NEW YORK SOCIETY FOR GASTROENTEROLOGY & ENDOSCOPY
48th Annual
NEW YORK COURSE
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Non-Surgical Techniques in Removing Large Colorectal Polyps

NYSGE 48th Annual New York Course
Doris C. Barnie GI Nurses and Associates Course
Thursday, December 12th, 2024

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Disclosures

- Redesign Health – equity ownership

OBJECTIVES

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Objectives

- Discuss best practices for polypectomy and endoscopic mucosal resection
- Review evidence behind the guideline recommendations
- Demonstrate technique with video
- Explore novel resection techniques and technologies

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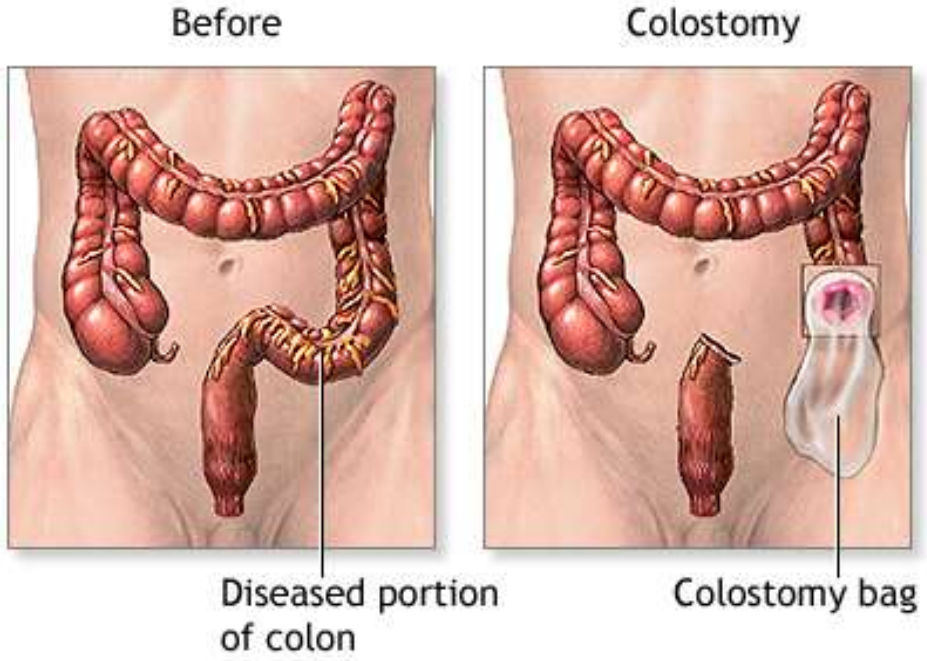
WHY ENDOSCOPIC RESECTION?

Endoscopic Resection has Lower Morbidity than Surgery

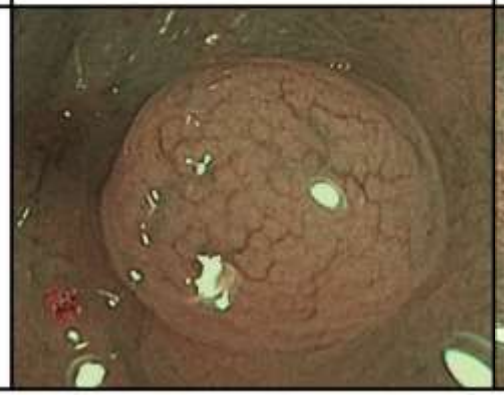
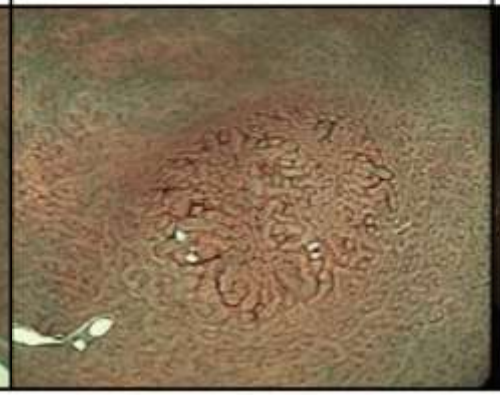
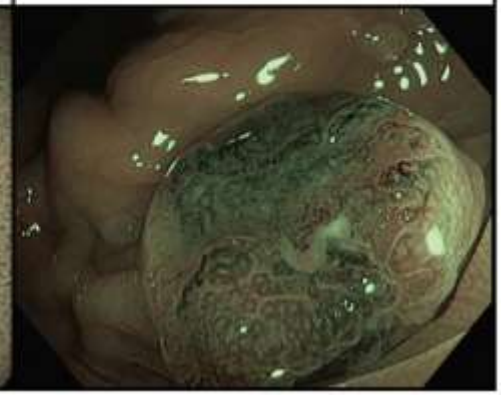
- Hassan et al. – Meta-analysis of 6779 large polyp (> 20 mm) EMR's
  - Perforation 1.5%
  - Bleeding 6.5%
  - Recurrence 13.8%
    - 90% treated endoscopically
  - Non-curative resection 8%
    - Majority were malignant pathology
- Compare to surgical resection Peery et al.
  - Mortality 0.7%
  - Major adverse event 14%
  - Ostomy 2.2%



Hassan C et al. Efficacy and safety of endoscopic resection of large colorectal polyps: a systematic review and meta-analysis. *Gut*. 2016.
Peery AF et al. Morbidity and mortality after surgery for nonmalignant colorectal polyps. *Gastrointestinal Endoscopy*. 2018.
Photo: https://medlineplus.gov/

LESION ASSESSMENT

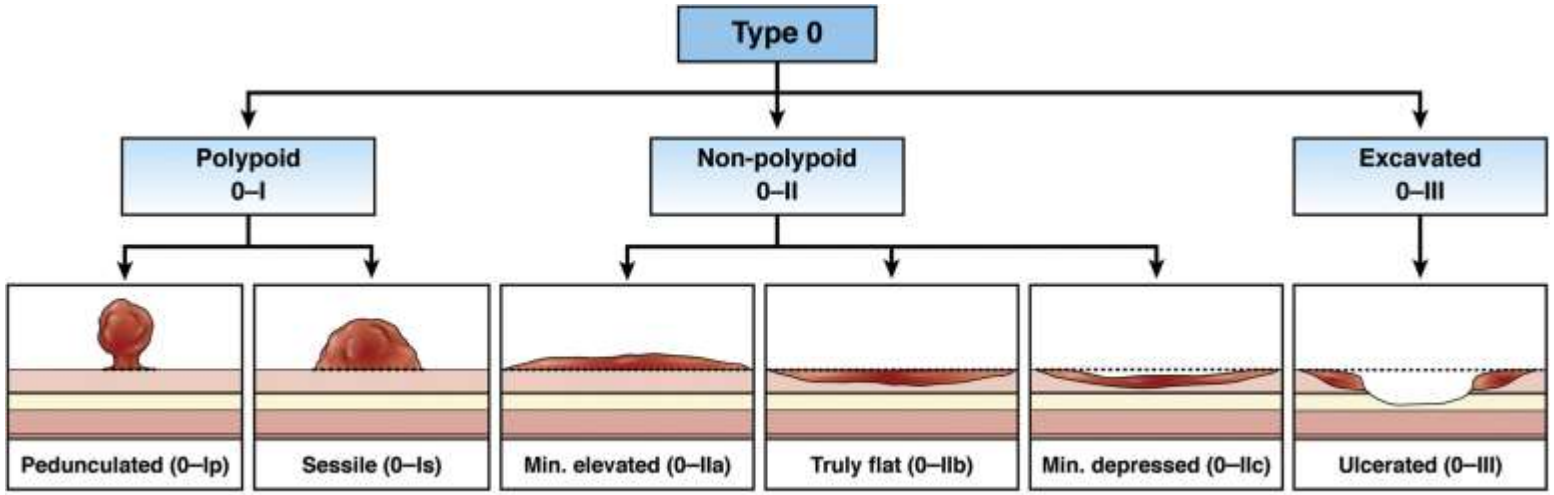
NICE Classification

	Type 1	Type 2	Type 3
Color	Same or lighter than background	Browner relative to background (verify color arises from vessels)	Brown to dark brown relative to background; sometimes patchy whiter areas
Vessels	None, or isolated lacy vessels may be present coursing across the lesion	Brown vessels surrounding white structures**	Has area(s) of disrupted or missing vessels
Surface pattern	Dark or white spots of uniform size, or homogeneous absence of pattern	Oval, tubular, or branched white structures** surrounded by brown vessels	Amorphous or absent surface pattern
Most likely pathology	Hyperplastic and sessile serrated lesions***	Adenoma****	Deep submucosal invasive cancer
			

Hayashi N et al. Endoscopic prediction of deep submucosal invasive carcinoma: validation of the Narrow-Band Imaging International Colorectal Endoscopic (NICE) classification. *Gastrointestinal Endoscopy*. 2013

Hewett DG et al. Validation of a Simple Classification System for Endoscopic Diagnosis of Small Colorectal Polyps Using Narrow-Band Imaging. *Gastroenterology*. 2012.

Paris Classification



Depressed Morphology Predicts Malignancy

- Rembacken et al. n=1000 colonoscopies – size and morphology correlated with malignancy
  - Depressed morphology: 75% risk of malignancy
- Saitoh et al. n=188 polyps – invasive malignancy based on morphology
  - Flat and depressed – 4.5% malignant
  - Polypoid – 0% malignant
- Moss et al. n=514 consecutive polyps >2 cm – invasive malignancy based on morphology
  - Paris IIc or IIa+IIc – 31.8% malignant
  - Paris IIa – 4.1% malignant

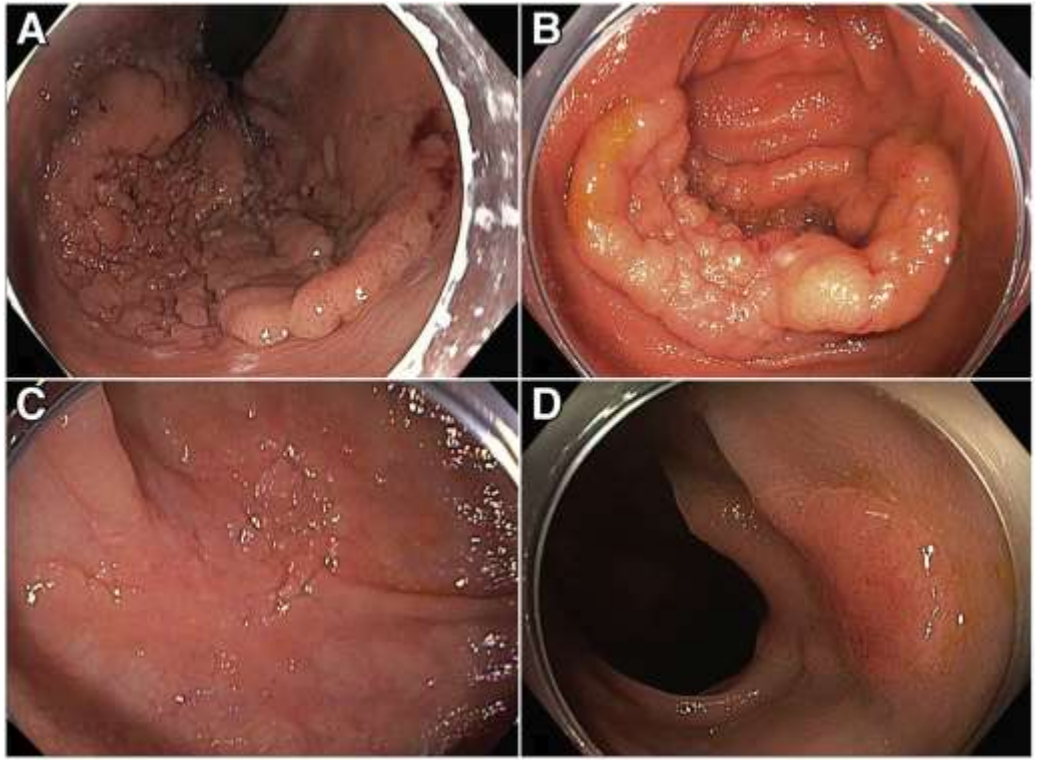
Moss et al.

Paris Classification	n (%)	n (%) with submucosal invasion
Is	146 (30.5)	11 (7.5)
IIa	222 (46.3)	9 (4.1)
IIb	9 (1.9)	1 (11.1)
IIc or IIa + c	22 (4.6)	7 (31.8)
Is + IIa	80 (16.7)	5 (6.3)
III	0 (0)	0 (0)

Saitoh Y et al. Prevalence and distinctive biologic features of flat colorectal adenomas in a North American population. *Gastroenterology*. 2001
Rembacken B et al. Flat and depressed colonic neoplasms: a prospective study of 1000 colonoscopies in the UK. *The Lancet*. 2000.
Moss et al. Endoscopic mucosal resection outcomes and prediction of submucosal cancer from advanced colonic mucosal neoplasia. *Gastroenterology*. 2011

Non-granularity Predicts Malignancy

- Laterally spreading tumor definition
  - Non-polypoid lesions >10 mm in diameter
- Granular (LST-G) definition
  - Nodular surface
  - Surface pattern has branching/lacy grooves
- Non-granular (LST-NG) definition
  - Smooth, featureless surface
- Submucosal invasion in 31.6% LST-NG vs 0.5% LST-G



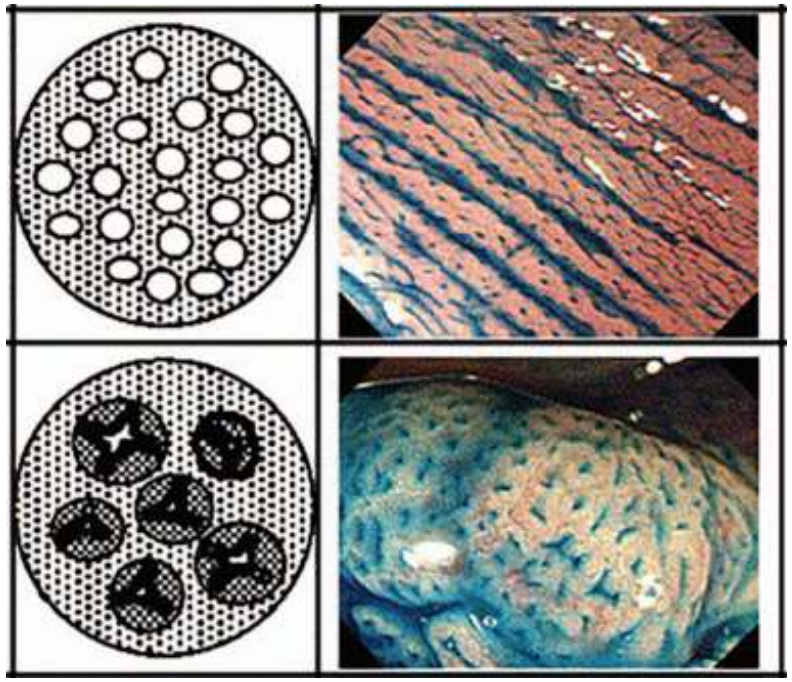
A&B: Granular lesions

C&D: Non-granular lesions

Bogie RMM et al. Endoscopic subtypes of colorectal laterally spreading tumors (LSTs) and the risk of submucosal invasion: A meta-analysis. *Endoscopy*. 2018

Kudo Pit Pattern

I: Normal



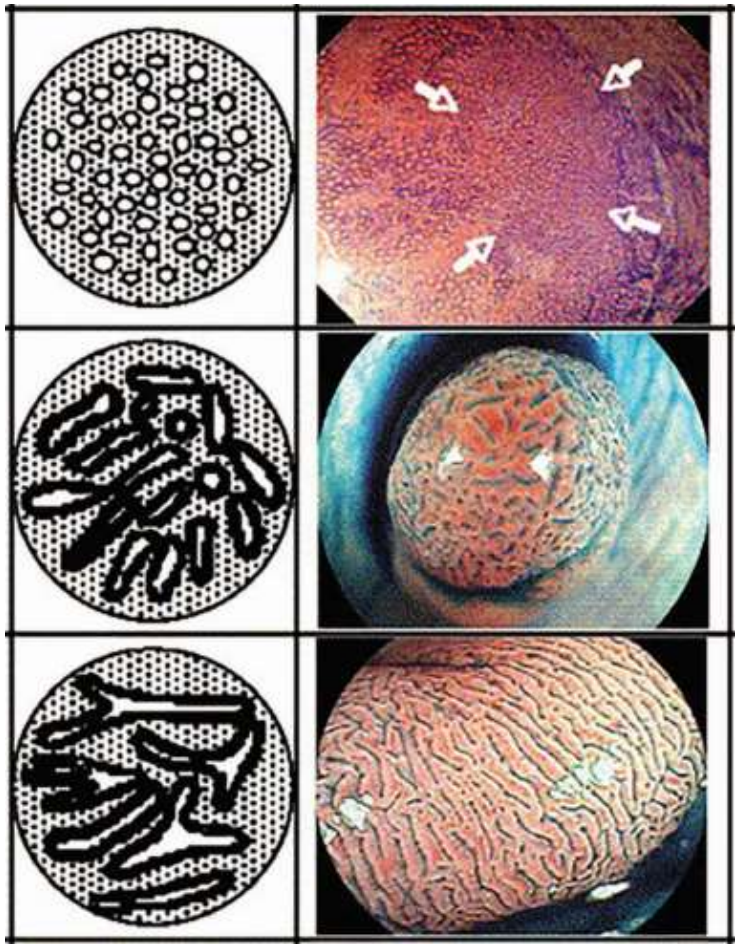
II: Hyperplastic

III_s

III_L

IV

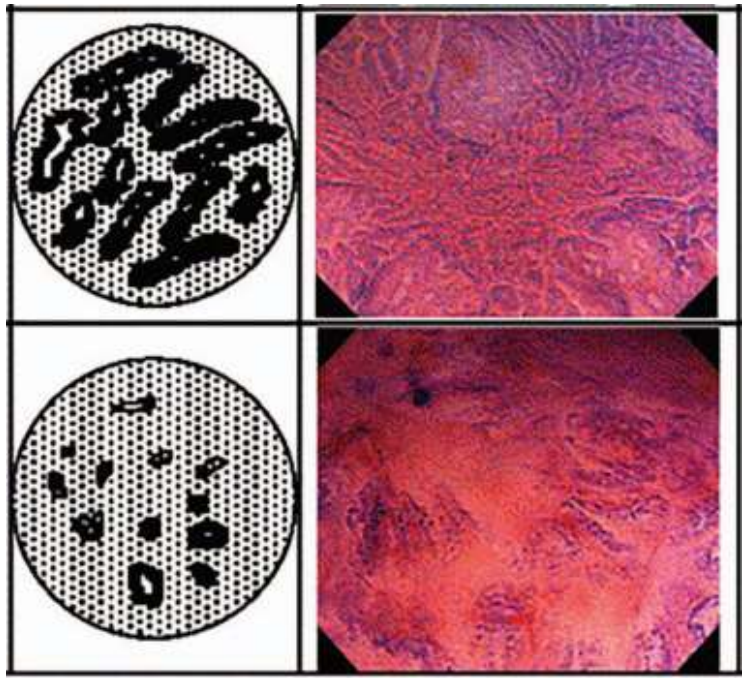
Adenomatous



V_I

V_N

Malignant



Tanaka S et al. High-magnification colonoscopy (with videos). Gastrointest Endosc 2006

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Kudo V pit pattern the strongest malignancy predictor

	n	% of total cohort	n (%) with SMI	*P* value
Kudo pit pattern				
Pit pattern I	7	1.5	0 (0)	<.001
Pit pattern II	41	8.6	0 (0)	
Pit pattern III	182	38.0	8 (4.4)	
Pit pattern IV	202	42.2	10 (5.0)	
Pit pattern V	25	5.2	14 (56.0)	
Unable to classify	22	4.6	1 (4.5)	

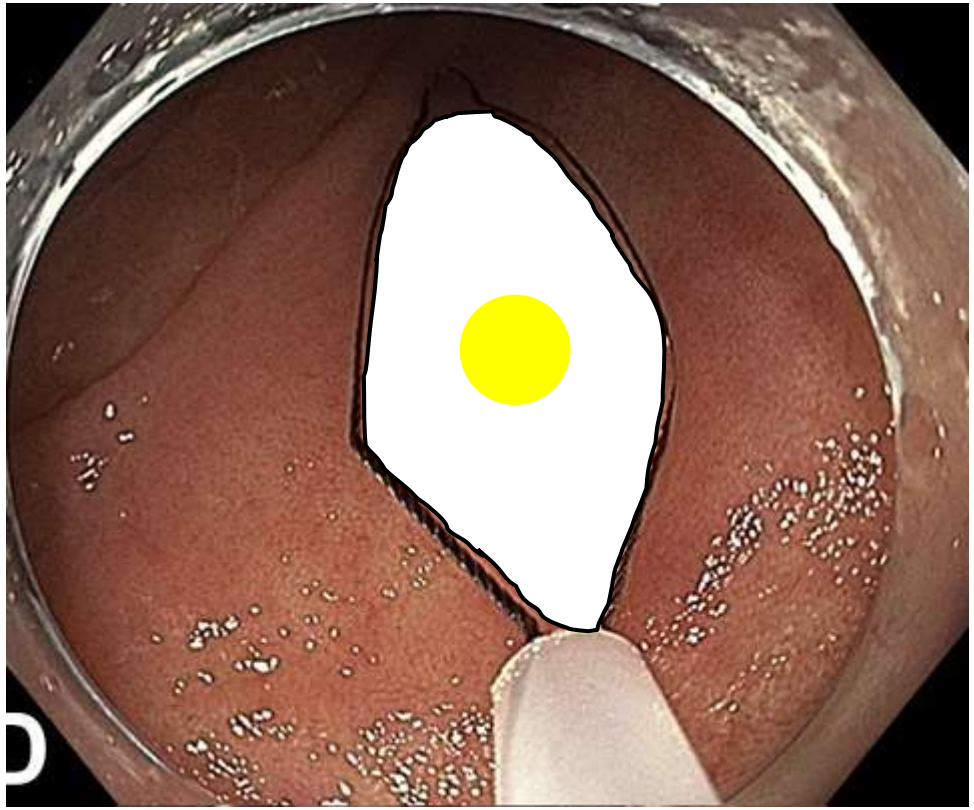
Risk of submucosal invasion (SMI) by Kudo pit pattern in n=514 polyps

Moss et al. Endoscopic mucosal resection outcomes and prediction of submucosal cancer from advanced colonic mucosal neoplasia. *Gastroenterology*. 2011

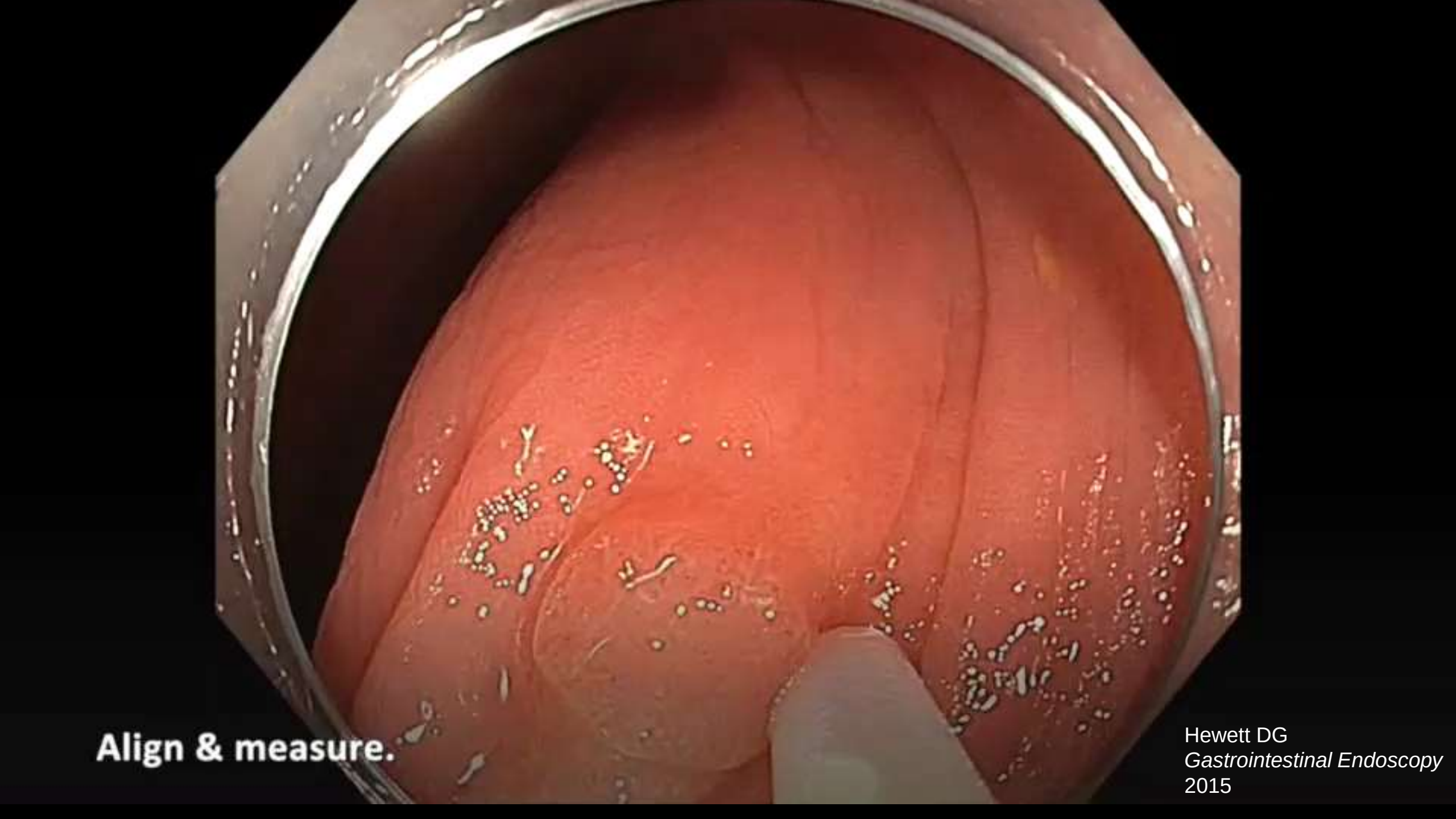
SMALL POLYP RESECTION

Cold Snare Polypectomy for Small Polyps

- Cold snare is best for diminutive (≤5 mm) and small (6-9 mm) polyps
  - Higher complete resection rates compared to forceps
  - Minimal risk of delayed bleeding compared to hot snare
- Jumbo forceps for tiny (1-2 mm) polyps
  - If resectable in one bite
- Use a dedicated cold snare
- “Fried Egg Technique”



Horiuchi A, Hosoi K, Kajiyama M, et al. Prospective, randomized comparison of 2 methods of cold snare polypectomy for small colorectal polyps. Gastrointestinal Endoscopy. 2015.
Raad D, Tripathi P, Cooper G, Falck-Ytter Y. Role of the cold biopsy technique in diminutive and small colonic polyp removal: a systematic review and meta-analysis. Gastrointestinal Endoscopy. 2016;



Hewett DG
Gastrointestinal Endoscopy
2015

EMR TECHNIQUE:
Submucosal Lift

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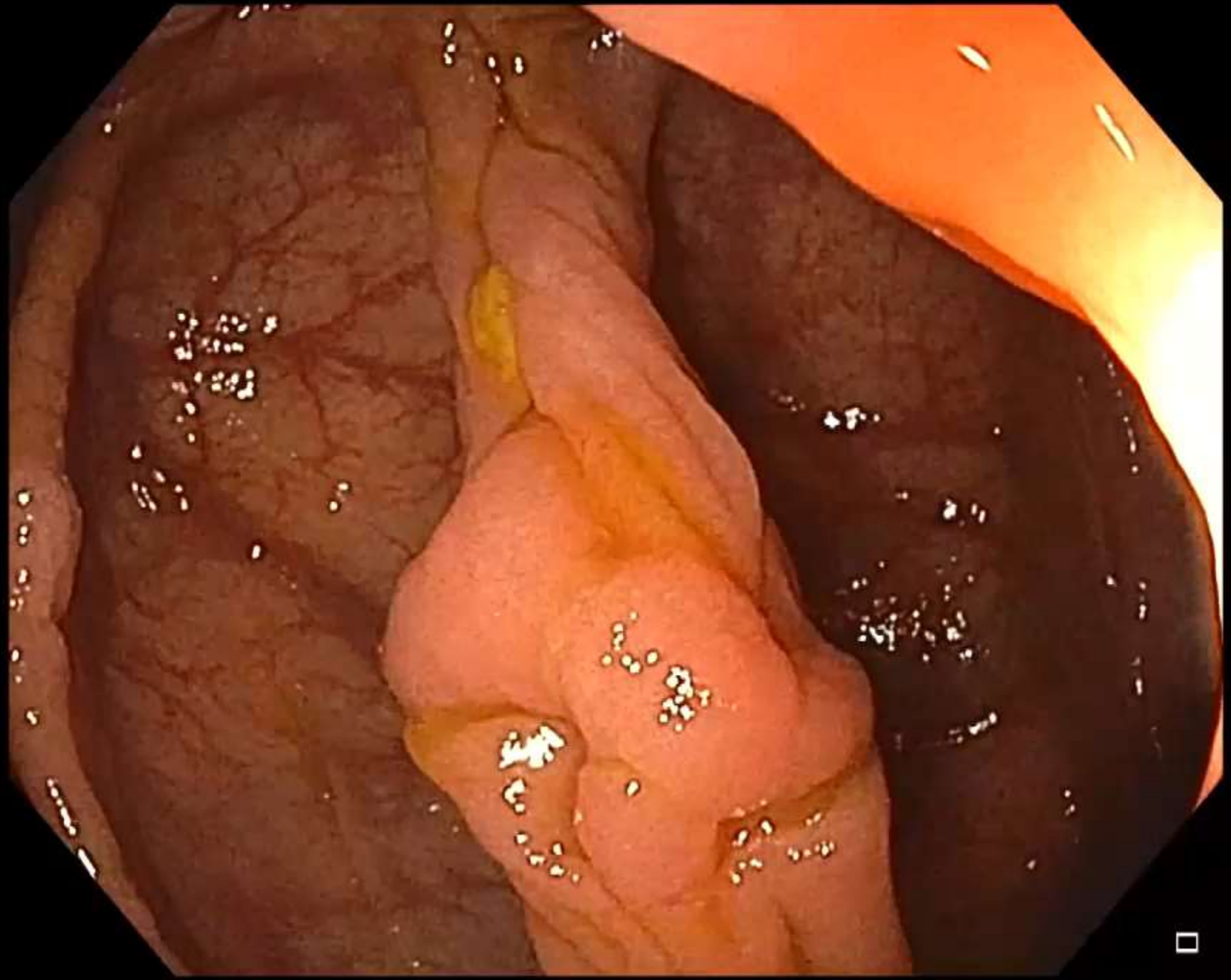
Viscous Solutions Improve Resection Success

- Meta-analysis of five RCT's with different solutions compared to normal saline n=504
  - En-bloc resection OR 1.91 (95% CI 1.11-3.29; p=0.02)
  - Recurrence OR 0.54 (95% CI 0.32-0.91; p=0.02)
  - Similar adverse events
- RCT of a commercial solution SIC-8000 (Eleview) showed reduced resection time

Study	Type of VS	No. of patients	
		NS	VS
Fasoulas et al[4]	Hydroxyethyl starch	24	25
Katsinelos et al[3]	50% dextrose	47	45
Kishihara et al[1]	Sodium hyaluronate	48	46
Moss et al[6]	Succinylated gelatin	39	41
Yoshida et al[2]	Hyaluronic acid	96	93

Summary of randomized controlled trials included (NS = normal saline; VS = viscous solution)

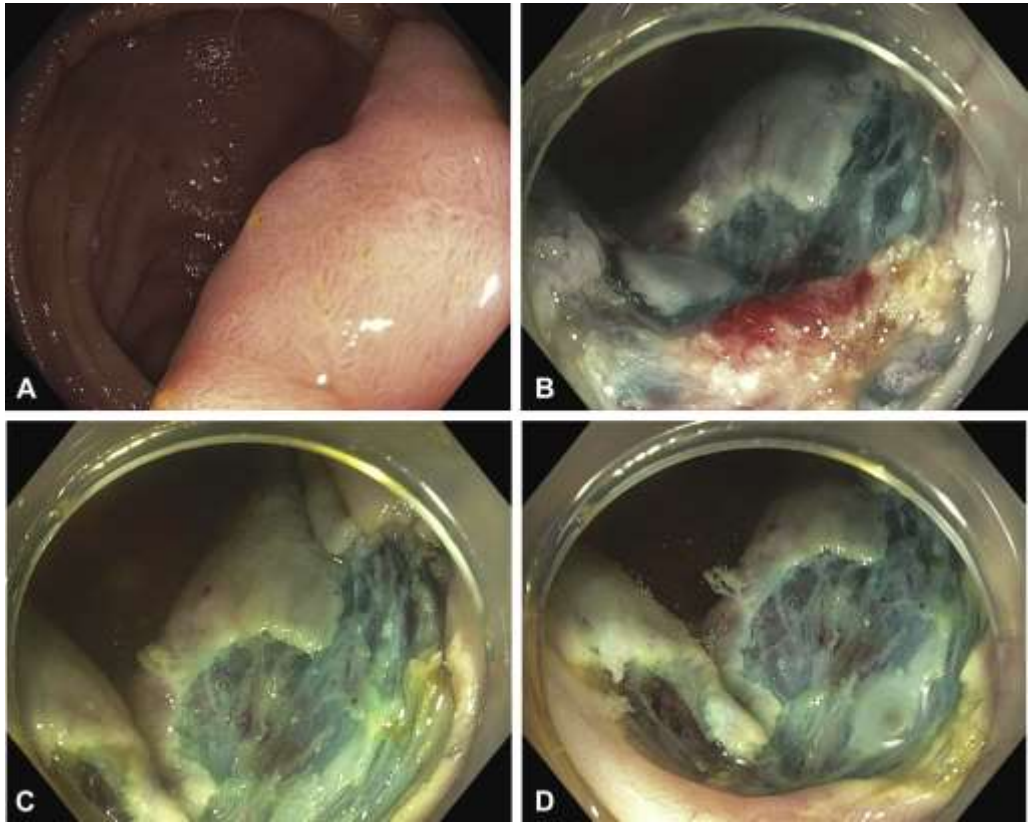
Yandrapu H et al. Normal saline solution versus other viscous solutions for submucosal injection during endoscopic mucosal resection: a systematic review and meta-analysis. *Gastrointestinal Endoscopy*. 2017.
Repici A. A novel submucosal injection solution for endoscopic resection of large colorectal lesions: a randomized, double-blind trial. *Gastrointestinal Endoscopy*. 2018.



EMR TECHNIQUE:
Residual Tissue and Margins

Residual Tissue Should be Resected, NOT Ablated

- **Ablation** (such as argon plasma coagulation) is not effective for tissue destruction
- **Avulsion** using hot biopsy forceps is effective for resection of residual tissue
- Retrospective study n=99 piecemeal EMR's with residual tissue
  - Recurrence **59.3% APC** vs **10.3% avulsion**



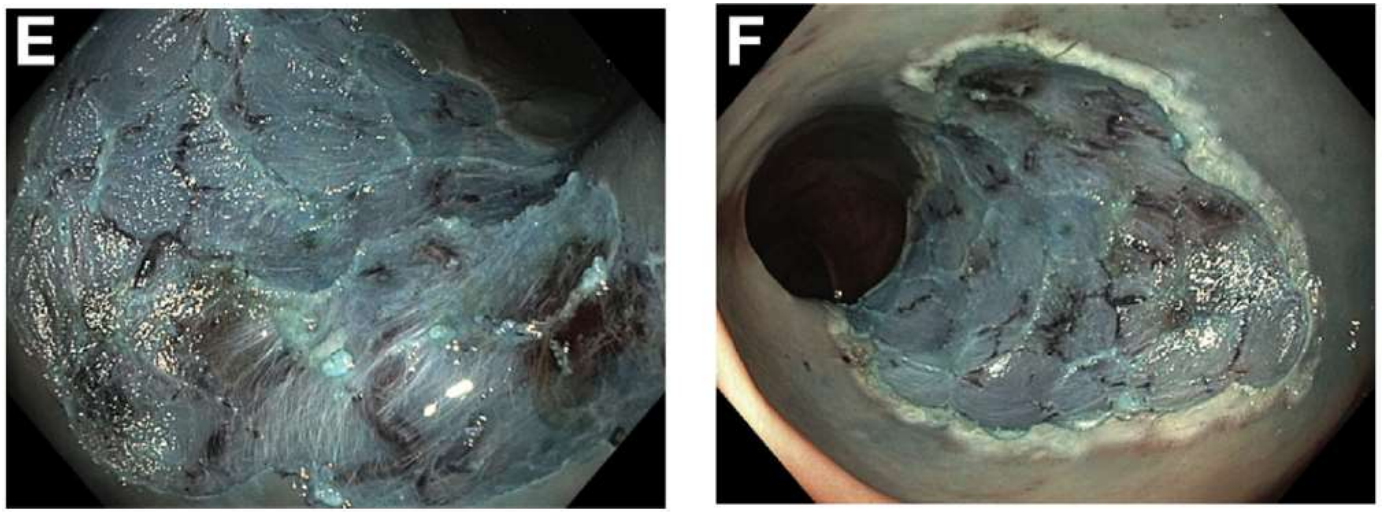
Example of avulsion for residual tissue

Holmes I et al.. Avulsion is superior to argon plasma coagulation for treatment of visible residual neoplasia during EMR of colorectal polyps (with videos). *Gastrointestinal Endoscopy*. 2016.
Andrawes S, Haber G. Avulsion: a novel technique to achieve complete resection of difficult colon polyps. *Gastrointestinal Endoscopy*. 2014.


20

Ablation of Resection Defect Margins Reduces Recurrence

- RCT of snare tip soft coagulation (STSC) of defect margin after complete EMR with visibly clean margins n=416 polyps >20 mm
  - Recurrence **5.2% STSC** vs **21% controls** (p<.001)
- Replicated in a multi-center prospective trial n=707 polyps underwent STSC
  - Recurrence **1.4%**
- Ongoing research of optimal ablation technique

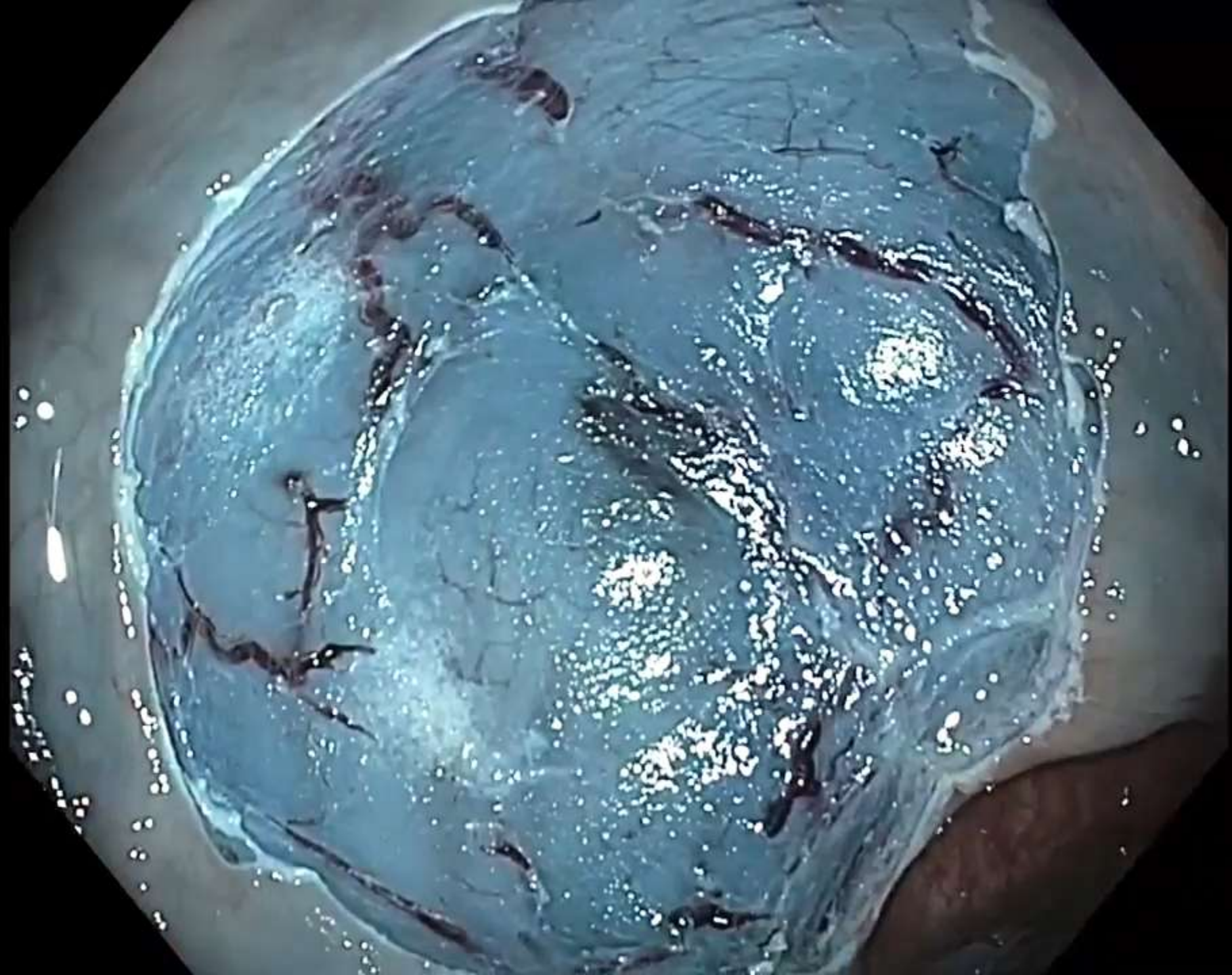


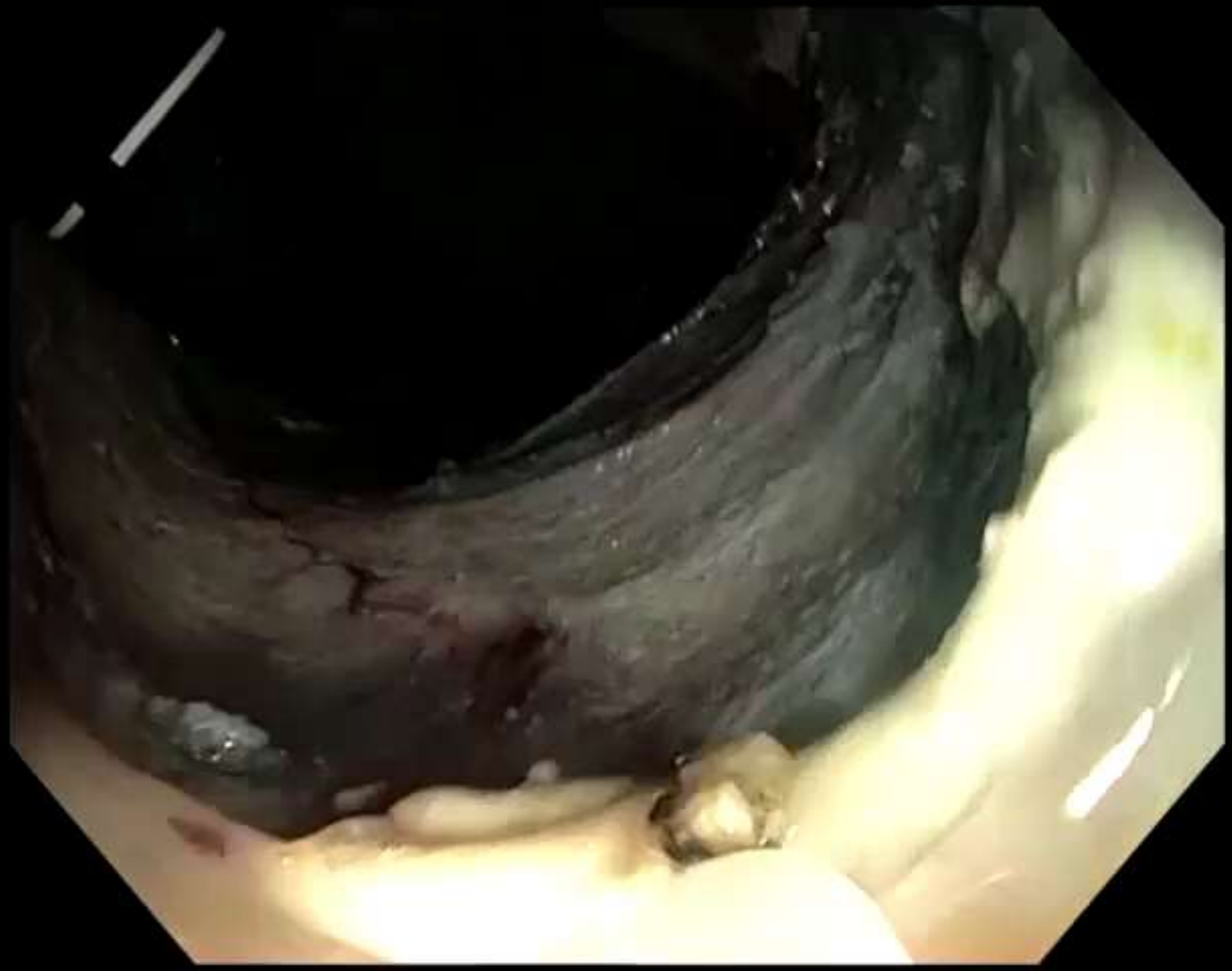
EMR resection defect

E) Before snare tip soft coagulation (STSC)

F) After STSC

Klein A, et al. Thermal Ablation of Mucosal Defect Margins Reduces Adenoma Recurrence After Colonic Endoscopic Mucosal Resection. *Gastroenterology*. 2019.
Sidhu M, et al.. Outcomes of Thermal Ablation of the Mucosal Defect Margin After Endoscopic Mucosal Resection: A Prospective, International, Multicenter Trial of 1000 Large Nonpedunculated Colorectal Polyps. *Gastroenterology*. 2021.





EMR TECHNIQUE:
Defect Closure

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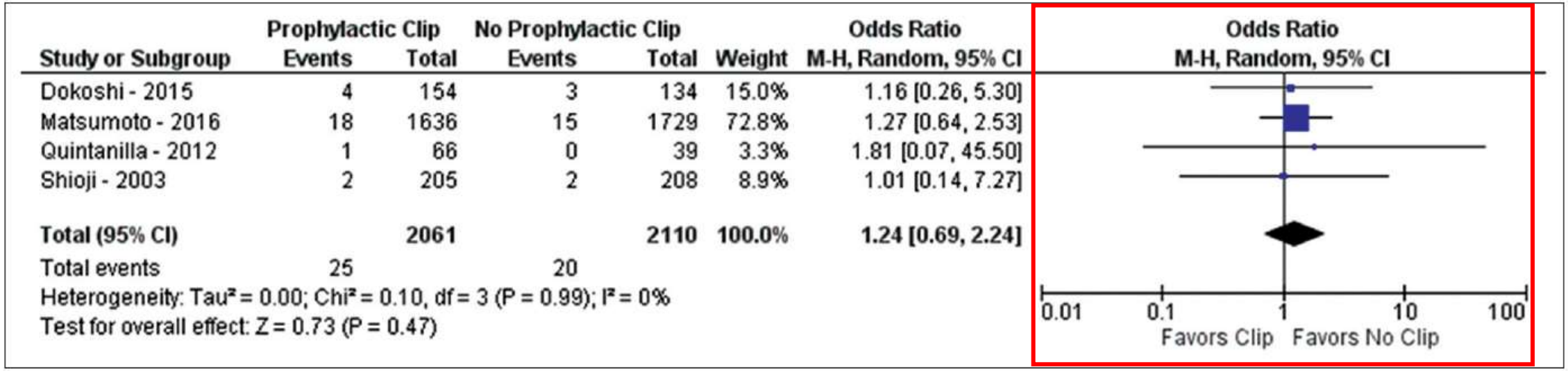
Prophylactic Clip Closure to Prevent Bleeding Has Mixed Results

- Multiple RCT's have shown no benefit in prophylactic clipping after polypectomy
- Caveat: many of these polyps were < 1 cm



Study or Subgroup	Prophylactic Clip Events	Prophylactic Clip Total	No Prophylactic Clip Events	No Prophylactic Clip Total	Weight	Odds Ratio M-H, Random, 95% CI
Dokoshi - 2015	4	154	3	134	15.0%	1.16 [0.26, 5.30]
Matsumoto - 2016	18	1636	15	1729	72.8%	1.27 [0.64, 2.53]
Quintanilla - 2012	1	66	0	39	3.3%	1.81 [0.07, 45.50]
Shioji - 2003	2	205	2	208	8.9%	1.01 [0.14, 7.27]
Total (95% CI)		**2061**		**2110**	**100.0%**	**1.24 [0.69, 2.24]**
Total events	25		20			

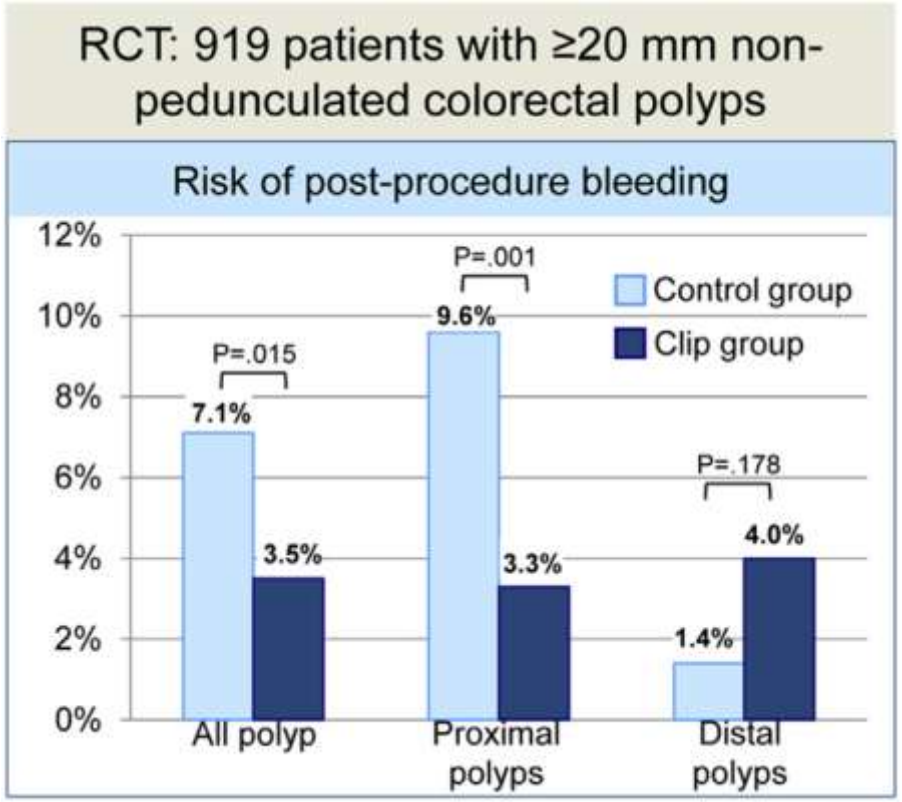
Heterogeneity: Tau² = 0.00; Chi² = 0.10, df = 3 (P = 0.99); I² = 0%
Test for overall effect: Z = 0.73 (P = 0.47)

Figure 4 Forest plot showing the comparison between prophylactic clipping and no prophylactic clipping for polypectomies in only randomized controlled trials

Boumitri C, Mir FA, Ashraf I, et al. Prophylactic clipping and post-polypectomy bleeding: a meta-analysis and systematic review. *Ann Gastroenterol*. 2016.

Closure of Resection Sites of Polyps >20 mm in the Right Colon Reduces Bleeding

- Large RCT n = 919 polyps >20 mm showed reduced bleeding with clip closure
  - Subgroup analysis indicated the benefit was entirely attributed to proximal polyps
  - Proximal defined as hepatic flexure, ascending, cecum
- Partial clipping is inadequate



Liaquat H, Rohn E, Rex DK. Prophylactic clip closure reduced the risk of delayed postpolypectomy hemorrhage: experience in 277 clipped large sessile or flat colorectal lesions and 247 control lesions. *Gastrointestinal Endoscopy*. 2013.

Pohl H, Grimm IS, Moyer MT, et al. Clip Closure Prevents Bleeding After Endoscopic Resection of Large Colon Polyps in a Randomized Trial. *Gastroenterology*. 2019.

EMR TECHNIQUE:
Mechanical Ligation of Pedunculated Polyp Stalk

Endoscopic Detachable Snare Reduces Bleeding in Pedunculated Polyps

- Efficacy for bleeding prevention after snare polypectomy evaluated in RCT
- Total 488 patients, polyps >1 cm
  - A) detachable snare n=163
  - B) epinephrine n=161
  - C) control (nothing) n=164
- Reduced bleeding risk in polyps >2 cm compared to controls
  - Comparable to epinephrine

Table 3 Bleeding and polyp size

	Group A (detachable snare)	Group B (epinephrine injection)	Group C (control group)
Polyps 1.0–1.9 cm	91	92	98
Bleeding	1 (1.1%)	3 (3.2%)	3 (3.1%)
Polyps ≥ 2 cm	72	69	66
Bleeding	2* (2.7%)	2* (2.9%)	10 (15.1%)

* $P < 0.05$ versus the control group.

Di Giorgio P, De Luca L, Calcagno G, Rivellini G, Mandato M, De Luca B. Detachable snare versus epinephrine injection in the prevention of postpolypectomy bleeding: a randomized and controlled study. Endoscopy. 2004 Oct;36(10):860-3

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EMR TECHNIQUE:
Closure of Large Defects

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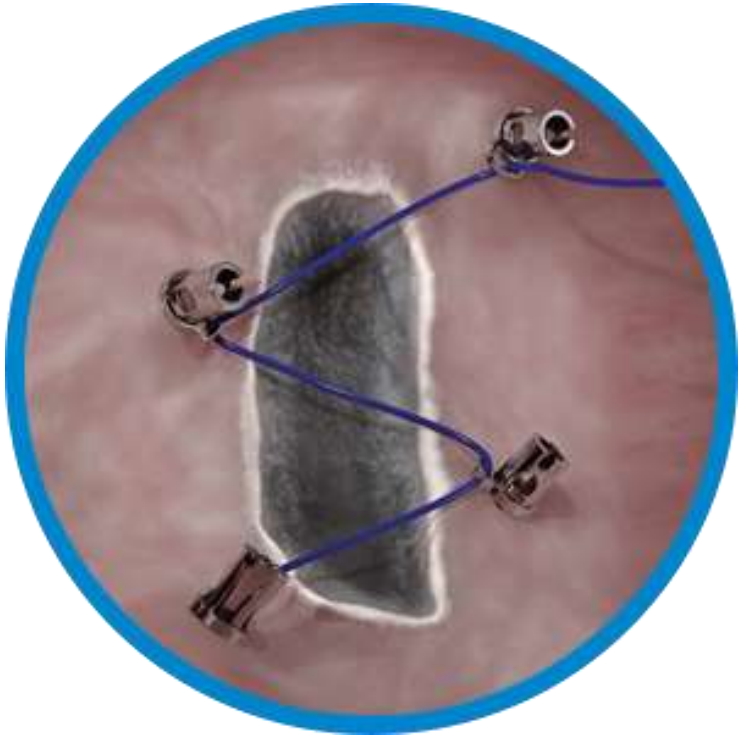
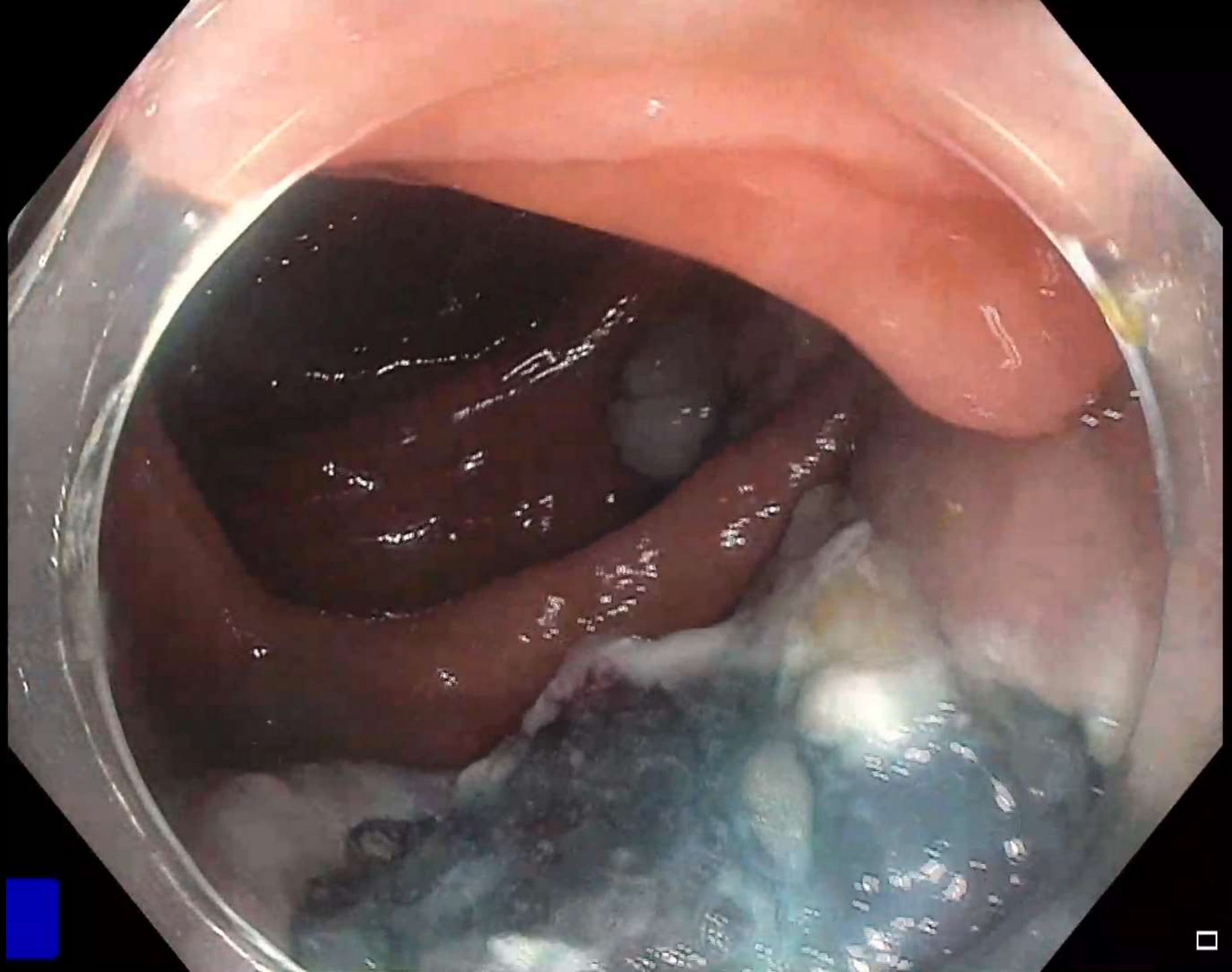
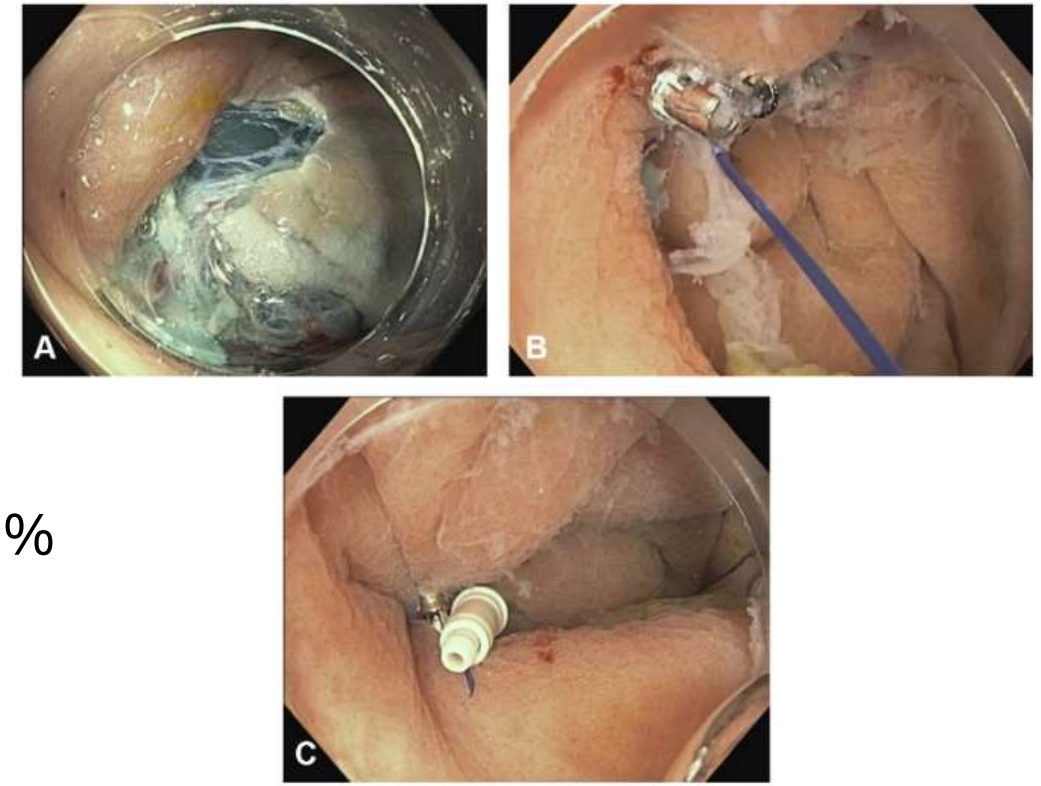
Through The Scope Suturing (X-Tack) for Large Defects





Mahmoud et al. Through The Scope Suturing

- Retrospective study n=93 patients
- Variety of indications
  - ESD 37.6%
  - EMR 20.4%
  - Stent fixation 14.0%
  - Fistula 11.8%
- Closure not feasible by another method in 24.7%
- Results
  - Technical success 89.2%
  - Single device used in 68.8%
  - Supplemental closure 24.7% (22.6% TTS clips)
  - One post-procedural bleed in a small bowel resection



1. Mahmoud T, Wong Kee Song LM, Stavropoulos SN, et al. *Gastrointestinal Endoscopy*. 2022.

Through The Scope Suturing Cost

TABLE 3. Advantages, disadvantages, and cost comparison of X-Tack, TTS clips, OTS clips, and OverStitch device

Device	Advantages	Disadvantages	Cost (U.S.$)
X-Tack	Efficacious for defects >30 mm Closure of irregularly shaped defects Closure of defects in the proximal colon No need for endoscope withdrawal Ease of use	Robustness of closure force undetermined	695 per device and cinch
TTS clips	Well studied Ease of use	Restricted grasp of tissue Low closure force Need for multiple clips Expensive if multiple clips are needed	150-250 per clip
OTS clips	Larger clip size compared with TTS clips Robust closure	Efficacious for defects <20 mm Need for endoscope withdrawal and device loading Device passage through narrowed, angulated lumen	438-600 per clip
OverStitch	No defect size limitation Full-thickness closure	Need for endoscope withdrawal and device loading Restricted access because of need for specialized double-channel upper endoscope Learning curve Expensive	1000 per 1 suture system 125 per additional suture and cinch

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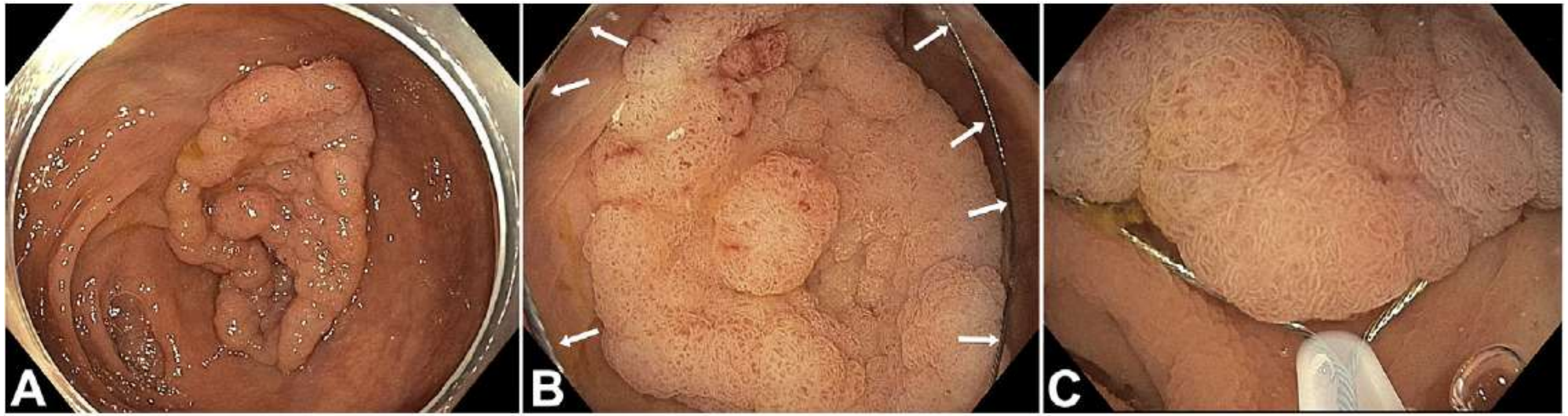
EMR TECHNIQUE: Novel Approaches

Underwater EMR – Lower Recurrence?

- Binmoeller et al. 2015 – attempted en bloc resection without lift in 53 LST's 20-40 mm in size
  - En bloc resection rate 55%
  - Recurrence rate 5%



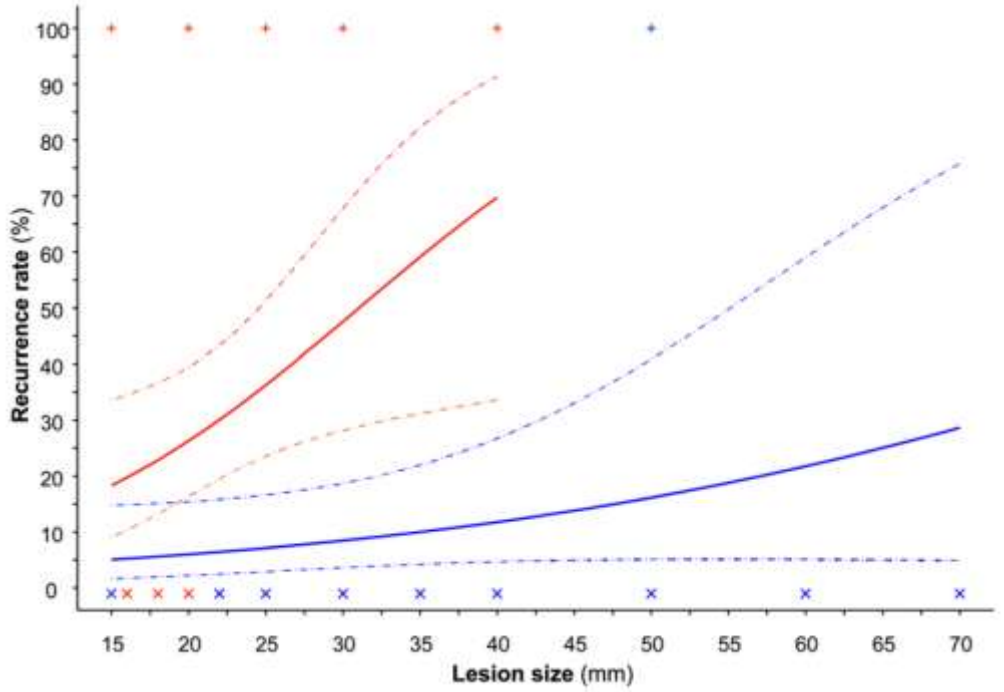
Laterally spreading tumor as viewed with A) gas insufflation B&C) underwater

Binmoeller KF, Hamerski CM, Shah JN, Bhat YM, Kane SD, Garcia-Kennedy R. Attempted underwater en bloc resection for large (2-4 cm) colorectal laterally spreading tumors (with video). *Gastrointestinal Endoscopy*. 2015.

4 cm granular IIa LST in cecum

Underwater EMR (UEMR) – Lower Recurrence?

- Schenck et al. 2017 – RCT with n= 101 polyps, single endoscopist
- Recurrence UEMR 7.3% vs EMR 28.3%



Recurrence based on lesion size for

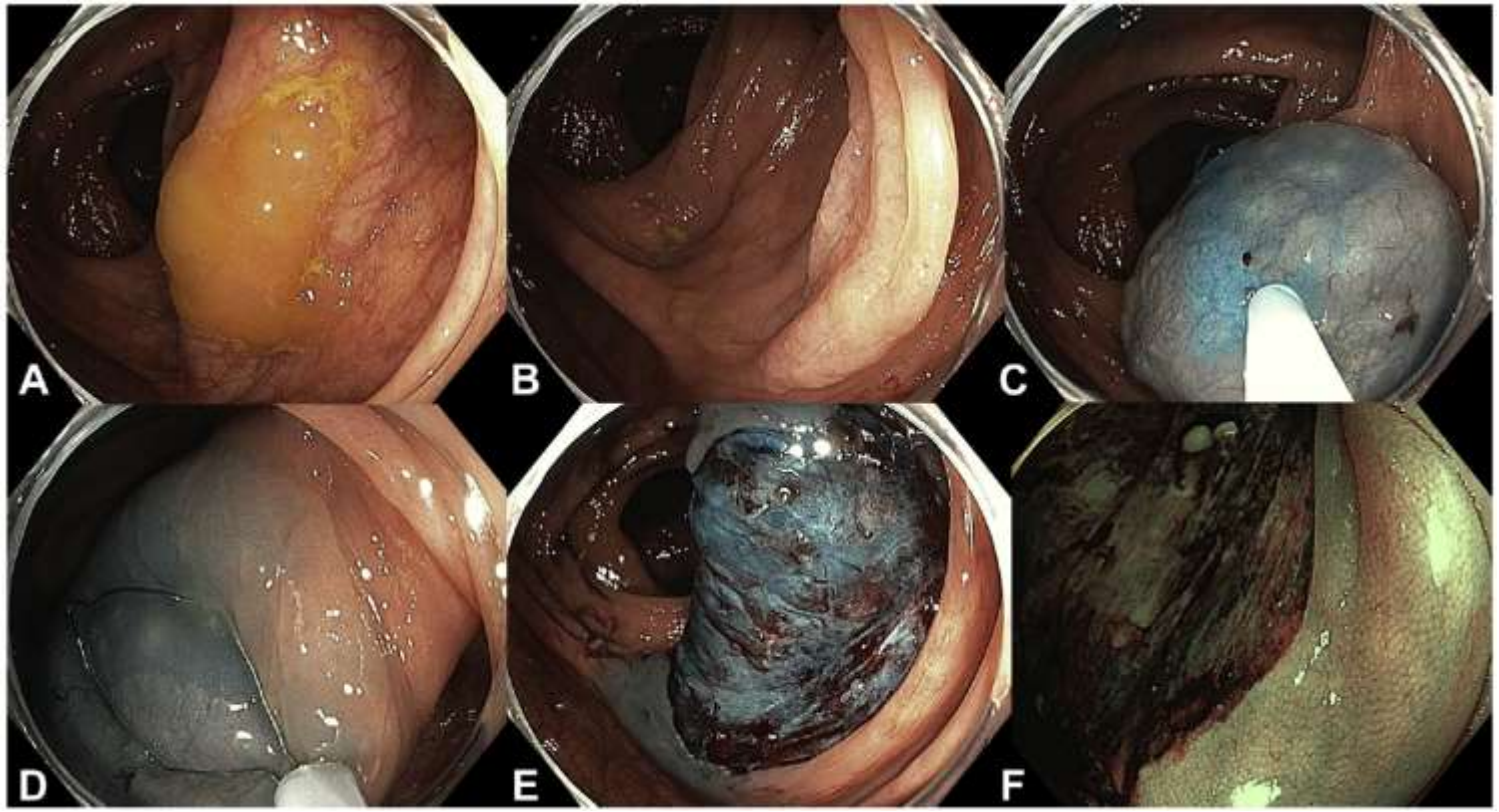
EMR (red) vs UEMR (blue)

Hatched line – 95% CI

Schenck RJ et al. Underwater endoscopic mucosal resection is associated with fewer recurrences and earlier curative resections compared to conventional endoscopic mucosal resection for large colorectal polyps. *Surg Endosc*. 2017

Cold Snare EMR to Avoid Delayed Bleeding

- Initial description Tutticci et al 2018
- N=163 sessile serrated polyps
- Follow-up on 82% (134) – only 1 residual (0.6%)
- No delayed bleeding



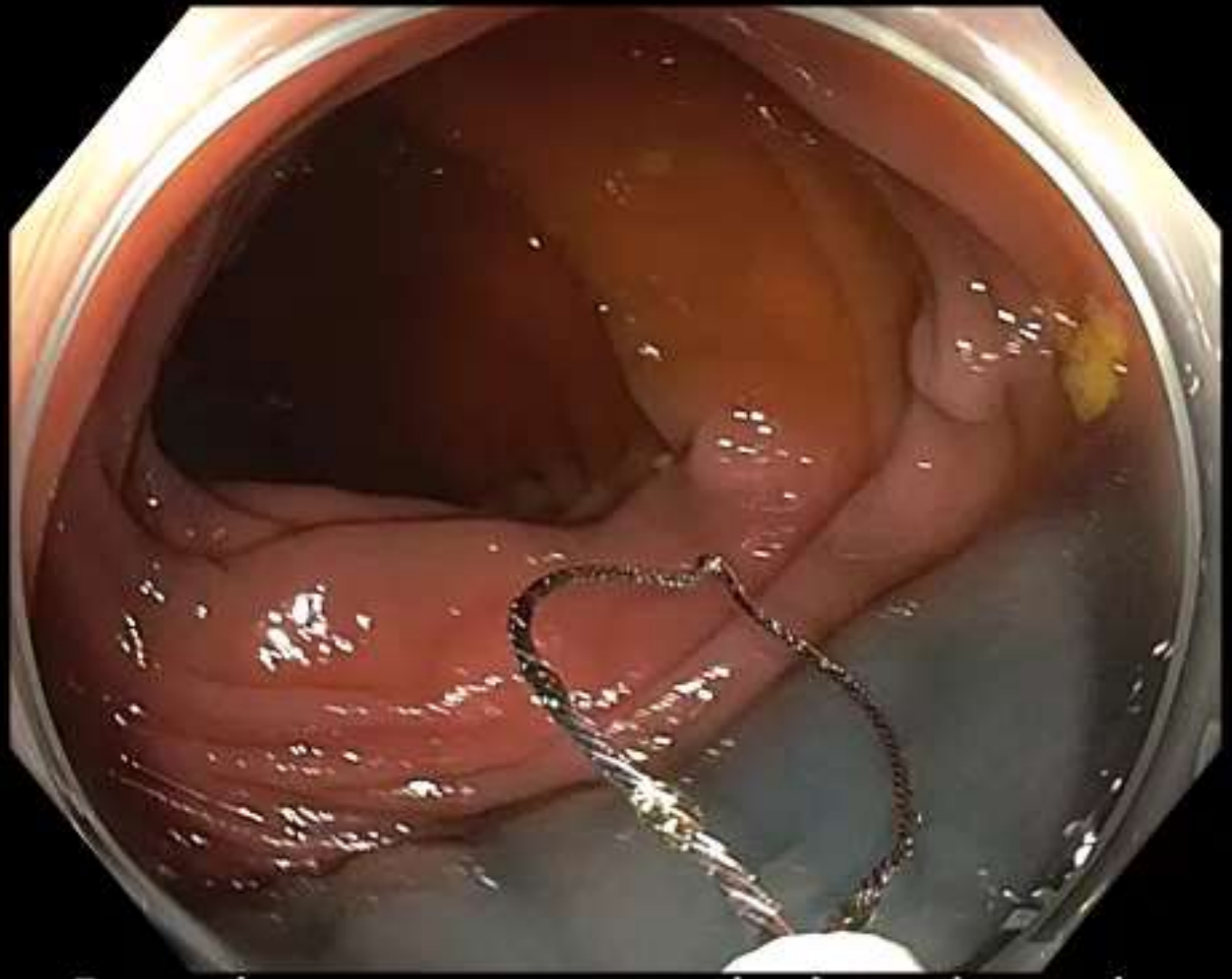
Cold EMR procedure photos

Tutticci NJ, Hewett DG. Cold EMR of large sessile serrated polyps at colonoscopy (with video). *Gastrointestinal Endoscopy*. 2018

Cold Snare EMR: Less Delayed Bleeding, Comparable Recurrence

Study	Design	Size of Polyps	Number of Polyps		Recurrence Rate	Delayed Bleeding Rate
Van Hattem 2020	Retrospective	≥20 mm	CS-EMR	121	4.3%	0
			C-EMR	353	3.6%	1.4%
Li 2020	RCT	6-20 mm	CS-EMR	132	Not reported	0.8%
			C-EMR	137	Not reported	2.6%

CS-EMR: Cold snare EMR
C-EMR: Conventional EMR



Resection commences at the lateral margin including a generous area of normal mucosa

BEYOND EMR:
Endoscopic Submucosal Dissection (ESD)

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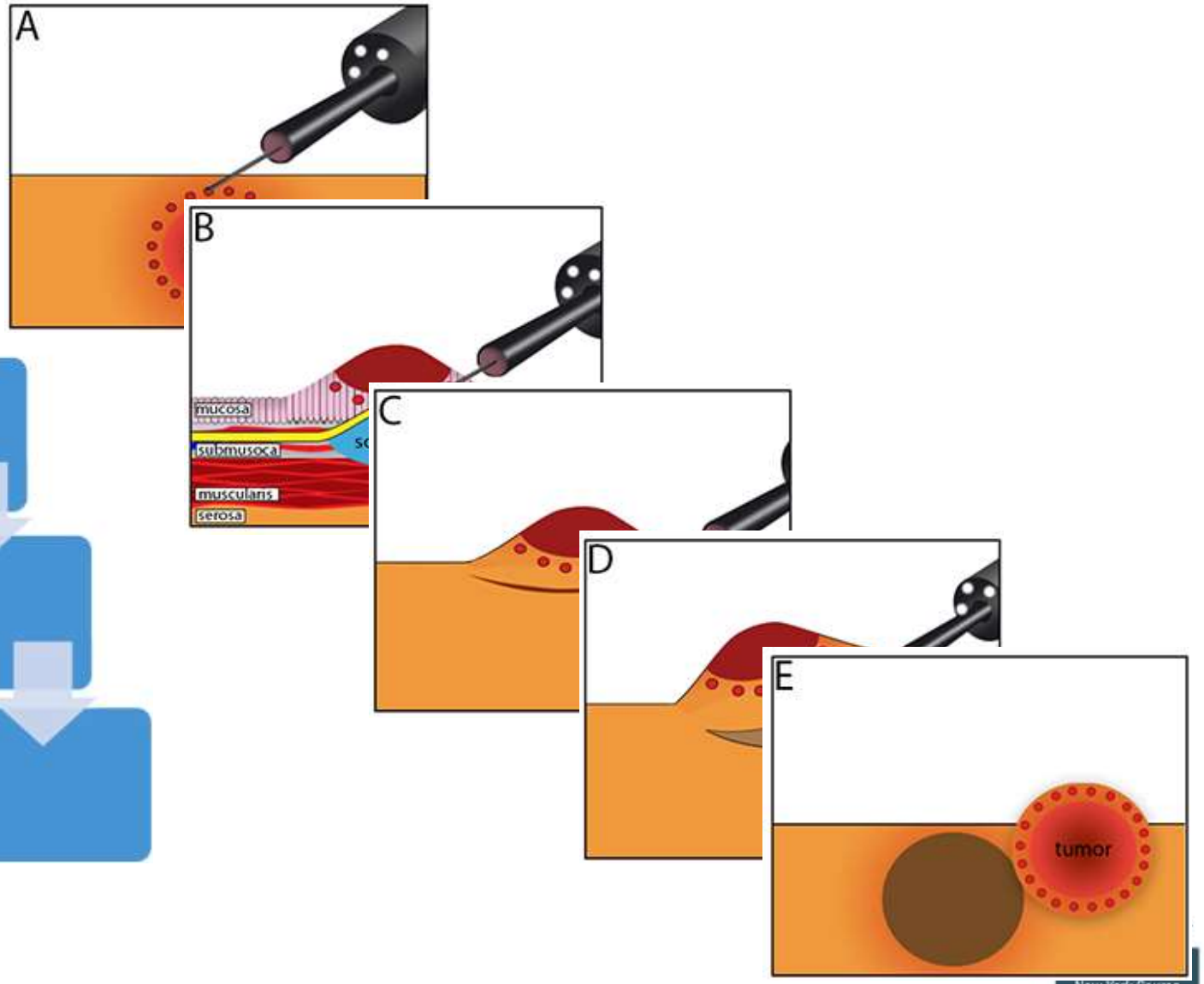
Basic ESD Technique

- Detail Evaluation Of Lesion By Narrow Band Imaging (NBI) Or Chromoendoscopy or endoscopic ultrasound (EUS)
- Marking With Argon Plasma Coagulation (Apc) Or Cautery At The Periphery Of Lesion (3-5 Mm From The Margin)
- Submucosal Injection
- Circumferential Incision With Esd-knife
- Reinjection Of Submucosal Solution And Cautery Dissection Aiming For Enbloc Resection Of Lesion



Rashid et al. EMR and ESD: Indications, techniques, and results. *Surgical Oncology*. 2022.

Indications for ESD

- Advantage of ESD is en-bloc resection with deep and lateral margin assessment
- Utility is in lesions in which EMR may not be technically successful or there is high suspicion for malignancy
  - Kudo V pit pattern
  - Non-granular lesions
  - Depressed morphology (Paris IIa or IIa+c)
  - Bulky lesions (Paris Is or Is+IIa)
  - Prior resection attempts with fibrosis
  - IBD associated lesions

Rashid et al. EMR and ESD: Indications, techniques, and results. *Surgical Oncology*. 2022.

ESD vs EMR

ESD is superior for complete and definitive resection

En bloc resection

ESD 84-95% vs EMR 33-57%

Recurrence

ESD 0-2% vs EMR 12-26%

EMR is technically simpler and has a lower complication rate

Bleeding rates

Equivalent

Perforation rates

ESR 2-5% vs EMR ~1%

Rashid et al. EMR and ESD: Indications, techniques, and results. *Surgical Oncology*. 2022.

Endoscopic Full Thickness Resection

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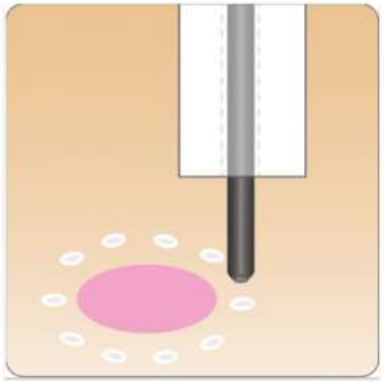
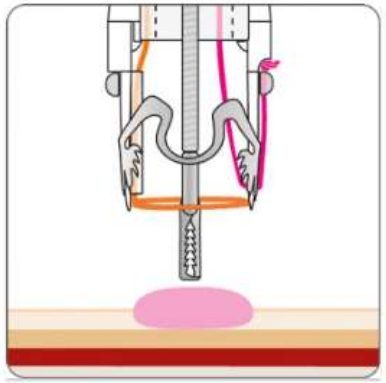
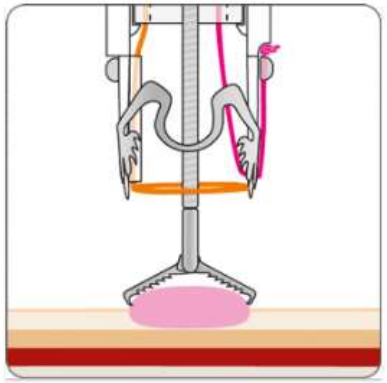
Full Thickness Resection Device (FTRD)



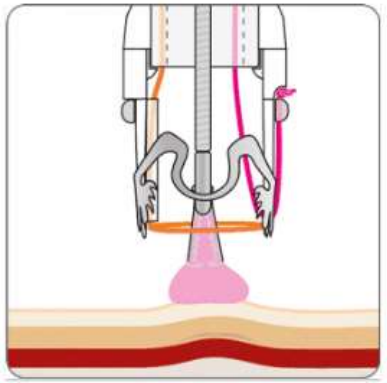
Marking of the lesion with the FTRD® Marking Probe



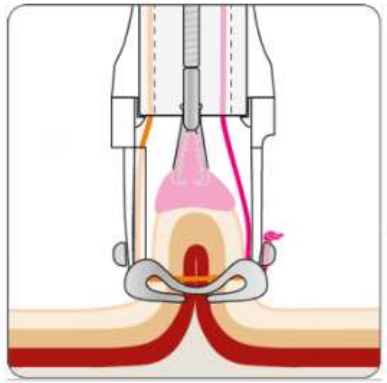
Insert the endoscope to the resection site and adjust lesion



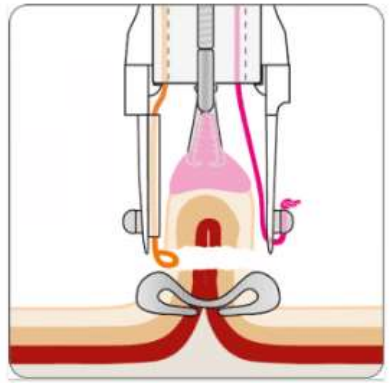
Grasping and mobilizing the lesion with the FTRD® Grasper (1)



Grasping and mobilizing the lesion with the FTRD® Grasper (2)



Ensure lesion is completely in the cap Fix FTRD® Grasper Apply clip



Resect tissue and retrieve specimen

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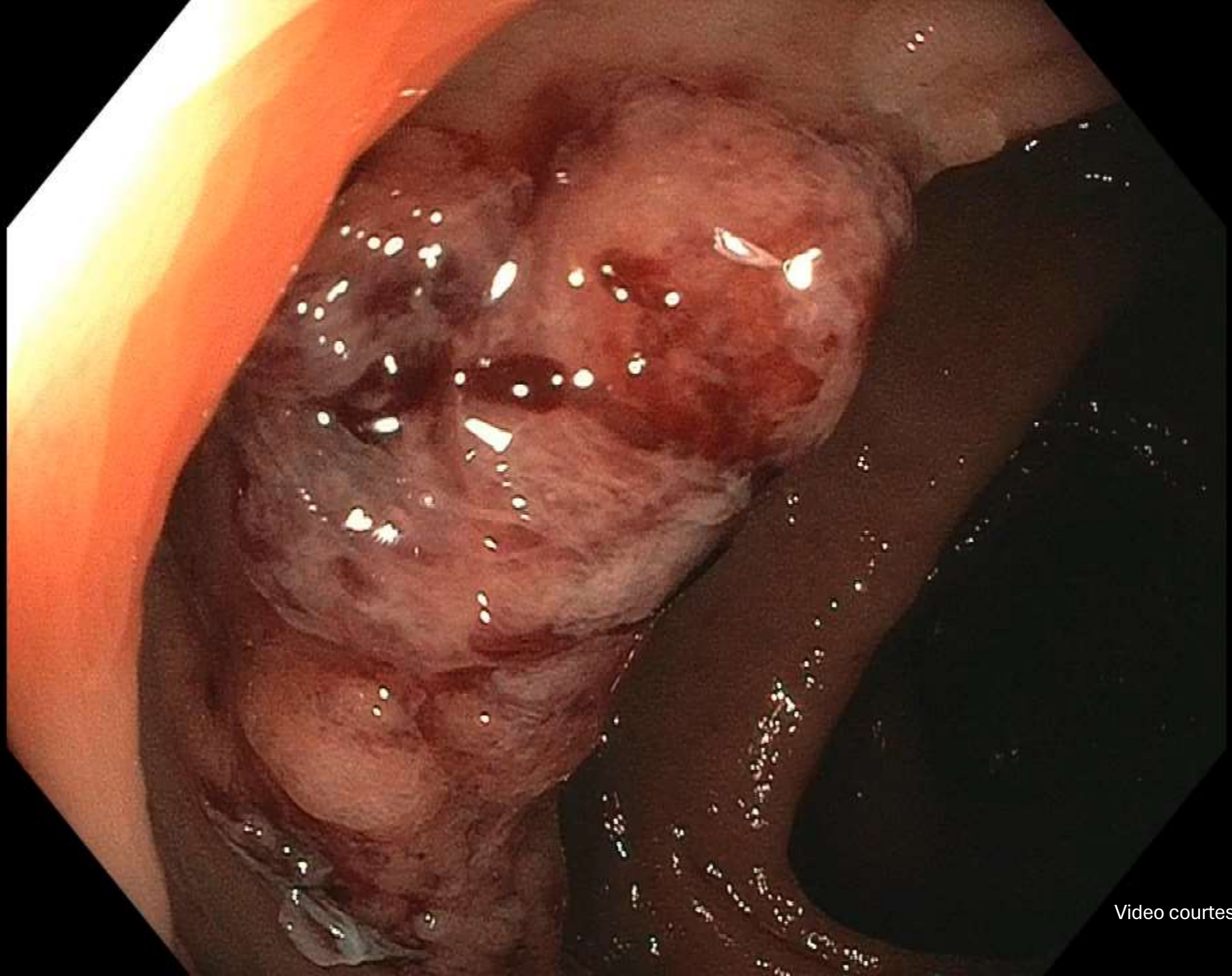
FTRD Colonic Applications

- Applications
  - Non-lifting colonic polyps
  - Recurrence after prior resection attempts
  - Suspected T1 carcinoma
  - Subepithelial lesions
  - Appendiceal polyps
- Considerations
  - Size of lesion
  - Location of lesion
  - Ability to pull into cap



Video courtesy of Nikhil Kumta MD

Prospective FTRD Data

- Consecutive prospective patients (N=367) who underwent FTRD of colorectal lesions
- Indications
  - Difficult polyps n=133
  - Suspected T1 cancer n=71
  - Re-resection after incomplete resection of T1 cancer n=150
  - Subepithelial tumors n=13

Zwager et al. Endoscopic full-thickness resection (eFTR) of colorectal lesions: results from the Dutch colorectal eFTR registry. Endoscopy. 2020.

FTRD has High Complete Resection Rates

- Results
  - Technical success in 308/367 procedures (83.9%)
  - eFTR not feasible in 5.7% (21 patients)
    - Unable to reach lesion or retract into cap
  - R0 resection 285 patients (82.4%)
    - R0 highest in T1 CRC's 88.2%
    - R0 lowest in difficult polyps 70.5%
  - Mean diameter of resected specimen 23 mm
  - Adverse events 9.3%
    - Surgery in 2.7% (10 patients) for n=7 perforation or n=3 appendicitis

BEYOND EMR
Powered Endoscopic Debridement

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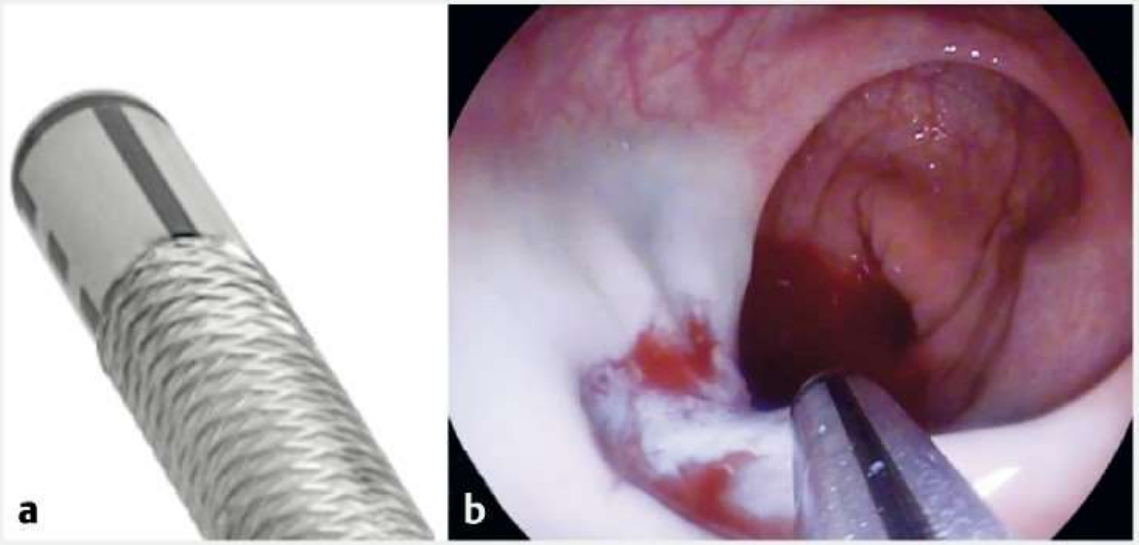
Powered Endoscopic Debridement (EndoRotor)



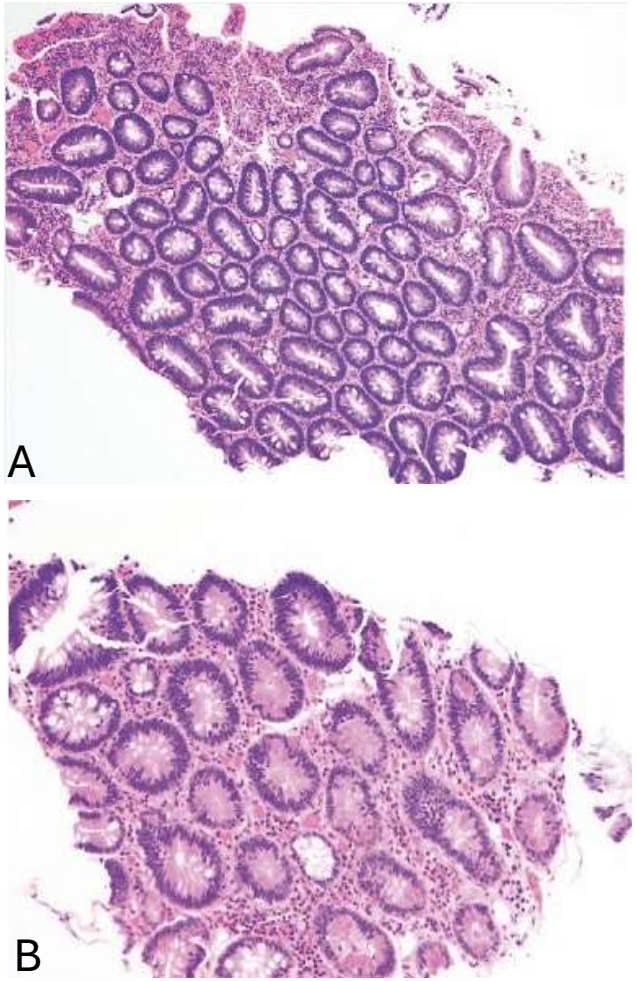
Video courtesy of Satish Nagula MD

Kandiah et al. Scarred Polyp Management with EndoRotor

- Case series, N = 19 patients with scarred polyps
- Submucosal injection used
- EMR initially to debulk if sessile
- Follow up examination at 2 months

Kandiah et al. Scarred Polyp Management with EndoRotor

- Results
  - Overall curative resection 84%
    - One attempt in 52.6% and two attempts in 31.5%
  - Three patients referred for ESD or surgery
- Adverse events
  - Two patients with intraprocedural bleeding
  - No post procedure bleeding or perforation



Pathology specimen from
(A) Standard biopsy forceps
(B) EndoRotor

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SUMMARY

Summary

- Assess for **risk of submucosal invasion** prior to resection
- **Viscous solutions** may improve resection **success**
- **Avulsion** superior to ablation for residual tissue
- **Ablation** of visibly clean margins **reduces recurrence**
- **Clip defects** for polyps > 20 mm in right colon
  - Consider **through-the-scope-suturing** for unclippable defects
- Employ **mechanical stalk ligation** for pedunculated polyps
- Consider **endoscopic full thickness resection** for suspected **invasive malignancy**
- Consider endoscopic powered resection (**EndoRotor**) for **scarred polyps**

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THANK YOU

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