Future developments in imaging techniques in IBD

Name: Helmut Neumann, MD, PhD, FASGE
Institution: University Medical Center Mainz, Germany
What can we do to improve endoscopic imaging?
More contrast
Dye-based Chromoendoscopy

**Indigo Carmine (0.1% - 0.5%)**
- 100 patients, rectum and sigmoid
- 48 patients no **polyps**
  BUT after staining 27 had polyps
  (3mm; 93% hyperplastic; 7% adenomas)

**Methylene blue (0.1% – 1%)**
- 263 patients with **ulcerative colitis**
- more intraepithelial neoplasias were found (32 vs. 10; P=.003)

Better detection and characterisation of colorectal lesions

Kiesslich R et al., Endoscopy 2001
Kiesslich R et al., Gastroenterology 2003
Potential limitations of traditional chromoendoscopy

- Dye **does not** always coat the surface **evenly**
  
  - Additional **costs**
    
    - Additional **time**
      
      - Distinct **Learning** curve
Dye-less chromoendoscopy
Optical Chromoendoscopy

**NBI**

- Optical filter
- Allow passage of
  - 415 nm (blue)
  - 540 nm (green)
- Narrowing of red light

- **Blue** = superficial capillaries (brown color)
- **Green** = subepithelial veins (cyan)
Optical Chromoendoscopy

**i-scan OE**

Combination of **optical CE** (vascular pattern) and **digital CE** (surface pattern)

*Neumann H et al., Dig Endosc 2014*
Digital Chromoendoscopy

FICE

i-scan

SPIES

Digital Postprocessing

- endoscopic image from the video processor
- reconstruct virtual images in real time
4 independently acting LEDs:

- Enhanced **visualization of hemoglobin**, and thus blood vessels, is generated by the high **peak** intensity of **short-wavelength light**.

- Specific light spectrum settings targeting the mucosal layers result in **improved contrast** and higher definition of imaging.
Increase the Field-of-View
G-Eye
G-Eye

Balloon deflated

Balloon inflated
EWAVE
(extra wide angle view)

Side view

Forward view

235°
Molecular imaging
**Molecular Imaging**

**in vivo - Polyp**

- **GE-137** conjugated to fluorescent cyanine dye
  - Binds to human tyrosine kinase c-Met
  - Specifically accumulates in c-Met-expressing tumors
- Intravenous injection in 15 patients

- 101 lesions detected with white-light
- Additional **22 with molecular imaging** (2nd pass)
  - 17 were only visible using molecular imaging
Computer assisted
LUMOS
Adaptive matrix imaging

Normal, white-light image

Adaptive Matrix applies recognition algorithms to 64 unique squares. Only squares containing distinguishing features are enhanced. Final image shows the enhancement with natural coloration.
LUMOS
Adaptive matrix imaging
Biopsy Technique

„Microgripper“ = nanoparticles that close when getting in contact with the body.

Animal model:
- Colon (300-1500 Grippers)
  = sampling of 50-80% of colon surface
  (0.3% with 40 standard biopsies)

- Bile ducts:
  = RNA and DNA analysis

New biopsy-technique for molecular diagnosis.
WavSTAT

- Optical fiber integrated into biopsy forceps
- Spectroscopy
- Pulsed laser system (337nm).

N = 122 polyps

Prediction of adenomatous histology

- Sensitivity: 81%
- Specificity: 84%
- Accuracy: 83%
- Negative predictive value: 96%
Conclusion

• New endoscopes allow for a better visualization and may help to increase the detection rates.

• New technologies, like molecular imaging or computed assisted detection and characterization modalities will allow for enhanced tissue diagnosis.

• Artificial intelligence will revolutionize our way to perform endoscopy in the future.