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Review Study of Endoscopic Techniques in Early Colonic Cancers

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Abstract: ***Endoscopic resection (ER) is an alternative to surgical resection of mucosal and submucosal neoplastic colonic lesions and intramucosal colonic cancers. ER techniques includes endoscopic mucosal resection (EMR)and endoscopic submucosal dissection (ESD). ER offers both diagnostic and therapeutic capability. Lesions limited to the mucosa and the superficial layers of the submucosa appear to be the most amenable to endoscopic cure. ESD seems superior to EMR in treating larger colonic lesions with higher en-bloc and curative resection rates, and lower recurrence rates. Both procedures appear to be safe in experienced hands. More studies are required to investigate the long-term outcomes.***

Keywords: Colon cancer, ESD, EMR

1. Background

Endoscopic resection (ER) is a suitable alternative forthe treatment of mucosal and submucosal neoplastic lesions[1]. ER includes endoscopic mucosal resection (EMR), which involves snare resection of dysplastic lesions, and endoscopic submucosal dissection (ESD) in which endoscopic tools are used to dissect lesions from the submucosa. ER is helpful for diagnosis and treatment and it can be used in all gastrointestinal tract benign and malignant lesions.

ER can be used in the treatment of colorectal cancers. EMR technique for colonic neoplasms has been reported in many studies, with complete resection rates of 86 to 97% [2]. Lesions of more the 2 cm were associated with incomplete resection in many cases. However, with the development of ESD, lesions more than 3 cm could also be treated effectively. [2]

2. Indications

According to the Japanese Society for Gastroenterological Endoscopy (JSGE), colonic neoplasms that may be amenable to EMR are categorised (table 1) [3]:

- ”JSGE type I lesions that are less than 3 cm in diameter
- JSGE type IIa lesions that are less than 3 cm in diameter
- JSGE type IIb lesions that are less than 5 mm in diameter
- JSGE type IIc+IIa lesions that are less than 1 cm
- JSGE type IIa+IIc lesions that are less than 1 cm in diameter
- JSGE type IV lesions that are less than 3 cm in diameter”

Table 1: Japanese Society for Gastroenterological Endoscopy criteria for endoscopic mucosal resection (EMR) of early endoluminal cancers

Cancer	JSGE type	Criteria for EMR
Early gastric cancer	I	Less than or equal to 2 cm
	IIb and IIc	Less than or equal to 1 cm
	Intestinal type adenocarcinoma	Limited to the mucosa
Oesophageal cancer	I, IIa, IIb, IIc	Diameter of less than or equal to 2 cm
		Involvement of less than one-third of the circumference of the esophageal wall
		Limitation to the mucosa of the esophagus
Colon cancer	I	Less than 3 cm
	IIa	Less than 3 cm
	IIb	Less than 5 mm
	IIc + IIa	Less than 1 cm
	IIa + IIc	Less than 1 cm
	IV	Less than 3 cm

From: Raju GS, Waxman I. High-frequency US probe sonography-assisted endoscopic mucosal resection. Gastrointestinal endoscopy. 2000 Dec 1;52(6):S39-49.

Depressed lesions may invade the submucosa, even when they are small. Deep invasion precludes the use of EMR. The Paris classification notes that deep invasion is more likely when [4]:

- The lesion diameter is >15 mm
- The border of an elevated or depressed lesion (Paris type 0-IIa or 0-IIc, respectively) presents as a smooth circle without indentations
- The lesion fails to lift after injection with saline into the submucosa

ESD, has also been used in the treatment of colon polyps and cancers. In a meta-analysis of 14 studies regarding patients undergoing ESD for large polyps, successful en-bloc polyp resection was achieved in 85% of the procedures [5]; in 75% of the procedures, the resection margins were histologically negative for adenoma. Other studies of

patients with colorectal neoplasms have found complete resection rates of 75 to 89 percent [6], [7]. Table 2: Paris classification system of superficial gastrointestinal neoplastic lesions [4]

Table 2: Paris classification system of superficial gastrointestinal neoplastic lesions

Type	Subclasses
0-I: Polypoid	0-Ip: Protruded, pedunculated
	0-Is: Protruded, sessile
0-II: Nonpolypoid	0-IIa: Slightly elevated
	0-IIb: Flat
	0-IIc: Slightly depressed
0-III: Excavated	

From: The Paris endoscopic classification of superficial neoplastic lesions: esophagus, stomach, and colon: November 30 to December 1, 2002. GastrointestEndosc 2003; 58:S3.

3. ER Techniques

3.1 EMR techniques

The techniques for EMR can be broadly divided into two groups: suction (suck-and-cut) and non-suction (lift-and-cut) techniques.

Submucosal injection: Submucosal injection is used to create a submucosal fluid cushion (SFC) which could decrease the incidence of perforation during EMR. Puckering or inability to raise the lesion during injection also suggests invasion of the muscularis propria [8]. There are many fluids which could be used including hypertonic saline, 50% dextrose and hydroxypropyl methylcellulose (HPMC). Normal saline is not preferable because of its fast absorption. The procedure necessitates about 10 to 40 mls. of the solution. The injections are performed with a needle at one or multiple sites adjacent to the tumour [9].

Suction methods: Once the lesion has been lifted away from the muscularis propria by the SFC, it is aspirated and resected. This technique is most commonly performed with a transparent cap attached to the tip of the endoscope [10].

Non-suctionmethods: Non-suctionmethods use a grasping device to pull the lesion away from the muscularis propria, after which a snare is used to resect the specimen. Compared to suction methods, this is more challenging [11].

Figure 1: A soft large-caliber EMR cap equipped with two external channels. The cap provides a standard single-channel endoscope an additional accessory channel (snare is inserted) and a water-flushing port [12].
From: Sumiyama K, Gostout CJ. Novel techniques and instrumentation for EMR, ESD, and full-thickness endoscopic luminal resection. Gastrointestinal endoscopy clinics of North America. 2007 Jul 1; 17(3):471-85.

3.2 ESD techniques

ESD is a variant of EMR in which a specialized needle-knife is used to dissect lesions from the submucosa. It offers the potential to remove mucosal and submucosal tumors en-bloc. This technique has been used in stomach, esophagus, colon and rectum [13], [14]

In ESD, a specially designed electrocautery knife is used to resect the lesion in one piece without the use of a snare. This helps in minimizing recurrence and achieves improved histopathological assessment.The procedure is usually done under sedation or general anesthesia. A colonoscope with a transparent hood is inserted through the anus to visualize the lesion. The submucosa is injected with the fluid to lift the lesion off the submucosa. Then a circumferential mucosal incision is made with the electrothermal knife around the lesion, followed by submucosal dissection. Endoscopic clips may be used to control bleeding and treat small perforations. [15].

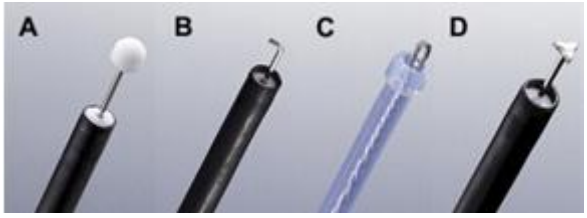

Figure 2: Needle knives for endoscopic submucosal resection (ESD). From left to right: (A) Insulated tip needle knife, (B) Hook knife, (C) Fex knife, and (D) Triangle tip knife. [16]
From: Fujishiro M. Endoscopic submucosal dissection for stomach neoplasms. World Journal of Gastroenterology: WJG. 2006 Aug 28; 12(32):5108.

4. Long term Outcome

Follow-up studies suggest that ER in carefully selected patients can achieve a long-term cure, although the number of patients reported is relatively small [17]. Outcomes following EMR in the colon are good, particularly if the lesion can be removed en-bloc. This was examined in a meta-analysis that included 31 observational studies and two randomized trials in which a total of 3422 adenomas or early carcinomas were removed using EMR [17]. The local recurrence rate in this study was 3% of the en-bloc resections, while it was 20% in piecemeal resections.

There are very few studies looking at the long-term outcomes in patients who had ESD for colonic lesion and suggested good long-term outcomes (***references to back this argument up***). A retrospective study included 589 patients with T1 rectal cancer who underwent ESD or laparoscopic-assisted colorectal surgery. ESD was associated with lower

complications rate, alongside favorable en-bloc and curative resection rates (87% and 80% retrospectively) [18].

5. Complications

In experienced hands, ER is a safe procedure that can be performed in the outpatient setting. Few complications have been described, including stricture formation, perforation and bleeding. In one review included 297 patients, the bleeding rate after ESD for early rectal cancer was 1.7%, the perforation rate was 4.7%.

Post endoscopic submucosal dissection electrocoagulation syndrome is another complication that can develop after ESD in the colon or rectum. It develops when an electrical current applied during the procedure extends past the mucosa into the muscularis propria and serosa, resulting in a transmural burn without perforation. Symptoms include fever, rebound tenderness, and marked leukocytosis. In a series with 82 patients who underwent ESD in the colon or rectum, post endoscopic submucosaldissection electrocoagulation syndrome was reported in 33 patients (40 %) [19].

6. Comparison of ESD and EMR

A meta-analysis of 15 studies found that ESD, compared with EMR, had higher en-bloc and curative resection rates, as well as lower rates of local recurrence for malignant and premalignant lesions of the gastrointestinal tract [17]. ESD needs more experience to be performed than EMR and there is a potential risk for more complications.

7. Conclusion

Both ESD and EMR are important tools in treating precancerous and early colonic cancer. Careful patient selection is essential to achieving good outcomes. More studies are still required to decide on the long-term outcomes and recurrence rates following these procedures. ESD appears superior to EMR in treating large colonic lesions, with higher en-bloc and curative resection rates and lower recurrence raters. However, it still requires advanced training and skill in order to offset the marginally higher complications risk. Further research is necessary to investigate the long-term outcomes for patients receiving these procedures.

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