Application of Chromoendoscopy, NBI and AFI in Esophagus – why, who, and how?

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Cancer of esophagus –
poor prognosis

- Cancer of esophagus
  - 7th leading cause of death in HK
  - Grave prognosis
- Adjuvant Chemotherapy / radiotherapy not effective
- Neoadjuvant chemoradiotherapy – evidence contradictory

WHO cancer statistics
Cancer of esophagus – poor prognosis

- Surgery remains the curative treatment for squamous carcinoma of esophagus
- Significant morbidity (up to 80%)

Law et al. J Gastroenterol Hepatol 2002
Asia Cancer Belt: Northern China, Japan, Iran, India
Superfical Esophageal Neoplasia

- Involving mucosa or superficial submucosa (m1,2,3; sm1)
  - Minimal risk of lymphatic spread (< 5%)

- Significantly better survival – 90%

Difficult to diagnose at early stage!

Hirofumi et al Surg Laparosc Endosc Tech 2000
# Superficial esophageal neoplasia Treatment with ESD

<table>
<thead>
<tr>
<th>Author</th>
<th>Journal / Year</th>
<th>No</th>
<th>Time</th>
<th>Complete resection (R0)</th>
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**Chiu et al Surgical Practice (in press)**
Superficial esophageal neoplasia
Lymphatic metastasis

Kodama et al Surgery 1998; Paris Classification GIE 2003
Characteristics of superficial esophageal neoplasia

- Usually only slight mucosal irregularity
- “Increased redness”
  - Increased vascularity
  - IPCLs
- HIGH INDEX OF SUSPICION
Superficial esophageal neoplasia

Endoscopic Assessment

**AIM**

- Recognize the superficial esophageal neoplasia
- Define the margin of the lesion
- Determination of the level of invasion of the tumor and the risk of lympho-vascular permeation
Finding ESCC

• Asymptomatic

• High risk groups
  – Head & Neck cancers
  – Heavy smoker. Heavy drinkers
  – History of ESCC treated with ChemoRT
  – High risk regions (Northern China) (Screening endoscopy)
How to recognize Superficial Esophageal Neoplasia?

- White light endoscopy
  - Difficult
- Lugol chromoendoscopy
  - Less operator dependent
- Narrow band imaging
- Autofluorescence (AFI)
Lugol Chromoendoscopy
Vital staining

• Lugol iodine (1.5 – 3%) in Esophagus
  – Staining of glycogen
  – Normal squamous mucosa – dark brown stain
  – Dysplasia / ca esophagus – non-staining (Salmon pink)
  – Inflammation / papilloma – light brown stain
Lugol chromoendoscopy
Preparation

- N-acetylcysteine solution / Gaviscon
- Vigorous wash over esophagus
- Spray catheter
  - Spray at each 5cm intervals
- Upper limit ~ 5cm from cricopharyngeus
  - Prevent aspiration
Esophageal chromoendoscopy
Reactive

- **Acetic acid**
  - Enhance pit pattern in Barrett’s esophagus
## Detection of esophageal cancer in high risk group

<table>
<thead>
<tr>
<th>Author</th>
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<td>Lu</td>
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<td>Cohort</td>
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Superficial Esophageal Neoplasia
Role of Magnifying endoscopy

- 80x magnification
- Vascular pattern (IPCL) at mucosal level
- Aim
  - To differentiate non-neoplastic or neoplastic lesion
  - To determine the depth of invasion (T1m / sm)

Intrapapillary capillary loops (IPCL)
Early Esophageal SCC
Severe Dysplasia

EMR / ESD

IPCL
Type IV
Early esophageal SCC
M1 tumour

EMR / ESD

IPCL
Type V1
Early Esophageal SCC
Submucosal (≥ SM2)

Esophagectomy

IPCL
Type Vn
Magnifying endoscopy
Intrapapillary Capillary Loops (IPCL)

- Histological depth of invasion and magnified appearance
  - 60/72 cases (83.3 %)
- IPCL of the m1 cancer lesions
  - M1 - 12.9 +/- 3.9 microm)
  - normal - 6.9 +/- 1.5 microm)
(P < 0.0001)

Inoue et al Endoscopy 2002
Lugol chromoendoscopy

- Advantages
  - Not operator dependent

- Disadvantages
  - Need to prepare the dye
  - Complications
    - Retrosternal pain
      - Relief by Sodium Thiosulphate
    - Severe mucositis
    - Aspiration of Lugol

Endoscopy 2001; GUT 2005
Towards Virtual chromoendoscopy.....

Recognition of superficial esophageal neoplasia

Fluorescence endoscopy

Narrow Band Imaging
Enhanced Observation of IPCL

Magnifying OGD

NBI + Magnifying OGD
What’s NBI?

- Narrowing the bandwidth of optic filters
- RGB filters concentrating source wavelength at 415nm, 445nm & 500nm

White light

NBI Filter = Specially Coated Glass

#1: center wavelength
#2: bandwidth
NBI in esophagus

Narrowing Bandwidth cuts “Optically Obstructive” light that decreases the contrast.
Superficial esophageal neoplasia
NBI magnifying endoscopy

IPCL Type V1
NBI enhanced magnifying endoscopy

- Prospective study on differentiating m1,2,3; sm1,2,3
  - 82% accuracy

- Tricks to perform NBI for esophagus
  - Vigorous wash
  - Antispasmodics (Buscopan)
  - Sedation
  - Short cap – for magnifying endoscopy

Yoshida et al. GIE 2004
NBI vs Lugol for superficial esophageal neoplasia [1]

- To compare NBI vs Lugol chromoendoscopy in detection of superficial esophageal neoplasia among patients with Head & Neck cancer

Chiu et al DDW 2007
NBI vs Lugol for superficial esophageal neoplasia [2]

- Prospective comparative study
- Inclusion
  - All patients with newly diagnosed head & neck cancer
  - Previous history of head & neck cancer with curative intent treatment given and remained disease free for > 2 years

Chiu et al DDW 2007
NBI vs Lugol for superficial esophageal neoplasia [3]

• January to November 2006
• 50 consecutive patients
• Duration:
  – NBI > Lugol (7.5 mins vs 5.7 mins; p < 0.001)
• NBI detection
  – 13 superficial esophageal cancer
  – 2 squamous esophageal cancer
• Lugol detection
  – Suspicious lesions (unstain or understain) in 22

Chiu et al DDW 2007
NBI vs Lugol for superficial esophageal neoplasia [4]

- Sensitivity
  - NBI 92.3%
  - Lugol 92.3%
- Specificity
  - NBI 91.7%
  - Lugol 72.2%
- ROC curve (AUC)
  - NBI 0.92
  - Lugol 0.82

Chiu et al DDW 2007
Superficial esophageal neoplasia

Pink silver sign [1]

Inoue et al Advanced Digestive Endoscopy Blackwell 2007
Superficial esophageal neoplasia
Pink Silver sign [2]

Inoue et al Advanced Digestive Endoscopy Blackwell 2007
Towards Virtual chromoendoscopy.....

Recognition of superficial esophageal neoplasia

Fluorescence endoscopy
Autofluorescence endoscopy

• **Aim**
  – To enhance the detection of superficial GI neoplasia
  – Less operator / expert dependent

• **Making the tumor “stand out” by itself**
  – Employ the difference in the intracellular components of fluorophores
  – Enhance the different autofluorescence effect between normal and tumor cells
Autofluorescence endoscopy
System Configuration

Monitor
Video Processor
Xenon Lamp
RGB Rotary Filter
Light Source Unit

G; 540-560nm
Ex; 390-470nm

AFI dedicated high sensitive CCD
Cut Filter
(Outside range of 500-630nm)

Mucosa
Superficial esophageal neoplasia
AFI [1]
Superficial esophageal neoplasia
AFI [2]
### AFI for superficial esophageal neoplasia
#### Case series

<table>
<thead>
<tr>
<th>Age/gender</th>
<th>Size</th>
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Uedo et al GIE 2005; Uedo et al Dig Endosc 2006
AFI – surveillance of Barrett’s Randomized trial

• 187 patients
• AFI targeted biopsy or Seattle protocol (conventional)
• Cross over to other method 10 wks after

• AFI targeted biopsy improved the diagnostic yield for neoplasia
  – Phase 1:
    • 1 neoplasia per 23 endoscopy (AFI)
    • 1 neoplasia per 93 endoscopy (conventional)
  – Phase 2 (cross over):
    • 1 neoplasia per 34 endoscopy (AFI)
    • 1 neoplasia per 62 endoscopy (conventional)
Conclusions

- Superficial esophageal neoplasia had a better prognosis
- Lugol chromoendoscopy enhanced the detection of superficial esophageal neoplasia among high risk patients
- Novel endoscopic technology including NBI and AFI is successful in achieving virtual chromoendoscopy