Best Practice & Research Clinical Gastroenterology 29 (2015) 627–638

Contents lists available at ScienceDirect

Best Practice & Research Clinical Gastroenterology

9

Image-enhanced endoscopy technology in the gastrointestinal tract: What is available?

Sabina Beg, BSc, MBBS, MRCP, Dr. (Gastroenterology Specialist Registrar), Krish Ragunath, MD, FRCP, FASGE, Professor *

Nottingham Digestive Diseases Biomedical Research Unit, Nottingham University Hospital, Queens Medical Centre, Derby Road, Nottingham NG7 2UH, UK

Keywords:
Image enhanced endoscopy
Narrow band imaging
FICE
I-SCAN
Auto-fluorescence imaging
Confocal laser endomicroscopy

A B S T R A C T

Gastrointestinal malignancy accounts for approximately a fifth of all cancer deaths in the United Kingdom. By the time patients are symptomatic, lesions are often advanced, with limited treatment options available. The development of effective endoscopic therapies means that neoplastic lesions can now be treated with improved patient outcomes. This has led to a paradigm shift, whereby the aim of digestive endoscopy is to identify premalignant conditions or early neoplastic change, in order to make an impact on their natural history. This has necessitated an improvement in imaging techniques in order to identify subtle mucosal changes that may harbour precancerous cells. At present there is an array of available imaging modalities, each with implications on cost, training and lesion detection. Here we describe the scientific rationale behind the major commercially available techniques as well as offering a glimpse at possible future directions.

Crown Copyright © 2015 Published by Elsevier Ltd. All rights reserved.

Introduction

Since its inception in the 1800s, endoscopic visualization has offered us the unique ability to correlate gastrointestinal mucosal change with patient symptoms. Over time, development in scope

* Corresponding Author. Tel.: +44 0115 924 9924.
E-mail addresses: Sabina.beg@nhs.net (S. Beg), k.ragunath@nottingham.ac.uk (K. Ragunath).

http://dx.doi.org/10.1016/j.bpg.2015.05.008
1521-6918/Crown Copyright © 2015 Published by Elsevier Ltd. All rights reserved.

technology has meant that endoscopy has become both more comfortable and effective, making this indispensible in daily clinical practice. As the focus of endoscopy has evolved towards to detecting asymptomatic premalignant change, the goal posts of acceptable image quality have also shifted. The advanced imaging modalities create the opportunity to make a real time in vivo histological prediction, a so-called 'optical biopsy.' This may eventually allow for dispensation with random non-targeted biopsies, possibly with cost savings, but more importantly offering greater accuracy in endoscopic diagnosis. Here we discuss the technology behind the most recent advances.

High definition and magnification white light endoscopy

Technology

The current standard of care is White Light Endoscopy (WLE), which produces a true to life depiction of the gastrointestinal mucosa. Whilst this concept remains unchanged, advances in technology means that the level of detail achievable with modern endoscopes is much improved.

The major revolution in endoscope design occurred in the 1950s with the introduction of fibreoptic technology. Despite a huge leap forward in imaging quality, this modality was subject to several limitations. Resolution capabilities were dependent on the number of fibres contained within the fibreoptic bundle and therefore constrained by the finite diameter of an endoscope. The inevitable rupture of fibres associated with endoscope flexion meant that image quality decreased throughout the lifetime of the scope, eventually requiring costly replacement [1,2]. In order to improve upon imaging capabilities there has had to be a departure from fibreoptic technology towards a distal digital sensor technique.

Contemporary endoscope systems consist of an external xenon arc lamp that illuminates the mucosa using the full spectrum of visible white light. Reflected light is projected through the endoscope lens onto the photoactive region of a Charge-Coupled Device (CCD) located within the endoscope tip. The consequent electric charge is transmitted to a video processor where it is interpreted as a digital image. The quality of the image produced is dependent on the pixel density of the CCD and the resolution of the screen on which the image is displayed [1,2]. Standard Definition (SD) endoscopes are equipped with CCDs that permit resolutions of up to 400,000 pixels. Developments in chip technology means that High Definition (HD) endoscopes boast CCDs capable of producing images of over one million pixels, enabling the visualisation of fine mucosal architecture and vascular detail (Figs. 1a, 2a and 3a) [1–4].

This effect is augmented when combined with magnification technology, whereby a selected region can be visualised in greater detail, with no loss in resolution. Magnification of up to 150 times occurs by adjusting the position of the lens at the endoscope tip by means of a button or lever integrated onto the scope controls [3,4]. Image clarity is dependent on maintaining a stable position of the scope, which is susceptible to motion artifact caused by patient movement. This can be overcome by the placement of cap on the endoscope tip that allows the scope tip to be anchored on the mucosal surface [4].

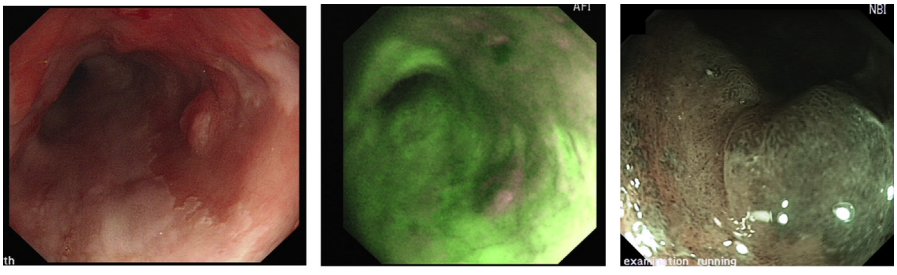

Fig. 1. Dysplastic lesion within Barrett's esophagus seen in a) HD WLE b) AFI c) NBI with magnification.

Download English Version:

https://daneshyari.com/en/article/3254092

Download Persian Version:

https://daneshyari.com/article/3254092

Daneshyari.com