EMR to ESD
East Meets West: Implementation of an ESD Program at an Academic Medical Center
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Adenomas
- 80% - 90% of adenomatous lesions are < 10 mm in size
- Conventional snare polypectomy has been the accepted treatment for more than 3 decades
- These lesions do not pose significant challenge to an appropriately trained and skilled endoscopist
- Assessment and treatment of larger lesions greater than 20 mm in maximum dimension is an evolving field of knowledge

Background

Polypectomy techniques
- Standard polypectomy
- Saline assisted polypectomy
- Endoscopic mucosal resection (EMR)
- Piecemeal EMR
- Endoscopic submucosal dissection (ESD)
History of Endoscopic Polyp Resection

- Endoscopic polypectomy was developed in 1960s
- In 1973, Deyhle et al. described a method for endoscopic resection of sessile polyps using local injection of saline
- Endoscopy 5:38-40
- In 1980s, Japanese were advancing EMR due to high incidence of gastric cancer
- In late 1990s, ESD was being described to perform en bloc resection
- Term endoscopic submucosal dissection was proposed in 2003 and adopted in 2004-2005 at the 67th Japanese Gastrointestinal Endoscopic Society meeting

Prior Thinking of Complex Colon Polyps

- If the polyp appeared to be malignant, it should not be removed.
- If the polyp crosses two interhaustral folds, it should not be removed because the polyp hidden between the two folds, or on the most proximal side of the first fold, may not be amenable to endoscopic access, and therefore cannot be removed.
- A polyp that is greater than one third of the circumference of the bowel wall should not be removed because of its large size.


Basic technique of EMR
Importance of Polyp Classification

- Large sessile or flat lesions of the colon are best described according to the Paris system of endoscopic classification of superficial neoplastic lesions.

- Application of an accepted classification system has many potential advantages:
  - Standardization of morphology
  - Descriptions and improved lesion categorization
  - Better understanding of the variations in lesion characteristics and biology is achieved
  - Lesion-specific treatment and surveillance algorithms can be developed

Paris Is 30-40 mm
- Left Colon Adenoma
  - ASA 3

Paris 0-3 mm
- Cecal Adenocarcinoma
  - ASA 2

Paris 0-30 mm
- Right Colon Adenoma
  - ASA 2

Paris 0-8 mm
- Cecal Adenoma
  - ASA 4

Paris 0-50 mm
- Rectal Adenoma
  - ASA 1
Predictors of Invasion

- Combining lesion granularity and morphology is useful in predicting the risk of SMI.

- A homogeneous 0-IIa c lesion has a risk of SMI of approximately 1% in large Japanese and Western cohorts.

- In contrast, 0-IIa c + NG lesions have the greatest risk of SMI at approximately 87% (relative risk 54, P < 0.001)

- The risk of SMI in 0-IIa NG lesions without a depressed component is intermediate at 15%-20%

- Among 0-IIa c + Is lesions, the risk of SMI is 10%-15%, if it occurs it is most frequently beneath the Is component.

ESD

- Advantages
  - En bloc resection
  - Evaluation of lateral and deep margins
  - Better evaluation of submucosal invasion
  - Fewer residual lesions
  - Low recurrence rate
  - Accurate histopathologic assessment – risk for lymph node metastasis and metastatic disease

- Disadvantages
  - Limited training opportunities
  - Expensive
  - Role is still emerging in USA
  - Technically difficult
  - Increased adverse event rates
    - Delayed bleeding – 2-15%
    - Perforation – 1-5%
Layers of Digestive Tract Wall

- Body wall
- Peritoneum
- Serosa
- Submucosa
- Mucosa
- Lamina propria
- Submucosal plexus
- Muscularis externa
- Inner circular muscle
- Outer longitudinal muscle
- Duct of large accessory digestive glands
- Gastroesophageal junction (GEJ)
**ESD Gastric Indications**

- Early cancer confined to the mucosa or superficial submucosa with low probability of lymph node metastasis

<table>
<thead>
<tr>
<th>Depth of Invasion</th>
<th>Ulceration</th>
<th>Differentiated</th>
<th>Undifferentiated</th>
</tr>
</thead>
<tbody>
<tr>
<td>( cT1a ) (Mi)</td>
<td>UI(-)</td>
<td>&lt; 2 cm</td>
<td>&lt; 2 cm</td>
</tr>
<tr>
<td>( cT1a ) (Mi)</td>
<td>UI(+)</td>
<td>2 cm - 3 cm</td>
<td>&gt; 3 cm</td>
</tr>
<tr>
<td>( cT1b ) (SM)</td>
<td>UI(-)</td>
<td>3 cm - 5 cm</td>
<td>&gt; 5 cm</td>
</tr>
<tr>
<td>( cT1b ) (SM)</td>
<td>UI(+)</td>
<td>3 cm - 5 cm</td>
<td>&gt; 5 cm</td>
</tr>
</tbody>
</table>

**Figure 1** Classification of indications according to tumour-related factors: a, absolute indication lesion; e, expanded indication lesion; c, out of indication lesion; \( cT1a \) (Mi), intramucosal cancer (preoperative diagnosis); \( cT1b \) (SM), submucosally invasive cancer (preoperative diagnosis); UI, finding of ulceration (scar).
Table 2 Indications for ESD for colorectal tumors
Lesions for which endoscopic en bloc resection is required
1) Lesions for which en bloc resection with snare EMR is difficult to apply
   • LSTMs, particularly LSTMs (PD)
   • Lesions showing a U-type pit pattern
   • Carcinoma with shallow T1 (SM) invasion
   • Large depressed-type tumors
   • Large protruded-type lesions suspected to be carcinoma
2) Mucosal tumors with submucosal fibrosis
3) Sporadic localized tumors in conditions of chronic inflammation such as ulcerative colitis
4) Local residual or recurrent early carcinomas after endoscopic resection

Adverse events after surgery for nonmalignant colon polyps are common and associated with increased length of stay and costs.

- 359 patients who underwent surgical resection for benign colon polyps
- 17% experienced an adverse event
- 36 incurred additional surgery
- 12 month mortality was 36
- Median LOS was 5 days (IQR 4-7 days), and costs were $143,28
- Costs significantly increased with AE: Costs ($25,557 vs $14,029; P < .0001)
- LOS (11 vs 5 days; P < .0001)
- Cohort of endoscopically treated patients had lower rate of AE (10% vs 18%; P = .09)
- Cost of endoscopic resections significantly lower ($225,20 vs $25,264; P < .0001)
**Prospective study of 479 patients**

**KEY STATISTICS**

<table>
<thead>
<tr>
<th>COMPLETE RESECT</th>
<th>OVERALL COMPLICATIONS</th>
<th>RECURRENCE RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>89%</td>
<td>8%</td>
<td>20.4%</td>
</tr>
<tr>
<td>BLEEDING</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td>PERFORATION</td>
<td>1.3%</td>
<td></td>
</tr>
</tbody>
</table>

- Lesion > 40 mm: 41%
- Lesion < 40 mm: 14%

Study Data

- Risk factors for failure of EMR
  - Prior attempt at EMR - OR 3.8
  - Sessile valve involvement - OR 3.4

- Use of APC associated with recurrence - OR 3.5

- 83.7% patients avoided surgery

Original Article

**Long-term adenoma recurrence following wide-field endoscopic mucosal resection (WF-EMR) for advanced colorectal mucosal neoplasia is infrequent: results and risk factors in 1000 cases from the Australian Colonic EMR (ACE) study**


- Multicentre, prospective study of 1000 consecutive EMRs
- Recurrent/residual adenoma (4 months following EMR) was present in 16.0%
- Late recurrent/residual adenoma (16 months following EMR) was uncommon (4.0%)
- On multivariate analysis, risk factors for recurrent adenoma were lesion size > 40 mm, use of argon plasma coagulation to ablate adenoma and intraprocedural bleeding
ACE Study Cont’d

• The recurrent adenoma was managed endoscopically in 93.1% of cases.

• 98.1% were adenoma-free and had avoided surgery at 16 months following EMR if EMR was successful and no submucosal invasion.

• However, 4.3% of patients with T1 cancer were recommended for additional surgery.

• These patients may have been able to avoid surgery if detailed pathologic assessment were available.

Clinical outcome of endoscopic submucosal dissection versus endoscopic mucosal resection of large colorectal tumors as determined by curative resection

Yukiko Suda, Masakane Fujisawa, Yukihiko Matsuda, Shigeki Funabashi, Tatsuo Honjo, Youichi Tanioka, Hiromasa Ishihara, Kanae Hirai, Takanori Ishii, Tokioho Kigih

• 145 colorectal tumors treated by ESD and 226 treated by EMR.

• ESD was associated with a longer procedure time (108 ± 71 min vs. 29 ± 25 min; p < 0.0001).

• ESD associated with higher en bloc resection rate (84% vs. 33%; p < 0.0001).

• Three (2%) recurrences in the ESD group and 33 (14%) in the EMR group requiring additional EMR (p < 0.0001).

• The perforation rate was 6.2% in the ESD group and 1.3% in the EMR group (p = NS).

• Delayed bleeding occurring in 1.4% and 3.1% of the procedures (p = NS).

• All complications were effectively treated endoscopically.

Accepted Manuscript

Long-term outcomes after endoscopic submucosal dissection for superficial colorectal tumors

Kengo Shippa, MD, Shinji Oka, MD, PhD, Ding Tian, MD, PhD, Kyoto University, MD, Doshisha University, BD, Yukinori Tanioka, BM, Kiyotaka Shimokado, MD, PhD, Hisato Akiyama, MD, Nara/Heime, MD, PhD, Fumi Shimokado, MD, PhD, Koji Arima, MD, PhD, Kiyotaka Shimokado, MD, PhD

• 222 patients with >5 years follow-up data.

• 5-year survival and disease-free rates were 94.6% and 100%, respectively.

• The local recurrence rate (1.5%)
  - significantly higher in patients undergoing incomplete resection (9.1%) compared to en bloc resection (0.6%).
  - in histological.

• Rates of total (≥6 mm) and carcinoma metachronous tumors after ESD were 18.9% and 4.0%, respectively.

• Patients should be surveyed for both local recurrence and metachronous tumors after ESD.
Paradigm shift in treatment of early colorectal cancer

ORIGINAL ARTICLE: Clinical Endoscopy

Preoperative indicators of failure of en bloc resection or perforation in colorectal endoscopic submucosal dissection: implications for lesion stratification by technical difficulties during stepwise training

- 716 Lesions treated by ESD
- En bloc resection rate 89.9%
  - Piecemeal resection rate 5.6%
  - Discontinued procedure 4.8%
- Perforation rate 8.6%
- Factors for technical failures or perforation analyzed
  - Presence of fold convergence
  - Poor endoscope operability
  - Lesions located other than the rectum
  - Protruded lesions
  - Presence of a semilunar fold


Management of Perforation
Tools for EMR/ESD

- **Necessary tools**
  - High quality electrosurgical unit
  - CO2 is a must!!!
  - Injection solution and dye
  - Various types of snare s or knives
  - Confidence and appropriate skill (proximal colon retroflexion) to remove entire lesion
  - If cancer then biopsy; if cancer is unlikely and not being removed during same session do not biopsy.

Electrosurgical Units

- These generators sense tissue impedance via signals from the return electrode and adjust power output accordingly.
- Generators without these features do not provide an acceptable level of electrosurgical safety for extensive and complex EMR.

Injection solution

- Blue dye, such as indigo carmine or methylene blue. DO NOT USE SPOT.
- **Advantages**
  - Defines lesion perimter. Useful in submucosal lesions.
  - Blue coloration delineates the extent of the submucosal cushion, defining the safe EMR zone.
  - Dyes such as indigo carmine and methylene blue are avid for the loose areolar connective tissue of the submucosa. Submucosa stains blue. Helps identify correct tissue plane.
  - Dye is not taken up by the muscularis propria. If MP is entered, a disruption to the blue appearance will be seen. Target sign.
## Northwestern Experience

<table>
<thead>
<tr>
<th>ESD procedures</th>
<th>N = 21</th>
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<tbody>
<tr>
<td>Location</td>
<td>Esophagus / Stomach / Colon</td>
</tr>
<tr>
<td></td>
<td>2 / 10 / 9</td>
</tr>
</tbody>
</table>

### KEY STATISTICS

<table>
<thead>
<tr>
<th></th>
<th>Rate</th>
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<tbody>
<tr>
<td>Bleeding</td>
<td>2 (9.5%)</td>
</tr>
<tr>
<td>Complication</td>
<td>3 (14%)</td>
</tr>
<tr>
<td>Location</td>
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