IMAGING OF HUMAN COLONIC TISSUE USING 2-PHOTON MICROSCOPY:
SET-UP OF AN EXPLORATORY STUDY

Rutger Schols \(^a\), Laurents Stassen \(^a\), Robert Riedl \(^b\), Ann Driessen \(^c\), Frans Ramaekers \(^d\), Ad Masclee \(^b\), Silvia Sanduleanu \(^b\), Marc van Zandvoort \(^d\)

Departments of \(^a\)Surgery, \(^b\)Gastroenterology, \(^c\)Pathology, Maastricht University Medical Center
Department of \(^d\)Genetics & Cell Biology, Molecular Cell Biology, Maastricht University
P. Debyelaan 25, 6229 HX Maastricht, The Netherlands
Correspondence to: rutger.schols@mumc.nl

Abstract

INTRODUCTION: Real-time histological diagnosis of large colorectal neoplasms, using image-enhanced endoscopy techniques, enables targeted (endoscopic vs. surgical) treatment and has the potential to increase the safety and effectiveness of the procedure. Two-photon microscopy (Helmchen, 2005) is a promising modality to obtain accurate deep tissue imaging. In this study we will explore ex-vivo feasibility of 2-photon microscopy for imaging of human colon as compared to standard histology.

METHODS: We will conduct a pilot study of colonic resection specimens from 10 patients who undergo surgery for colorectal cancer. We will examine colonic specimens using two-photon microscopy and former histopathology, in a stepwise fashion:

- **Step 1: Application and characteristics**
  - Determine optimal staining protocols
  - Determine depth penetration of 2-photon microscopy in ‘colonic wall layers’

- **Step 2: Benign versus (pre)malignant colonic tissues**
  - Determine whether benign and (pre)malignant tissue can be distinguished by 2-photon microscopy
  - Correlate 2-photon microscopy images with pathological examination results
  - Assess quality of the obtained microscopic images: to what extent do the images give a recognizable image for the endoscopist?

HYPOTHESIS: We assume 2-photon microscopy provides deep (>250 micrometer) tissue imaging and thus may allow assessment of local invasion; that it provides detailed information on intracellular level–nuclear level– to differentiate low-grade dysplasia from high-grade dysplasia; and that it can identify vascular phenotypes, which are associated with severe histological/molecular characteristics (i.e. prognostic markers).

First impression of 2-photon microscopy on ex vivo human colonic tissue...

PERSPECTIVES: The aforementioned steps are crucial to assess the feasibility of 2-photon microscopy for a more accurate and earlier detection of (pre)malignant lesions in the colon. This is essential in order to improve diagnostic precision and, ultimately, to achieve more safe and radical endoscopic resections. If the characteristics of the 2-photon microscopy really add value compared to the current imaging techniques, this technique can potentially be incorporated in a colonoscopy device in the future.

REFERENCES