2019 SCSG GI SYMPOSIUM

Annenberg Center For Health Sciences at Eisenhower
Imparting knowledge. Improving patient care.

Jointly provided by the Annenberg Center for Health Sciences at Eisenhower and Southern California Society of Gastroenterology.

Southern California Society of Gastroenterology
SCSG

Controversies (and Breakthroughs) of Colonoscopy

Questions and (Some) Answers from DDW and the Literature in 2019 (and 2018)

Outline

- Improving Polyp Detection
- Colon Polypectomy
  - Just how good (or bad) are we?
  - Is “EMR” Changing?
- Preventing Delayed Post-Polypectomy Bleeds
  - Next Talk
- Colonoscopy Inspection, Detection, and Resection: Computers to the Rescue?

Improving Polyp Detection

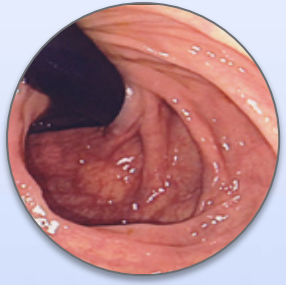
Guiding Principle

Implementing Systems-Based Best Practice Techniques

- Split Dose Bowel Preparation

Improving Implementation of Existing Techniques & Technology

- Quality Metric Measurement/Feedback
- Training
- Video Coaching
- High Definition Colonoscopes



Implementing Novel Techniques Using Existing Technology

- Cecal Retroflexion
- Water Immersion
- Chromoendoscopy

Developing Accessories to Utilize with Existing Technology

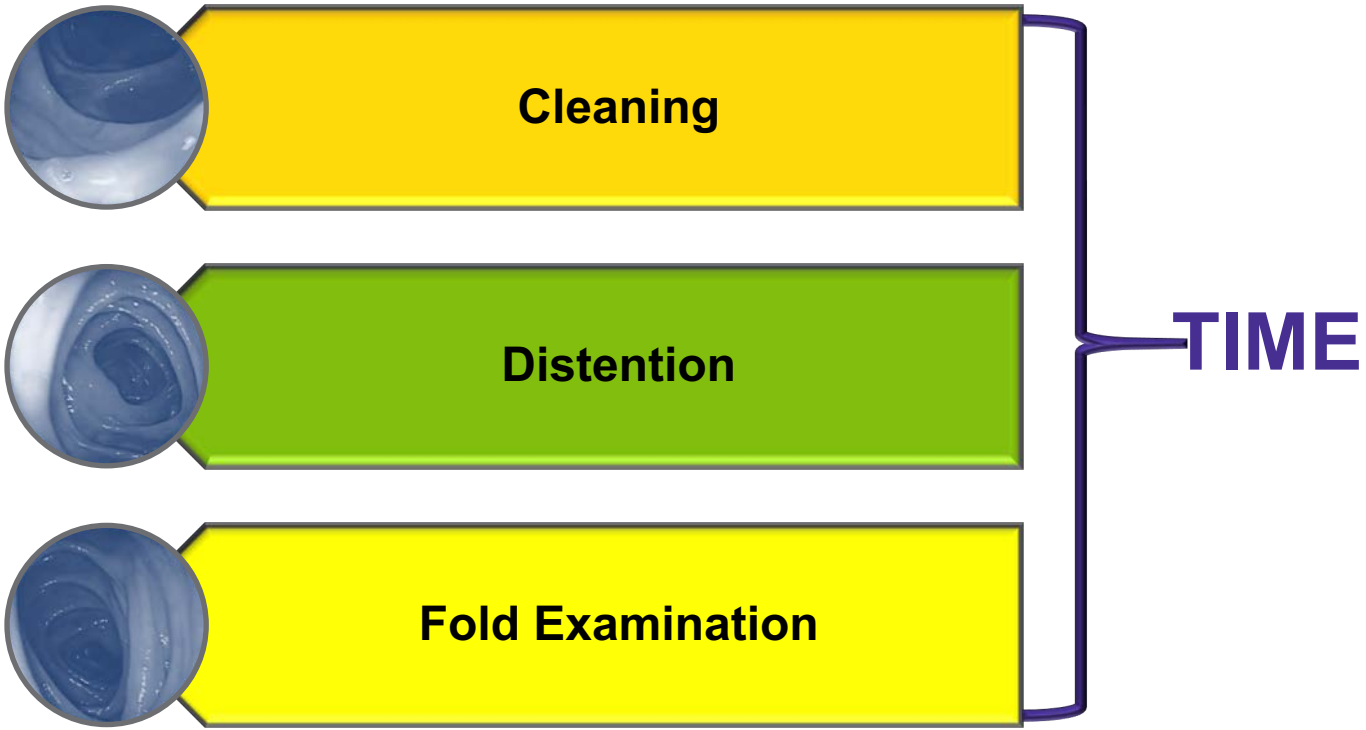
- Mucosal Exposure Devices

Developing Novel/Disruptive Technology

- Artificial Intelligence
- New "wide field of view" colonoscopes

Easier ⟵ ⟶ *Harder*

Components to Optimal Colonoscopy Inspection

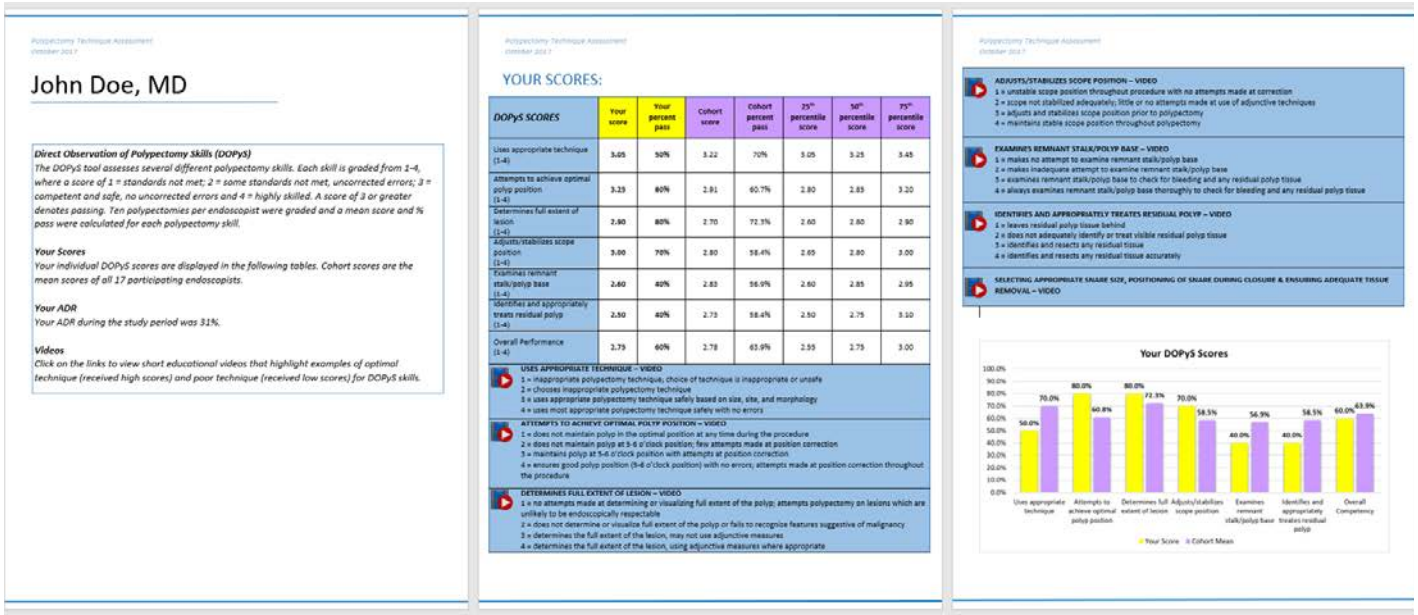


Methods: *Grading Colonoscopy Inspection Quality*

Score	0	1	2	3	4	5
Fold Examination	**Very Poor** *Not looking behind any folds; "straight pull-back" technique*	**Poor**	**Fair**	**Good**	**Very Good**	**Excellent** *Looking behind all folds*
Cleaning	**Very Poor** *No attempt to clean stool and pools of liquid*	**Poor**	**Fair**	**Good**	**Very Good**	**Excellent** *All stool and pools of liquid removed*
Luminal Distension	**Very Poor** *No colonic distension, or spasm*	**Poor**	**Fair**	**Good**	**Very Good**	**Excellent** *Optimal colonic distension*

Modified from Rex D, GIE 2000.

Can We Deliver More Granular Feedback?



Polypectomy Technique Assessment
October 2017

John Doe, MD

Direct Observation of Polypectomy Skills (DOPyS)
The DOPyS tool assesses several different polypectomy skills. Each skill is graded from 1–4, where a score of 1 = standards not met; 2 = some standards not met, uncorrected errors; 3 = competent and safe, no uncorrected errors and 4 = highly skilled. A score of 3 or greater denotes passing. Ten polypectomies per endoscopist were graded and a mean score and % pass were calculated for each polypectomy skill.

Your Scores
Your individual DOPyS scores are displayed in the following tables. Cohort scores are the mean scores of all 17 participating endoscopists.

Your ADR
Your ADR during the study period was 31%.

Videos
Click on the links to view short educational videos that highlight examples of optimal technique (received high scores) and poor technique (received low scores) for DOPyS skills.

Polypectomy Technique Assessment
October 2017

YOUR SCORES:

DOPyS SCORES	Your score	Your percent pass	Cohort score	Cohort percent pass	25th percentile score	50th percentile score	75th percentile score
Uses appropriate technique (1-4)	3.05	50%	3.22	70%	3.05	3.25	3.45
Attempts to achieve optimal polyp position (1-4)	3.25	80%	2.91	60.7%	2.80	2.85	3.20
Determines full extent of lesion (1-4)	2.80	80%	2.70	72.3%	2.60	2.80	2.90
Adjusts/stabilizes scope position (1-4)	3.00	70%	2.80	58.4%	2.65	2.80	3.00
Examines remnant stalk/polyp base (1-4)	2.60	40%	2.83	56.9%	2.60	2.85	2.95
Identifies and appropriately treats residual polyp (1-4)	2.50	40%	2.73	58.4%	2.50	2.75	3.10
Overall Performance (1-4)	2.75	60%	2.78	63.9%	2.55	2.75	3.00

USES APPROPRIATE TECHNIQUE – VIDEO
1 = inappropriate polypectomy technique; choice of technique is inappropriate or unsafe
2 = chooses inappropriate polypectomy technique
3 = uses appropriate polypectomy technique safely based on size, site, and morphology
4 = uses most appropriate polypectomy technique safely with no errors

ATTEMPTS TO ACHIEVE OPTIMAL POLYP POSITION – VIDEO
1 = does not maintain polyp in the optimal position at any time during the procedure
2 = does not maintain polyp at 5-6 o'clock position; few attempts made at position correction
3 = maintains polyp at 5-6 o'clock position with attempts at position correction
4 = ensures good polyp position (5-6 o'clock position) with no errors; attempts made at position correction throughout the procedure

DETERMINES FULL EXTENT OF LESION – VIDEO
1 = no attempts made at determining or visualizing full extent of the polyp; attempts polypectomy on lesions which are unlikely to be endoscopically resectable
2 = does not determine or visualize full extent of the polyp or fails to recognize features suggestive of malignancy
3 = determines the full extent of the lesion, may not use adjunctive measures
4 = determines the full extent of the lesion, using adjunctive measures where appropriate

Polypectomy Technique Assessment
October 2017

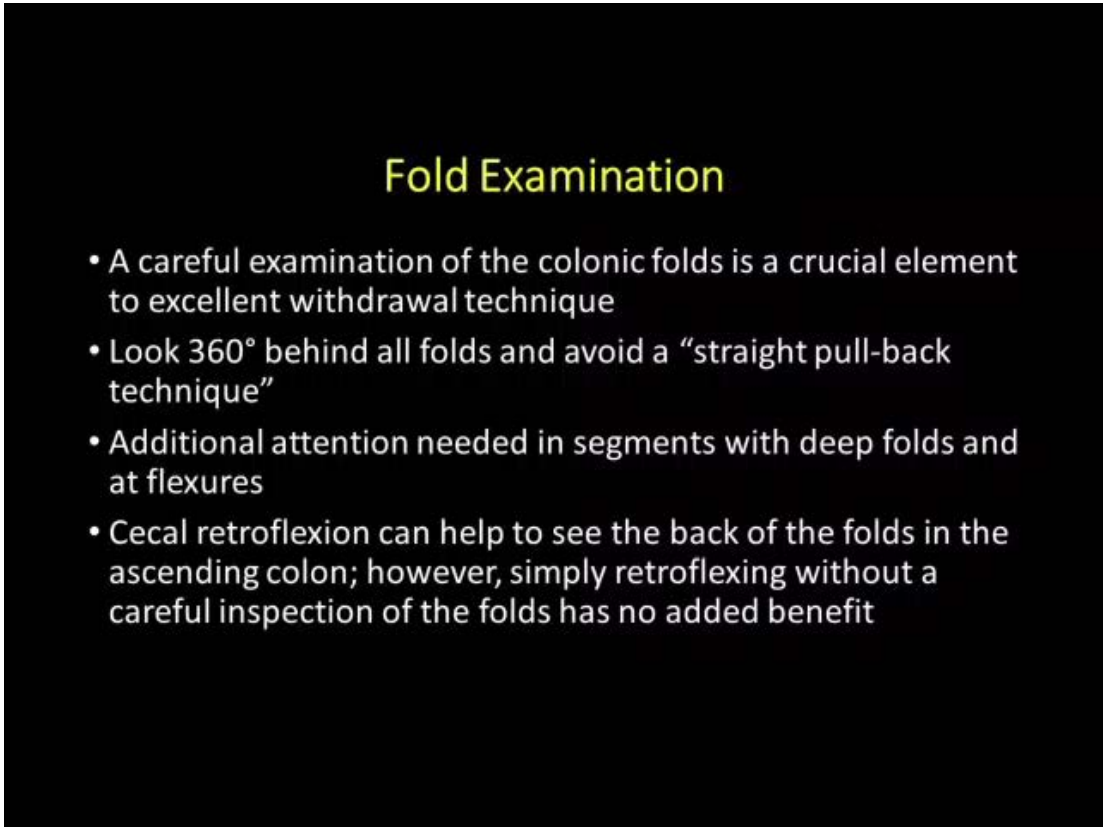
ADJUSTS/STABILIZES SCOPE POSITION – VIDEO
1 = unstable scope position throughout procedure with no attempts made at correction
2 = scope not stabilized adequately; little or no attempts made at use of adjunctive techniques
3 = adjusts and stabilizes scope position prior to polypectomy
4 = maintains stable scope position throughout polypectomy

EXAMINES REMNANT STALK/POLYP BASE – VIDEO
1 = makes no attempt to examine remnant stalk/polyp base
2 = makes inadequate attempt to examine remnant stalk/polyp base
3 = examines remnant stalk/polyp base to check for bleeding and any residual polyp tissue
4 = always examines remnant stalk/polyp base thoroughly to check for bleeding and any residual polyp tissue

IDENTIFIES AND APPROPRIATELY TREATES RESIDUAL POLYP – VIDEO
1 = leaves residual polyp tissue behind
2 = does not adequately identify or treat visible residual polyp tissue
3 = identifies and resects any residual tissue
4 = identifies and resects any residual tissue accurately

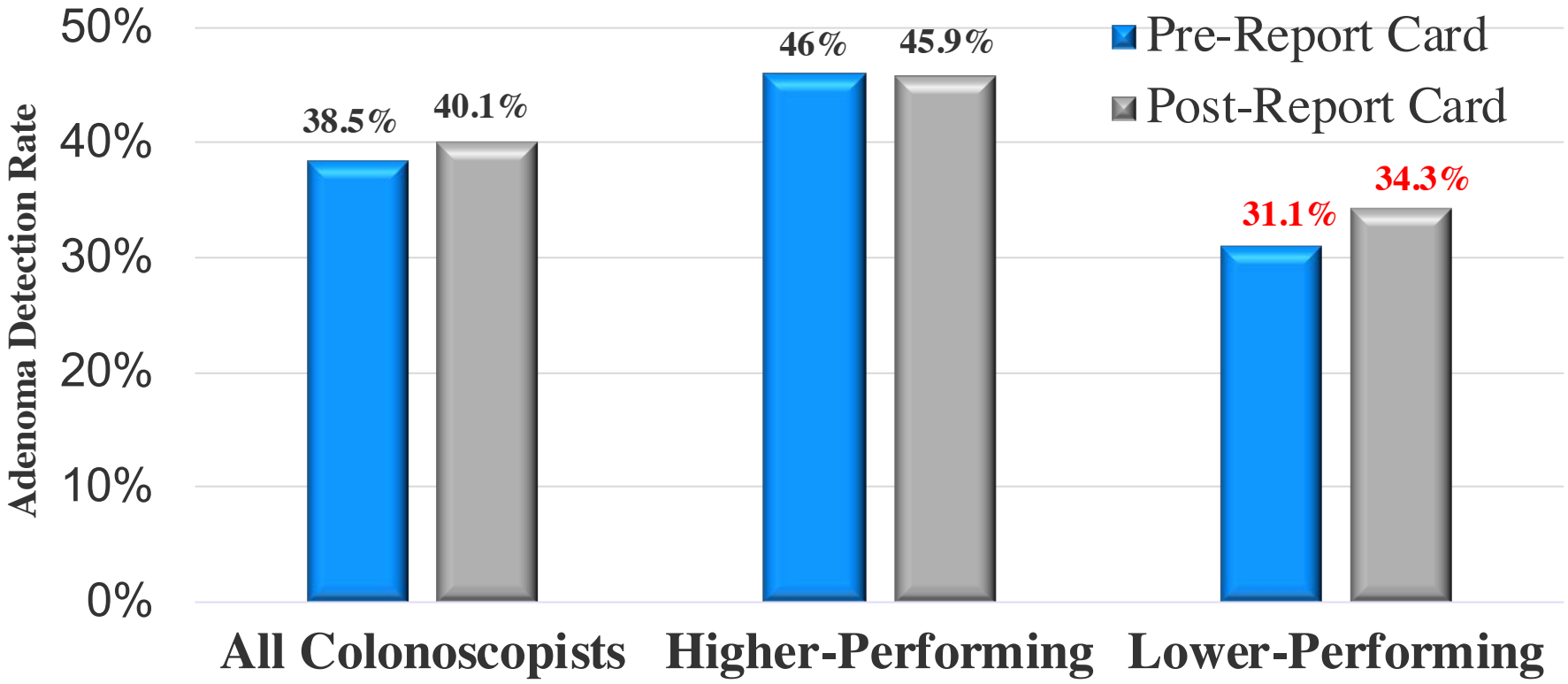
SELECTING APPROPRIATE SNARE SIZE, POSITIONING OF SNARE DURING CLOSURE & ENSURING ADEQUATE TISSUE REMOVAL – VIDEO

Structured Feedback with Video Didactics



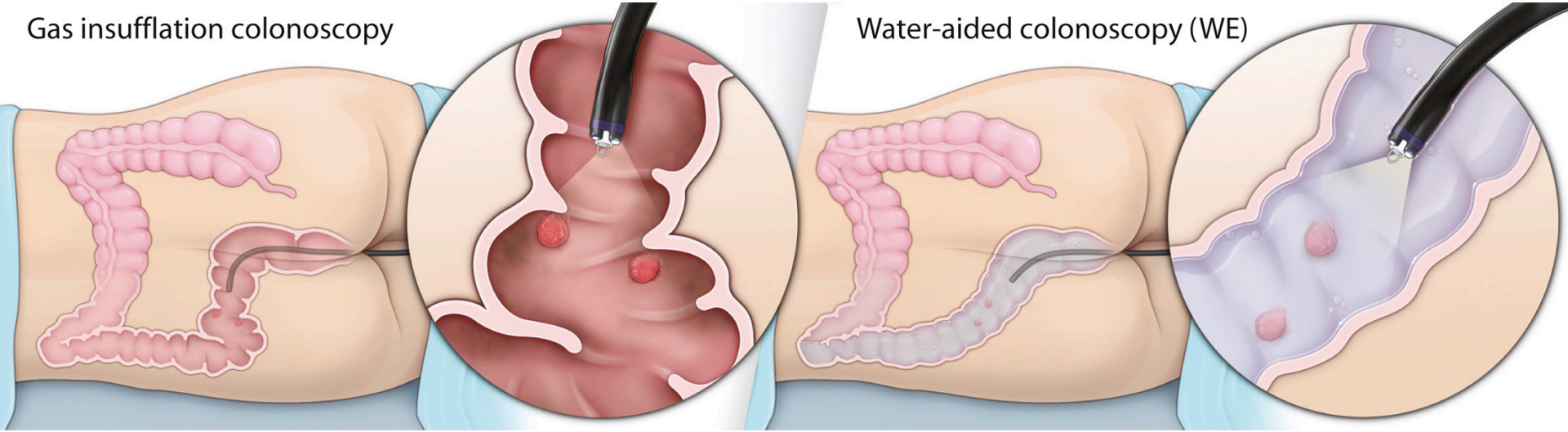
Video Coaching to Improve ADR

ADR significantly improved among lower-performing colonoscopists (p<0.05)



DULOY A ET AL; KESWANI RN, DDW, 2019

Water Aided Colonoscopy Impact on ADR

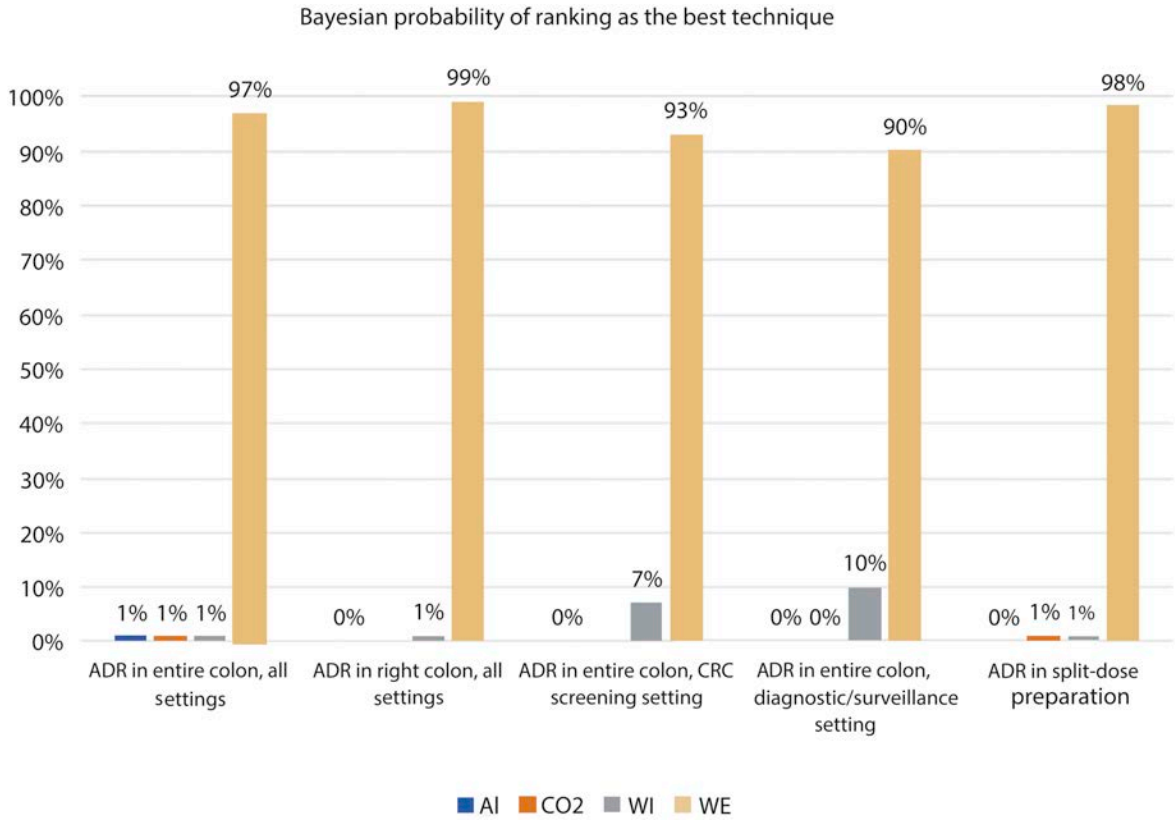


FUCCIO L ET AL; CADONI S, GIE, 2018

Northwestern Medicine®

Water Aided Colonoscopy Impact on ADR

- Raw estimates of overall ADR were
  - **WE**: 41.7%
  - **WI**: 34.4%
  - **AI**: 30.2%
  - **CO_2**: 31.1%



FUCCIO L ET AL; CADONI S, GIE, 2018

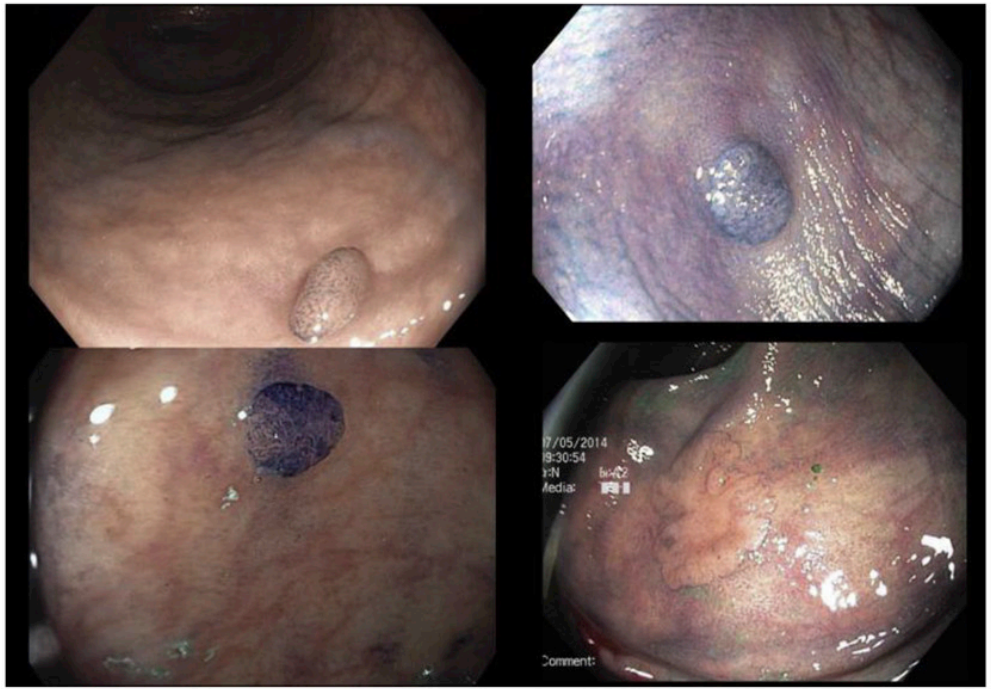
Northwestern Medicine®

Chromoendoscopy

- Prior studies with a significant increase in adenoma detection in chromoendoscopy
- However, the increase in adenoma detection was small without increase in advanced adenoma detection
- Given difficulty in use of chromoendoscopy, it has not been widely adopted for routine screening colonoscopy

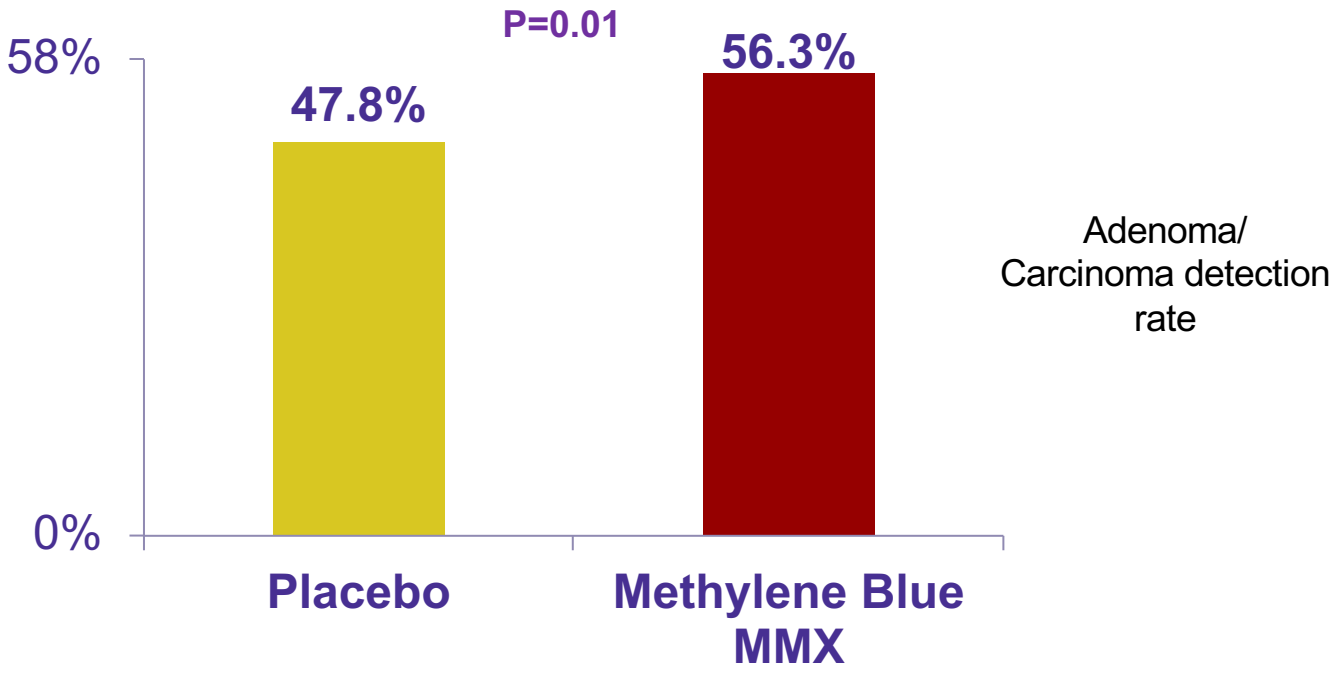
Kahi CJ et al; Rex DK, American Journal of Gastroenterology, 2010

Chromoendoscopy that is tolerable (for the colonoscopist)



REPICI A ET AL; HASSAN C, GASTROENTEROLOGY, 2019

Chromoendoscopy that is tolerable (for the colonoscopist)



REPICI A ET AL; HASSAN C, GASTROENTEROLOGY, 2019

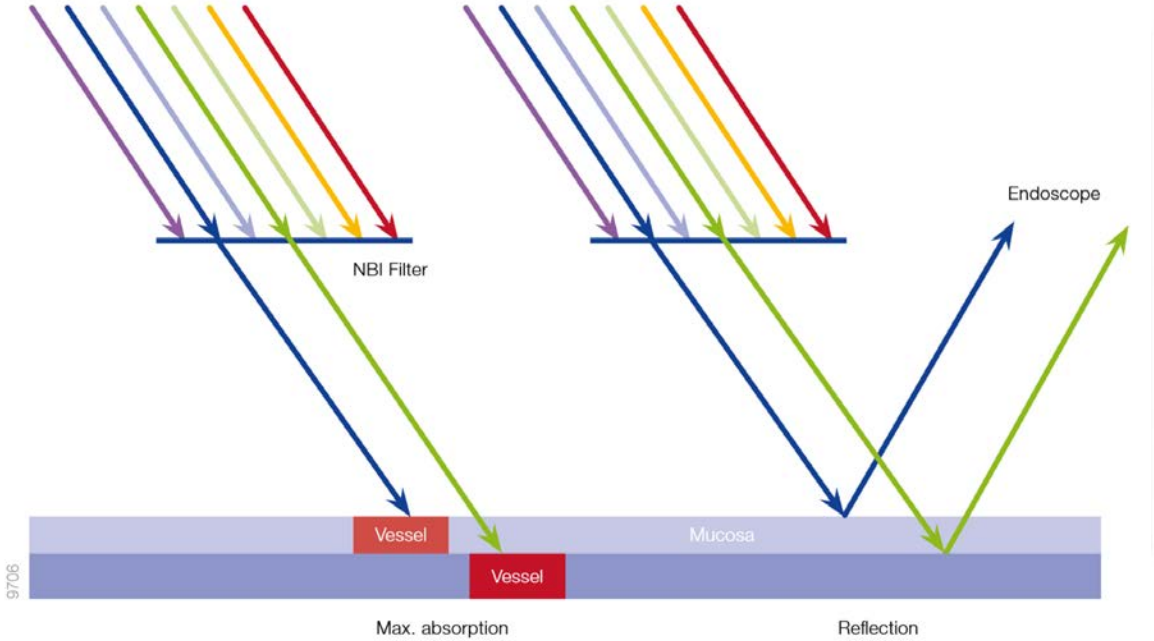
Northwestern Medicine®

Improving ADR via Lights and More

- Lights
  - Traditionally found to be **ineffective** at improving ADR likely because everything is just too dark.
  - Newer data emerging, especially for NBI (Olympus) and BLI (FUJI)
- Devices discussed yesterday but brief recap

Narrow Band Imaging

EVIS EXERA III series 190



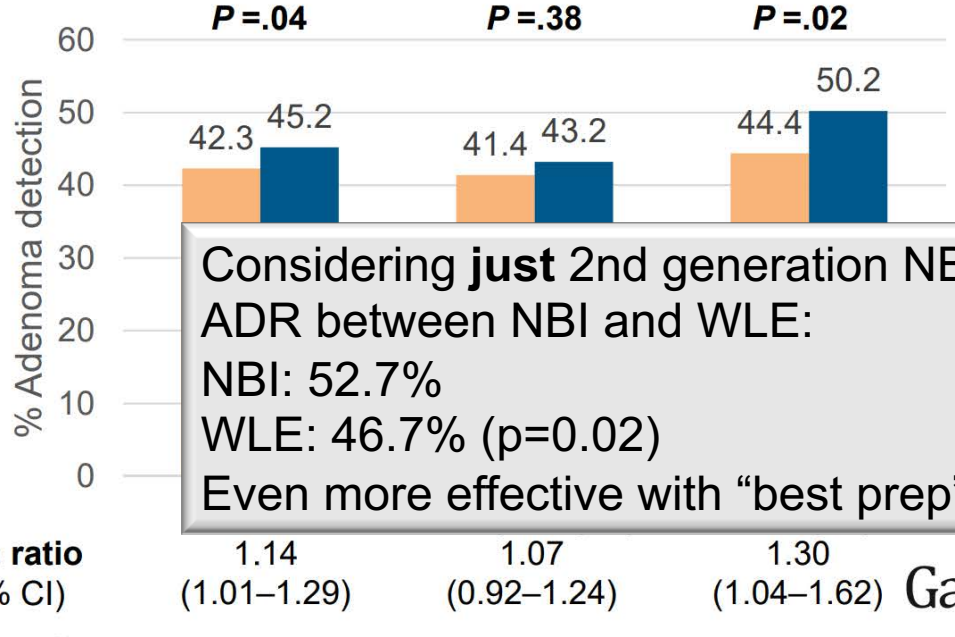
Absorption of narrow band light by capillaries on the mucosal surface (blue) and veins in the submucosa (green).

Narrow Band Imaging

Individual patient level data meta-analysis for high definition White Light Endoscopy (WLE) vs Narrow Band Imaging (NBI) stratified by bowel preparation

11 international centers

4491 individual patient datasets



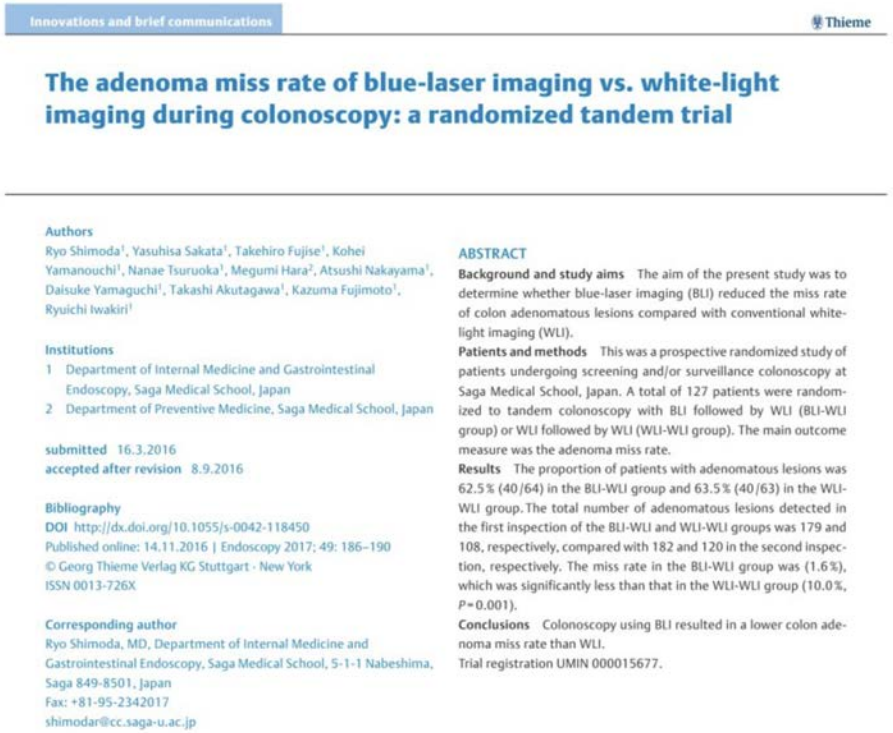
Considering **just** 2nd generation NBI (3 studies) – ADR between NBI and WLE:
NBI: 52.7%
WLE: 46.7% (p=0.02)
Even more effective with "best prep" (OR 1.62)

Gastroenterology

ATKINSON NSS ET AL; EAST JE, GASTROENTEROLOGY 2019 (IN PRESS)

Blue Light Imaging

- Multiple randomized studies demonstrating superiority of BLI versus WLE



Innovations and brief communications

Thieme

The adenoma miss rate of blue-laser imaging vs. white-light imaging during colonoscopy: a randomized tandem trial

Authors

Ryo Shimoda[1], Yasuhisa Sakata[1], Takehiro Fujise[1], Kohei Yamanouchi[1], Nanae Tsuruoka[1], Megumi Hara[2], Atsushi Nakayama[1], Daisuke Yamaguchi[1], Takashi Akutagawa[1], Kazuma Fujimoto[1], Ryuichi Iwakiri[1]

Institutions

1 Department of Internal Medicine and Gastrointestinal Endoscopy, Saga Medical School, Japan
2 Department of Preventive Medicine, Saga Medical School, Japan

submitted 16.3.2016
accepted after revision 8.9.2016

Bibliography

DOI http://dx.doi.org/10.1055/s-0042-118450
Published online: 14.11.2016 | Endoscopy 2017; 49: 186–190

ISSN 0013-726X

Corresponding author

Ryo Shimoda, MD, Department of Internal Medicine and Gastrointestinal Endoscopy, Saga Medical School, 5-1-1 Nabeshima, Saga 849-8501, Japan
Fax: +81-95-2342017
shimodar@cc.saga-u.ac.jp

ABSTRACT

Background and study aims The aim of the present study was to determine whether blue-laser imaging (BLI) reduced the miss rate of colon adenomatous lesions compared with conventional white-light imaging (WLI).

Patients and methods This was a prospective randomized study of patients undergoing screening and/or surveillance colonoscopy at Saga Medical School, Japan. A total of 127 patients were randomized to tandem colonoscopy with BLI followed by WLI (BLI-WLI group) or WLI followed by WLI (WLI-WLI group). The main outcome measure was the adenoma miss rate.

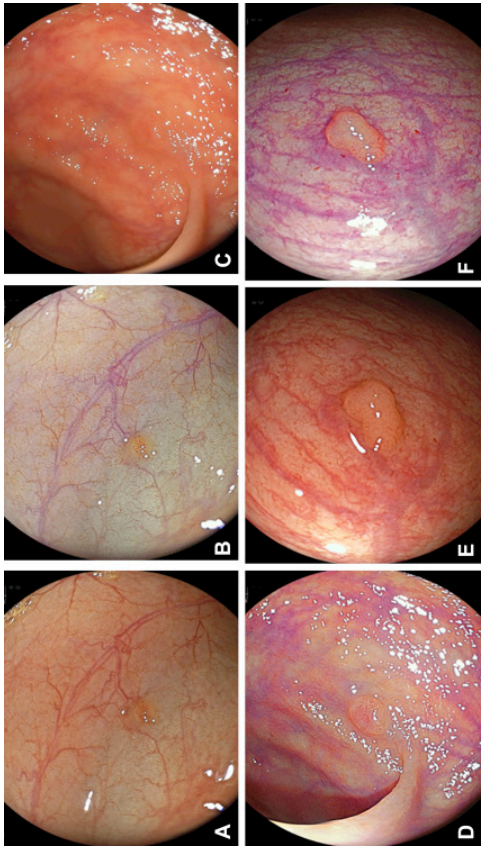
Results The proportion of patients with adenomatous lesions was 62.5 % (40 /64) in the BLI-WLI group and 63.5 % (40 /63) in the WLI-WLI group. The total number of adenomatous lesions detected in the first inspection of the BLI-WLI and WLI-WLI groups was 179 and 108, respectively, compared with 182 and 120 in the second inspection, respectively. The miss rate in the BLI-WLI group was (1.6 %), which was significantly less than that in the WLI-WLI group (10.0 %, $P = 0.001$).

Conclusions Colonoscopy using BLI resulted in a lower colon adenoma miss rate than WLI.

Trial registration UMIN 000015677.

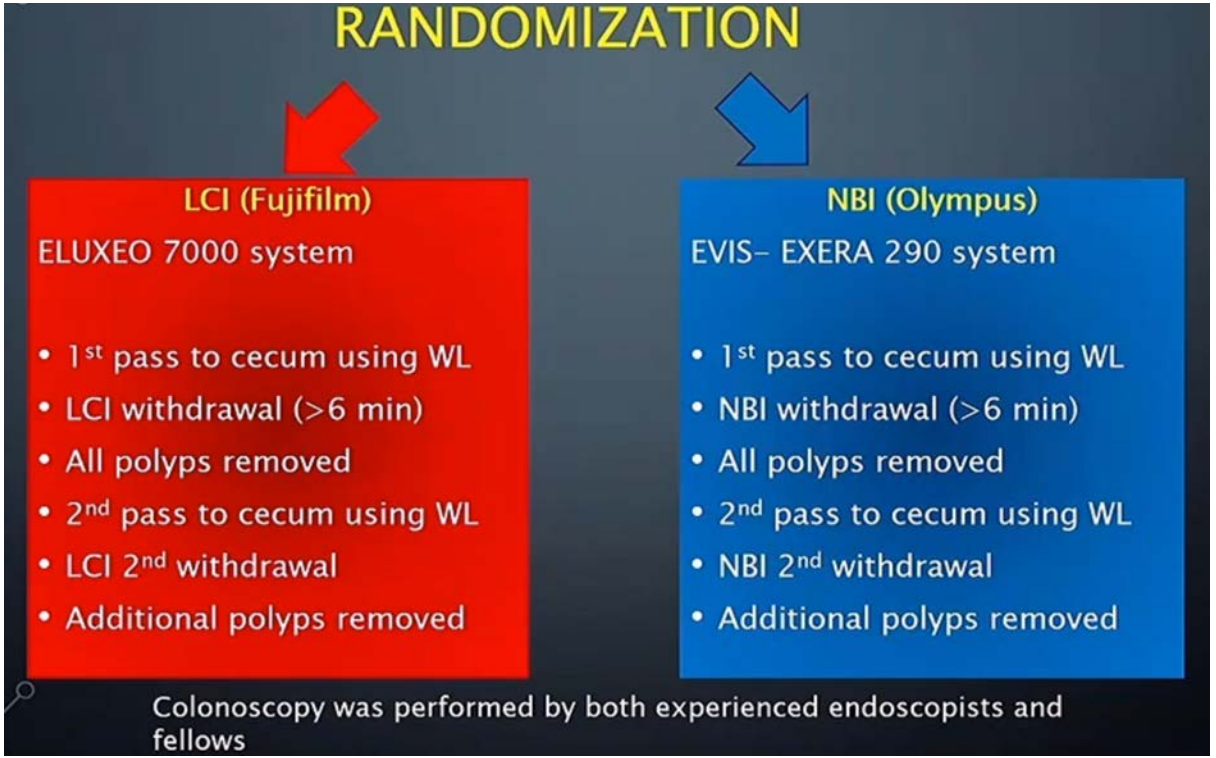
Linked Color Imaging (FUJI)

- Post-processing technique which emphasizes mucosal pattern/color and blood vessels
- Superior to WLE for detection of colorectal polyps, including SSPs



MIN ET AL, GIE, 2017
FUJIMOTO ET AL., EIO, 2018

LCI versus NBI



LEUNG WK ET AL; LO SH, DDW, 2019

LCI versus NBI

	LCI	NBI	P
First colonoscopy			
Patients with polyps (%)	76 (55.9)	97 (71.3)	0.008
Patients with adenomas (%)	54 (39.7)	70 (51.5)	0.05
Patients with advanced adenomas (%)	9 (6.6)	9 (6.6)	1.0
Patients with serrated polyps (%)	30 (22.1)	47 (34.6)	0.02
Patients with proximal polyps (%)	56 (41.2)	56 (41.2)	1.0
Patients with proximal adenomas (%)	43 (31.6)	48 (35.3)	0.52
Mean number of polyps per patient (SD)	1.35 (1.80)	2.04 ± 2.91	0.019
Mean number of adenomas per patient (SD)	0.90 (1.48)	1.26 ± 2.25	0.11

	LCI	NBI	P
Second colonoscopy			
Patients with polyps (%)	38 (27.9)	48 (35.3)	0.19
Patients with adenoma (%)	21 (15.4)	28 (20.6)	0.27
Patients with advanced adenoma (%)	4 (2.9)	2 (1.5)	0.68
Patients with serrated polyps (%)	13 (9.6)	20 (14.7)	0.19
Patients with proximal polyps (%)	13 (9.6)	27 (19.9)	0.017
Patients with proximal adenoma (%)	8 (5.9)	18 (13.2)	0.04
Mean number of polyps per patient (SD)	0.38 (0.70)	0.50 (0.82)	0.17
Mean number of adenomas per patient (SD)	0.23 (0.61)	0.25 (0.54)	0.33

LEUNG WK ET AL; LO SH, DDW, 2019

Comparing Mucosal Exposure Devices

- Evaluate Endocuff and Endorings compared to HD forward viewing colonoscopy

- Compare three mucosal exposure devices to each other *i.e* Endocuff *versus* EndoRings *versus* FUSE.

Olympus HD colonoscope

Olympus HD colonoscope with Endocuff

Olympus HD colonoscope with EndoRings

Full Spectrum Endoscopy (FUSE)

REX DK ET AL, GIE, 2018

Detection endpoints

APC

- The overall APC with Endocuff , EndoRings , and control were all higher than FUSE ($p < 0.001$)
- APC with Endocuff was higher than control ($p=0.014$)
- Right colon APC was higher for Endocuff ($p<0.001$), EndoRings ($p=0.043$) and control ($p=0.003$) compared to FUSE; Endocuff was higher than control ($p=0.023$)
- There were no differences between modalities in APC for conventional adenomas ≥ 10 mm either overall ($p=0.306$) or at any of the study sites.

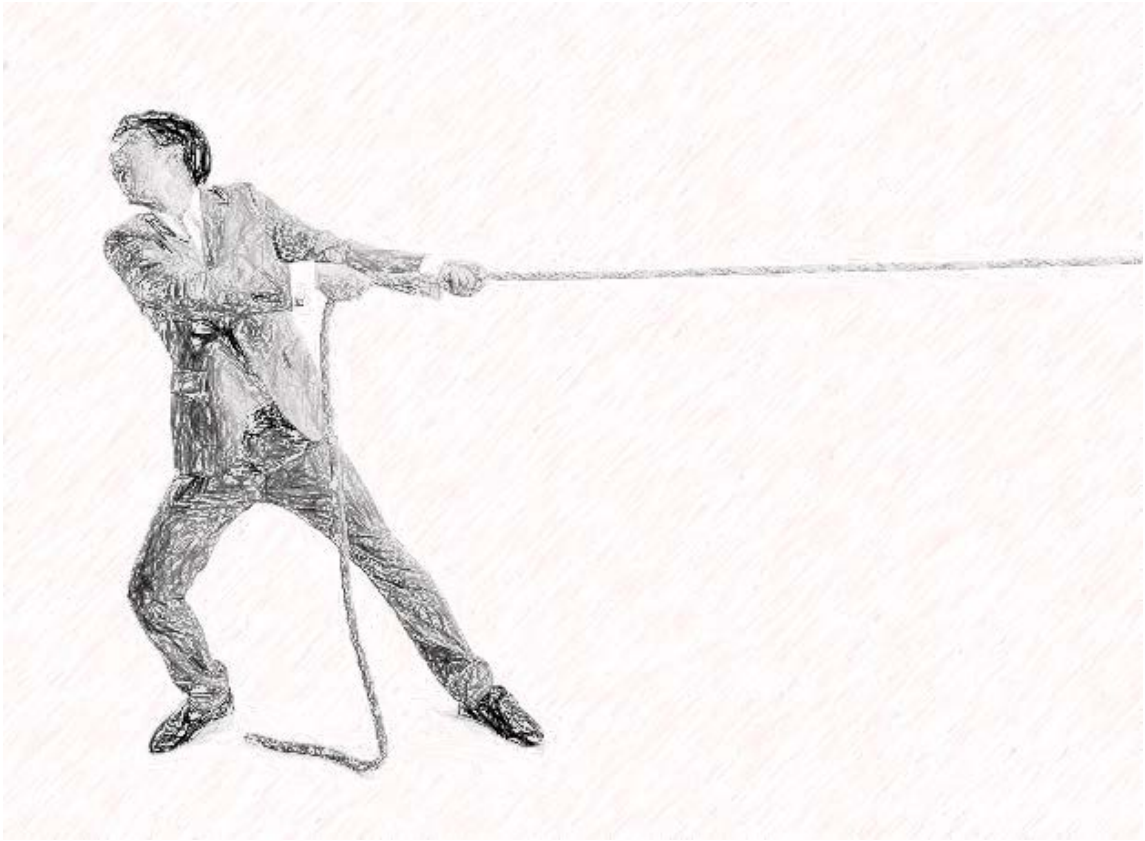
SSPC

- There were some statistically significant differences between devices in serrated detection but they were small and did not appear clinically significant

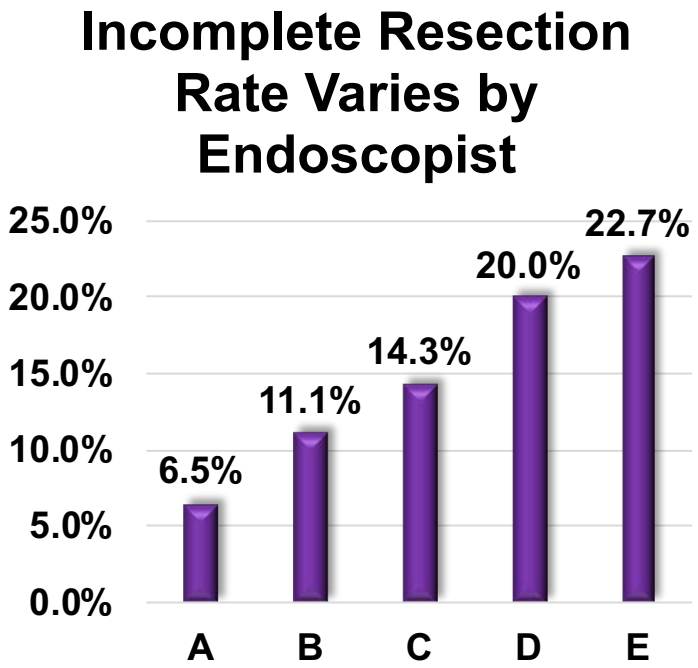
	Study arm			
	Control	Endocuff	EndoRings	FUSE
Adenomas per colonoscopy (APC)				
All sites	1.53 (2.33)	1.82 (2.58)	1.55 (2.42)	1.30 (1.96)
Indianapolis	1.89 (2.69)	2.17 (2.88)	1.97 (2.77)	1.59 (2.18)
Milan	0.83 (1.18)	0.80 (1.25)	0.72 (1.17)	0.68 (1.19)
New York	0.92 (1.15)	2.00 (2.34)	0.75 (0.94)	0.80 (1.32)
SSP per colonoscopy				
All sites	0.17 (0.54)	0.17 (0.54)	0.20 (0.81)	0.18 (0.74)
Indianapolis	0.24 (0.64)	0.23 (0.63)	0.29 (0.98)	0.25 (0.89)
Milan	0.03 (0.16)	0.04 (0.26)	0.01 (0.12)	0.03 (0.16)
New York	0.04 (0.20)	0.07 (0.26)	0.04 (0.20)	0.04 (0.20)

REX DK ET AL, GIE, 2018

Controversies in Polypectomy



Variability in Colon Polypectomy Performance



- In a study of 5 endoscopists removing 346 polyps, 10.1% of polyps overall were incompletely resected
- This rate varied significantly by endoscopist

Pohl H et al, Gastroenterology, 2013

Diminutive (≤ 5 mm) Polypectomy

	All polyps ($N=261$ polyps)	Jumbo forceps ($N=144$ polyps)	Cold snare ($N=117$ polyps)	P value
Incomplete resection, n (%)	25 (9.6%)	16 (11.1%)	9 (7.7%)	0.41
Failure of tissue retrieval, n (%)	5 (1.9%)	0 (0%)	5 (4.3%)	0.02
Post-polypectomy bleeding, n (%)	0 (0%)	0 (0%)	0 (0%)	N/A
Perforation, n (%)	0 (0%)	0 (0%)	0 (0%)	N/A

DESAI S ET AL; KRINSKY ML, SURGICAL ENDOSCOPY, 2019

Measuring Polypectomy Technique

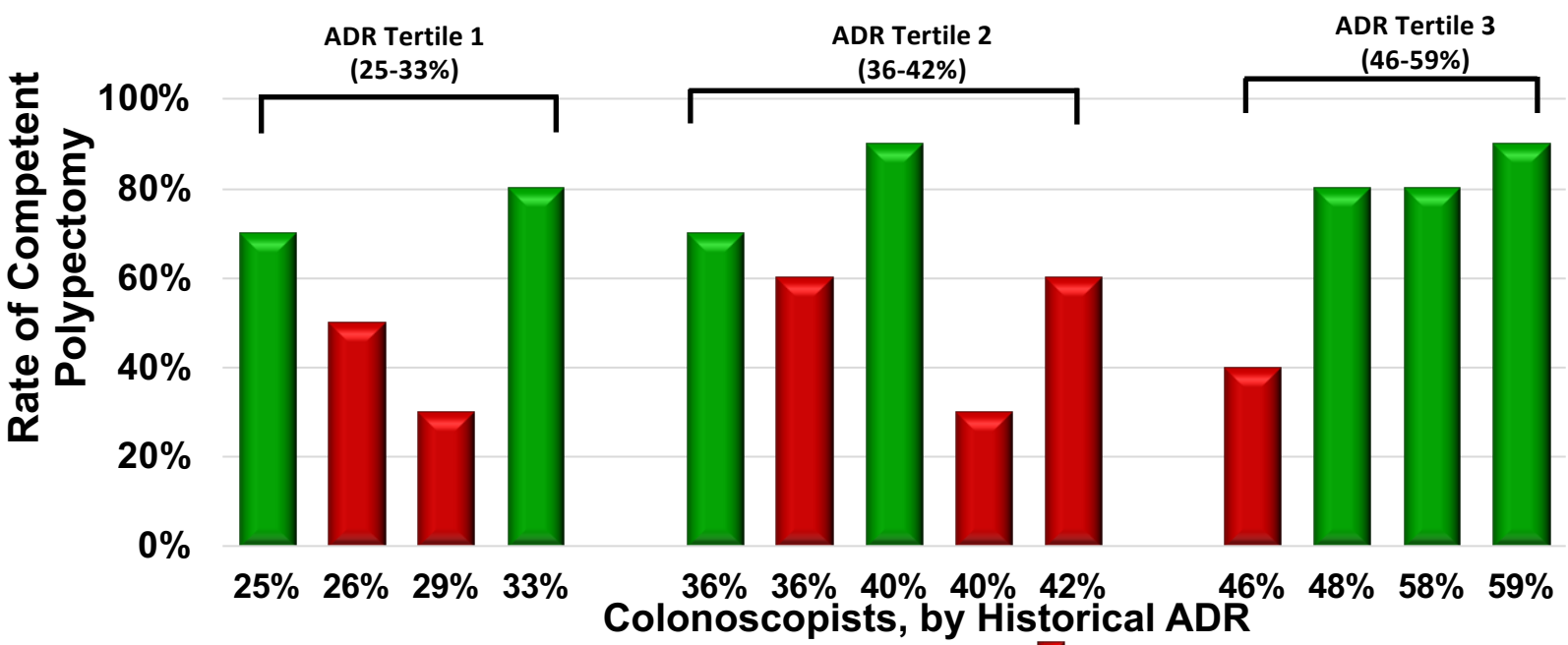
- Direct Observation of Polypectomy Skills (DOPyS)
  - 33 individual skills and overall polypectomy competency graded from 1-4, with a score ≥3 denoting competency

Skill	Descriptors
Achieves optimal polyp view and position	• Ensures clear views by aspiration/insufflation/wash • Maintains optimal polyp position (5-6 o'clock) • Takes appropriate action for position correction and clear views throughout the procedure

Gupta S et al, GIE 2011; Gupta S et al, GIE 2012.

Good Polyp Detectors are not Necessarily Good Polyp Resectors

Polypectomy competency rates do not correlate with ADR

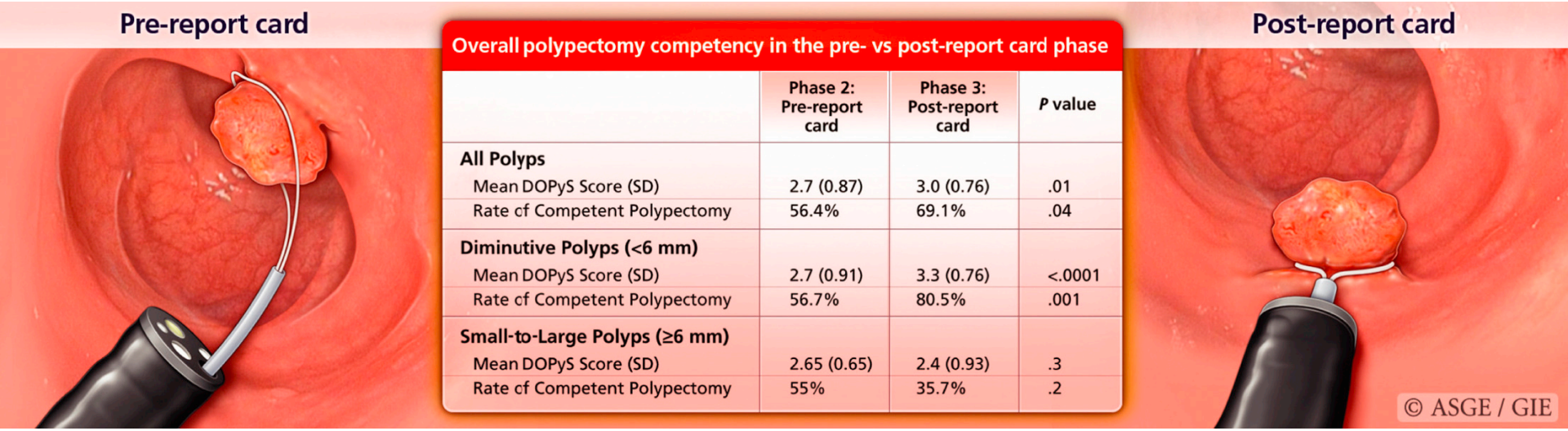


DULOY A, KALTENBACH T, KESWANI RN, GIE, 2018

Video Coaching to Improve Technique

DULOY A ET AL; KESWANI RN, GIE, 2019

Video Coaching to Improve Technique



Overall polypectomy competency in the pre- vs post-report card phase

	Phase 2: Pre-report card	Phase 3: Post-report card	*P* value
All Polyps			
Mean DOPyS Score (SD)	2.7 (0.87)	3.0 (0.76)	.01
Rate of Competent Polypectomy	56.4%	69.1%	.04
Diminutive Polyps (<6 mm)			
Mean DOPyS Score (SD)	2.7 (0.91)	3.3 (0.76)	<.0001
Rate of Competent Polypectomy	56.7%	80.5%	.001
Small-to-Large Polyps (≥6 mm)			
Mean DOPyS Score (SD)	2.65 (0.65)	2.4 (0.93)	.3
Rate of Competent Polypectomy	55%	35.7%	.2

DULOY A ET AL; KESWANI RN, GIE, 2019

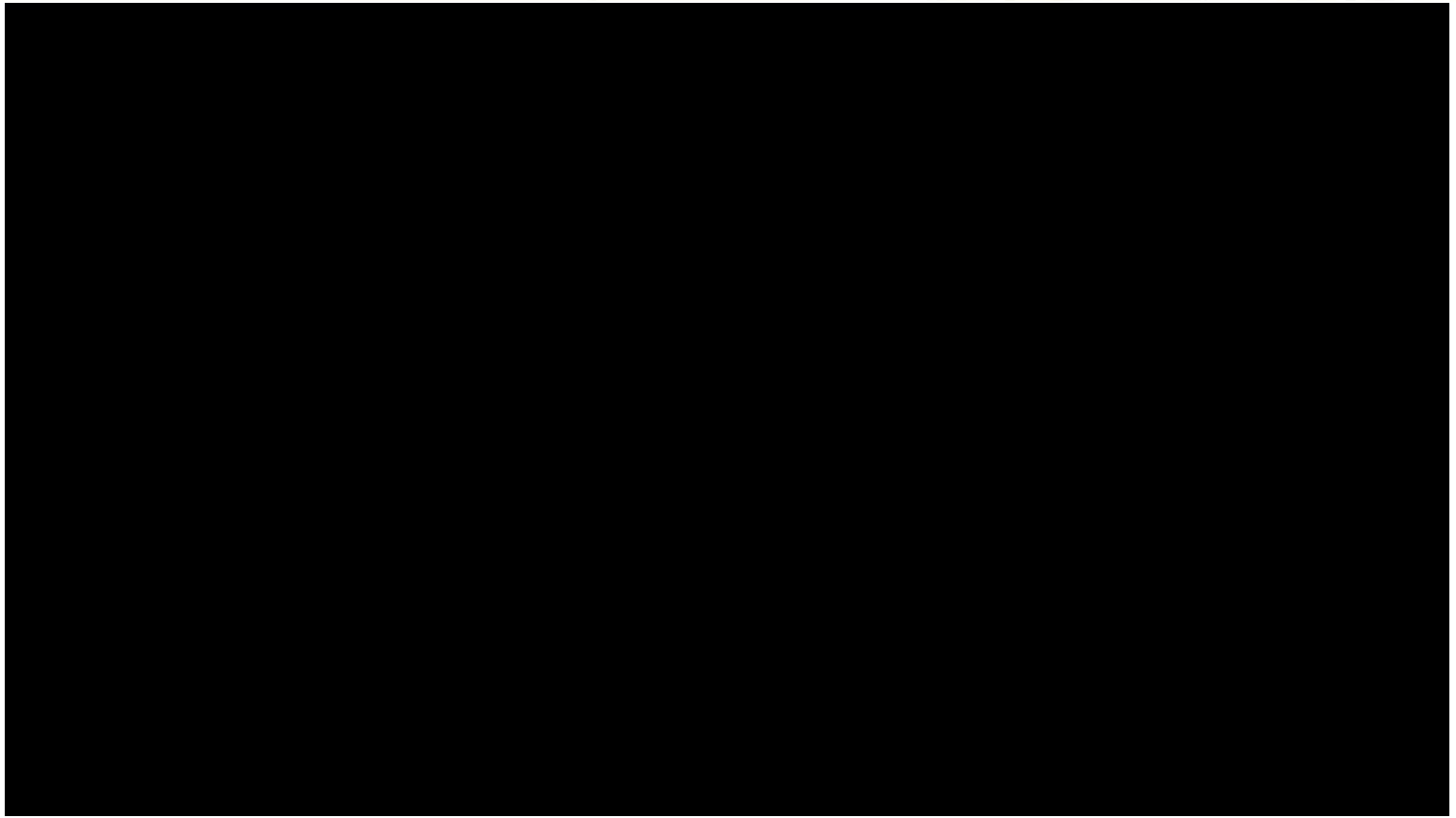
The Changing Landscape of Endoscopic Resection

- Cold EMR
- Underwater EMR
- Full Thickness Resection
- No EMR? (ESD)
  - Covered another day!

Cold EMR

- Applied generally for SSPs
- Goal is to reduce/eliminate risk of post-polypectomy bleeding which can be as high as 5% in large right-sided lesions

What is Cold EMR?



Early Data Supporting Cold EMR

- Systematic review and pooled analysis for SSPs

Events	≥ 10 mm polyps (n=829 pts)	≥ 20 mm polyps (n= 361 pts)	Cold EMR (n=112 pts)
Recurrence rate	5.5% (CI: 2.7%-8.4%)	7.2% (CI: 3.1%-11.3%)	1.2% (CI: 0%-3%)
En-bloc vs piecemeal recurrence rates	2.6% (CI: 0.5%-4.7%) vs 3.4% (CI: 0.1% - 6.6%)	NA	NA
Technical success	99.5% (CI: 99.1%-99.9%)	99.1% (CI: 98.3%-99.8%)	98.7% (CI: 97.1%-100%)
Immediate bleeding	1.5% (CI: 0.2%-2.8%)	3% (CI: 0.3%-5.6%)	1.1% (CI: 0% - 3.1%)
Delayed bleeding	2% (CI: 0.5%3.4%)	3.6% (CI: 1.9%-5.4%)	0%
Perforation	0.4% (CI: 0%-0.9%)	0.5% (CI: 0%-1.2%)	0%

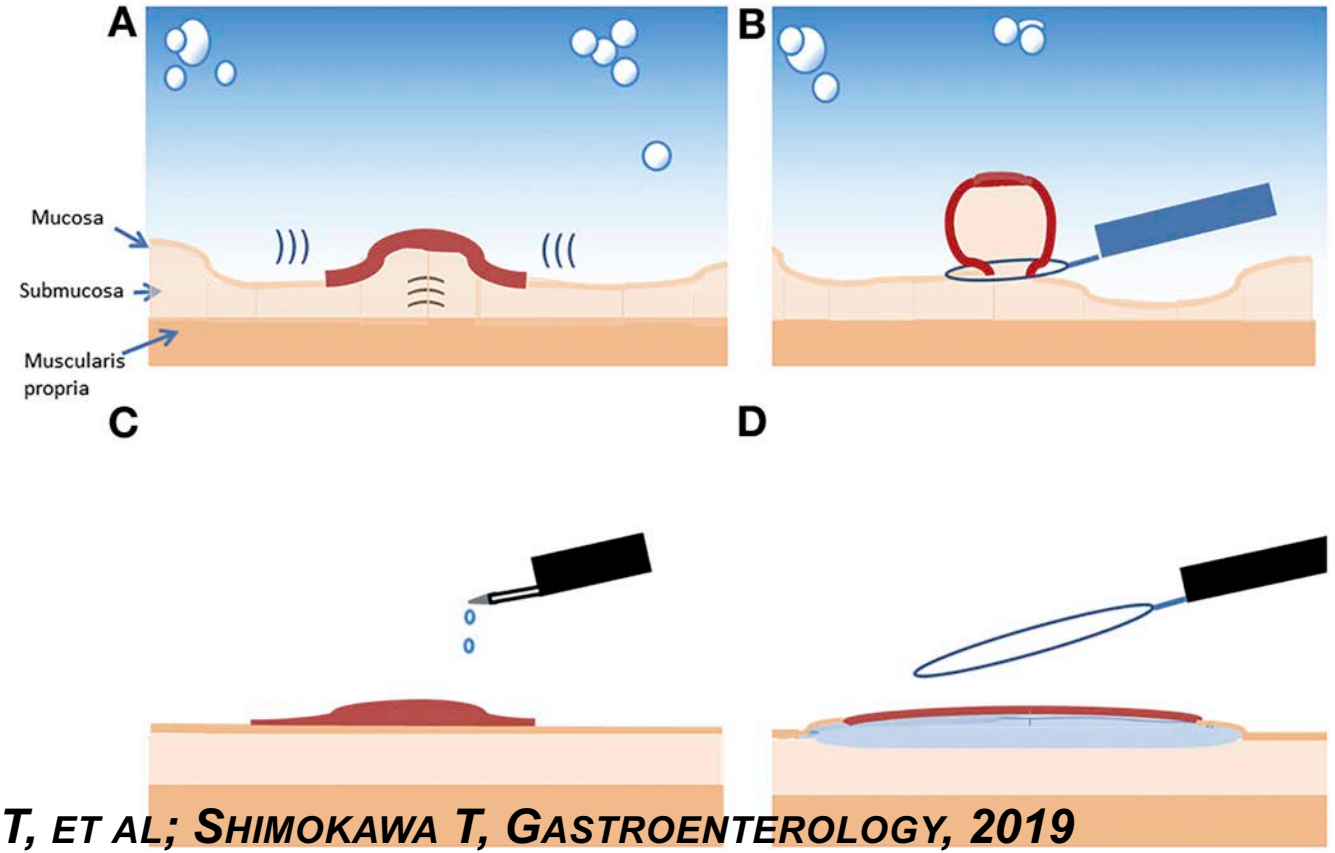
CHANDRESEKAR VT ET AL; SHARMA P, DDW 2019

What is Underwater EMR?

- Underwater Endoscopic Mucosal Resection (UEMR) without submucosal injection has emerged as an alternative technique to conventional injection-assisted EMR (CEMR)
  - First described by Binmoeller et al. in 2012
    - Numerous publications since
  - Recent retrospective comparative study of UEMR vs CEMR
    - Lower adenoma recurrence rate with UEMR (7.3% vs 28.3%)
    - Fewer procedures to reach curative resection (1.0 vs 1.3)
    - No difference in adverse events
- No prospective randomized data comparing UEMR vs standard EMR

Schenck et al. Surg Endosc 2017

Rationale for Underwater EMR



YAMASHINA T, ET AL; SHIMOKAWA T, GASTROENTEROLOGY, 2019

What is Underwater EMR?

Results

Outcomes	CEMR (n = 106)	UEMR (n = 113)	P-Value
# of resection pieces			
1 (en bloc)	27 (25.5%)	58 (51.3%)	p=0.001
2	16 (15.1%)	16 (14.2%)	
3	16 (15.1%)	11 (9.7%)	
>3	47 (44.3%)	28 (24.8%)	p=0.003
Additional Techniques required			
Biopsy forceps (cold)	16 (15.1%)	7 (6.2%)	
APC	3 (2.8%)	1 (0.9%)	
Hot avulsion	9 (8.5%)	5 (4.4%)	
All additional techniques	28 (26.4%)	13 (11.5%)	p=0.006

- Prophylactic clips used equally

HAMERSKI C ET AL, DDW 2018

Results

Outcomes	CEMR (n = 106)	UEMR (n = 113)	P-Value
Resection time (min)	16.3 ± 13.0 (2 – 85)	10.1 ± 8.5 (1 – 45)	p<0.0001
Total procedure time (min)	43.4 ± 20.4 (15 - 120)	36.4 ± 19.9 (10 - 110)	p=0.011

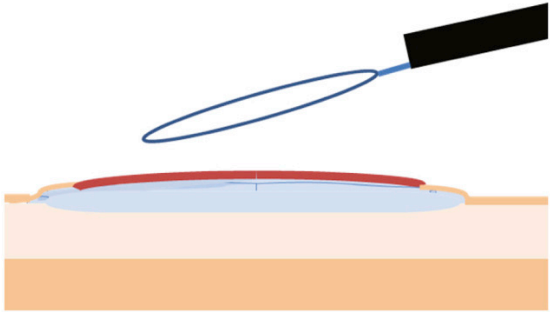
- UEMR resulted in significantly shorter resection time as well as shorter total procedure time

HAMERSKI C ET AL, DDW 2018

Underwater EMR

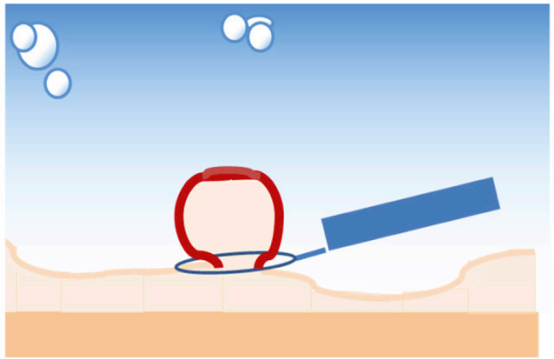
Comparison of underwater and conventional endoscopic mucosal resection (EMR) for intermediate-size colorectal polyps

Conventional EMR



vs.

Underwater EMR

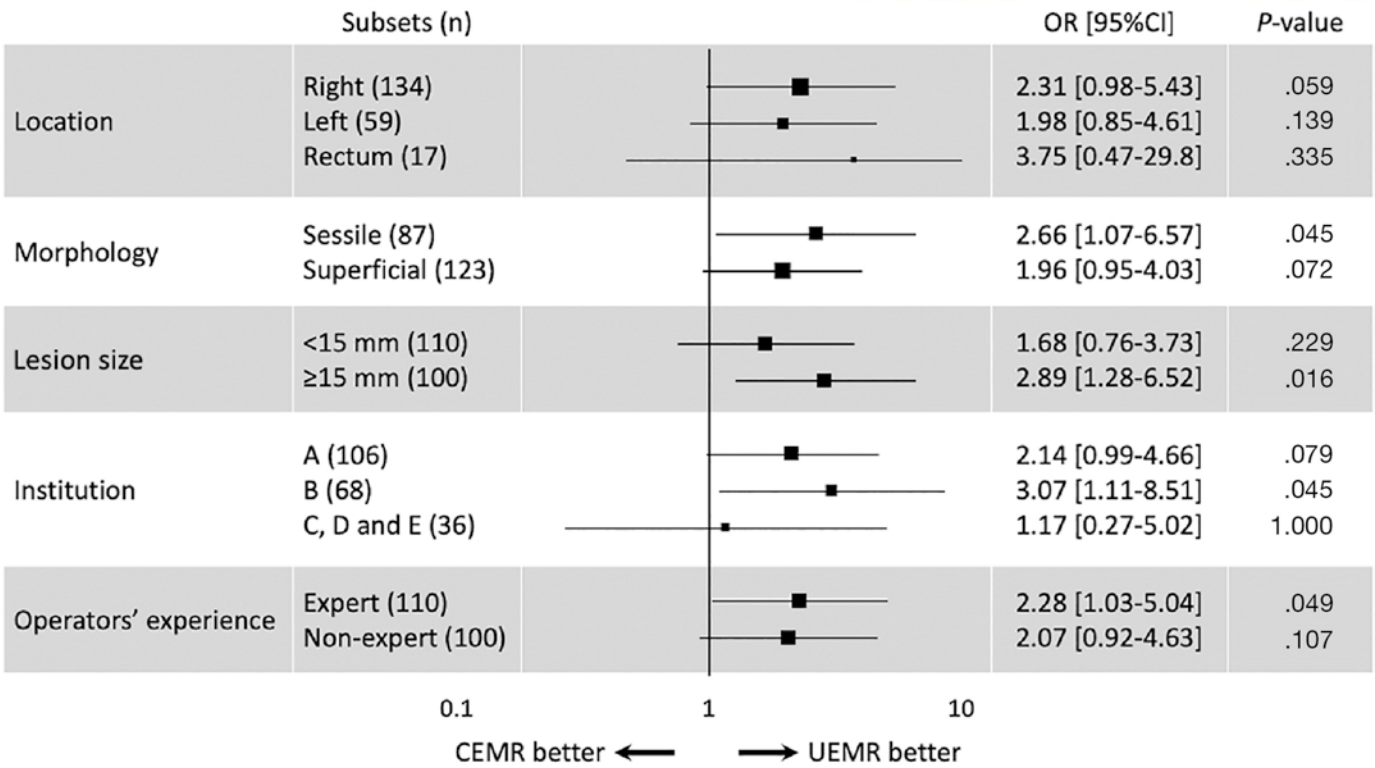


Similar bleeding rates; no perforation rates in either group

Gastroenterology

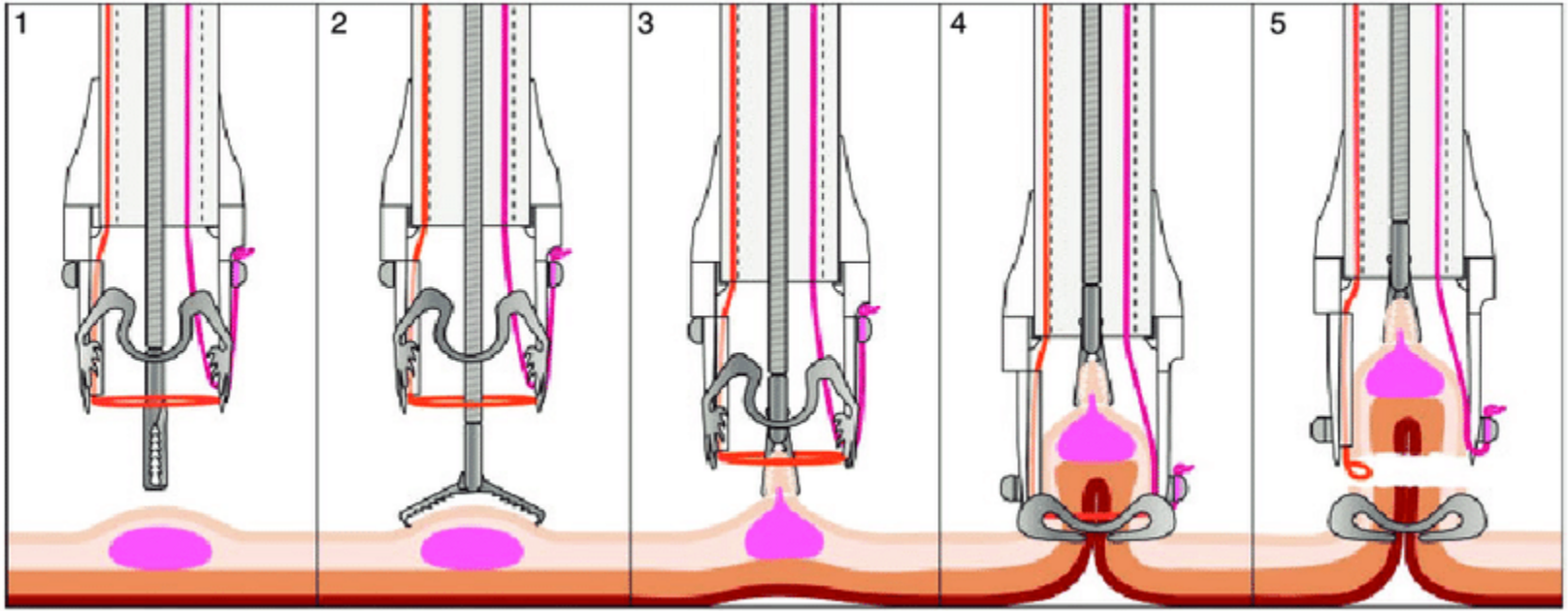
YAMASHINA T, ET AL; SHIMOKAWA T, GASTROENTEROLOGY, 2019

Underwater EMR Superior in All Subgroups



YAMASHINA T, ET AL; SHIMOKAWA T, GASTROENTEROLOGY, 2019

What is Full Thickness Resection?



Use of EFTR

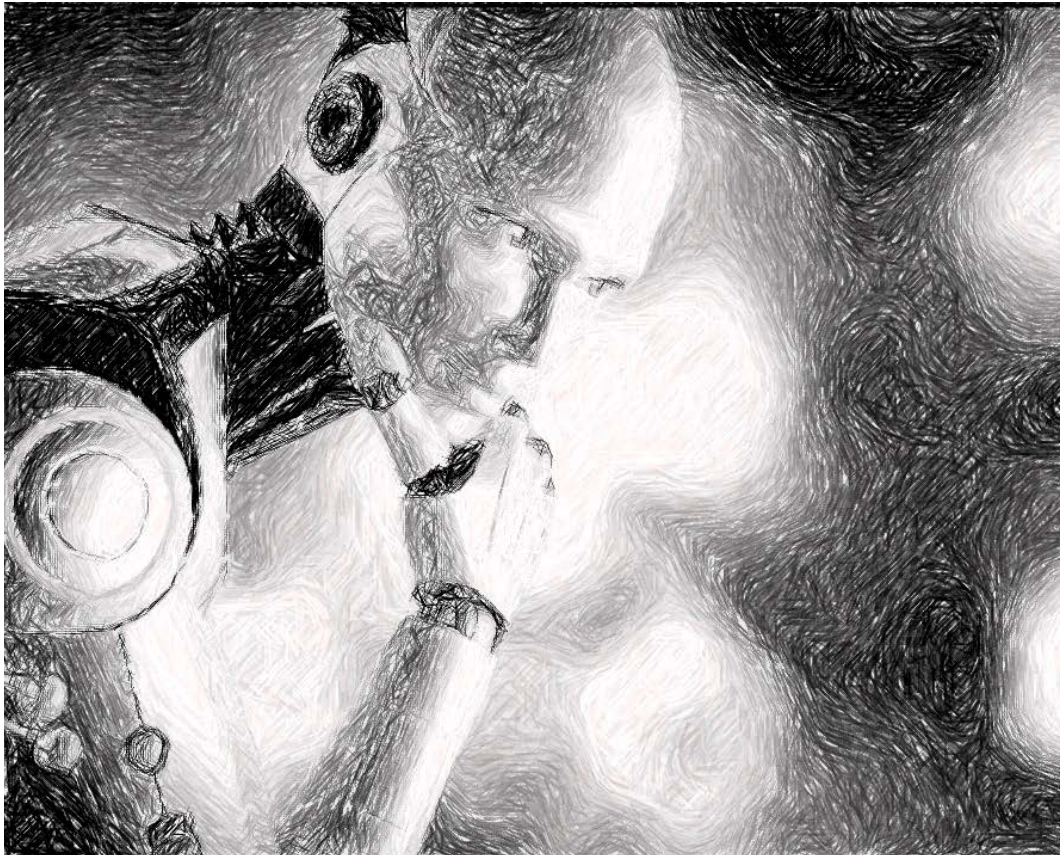
- Most logical use is T1 colon cancers or adenomas which cannot be removed via traditional endoscopic means

EFTR for T1 Cancers

Of 156 T1 cancers, technical success achieved in 144/156 (92.3%), mean procedural time was 42 minutes. R0 resection was achieved in 112/156 (71,8%). Severe procedure-related adverse events were recorded in 3,9%. Discrimination between high- vs. low-risk tumor was successful in 155/156 cases (99.3 %). In total 53 patients (34%) underwent oncologic resection due to high risk features whereas 98 patients (62%) were followed endoscopically.

KULLMER A ET AL; SCHMIDT A, DDW 2019.

Artificial Intelligence



What is Artificial Intelligence?

- AI allows unsupervised computer algorithms to do specific tasks that traditionally required a human brain

Associated/Related Terms		
Machine Learning	Deep Learning	Neural Networks
Random Forests	Convolutional Neural Networks	Transfer Learning

Challenges of AI Image Recognition Rapidly Fading Away

Polyp **Adenoma** **Serrated** **Adenocarcinoma** **Hyperplastic**

Convolutional Neural Networks

ImageNet Classification with Deep Convolutional Neural Networks

Alex Krizhevsky
University of Toronto
kriz@cs.utoronto.ca

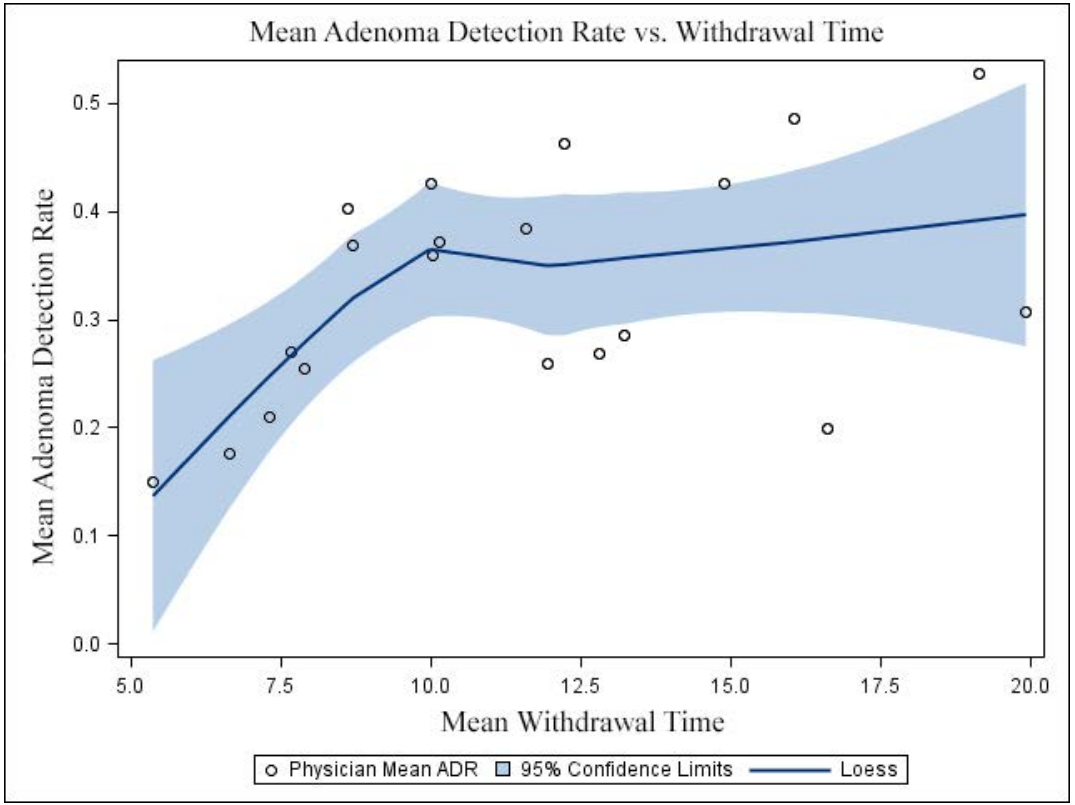
Ilya Sutskever
University of Toronto
ilya@cs.utoronto.ca

Geoffrey E. Hinton
University of Toronto
hinton@cs.utoronto.ca

“AI”: Making the Case for Screening Colonoscopy

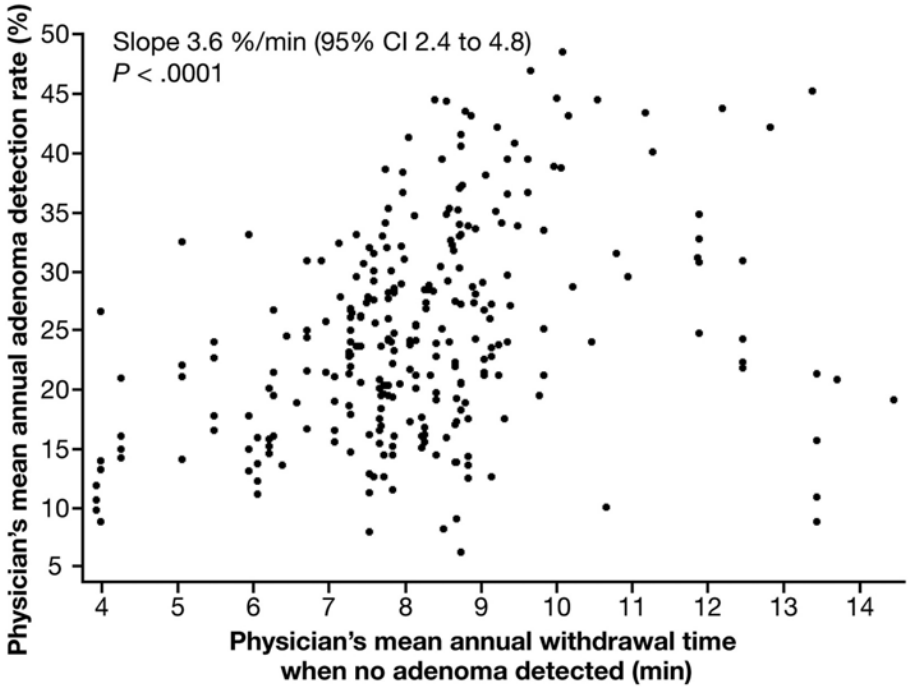
- Variability has been demonstrated in all aspects of screening colonoscopy
  - Inspection
  - Detection
  - Resection
- Reduction of colonoscopy costs is a primary concern of payers

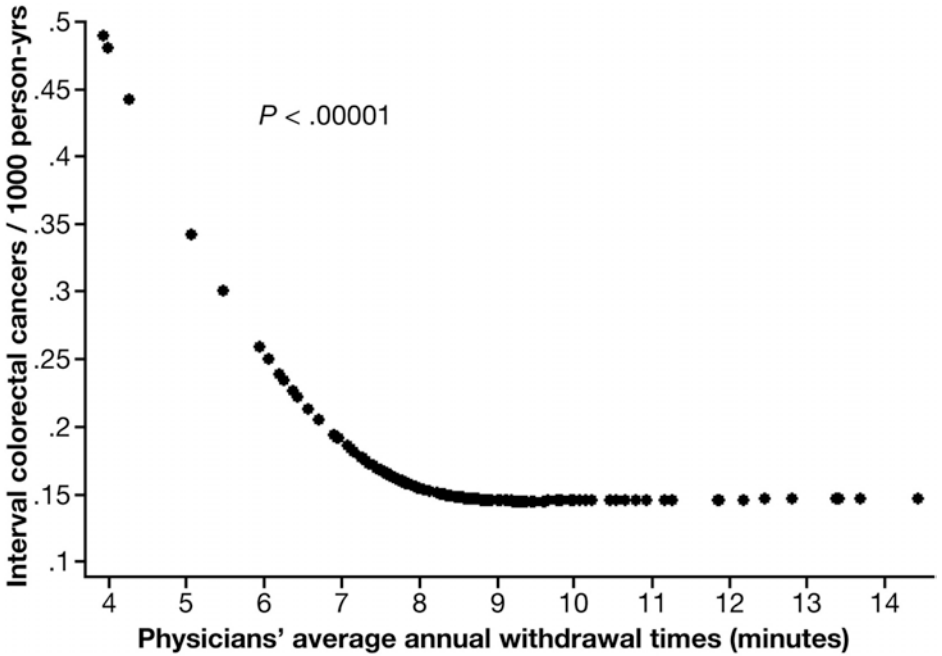
Variability in Inspection Quality



KESWANI RN ET AL; PANDOLFINO J, AMERICAN JOURNAL OF GASTROENTEROLOGY, 2015

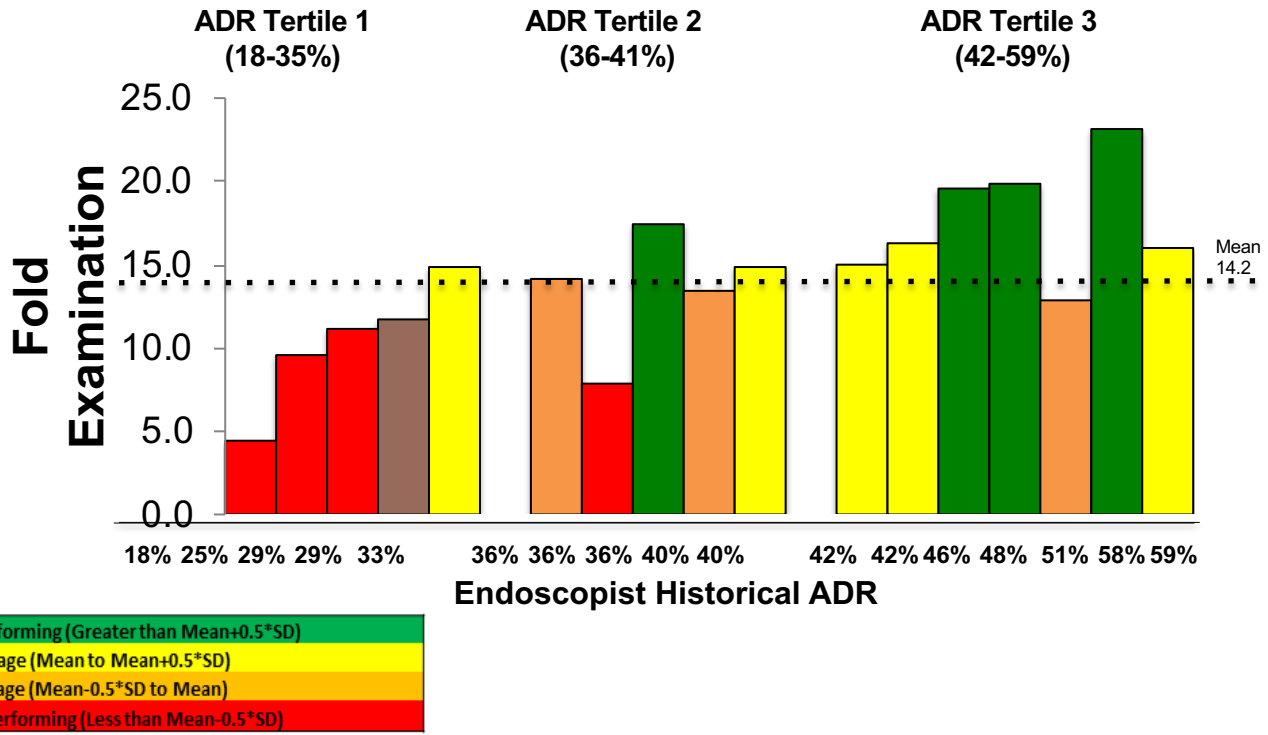
Association of Withdrawal Time with Adenoma Detection Rate





SHAUKAT A ET AL; ALLEN JA, GASTROENTEROLOGY, 2015

Variation in Technique Among Endoscopists



DULOY A ET AL; KESWANI RN, CLINICAL GASTROENTEROLOGY AND HEPATOLOGY, 2018

Cecal Intubation and Inspection

AUTOMATED COMPUTER
DEEP C

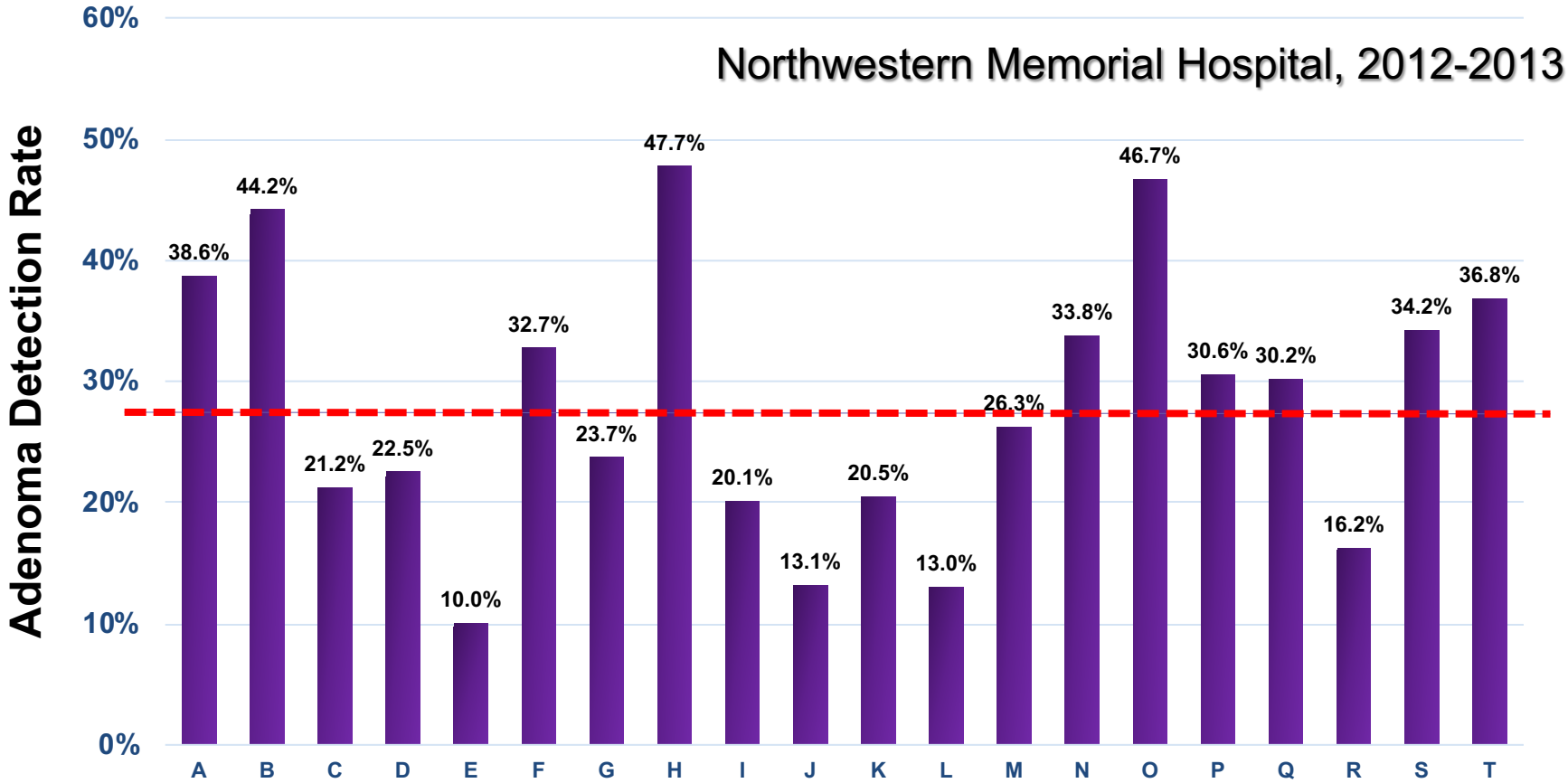
*Daniel J. Low[1,2], Hojjat sale
Karam Elsolh[1], Shai Genis[1],
Joseph John Barfett[3], Sami*

Compared to 'gold standard' video review, CNN predictions were extremely accurate for insertion time (IT) (R^2=0.996), withdrawal time (WT) (R^2=0.995) and total time (TT) (R^2=0.999). The mean difference in withdrawal time between expert video review and CNN predictions was 26 seconds. By contrast, the mean difference in withdrawal time between expert video review and manual WT entries was 5 minutes 15 seconds. In 13 of 14 cases, CNN-predicted WTs outperformed manually entered WTs relative to expert video review.

AUTOMATED INSERTION TIME, CECAL INTUBATION, AND WITHDRAWAL TIME DURING LIVE COLONOSCOPY USING CONVOLUTIONAL NEURAL NETWORKS - A VIDEO VALIDATION STUDY

Christopher Rombaoa[1], Ankush Kalra[1], Tyler Dao[1], James Requa[1], Andrew Ninh[1], Jason B. Samarasena[1], William E. Karnes[1]

In Support of Need to Reduce ADR Variability



Impact of AI on Polyp Detection

Endoscopy

OPEN ACCESS

ORIGINAL ARTICLE

Real-time automatic detection system increases colonoscopic polyp and adenoma detection rates: a prospective randomised controlled study

Pu Wang,[1] Tyler M Berzin,[2] Jeremy Romek Glissen Brown,[2] Shishira Bharadwaj,[2] Aymeric Becq,[2] Xun Xiao,[1] Peixi Liu,[1] Liangping Li,[1] Yan Song,[1] Di Zhang,[1] Yi Li,[1] Guangre Xu,[1] Mengtian Tu,[1] Xiaogang Liu[1]

Gastroenterology 2018;155:1069–1078

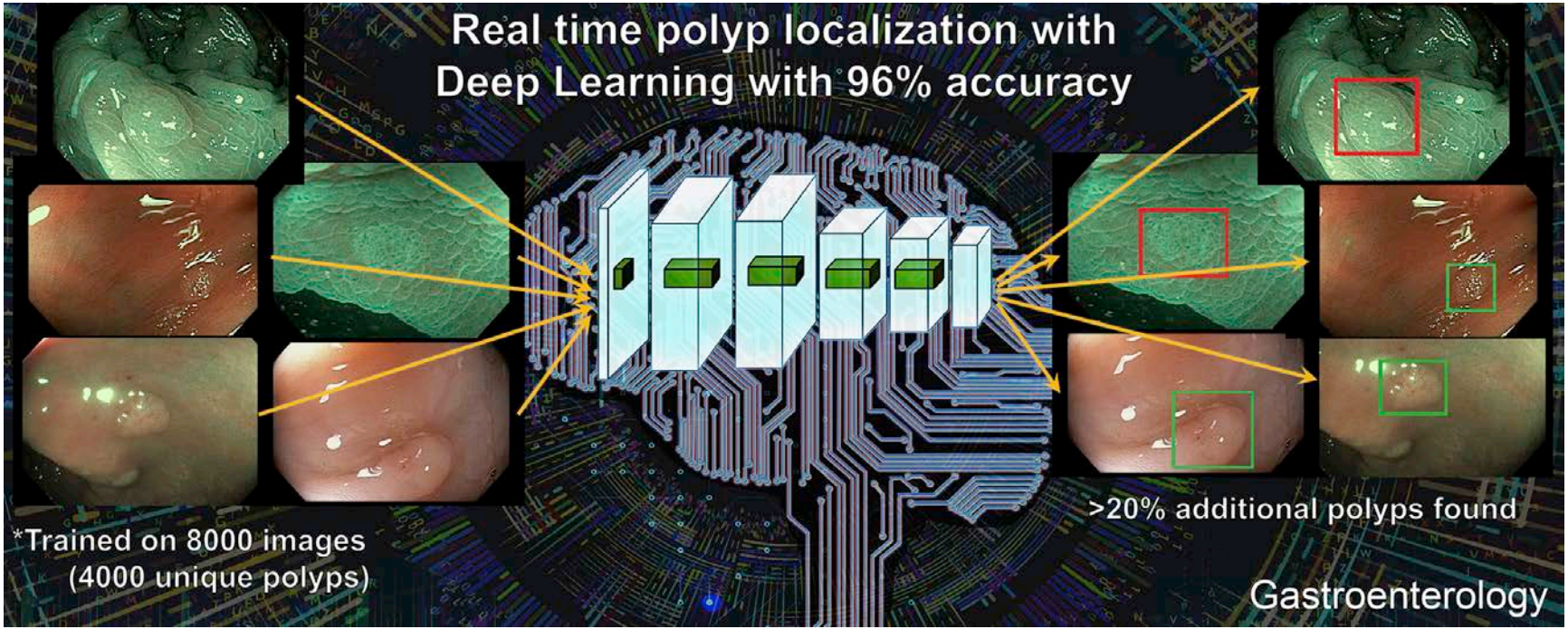
Deep Learning Localizes and Identifies Polyps in Real Time With 96% Accuracy in Screening Colonoscopy

Gregor Urban,[1,2] Priyam Tripathi,[4] Talal Alkayali,[4,5] Mohit Mittal,[4] Farid Jalali,[4,5] William Karnes,[4,5] and Pierre Baldi[1,2,3]

[1]Department of Computer Science, University of California, Irvine, California; [2]Institute for Genomics and Bioinformatics, University of California, Irvine, California; [3]Center for Machine Learning and Intelligent Systems, University of California, Irvine, California; [4]Department of Medicine, University of California, Irvine, California; and [5]H.H. Chao Comprehensive Digestive Disease Center, University of California, Irvine, California

CLINICAL AT

Deep Learning Improves Polyp Detection Rates



URBAN G ET AL; BALDI P, GASTROENTEROLOGY, 2018

Impact of AI on Polyp Detection

Polyp Characteristics	Routine Colonoscopy	CADe colonoscopy
Polyp Detection Rate	29.1%	45.0% [p<0.01]
Adenoma Detection Rate	20.3%	29.1% [p<0.01]
Mean Number of Detected Adenomas	0.31	0.53 [p<0.01]

WANG P ET AL; LIU X, GUT, 2019

Polyp Recognition

APPLICATION OF CONVOLUTIONAL NEURAL NETWORKS COULD DETECT ALL LATERALLY SPREADING TUMOR IN COLONOSCOPIC IMAGES

Satoki Shichijo[1], Kazuharu Aoyama[2], Tsuyoshi Ozawa[3], Motoi Miura[2], Hiromu Fukuda[1], Yoji Takeuchi[1], Hirotoshi Takiyama[4], Toshiaki Hirasawa[5], Tatusya Onishi[7,6], Keigo Matsuo[8], Soichiro Ishihara[7], Ryu Ishihara[1], Tomohiro Tada[7,2]

Polyp Classification

COMPUTER-AIDED DIAGNOS
SYSTEM USING ARTIFI

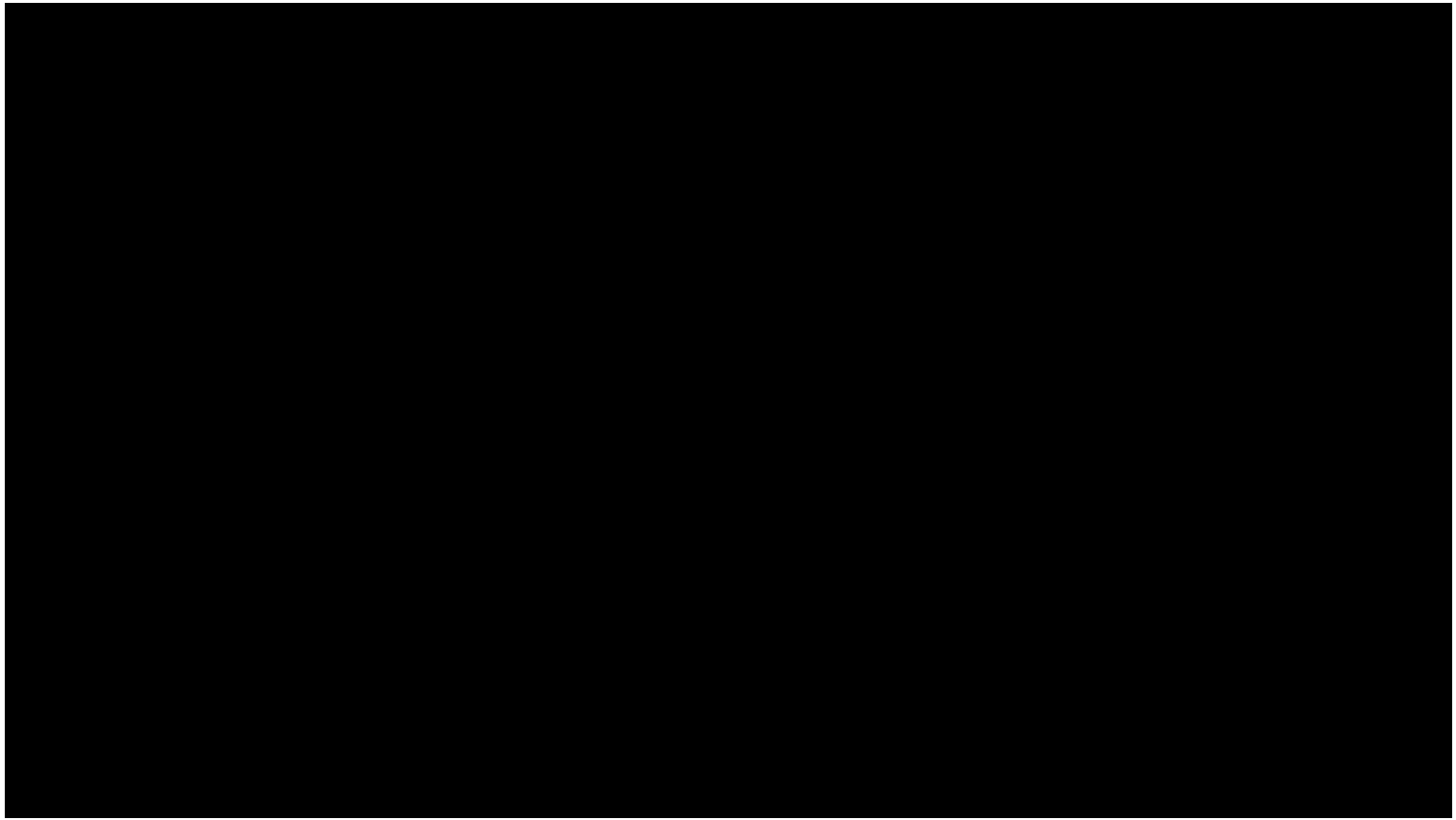
Yoriaki Komeda[1], Hisashi Ha
Watanabe[1], Hiroshi Kashida[1]

All of the 11 polyps were identified by the CAD system. While, only 3 snap shots were taken in the 3 videos without polyps (27%)… 2 pictures of anus and 1 of ileocecal valve. Eight out of 11 polyps (73%) were properly classified by the CAD system; Eight adenomas were properly recognized as adenoma, however, 2 hyperplastic polyps and 1 juvenile polyp were miss-classified as adenoma.

REAL-TIME COMPUTER-ASSISTED DIAGNOSIS SYSTEM OF COLORECTAL POLYPS IN STANDARD COLONOSCOPY VIDEOS

Tsuyoshi Ozawa[1], Soichiro Ishihara[2], Mitsuhiro Fujishiro[5], Motoi Miura[3], Kazuharu Aoyama[3], Tomohiro Tada[4,3,2]

In Action



Northwestern Medicine

Interventional Endoscopy