European Colorectal Congress

29 November – 2 December 2020, St.Gallen, Switzerland

Sunday, 29 November 2020

MASTERCLASS

Introduction & course objectives
Michel Adamina, Winterthur, CH

Myths and facts about oral antibiotics, bowel preparation, and timing of iv antibiotics to reduce surgical site infection
Frédéric Ris, Geneva, CH

Management of colorectal GIST – all you should know from diagnosis to handling recurrences
Paris Tekkis, London, UK

Do and don't in taTME surgery – a decade of experience explaned
Roel Hompes, Amsterdam, NL

What your pathologist can do for you: from standard margins recommendations to molecular pathology, liquid biopsies, and the microbiome
Phil Quirke, Leeds, UK

Prehabilitation, patient blood management, frailty index – welcome addition or resource wasting
Des Winter, Dublin, IE

Selective use of neoadjuvant and adjuvant radiotherapy for rectal cancer
Chris Cunningham, Oxford, UK

Handling large rectal adenoma and malignant polyps
Willem Bemelman, Amsterdam, NL

All techniques to avoid staple line intersections in colorectal surgery
Antonino Spinelli, Milano, IT

Management of pelvic sepsis after colorectal / coloanal anastomosis and oncological outcomes of the GRECCAR 5 trial
Quentin Denost, Bordeaux, FR

Best practices in colostomy construction and repair of parastomal hernia
Eva Angenete, Göteborg, SE

The EBSQ Coloproctology Examination
Michel Adamina, Winterthur, CH

Wrap-up
Michel Adamina, Winterthur, CH

Sunday, 29 November 2020

COURSE OF PROCTOLOGY

Introduction & course objectives
Bruno Roche, Geneva, CH

Complex pelvic fistula revisited: established wisdom and innovative approaches
Alexander Herold, Mannheim, DE

Obstretrical trauma: assessment, timing and options to repair
Patrick Hohlfeld, Lausanne, FR

The painful bottom – Proctalgia beyond the classical abscess, fissures, and hemorrhoids
Bruno Roche, Geneva, CH

Sexually transmitted diseases in proctology
Karel Skala, Geneva, CH

Anorectal trauma and foreign bodies
Richard Cohen, London, UK

Pilonidal sinus – strategies and outcomes
Frédéric Ris, Geneva, CH

Fecal incontinence: investigations and conservative treatment
Beatrice Salvioli, Milano, IT

Fecal incontinence: neuromodulation and interventional options
Joan Robert-Yap, Geneva, CH

The pelvic floor revealed: transperineal / transvaginal / transanal repairs explained
Bruno Roche, Geneva, CH

The pelvic floor revealed: investigations and pelvic floor therapy
Jacqueline de Jong, Bern, CH

Obstructed defecation and IBS: investigations, differential diagnosis, and treatment strategies
Daniel Pohl, Zurich, CH

Obstructed defecation: surgical options
André d'Hoore, Leuven, BE

Wrap-up
Alexander Herold, Mannheim, DE

Monday, 30 November 2020

SCIENTIFIC PROGRAMME

Opening and welcome
Jochen Lange, St. Gallen, CH

Is cancer an infectious disease: role of the microbiome
Philip Quirke, Leeds, UK

Ethical considerations in crisis – lessons from Covid-19
Omar Faiz, London, UK

SATELLITE SYMPOSIUM
Medtronic

Prophylactic mesh in colorectal surgery
René H. Fortelny, Wien, AT

Lars Pahlman lecture: Extending the limits of liver surgery
Markus Büchler, Heidelberg, DE

Multimodal approaches to colorectal liver metastases
Mohammed Abu Hilal Brescia, IT

SATELLITE SYMPOSIUM
Ethicon

Urogenital dysfunction in patients treated for rectal cancer – what do we know and what can we do?
Eva Angenete, Göteborg, SE

Hemorrhoids – new options and time-tested solutions
Alexander Herold, Mannheim, DE

Anal pain and emergency proctology: what every surgeon should know & do
Richard Cohen, London, UK

All you need to know about anorectal fistula
Bruno Roche, Genève, CH

Strategies and outcomes for obstructive cancers of the colon and rectum
Willem Bemelman, Amsterdam, NL

Tuesday, 1 December 2020

BREAKFAST SYMPOSIUM
Karl Storz

Lessons learned along the robotic learning curve: a video guide for colorectal surgeons
Jim Khan, Portsmouth, UK

EAES presidential lecture: Strategies for lifelong learning and implementation of new technologies
Andrea Pietrabissa, Pavia, IT

SATELLITE SYMPOSIUM
Intuitive

A journey in global surgery – why getting out of the comfort zone
Raffaele Rosso, Lugano, CH

Enhanced recovery pathwaysreloaded – a practical guide to success
Roberto Persiani, Roma, IT

Cancer at the extremes of age: are there any differences in handling youngsters and seniors
Des Winter, Dublin, IE

Management pearls for early rectal cancer
Roel Hompes, Amsterdam, NL

Ventral rectopexy: indications, tricks of the trade, and long-term results
Chris Cunningham, Oxford, UK

SATELLITE SYMPOSIUM
BBraun

Total neoadjuvant therapy for colon and rectum cancers
Ronan O'Connell, Dublin, IE

Randomized trial evaluating chemotherapy followed by pelvic reirradiation vs chemotherapy alone as preoperative treatment for locally recurrent rectal cancer (GRECCAR 15)
Quentin Denost, Bordeaux, FR

Timeline of surgery following neoadjuvant radiotherapy – balancing morbidity and efficacy
Torbjörn Holm, Stockholm, SE

Poster award
Michel Adamina, Winterthur, CH

Wednesday, 2 December

Place and outcome of total colectomy in the surgical armentarium
Neil Mortensen, Oxford, UK

Kono S anastomosis and over the valve stricturoplasties: hope for better outcomes
André D'Hoore, Leuven, BE

New drugs, old fears: state of the art management of IBD patients
Gerhard Rogler, Zurich, CH

SATELLITE SYMPOSIUM
Takeda

Do resection of the mesentery in Crohn's & appendectomy in ulcerative colitis alter the course of disease
Christianne Buskens, Amsterdam, NL

The septic abdomen: getting out of misery and closing the case
Marja Boermeester, Amsterdam, NL

Management strategies for patients with advanced colorectal cancers
Paris Tekkis, London, UK

Anastomotic leak in colorectal surgery: insights, perspectives, and practical strategies
Antonino Spinelli, Milano, IT

Closing words
Michel Adamina, Winterthur, CH

Information & Registration

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Technical Note

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A novel method for near-infrared fluorescence imaging of the urethra during perineal and transanal surgery: demonstration in a cadaveric model

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Abstract

Aim Transanal total mesorectal excision is a promising novel sphincter-saving procedure for low rectal cancer. However, the transanal bottom-up dissection is associated with increased rates of iatrogenic urethral injuries. Near-infrared fluorescence (NIRF) imaging, given its deeper tissue penetration, has been explored in a limited number of studies for enhanced intra-operative urethral visualization. In this study, we explored the feasibility of a novel, ultrabright, biocompatible fluorescent polymer to coat urinary catheters for the purpose of intra-operative urethral visualization.

Methods In an *ex vivo* experiment, using a near-infrared laparoscope, the fluorescent signal of a coated catheter (near-infrared coating of equipment, NICE) was qualitatively and quantitatively compared to the signal of indocyanine green (ICG)/Instillagel® mixtures and ICG-filled catheters at several concentrations. Also, in three male human torsos, using fluorescent urinary catheters, NIRF-guided perineal dissections and a transanal total mesorectal excision were performed. Intra-operative NIRF-based urethral visualization was performed systematically.

Results During the qualitative and quantitative fluorescence signal assessment, NICE-coated catheters were clearly superior to the ICG-based solutions. In the cadaveric experiments, enhanced urethral visualization was possible even at early stages of dissection, when the organ was covered by several tissue layers.

Conclusions NICE-coated catheters represent a promising potential to allow for NIRF-based intra-operative urethral visualization.

Keywords Fluorescene imaging, fluorescence imaging guided surgery, near-infrared, urethra injury, transanal surgery, colorectal cancer

Introduction

Iatrogenic urethral injury (IUI) is a severe complication, historically rare in colorectal surgery and almost exclusively involving patients undergoing abdominoperineal resections [1].

Transanal total mesorectal excision (taTME) is a relatively novel technique to treat middle and low rectal cancer, aimed at sphincter preservation, despite deeply located rectal lesions [2]. taTME comprises a transanal and a transabdominal phase, and the novelty of this procedure is represented by the transanal bottom-up dissection of the rectum, potentially allowing resection of very low lesions [3,4]. However, given the reversed surgical anatomical prospective, specific training is required in order to identify the anatomical landmarks safely, the identification of which is necessary to perform the dissection within the correct planes [5]. Since the prostate and the urethra are adjacent during the transanal phase, there is the risk of injuring both structures. Consequently, an increased IUI rate following taTME has been reported in male patients [6,7]. Therefore, a method allowing for an enhanced intra-operative urethral identification could potentially reduce the risk of IUI.

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Previously, several intra-operative urethral visualization methods have been proposed [5] using light-emitting catheters [8,9] or near-infrared fluorescence (NIRF) imaging [10,11]. Near-infrared light offers higher tissue penetration compared with visible wavelengths [12]. Consequently, an improved visualization of underlying anatomical structures can be expected using NIRF imaging. Additionally, NIRF imaging is user-friendly and does not cause disruption to the progress of the operation. In particular, promising results were reported by 'clotting' an indwelling catheter using a mixture of indocyanine green (ICG) and silicone [11] or instilling a mixture of ICG and lubricant gel directly into the urethra [10]. However, a patent catheter is necessary during surgery and the application of fluorescent gel into the urinary tract might result in a transitory fluorescent signal and a potential fluorescence pollution of the surgical field.

Our group developed a biocompatible fluorescent coating, called NICE (near-infrared coating of equipment). NICE is based on a specially designed dye-loaded polymeric material which operates in the same spectral range as ICG. However, it is much brighter [13,14].

In this work, the superior brightness of NICE over ICG-based solutions is demonstrated *in vitro*.

Additionally, NIRF-guided surgery using NICE-coated catheters inserted into the urethra of three male human anatomical specimens is presented.

Method

The NICE fluorescent coating was synthesized incorporating a biocompatible polymer, i.e. poly(methyl methacrylate) (PMMA), to a specially engineered fluorescent dye, exhibiting similar optical properties to ICG. However, it is more efficient in terms of brightness and stability [13,14]. The details of the chemical composition of the NICE will be reported elsewhere.

Standard 16 French urinary catheters were coated by means of direct immersion into the NICE and then left to dry for 5 min. This process was repeated three times before using the catheters.

A near-infrared laparoscopic camera (D-Light-P, Karl Storz GmbH, Tuttlingen, Germany) was used during all experiments. A summary of the *ex vivo* and human anatomical specimen experiments is presented in the video accompanying this paper.

Ex vivo experiment

The fluorescence signals of a syringe filled with 5 ml of Instillagel® (CliniMed Limited, Loudwater, UK) mixed with ICG (Infracyanine®, SERB, Paris, France) at different concentrations (2.5 mg/ml, 0.25 mg/ml and 0.025 mg/ml) were qualitatively assessed at different distances (5 and 10 cm (Video S1). Successively, the same qualitative analysis was performed using a 16

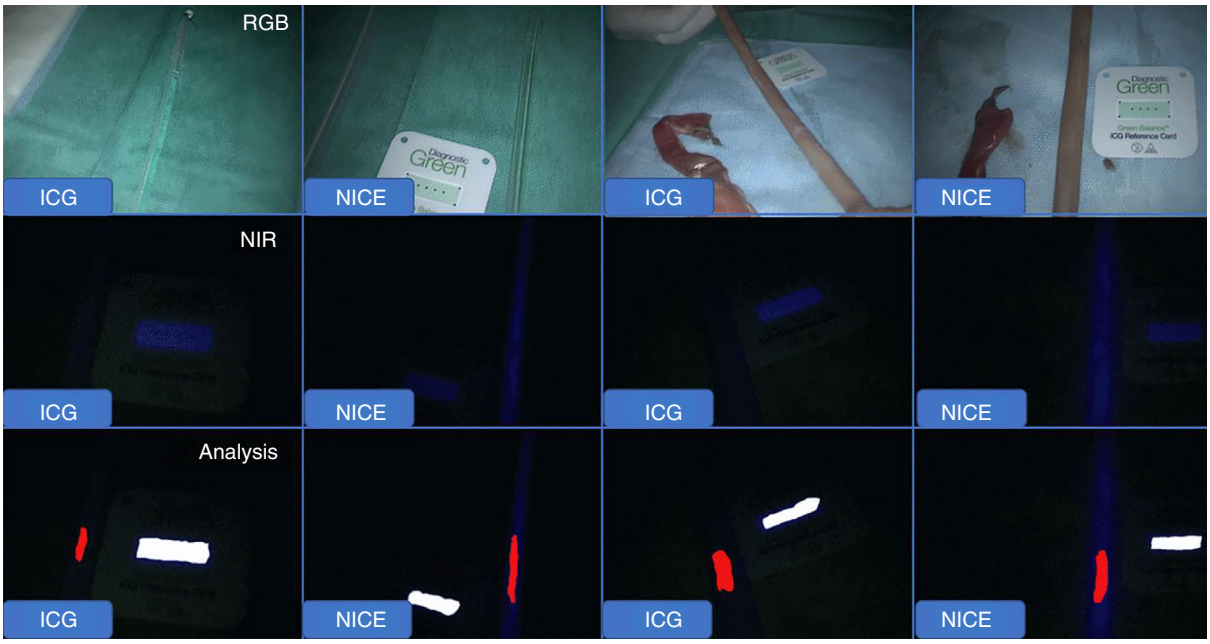

Figure 1 *Ex vivo* experiment: the fluorescence intensity emitted by an ICG-filled catheter is compared to the fluorescence of a NICE-coated catheter, naked (left half of the panel) or after insertion within a porcine oesophagus (right half of the panel). The images are shown in white light (RGB) (first row) and in NIR mode (central row). The bottom row shows the software-based fluorescence quantification (in red); the region of interest is depicted, and the ICG reference card is shown in white.

French urinary catheter filled with ICG at the same concentrations mentioned above either entirely or only within the balloon chamber.

The fluorescence intensity of the best performing solution (catheter filled entirely with 0.025 mg/ml of ICG) was quantitatively compared to a NICE-coated catheter. The quantification was performed using proprietary software (ER-PERFUSION, IRCAD, Strasbourg, France), which allows extrapolation of the absolute fluorescence intensity values (in arbitrary units) pixel by pixel. Since the measured fluorescence intensity is dependent strictly upon the distance between the near-infrared light source and the target object [15], an ICG reference card (Diagnostic Green, Aschheim, Germany) exhibiting a constant fluorescent signal was used. The relative fluorescence was calculated as the ratio between the absolute fluorescence of the region of interest and that of the reference card. The quantitative analysis was performed both on the bare catheters and after inserting them into a fresh porcine oesophagus (Fig. 1), previously harvested from animals used for training purposes.

Human anatomical specimen experiments

Three male human torsos were used for this experiment (Video S1). The specimens were placed in the lithotomy position and a 16 French NICE-coated catheter was inserted retrogradely into the urethra. Due to benign prostatic hyperplasia, complete insertion of the catheter was impossible in two cadavers. Consequently, it was chosen to perform only NIRF-guided perineal dissections in these specimens (Fig. 2).

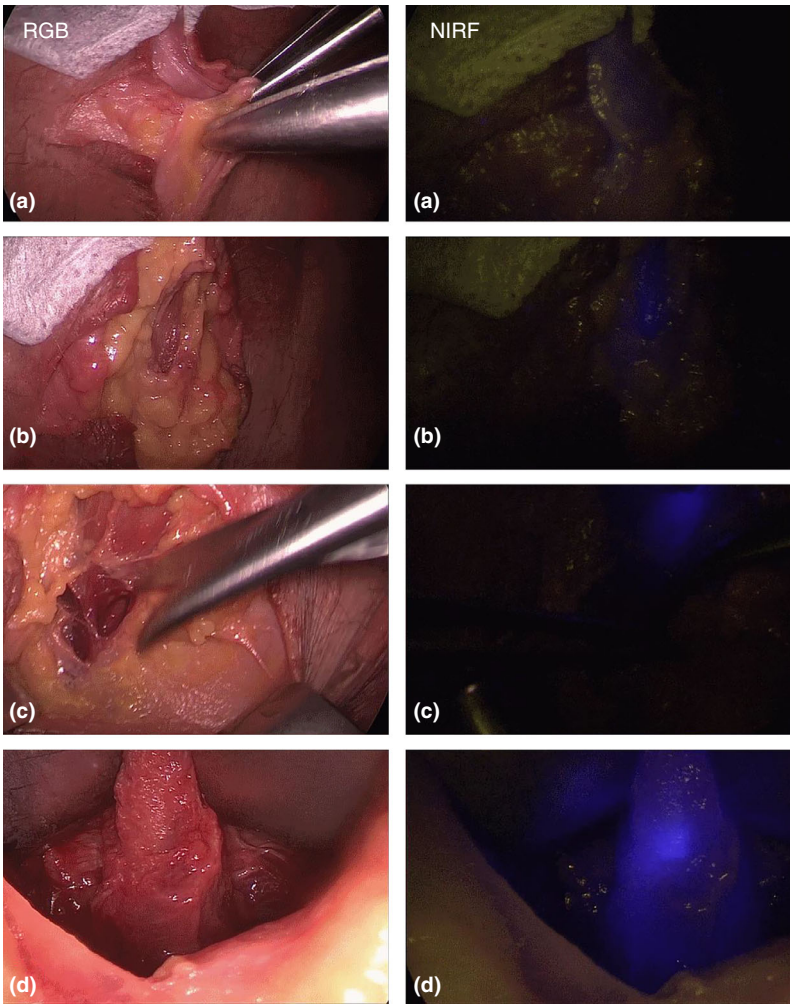

Figure 2 NIRF-guided perineal dissection: several steps of the procedure are shown in chronological order. The RGB images (left) with the corresponding NIR images (right) are displayed. In the early phases of the procedure (top), thick tissue layers cover the urethra and only a slight fluorescence is visible. When the dissection advances ((a) to (d) direction), the fluorescence emitted by the NICE catheter becomes more evident. However, the NIRF guidance was present throughout the dissection phases.

The previous day, the third cadaver had undergone a robot-assisted prostatectomy for training purposes. Accordingly, it was possible to insert the NICE catheter completely through the urethra into the bladder. This specimen therefore underwent both a laparoscopy and a taTME, using a transanal port (SILS™, Medtronic, Watford, UK).

Results and discussion

The coating process of the catheters with NICE was easy and reproducible, taking approximately 20 min.

The ICG/Instillagel® mixture and the ICG-filled catheter balloon chamber showed no visible fluorescence at the qualitative analysis. The relative fluorescence of the entirely ICG-filled catheter (0.025 mg/ml of ICG) and of the NICE-coated catheter was 0.3 a.u. and 1.22 a.u. respectively. Once the catheters were inserted into a porcine oesophagus, the relative fluorescence measured 0.28 a.u. for the ICG catheter and 1.11 a.u. for the NICE catheter.

The strong fluorescent signal of the NICE catheter allowed for an enhanced visualization of the urethra during perineal dissection by regularly switching the camera mode to NIRF imaging. The NICE catheter emitted a fluorescent signal, even in the early stages of the procedure when thick tissue layers covered the urethra. In the last case, the urethra was clearly visible during laparoscopy and during the transanal dissection.

Previously, several methods to identify the urethra intra-operatively using NIRF imaging have been proposed. Barnes *et al.* successfully identified the urethra in cadavers during perineal dissections and taTME procedures, both by instilling an ICG/Instillagel® mixture [11] and the preclinical IRDye 800BK® dye directly into the urethra, or by placing a urinary catheter 'clotted' with a silicone/ICG mixture [10]. Despite the remarkable results by the authors, it must be emphasized that oncological colorectal procedures usually last several hours and a patent urinary catheter is necessary to monitor the patient's urinary output, empty the bladder and ensure an adequate bladder clearance. Hence, placing an ICG/silicone-filled catheter is impractical. Additionally, the application of a fluorescent gel or dye beside the catheter might result in spillage from the urinary meatus, with a consequent potential loss of the fluorescent signal.

Our study has several limitations, as it is a limited sample-size feasibility study using cadaveric models. The presence of benign prostatic hyperplasia impaired the correct placement of the NICE catheter in two out of three specimens. Consequently, it was chosen to perform a perineal urethral dissection instead of a taTME. However, perineal dissection allowed us successfully to demonstrate the enhanced urethral visualization. Additionally, NICE is currently undergoing approval for clinical use, and as a result it is not yet available for human procedures. However, NICE is a promising technology, which provides enhanced intra-operative urethral localization.

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Conflicts of interest

Michele Diana is the PI of the ELIOS project and co-PI of the NICE project. Andrey Klymchenko is co-PI of the NICE project. Michele Diana and Andrey Klymchenko are inventors of the NICE technology (European patent application no. 18305075.6). Jacques Marescaux is the President of IRCAD, which is partly funded by Karl Storz, Medtronic and Siemens Healthcare. The remaining authors have no conflict of interest to declare.

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Supporting Information

The video may be found in the online version of this article and also on the Colorectal Disease Journal YouTube and Vimeo channels:

Video S1. NICE coated catheter: in vitro and human anatomical specimen applications.