completion of the oncological resection and after dissection of the vascular branch, the surgeon performs an initial laparoscopic identification of the planned anastomotic site. The proximal transection point is selected visually, based on tissue quality and perfusion appearance under white light. The surgeon places an instrument beside the bowel as the landmark for the anastomotic site.

2. Exteriorization of the bowel
    a. Through the extraction incision, the bowel segment intended for anastomosis is brought outside the abdomen and positioned in a tension free manner on a flat surface besides a sterile ruler adjacent to the segment to allow for later calibrated spatial measurements.
3. LSCI perfusion mapping
    a. The PerfusiX-IGS device, positioned at 30cm working distance, is activated by the researcher. The system records a real-time LSCI perfusion map. Acquisition requires approximately 30 seconds and does not interfere with the procedure or influence the anastomotic decision. The perfusion map will be documented photographically.
4. Standard of care ICG fluorescence assessment
    a. Indocyanine green (ICG) is administered intravenously, following standard practice. Using the QUEST 2.0 or Arthrex Synergy imaging system, the surgeon subjectively evaluates the fluorescence inflow pattern and determines whether the preselected transection boundary corresponds to adequately perfused tissue. This subjective impression and the apparent demarcation line are documented photographically. Surgeons were allowed to change the surgical plan intraoperatively by performing an additional bowel resection based on their subjective interpretation of the fluorescence signal. This follows the protocol of the QUANTICOLON study.
5. Postoperative quantitative ICG analysis
    a. Following surgery, ICG video files are analyzed using the Quest Research Tool or a different validated research tool to generate curves. The curves are matched to the corresponding LSCI map collected intraoperatively. The distance between the LSCI and ICG line of demarcation (i.e., intended resection lines) on each photograph or video was measured with a custom-made Python code. This enables objectified comparison of perfusion modalities to determine whether quantified ICG improves concordance with LSCI beyond the subjective intraoperative interpretation.

6.3 Withdrawal of individual subjects

Subjects may withdraw the study at any time for any reason if they wish to do so without any consequences. The investigator can decide to withdraw a subject from the study for urgent medical reasons.

6.4 Replacement of individual subjects after withdrawal

Should a participant withdraw prior to successful acquisition of both ICG and LSCI imaging, the subject will be replaced to maintain the integrity of the dataset and ensure complete paired imaging for all included cases. Replacement will occur by enrolling in the next eligible surgical patient meeting with all inclusion criteria.

6.5 Follow-up of subjects withdrawn from treatment

Subjects who withdraw or are withdrawn from participation will continue to receive standard postoperative care according to clinical guidelines. No additional follow-up procedures are mandated by the study. All imaging data collected prior to withdrawal, if consent allows, will be used for analysis; otherwise, it will be destroyed. No further study-related interactions are required.

7. STATISTICAL ANALYSIS

All statistical analyses will be performed using SPSS statistics software. A two-sided p-value <0.05 will be considered statistically significant. Continuous variables will be reported as mean ± standard deviation (SD) or median with interquartile range (IQR), depending on data distribution. Categorical variables will be presented as counts and percentages. Normality of continuous data will be assessed using the Shapiro–Wilk test and visual inspection of histograms.

Primary Endpoint Analysis

Agreement will be assessed in two ways:

1. Categorical agreement (adequate vs. inadequate perfusion):

- Agreement between modalities will be evaluated using **Cohen's kappa coefficient (κ)**.

2. Spatial agreement:

The spatial correspondence between the ICG demarcation line and the LSCI perfusion boundary will be quantified by measuring the distance (in mm) between both lines. This will be generated from calibrated photographs using a custom-made Python script.

- Agreement will be evaluated using Bland–Altman analysis, including mean difference and limits of agreement

Secondary endpoints

1. Postoperative quantitative ICG analysis:

- Agreement between quantified ICG parameters and LSCI perfusion boundaries will be analyzed similarly to the primary endpoint with the Bland–Altman analysis.
- Improvement in agreement (quantitative vs. subjective ICG) will be assessed using:
    - Comparison of extracted values
    - Reduction in mean spatial difference

2. Feasibility of LSCI (PerfusiX-IGS):

- Descriptive statistics:
    - Proportion of successful acquisitions
    - Acquisition time (seconds)
    - Technical failures (%)

3. Successful acquisition of calibrated photo documentation:

- Reported as percentage of cases with usable data

4. Postoperative clinical outcomes (30-day follow-up):

- The incidence of overall complications and anastomotic leakage will be reported as proportions (%).
- Complications will be categorized according to the Clavien–Dindo classification and summarized descriptively.

Given the exploratory nature of the study, these analyses will be considered hypothesis-generating.

8. ETHICAL CONSIDERATIONS

8.1 Regulation statement

This study qualifies as non-WMO since it involves no additional interventions beyond standard of care, and LSCI is non-contact, non-invasive, and does not influence treatment decisions. The study aligns with the Declaration of Helsinki.

Risks and Burden

No physical risk. LSCI is optical, dye-free and non-contact. Images are collected only after clinical decision-making is complete.

Informed Consent

Patients provide consent for postoperative analysis of intraoperative images and videos.

8.2 Recruitment and consent

Recruitment will occur during standard outpatient clinic visits with the treating colorectal surgeon. The treating physician will introduce the study and assess suitability based on inclusion and exclusion criteria. If the patient expresses interest, written study information is provided, and adequate

decision-making time is offered. Consent is obtained prior to surgery, in accordance with the procedure described in prior LUMC NWMO protocols.

8.3 Benefits and risks assessment

Participants do not receive direct clinical benefit from participation. LSCI measurements are non-invasive, observational and not used to guide clinical decision-making. Because the results do not influence patient care, no improvement in individual outcomes can be expected. The risks are minimal and limited to handling of imaging data.

9. ADMINISTRATIVE ASPECTS, MONITORING AND PUBLICATION

9.1 Handling and storage of data and documents

All clinical data will be entered into Castor EDC using coded study numbers. Imaging data (ICG videos, LSCI maps, calibrated photographs) will be stored on the secured LUMC I-drive with restricted researcher access. The key linking subject identity to the study code will be stored separately by the principal investigator. Depersonalized study data shall be securely transferred to LIMIS Development B.V., during the study. All transferred data will be coded with a study identification number, ensuring that no directly identifiable patient information (such as name, date of birth, or hospital ID) is shared with LIMIS. The key linking the study identification number to patient identity will remain exclusively at the research site. Data transfer and handling will comply with the General Data Protection Regulation (AVG), hospital data protection policies, and Good Clinical Practice requirements. Data will be stored for 15 years and will be handled in accordance with the GDPR.

9.2 Monitoring and Quality Assurance

Because this is a non-WMO study with minimal risk, monitoring will follow LUMC institutional policy for non-interventional imaging research.

9.3 Amendments

Only substantial changes to the protocol that may affect the ‘approval for exemption from review’ (Dutch abbreviation: niet-WMO verklaring), need to be submitted to the MREC

10. REFERENCES

1. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2024;74(3):229–63.
2. Morgan E, Arnold M, Gini A, Lorenzoni V, Cabasag CJ, Laversanne M, et al. Global burden of colorectal cancer in 2020 and 2040: incidence and mortality estimates from GLOBOCAN. Gut. 2023;72(2):338–44.
3. Arron MNN, Greijdanus NG, Ten Broek RPG, Dekker JWT, van Workum F, van Goor H, et al. Trends in risk factors of anastomotic leakage after colorectal cancer surgery (2011-2019): A Dutch population-based study. Colorectal Dis. 2021;23(12):3251–61.
4. McDermott FD, Heeney A, Kelly ME, Steele RJ, Carlson GL, Winter DC. Systematic review of preoperative, intraoperative and postoperative risk factors for colorectal anastomotic leaks. Br J Surg. 2015;102(5):462–79.
5. Faber RA, Meijer RPJ, Droogh DHM, Jongbloed JJ, Bijlstra OD, Boersma F, et al. Indocyanine green near-infrared fluorescence bowel perfusion assessment to prevent anastomotic leakage in minimally invasive colorectal surgery (AVOID): a multicentre, randomised, controlled, phase 3 trial. Lancet Gastroenterol Hepatol. 2024;9(10):924–34.
6. Alekseev M, Rybakov E, Shelygin Y, Chernyshov S, Zarodnyuk I. A study investigating the perfusion of colorectal anastomoses using fluorescence angiography: results of the FLAG randomized trial. Colorectal Dis. 2020;22(9):1147–53.
7. De Nardi P, Elmore U, Maggi G, Maggiore R, Boni L, Cassinotti E, et al. Intraoperative angiography with indocyanine green to assess anastomosis perfusion in patients undergoing laparoscopic colorectal resection: results of a multicenter randomized controlled trial. Surg Endosc. 2020;34(1):53–60.
8. Rinne JKA, Huhta H, Pinta T, Turunen A, Mattila A, Tahkola K, et al. Indocyanine Green Fluorescence Imaging in Prevention of Colorectal Anastomotic Leakage: A Randomized Clinical Trial. JAMA Surg. 2025;160(5):486–93.
9. Faber RA, Tange FP, Galema HA, Zwaan TC, Holman FA, Peeters K, et al. Quantification of indocyanine green near-infrared fluorescence bowel perfusion assessment in colorectal surgery. Surg Endosc. 2023;37(9):6824–33.
10. Slooter MD, Mansvelders MSE, Bloemen PR, Gisbertz SS, Bemelman WA, Tanis PJ, et al. Defining indocyanine green fluorescence to assess anastomotic perfusion during gastrointestinal surgery: systematic review. BJS Open. 2021;5(2).
11. Skinner GC, Liu YZ, Harzman AE, Husain SG, Gasior AC, Cunningham LA, et al. Clinical Utility of Laser Speckle Contrast Imaging and Real-Time Quantification of Bowel Perfusion in Minimally Invasive Left-Sided Colorectal Resections. Dis Colon Rectum. 2024;67(6):850–9.
12. Heeman W, Wildeboer ACL, Al-Taher M, Calon JEM, Stassen LPS, Diana M, et al. Experimental evaluation of laparoscopic laser speckle contrast imaging to visualize perfusion deficits during intestinal surgery. Surg Endosc. 2023;37(2):950–7.
13. Wildeboer A, Heeman W, van der Bilt A, Hoff C, Calon J, Boerma EC, et al. Laparoscopic Laser Speckle Contrast Imaging Can Visualize Anastomotic Perfusion: A Demonstration in a Porcine Model. Life. 2022;12(8):1251.
14. Heeman W, Steenbergen W, van Dam G, Boerma EC. Clinical applications of laser speckle contrast imaging: a review. J Biomed Opt. 2019;24(8):1–11.