ESD history and future –simple is hard

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Incidence map of gastric cancer

Estimated age-standardised incidence rate per 100,000
Stomach: both sexes, all ages
History of ESD

To provide curability, better QOL

To improve technical skill
Agenda

Curability

Technique
Polypectomy

EMR

1970s
- Polypectomy; Deyhle et al., *Endoscopy*, 1973 (colon)

1980s
- Strip Biopsy; Tada et al., *Gastroenterol Endosc*, 1984

1990s
- EMR-C; Inoue et al., *Gastrointest Endosc*, 1993

2000s
- EMR-L; Akiyama et al., *Gastrointest Endosc*, 1997

Technical limitation by EMR

- En bloc resection
- Piecemeal resection

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Method</th>
<th>Recurrence Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tanabe et al.</td>
<td>Strip Biopsy, EAM</td>
<td>3.5% (15/423)</td>
</tr>
<tr>
<td>Kawaguchi et al.</td>
<td>Strip Biopsy, EMR-C</td>
<td>35.3% (97/266)</td>
</tr>
<tr>
<td>Ida et al.</td>
<td>EMR+Laser</td>
<td>6.7% (11/165)</td>
</tr>
<tr>
<td>Chonan et al.</td>
<td>EMR</td>
<td>10.9% (21/193)</td>
</tr>
<tr>
<td>Hirao et al.</td>
<td>ERHSE</td>
<td>2.3% (8/349)</td>
</tr>
<tr>
<td>Mitsunaga et al.</td>
<td>Strip Biopsy</td>
<td>18.2% (54/296)</td>
</tr>
</tbody>
</table>

# Original criteria in EMR era

<table>
<thead>
<tr>
<th>Depth</th>
<th>Mucosal cancer</th>
<th>Submucosal cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UL(-)</td>
<td>UL(+)</td>
</tr>
<tr>
<td>Histology</td>
<td>≤ 20 20</td>
<td>≤ 30 30</td>
</tr>
<tr>
<td>Differentiated</td>
<td>&lt;</td>
<td>&lt;</td>
</tr>
<tr>
<td>Undifferentiated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Guideline criteria for EMR: Blue
Surgery: Red
Concept of endoscopic resection

EMR/ESD

Laparoscopic

Open
## EGC with no risk of LN metastasis

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Incidence</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differentiated adenocarcinoma</td>
<td>0/1230 (0%)</td>
<td>0-0.3%</td>
</tr>
<tr>
<td>Intramucosal cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No lymph-vascular involvement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irrespective of ulcer findings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tumor less than 3cm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differentiated adenocarcinoma</td>
<td>0/929 (0%)</td>
<td>0-0.4%</td>
</tr>
<tr>
<td>Intramucosal cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No lymph-vascular involvement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without ulcer findings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irrespective of tumor size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minute submucosal penetration (SM1)</td>
<td>0/145 (0%)</td>
<td>0-2.5%</td>
</tr>
<tr>
<td>No lymph-vascular involvement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tumor less than 3cm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Gotoda T, et al. Gastric Cancer, 2000*

Polypectomy; Deyhle et al., Endoscopy, 1973 (colon)

Strip Biopsy; Tada et al., Gastroenterol Endosc, 1984

EMR-C; Inoue et al., Gastrointest Endosc, 1993

EMR-L; Akiyama et al., Gastrointest Endosc, 1997

En bloc resection
- regardless size, fibrosis and/or location -

well diff. adenoca., Type 0-IIc, 20x20mm, M, ly0, v0, ul(-)

well diff. adenoca., Type 0-IIc, 50x40mm, M, ly0, v0, ul-IlIs

well diff. adenoca., Type 0-IIc, 65x45mm, M, ly0, v0, ul-IlIs

well diff. adenoca., Type 0-IIc, 8x7mm, M, ly0, v0, ul(-)

well diff. adenoca., Type 0-IIc, 30x25mm, M, ly0, v0, ul-IlIs

well diff. adenoca., Type 0-IIc, 21x17mm, M, ly0, v0, ul-IlIs
### Expanded criteria in ESD era

<table>
<thead>
<tr>
<th>Histology</th>
<th>Depth</th>
<th>Mucosal cancer</th>
<th>Submucosal cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UL(-)</td>
<td>UL(+)</td>
<td>SM1</td>
</tr>
<tr>
<td>Differentiated</td>
<td>≤20</td>
<td>20</td>
<td>≤30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>≤30</td>
</tr>
<tr>
<td>Undifferentiated</td>
<td>≤30</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

- **Guideline criteria for EMR**
- **Expanded criteria for ESD**
- **Surgery**

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Soetikno R, Kaltenbach T, YehR, Gotoda T. JCO, 2005

Gotoda T, et al. Gastric Cancer, 2000

Hirasawa T, Gotoda T, et al. Gastric Cancer, 2009
Summary of ESD

- Large *en bloc* resection
- Less local recurrence
- Precise histological assessment
Survival by treatment groups


<table>
<thead>
<tr>
<th>Observation period (months)</th>
<th>Number of at risk patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>standard criteria</td>
</tr>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>631</td>
</tr>
<tr>
<td></td>
<td>621</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>JGCA criteria</th>
<th>NCC criteria</th>
<th>Multiple cancers</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n = 635)</td>
<td>(n = 625)</td>
<td>(n = 225)</td>
</tr>
<tr>
<td>Mean age (years)</td>
<td>66-4</td>
<td>66-5</td>
</tr>
<tr>
<td>Men</td>
<td>479 (75-4)</td>
<td>505 (80-8)</td>
</tr>
<tr>
<td>Past history of cancer</td>
<td>154 (24-3)</td>
<td>87 (13-9)</td>
</tr>
<tr>
<td>Mean tumour size (mm)</td>
<td>10-8</td>
<td>23-8</td>
</tr>
</tbody>
</table>

Comparison of survival

Overall survival

standard criteria
expanded criteria
<table>
<thead>
<tr>
<th>Study</th>
<th>Favours EMR group</th>
<th>Favours ESD group</th>
<th>Odds ratio (95%CI)</th>
<th>% Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Colorectal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonaka 2008</td>
<td></td>
<td></td>
<td>9.38 (1.95, 45.06)</td>
<td>6.5</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td>9.38 (1.95, 45.06)</td>
<td>6.5</td>
</tr>
<tr>
<td><strong>Esophageal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ishihara 2008</td>
<td></td>
<td></td>
<td>12.50 (1.59, 98.03)</td>
<td>5.2</td>
</tr>
<tr>
<td>Jung 2008</td>
<td></td>
<td></td>
<td>5.65 (1.75, 18.21)</td>
<td>7.7</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td>6.85 (2.48, 18.97)</td>
<td>12.8</td>
</tr>
<tr>
<td><strong>Gastric</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oda 2006</td>
<td></td>
<td></td>
<td>1.21 (0.95, 1.52)</td>
<td>9.9</td>
</tr>
<tr>
<td>Odashima 2006</td>
<td></td>
<td></td>
<td>2.92 (1.39, 6.16)</td>
<td>8.9</td>
</tr>
<tr>
<td>Oka 2006</td>
<td></td>
<td></td>
<td>15.86 (10.55, 23.83)</td>
<td>9.7</td>
</tr>
<tr>
<td>Shimura 2007</td>
<td></td>
<td></td>
<td>16.34 (6.03, 44.32)</td>
<td>8.2</td>
</tr>
<tr>
<td>Watanabe 2006</td>
<td></td>
<td></td>
<td>0.97 (0.45, 2.11)</td>
<td>8.8</td>
</tr>
<tr>
<td>Hoteya 2007</td>
<td></td>
<td></td>
<td>3.60 (2.21, 5.84)</td>
<td>9.5</td>
</tr>
<tr>
<td>Kim 2007</td>
<td></td>
<td></td>
<td>1.18 (0.82, 1.71)</td>
<td>9.7</td>
</tr>
<tr>
<td>Hoteya 2008</td>
<td></td>
<td></td>
<td>3.29 (0.83, 12.98)</td>
<td>7.1</td>
</tr>
<tr>
<td>Min 2008</td>
<td></td>
<td></td>
<td>1.59 (0.72, 3.52)</td>
<td>8.8</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td>2.95 (1.39, 6.25)</td>
<td>80.7</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td></td>
<td></td>
<td>3.60 (1.84, 7.04)</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Cao Y et al. Endoscopy, 2009
Local and distant metastasis
Possibility of LN metastasis

Category 5.2 Vienna classification
Macroscopic type: 0 IIc
Size: 21×10mm
Depth of invasion: SM1 (500μm)
ly0, v0
Peptic ulcer: UI-II

April 2005
EUS-FNA

December 2007

May 2009

EUS-FNA

We could cure ...

Distal gastrectomy in July 2009
Agenda

Curability

Technique
ESD vs. EMR meta-analysis

- Local recurrence was lower with ESD (OR 0.09, 95%CI 0.04–0.18)

- ESD took longer than EMR (weighted mean difference [WMD] 1.76; 95%CI 0.60–2.92)

- ESD showed higher bleeding and perforation rates (OR 2.20, 95%CI 1.58–3.07; OR 4.09, 95%CI 2.47–6.80)

Cao Y et al. Endoscopy, 2009
Frequency of complications during ESD
- 1534 operations : 2000-2004 at NCCH -

✓ Perforation ; 4% (64 cases)
✓ Delayed bleeding ; 4% (63 cases)
  ▶ 2000 〜 2002 : 6.5% (50/766)
  ▶ 2003 〜 2004 : 1.7% (13/768)
✓ Respiratory complications (atelectasis, pneumothorax) ; 0.3% (5 cases)

Oda I, Gotoda Tet al. Dig Endosc,2005
Endoscopic hemostasis

Soft coagulation mode 80W (ESG-100, Olympus Co.)
Endoscopic closure by metallic clips

Result of gastric perforation during ESD - 2460 operations: 1987-2004 at NCCH -

121 patients (4.9%) with perforation

4 surgical treatment (1987-1993)

2 failure & additional surgical treatment
115 success (98.3%)

No counter traction

Kondo H, Gotoda T et al. Gastrointest Endosc, 2004

Gotoda T et al. Gastrointest Endosc, 2009
Magnetic-anchor–guided ESD

Gotoda T et al. Gastrointest Endosc, 2009
Counter traction
Recent results of ESD

Intelligent fingers in Poland

2008 in Rotterdam

2010 in Tokyo
Training
Limited Global Adaptation of ESD?

Diagnosis; WL, AIM, IEE, etc

Submucosal Injection

Circumferential Incision

Submucosal Dissection

Pathological Interpretation

Surveillance

- New devices ....
- Require skilful technique
- Bleeding
- Risk of perforation
- Metal clips
- Time-consuming
- Costly
- No early gastric cancer
Incidence of gastric cancer

Estimated age-standardised incidence rate per 100,000
Stomach: both sexes, all ages
Recommended steps for training ESD

- Animal training
- Gastric ESD in distal stomach
- Rectal ESD
- Esophageal ESD
- Gastric ESD in proximal stomach
- Colonic ESD
Endoluminal treatment in new era

2000s

ESD; Ono et al, *Gut*, 2001

2010


Laparoscopic and endoscopic cooperative surgery
Blood vessels in the excision area around the tumour were prepared using an ultrasonically activated device (Autosonix; Tyco Healthcare, Tokyo, Japan) and Ligasure (Tyco Healthcare, Tokyo, Japan)

These procedures dissected the tumour and only the minimal extra tissue area of the stomach wall.

For patients

Curability

Technical limitation

Treatment
Thank you for your kind attention

Simple is hard

Steve Jobs
1955-2011