

Aids to Colonoscopy

Lawrence Hookey

Professor, Queen's University

President, Canadian Association of Gastroenterology



Conflicts of interest

- Pendopharm Pharmaceuticals, consultant, research funding
- Vantage Endoscopy, consultant
- Canadian Association of Gastroenterology president



Outline

- Improving pre-colonoscopy
- Improving colonoscopy insertion
- Improving polyp detection: Simple to complex
- Things you don't need

Objectives

At the end of this session you should be able to:

1. Discuss the differences and relative merits of ADR, PDR, SDR, and APC
2. List three proven interventions for improving ADR
3. Outline two challenges when designing colonoscopy polyp detection trials

Pre- procedure: Colonoscopy Preparation Keys

Bowel preparation can be improved through attention to:

- Timing
- Diet
- Education
- Rescue strategies
- Monitoring your own data and adjusting as you go

Improving Insertion (and thus everything else)

- Navigation systems
- Position changes
- Water insufflation/ exchange
- Distal Cap attachment

Nav systems: KHSC RFP 2022

- I told a vendor I would not look at a system that did not have navigation
- Clearly written into our RFP (request for proposals)
- Too many years of frustration of teaching courses, seeing how much navigation helps, then going back to scoping blind

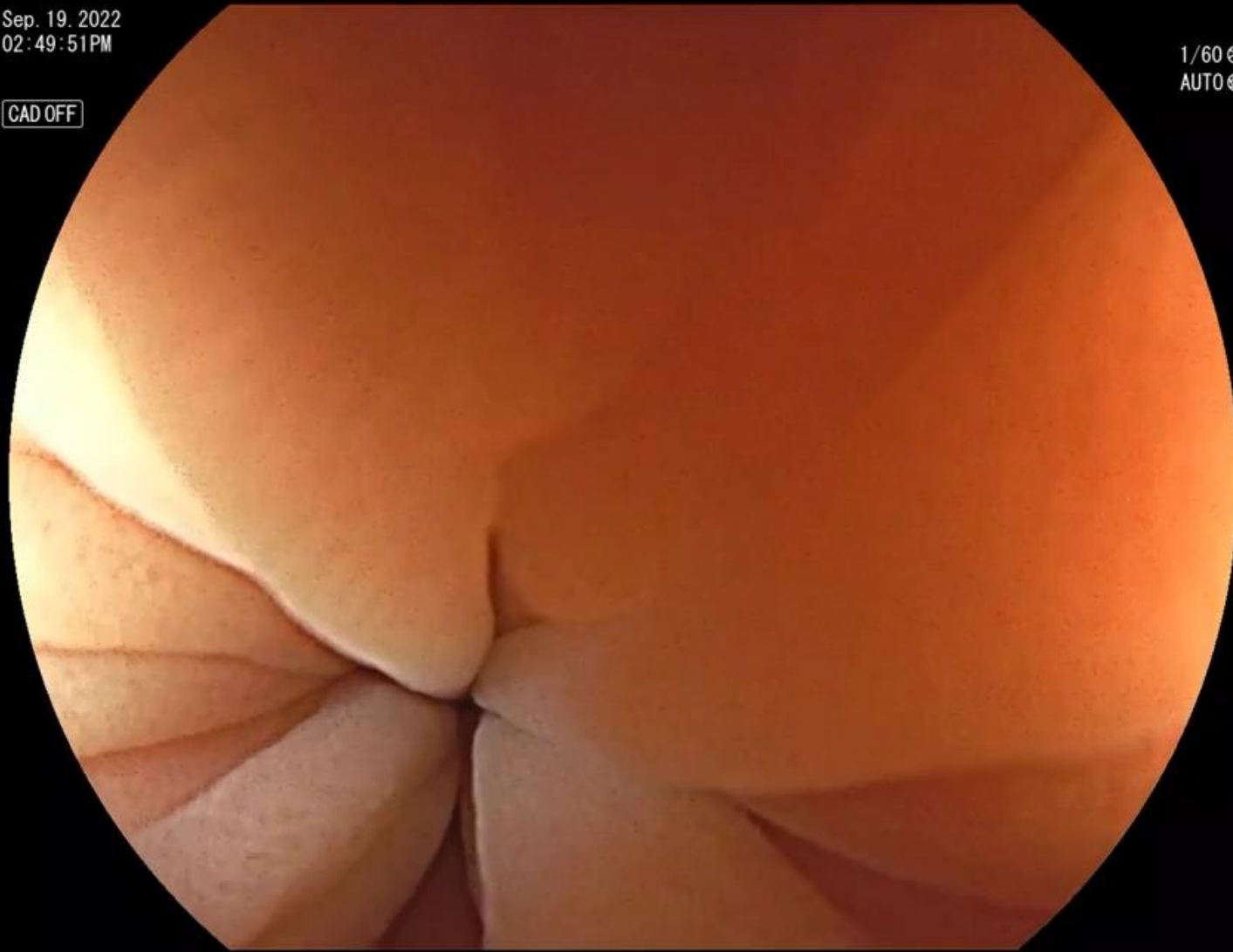
How do I use scope navigation systems?

- Every case- personal learning, reinforcing concepts and what to do in difficult cases
- Especially in prior failed cases, I don't use balloon enteroscopy, navigation is my first tool
- When teaching, an invaluable tool, allows quick assessment of situation at any point

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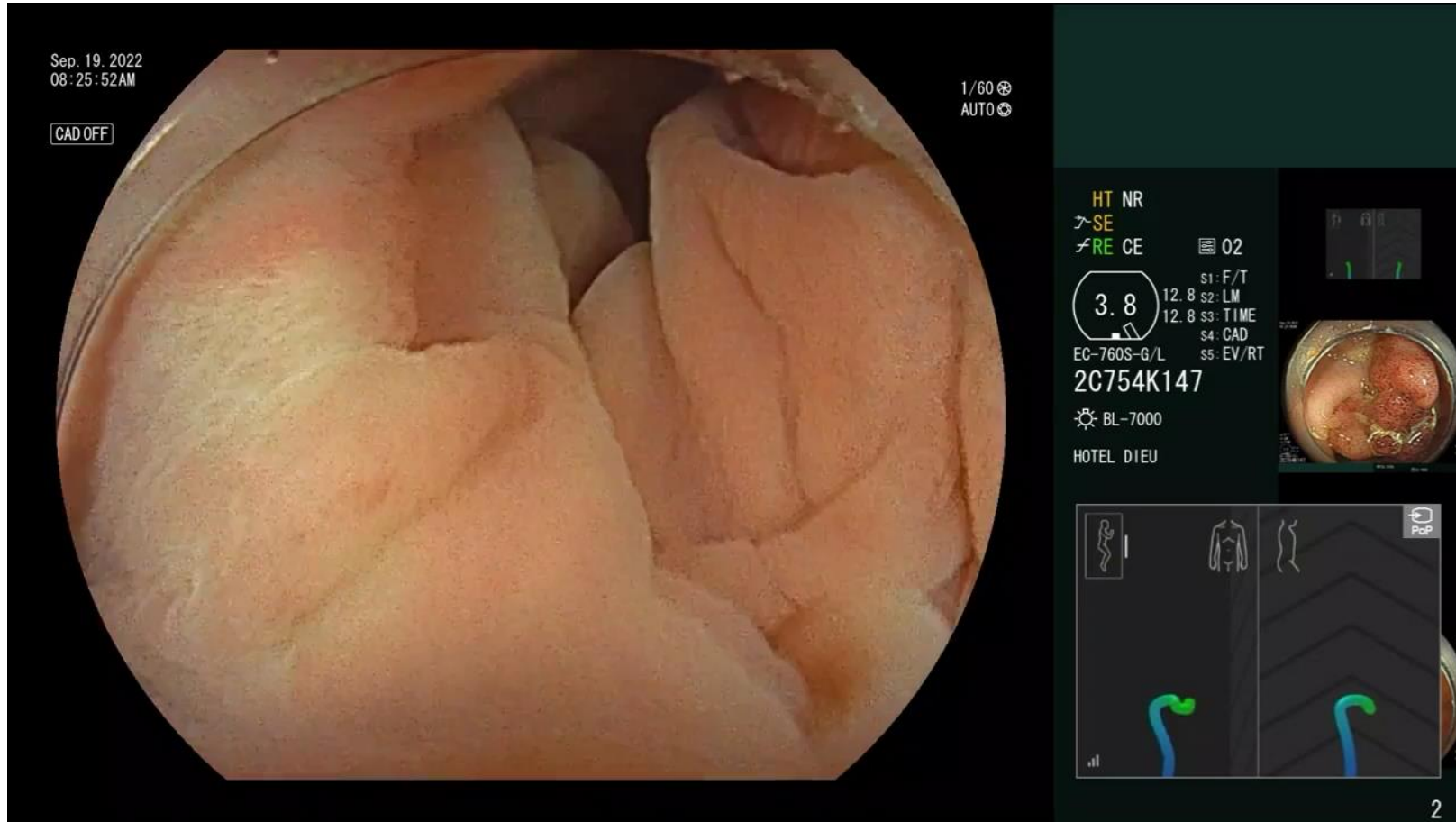
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2nd case



Barriers to widespread implementation

- Psychology
- Ego
- Cognitive/ sensory overload
- Fear of questions they can't answer



Advantages of navigation system

Proactive colonoscopy

Teaching – seeing is believing!

Tough cases – not nearly as
challenging as before!

External abdominal pressure no
more

Withdrawal quality improvement- what do we measure?

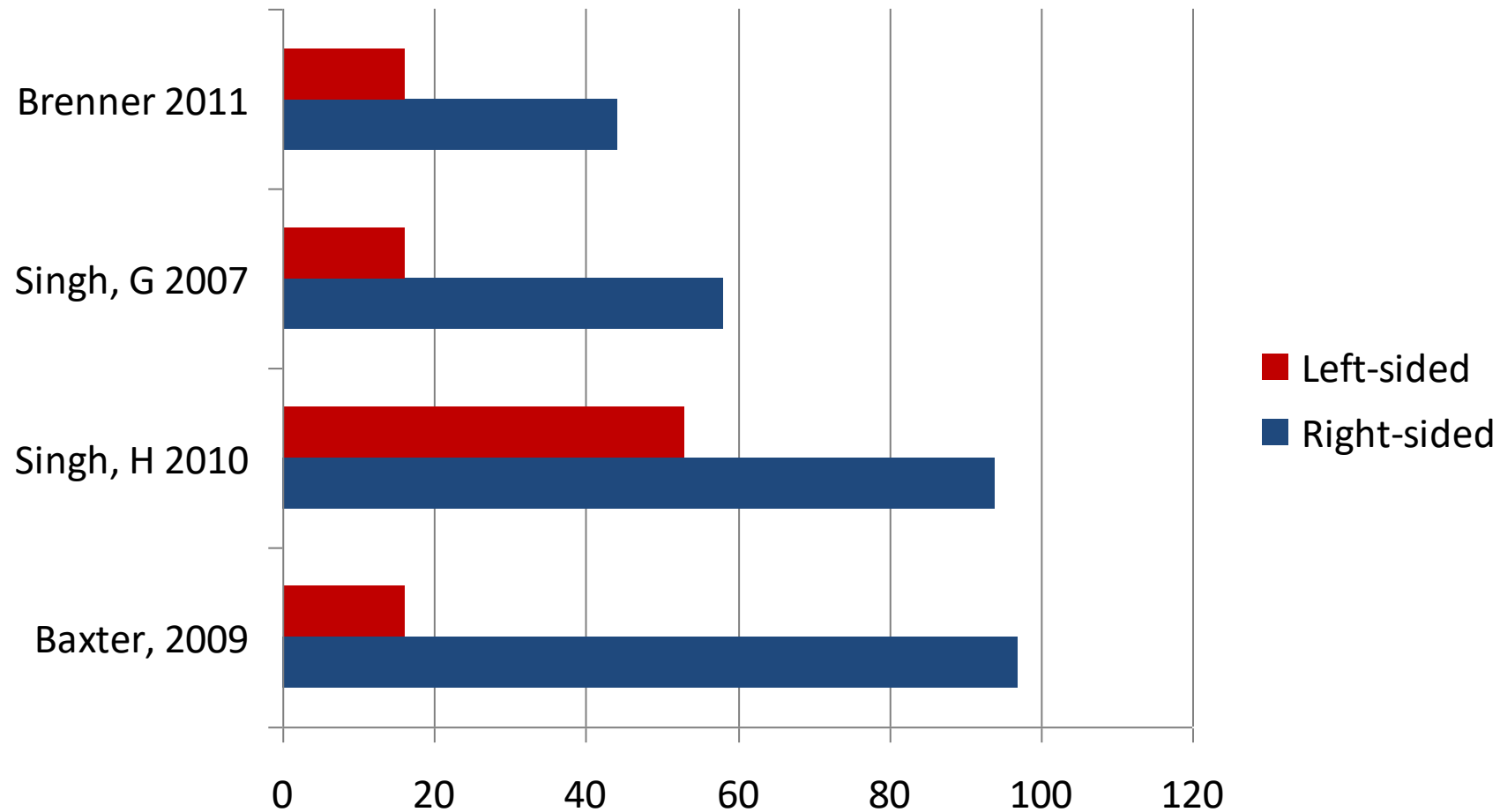
- ADR: adenoma detection rate- number of colonoscopies where you found adenoma/ total colonoscopies
- PDR: Number of colonoscopies where you find one or more polyps
- SDR: detection rate
- APC: Adenomas per colonoscopy



Colon cancer screening- quotes from the (not so distant) past

- “Who misses polyps??- not me”
- “We don’t need to be like the Japanese, they have different polyps than us”
- “The ditzel 2mm polyps don’t matter, people take those off to juice their numbers”
- “surgeons must be missing them all”

Residual risk after colonoscopy: right vs left colon



So how do we do better?

K.I.S.S

KEEP.**I**T.**S**IMPLE, **S**TUPID!

Picture this... Bob Barclay and I, DDW, 2006



ORIGINAL ARTICLE

Colonoscopic Withdrawal Times and Adenoma Detection during Screening Colonoscopy

Robert L. Barclay, M.D., Joseph J. Vicari, M.D., Andrea S. Doughty, Ph.D.,
John F. Johanson, M.D., and Roger L. Greenlaw, M.D.

NEJM, 2006

Withdrawal times

- Time withdrawing *not* including washing/ polypectomy
- Barclay introduced the threshold of 6 minutes
- Subsequent research suggests 9 minutes is the sweet spot

Position changes- good for insertion- what about withdrawal?

A randomized controlled trial assessing the effect of prescribed patient position changes during colonoscope withdrawal on adenoma detection (CME)

George Ou, MD, Edward Kim, MD, FRCPC, Pardis Lakzadeh, BSc, Jessica Tong, BSc, Robert Enns, MD, FRCPC, Alnoor Ramji, MD, FRCPC, Scott Whittaker, MD, FRCPC, Hin Hin Ko, MD, FRCPC, Brian Bressler, MD, MS, FRCPC, Lawrence Halparin, MD, FRCPC, Eric Lam, MD, FRCPC, Jack Amar, MD, FRCPC, Jennifer Telford, MD, MPH, FRCPC

Vancouver, British Columbia, Canada

Ou et al, GIE, 2014

Results

- No difference in ADR between groups

	Control (n = 388)	Dynamic (n = 388)	OR, 95% CI; P value
Polyp detection rate	58.2% (n = 226)	58.0% (n = 225)	0.99, 0.74-1.32; .93
Adenoma detection rate	37.9% (n = 147)	41.8% (n = 162)	1.17, 0.88-1.57; .28

But... 52% of control group had position changes during withdrawal

Water insufflation/exchange

How do we decide if we need more?

- Assessing study design



"New technology is not good or evil in and of itself. It's all about how people choose to use it."

- David Wong

A case study of a study

Hindawi Publishing Corporation
Diagnostic and Therapeutic Endoscopy
Volume 2015, Article ID 167406, 5 pages
<http://dx.doi.org/10.1155/2015/167406>

Research Article

High Definition Colonoscopy Combined with i-SCAN Imaging Technology Is Superior in the Detection of Adenomas and Advanced Lesions Compared to High Definition Colonoscopy Alone

Bowman et al, Dig and Ther Endoscopy, 2015

1927 patients

-1007 with i-scan

-920 with high definition

- Groups very similar
- Single centre, multiple endoscopists

	i-scan	HD	p value
Polyp detection rate (%)	56	47	0.03
Adenoma Detection rate (%)	33	27	<0.01

Questions??

Biases?	
What constituted the difference?	
Was everything else the same?	
Randomized?	

Questions??

Biases?	New technology, different time period
What constituted the difference?	Mainly small polyps, but also dif in advanced lesions
Was everything else the same?	Withdrawal time longer in i-SCAN group
Randomized?	Historical cohort

How do we do it better?

- Randomized trials – good
- Blinding near impossible- bad
- How to offset this?
- Second pass effect- known increased detection – Rex et al (Gastro, 1997)

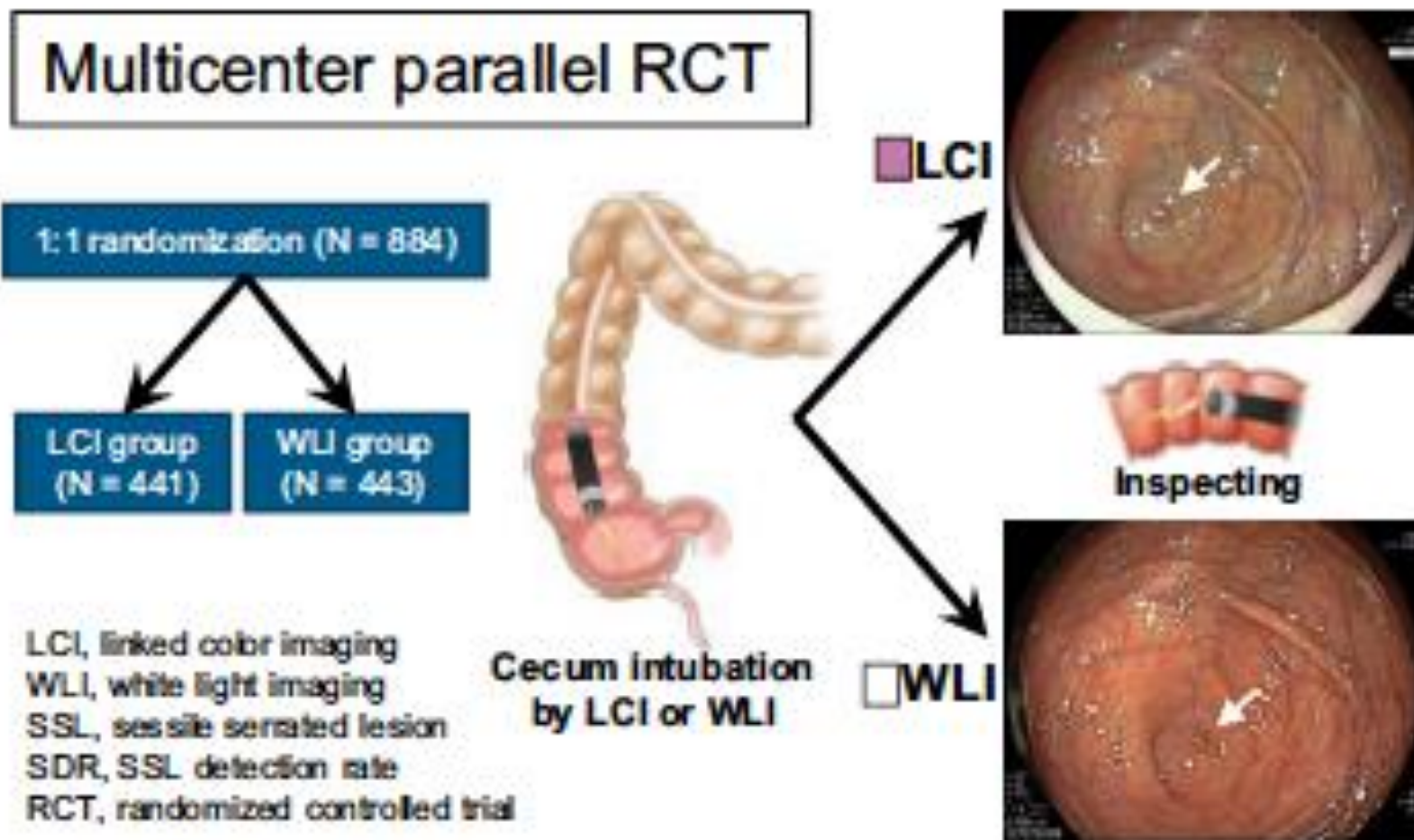
The good news?

The good news?

Things have gotten a lot better



Colorectal Sessile Serrated Lesion Detection Using Linked Color Imaging: A Multicenter, Parallel Randomized Controlled Trial



Outcomes	LCI	WLI	
PDR	57.1	46.5	0.002
ADR	38.5	33	0.083
SDR	11.3	5.9	0.004
Diminutive polyps	47.2	32.7	<0.001
Flat lesion detection	53.7	42.2	0.001

Impact factors associated with SDR

Factors	HR	95% CI	P
Operator experience	1.850	1.045-3.273	0.035
Withdrawal time	1.157	1.060-1.263	0.001
LCI vs. WLI	1.990	1.203-3.293	0.007

What further role does enhanced imaging have then?

- characterization of lesions
- Especially now that submucosal dissection has come to Canada

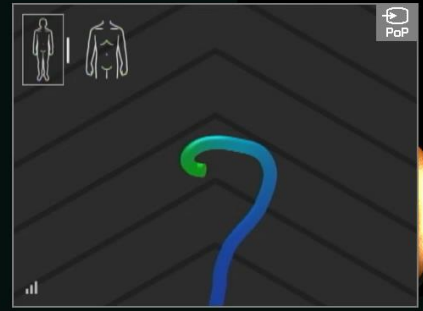
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S5: EV/RT



Prior to SMD

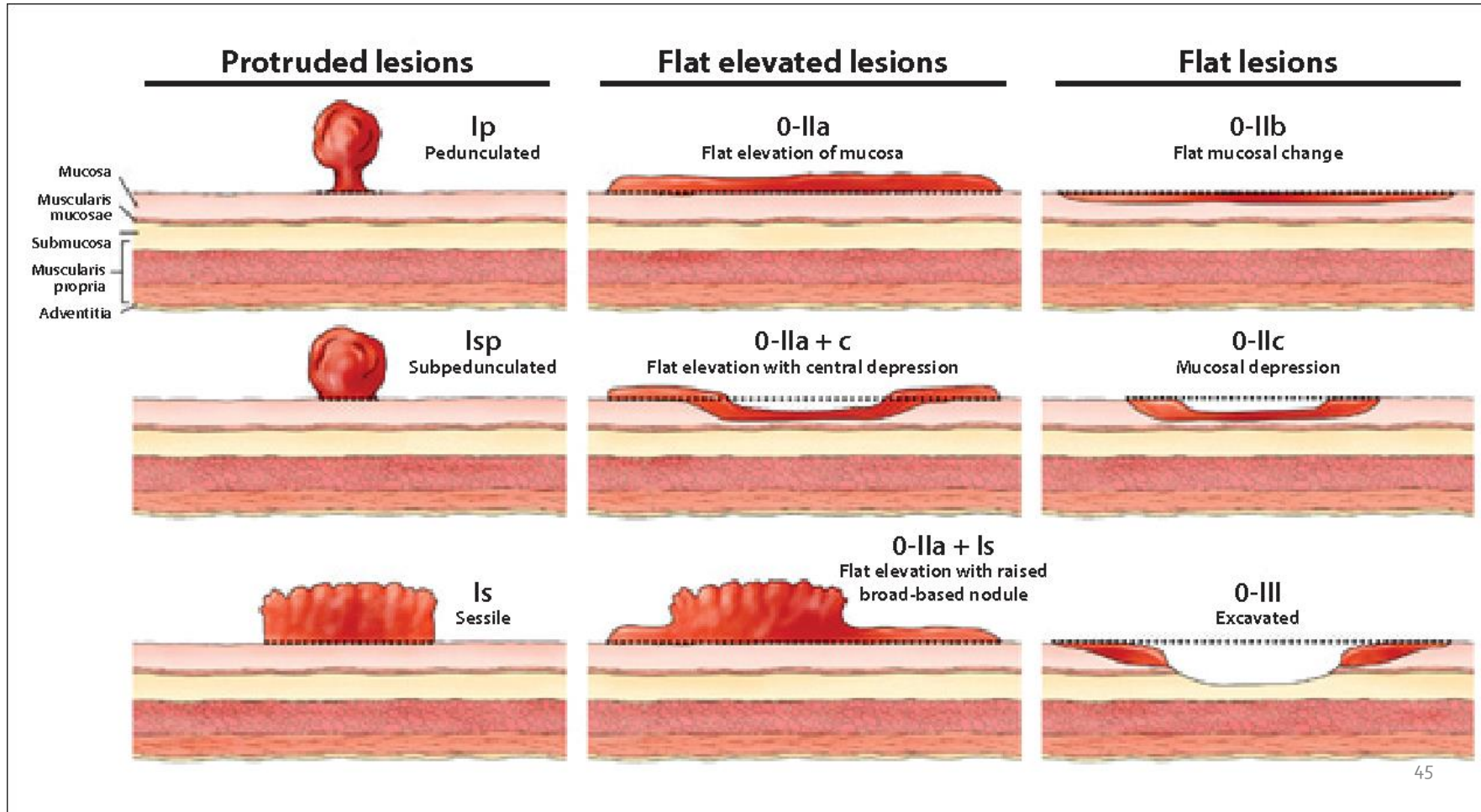


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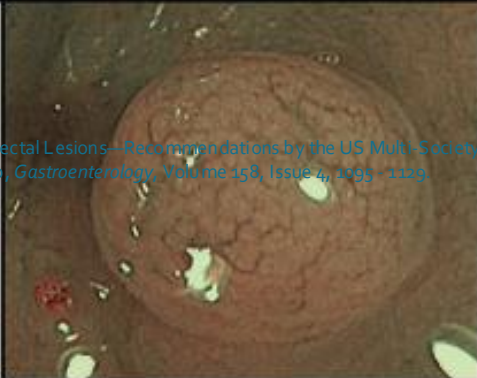

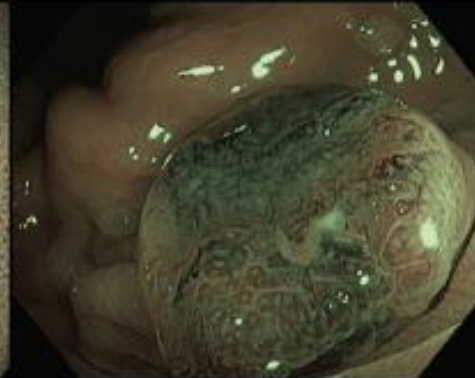
All Polyps

Now with SMD, we need to choose our targets

Paris Classification: Digging Deeper

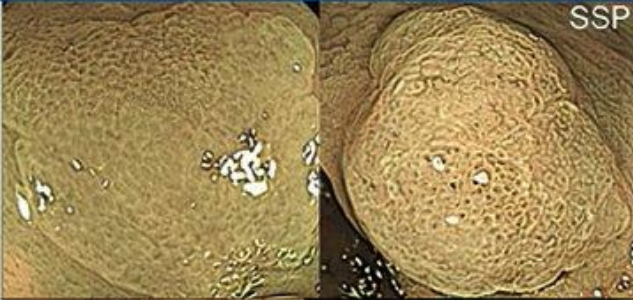
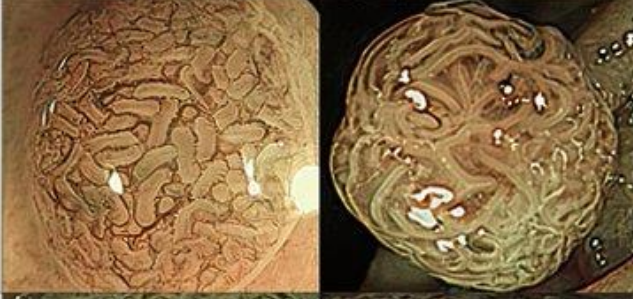
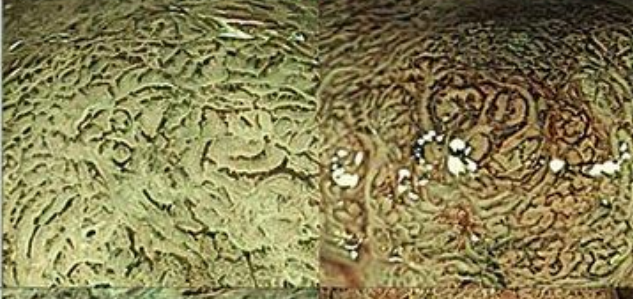
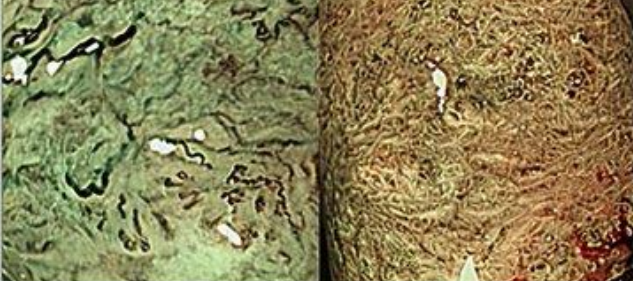


Optical diagnosis of colorectal lesions, NICE classification (NBI)

	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
			


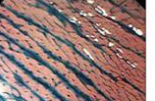


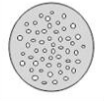
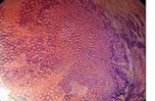

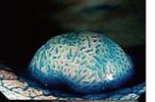




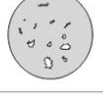

Endoscopic Removal of Colorectal Lesions—Recommendations by the US Multi-Society Task Force on Colorectal Cancer
 Kaltenbach, Tonya et al. 2020. *Gastroenterology*, Volume 158, Issue 4, 1095 - 1109

JNET Classification

	Vessel pattern	Surface pattern	Most likely histology	Endoscopic Images
Type 1	<ul style="list-style-type: none"> · Invisible¹ 	<ul style="list-style-type: none"> · Regular dark or white spots · Similar to surrounding normal mucosa 	Hyperplastic polyp/ Sessile serrated polyp ³	
Type 2A	<ul style="list-style-type: none"> · Regular caliber² · Regular distribution (meshed/spiral pattern) 	<ul style="list-style-type: none"> · Regular (tubular/branched/papillary) 	Low grade intramucosal neoplasia	
Type 2B	<ul style="list-style-type: none"> · Variable caliber · Irregular distribution 	<ul style="list-style-type: none"> · Irregular or obscure 	High grade intramucosal neoplasia / Shallow submucosal invasive cancer ⁴	
Type 3	<ul style="list-style-type: none"> · Loose vessel areas · Interruption of thick vessels 	<ul style="list-style-type: none"> · Amorphous areas 	Deep submucosal invasive cancer	

KUDO Classification & correlation with pathology (Histology)

- The pit-pattern of colorectal polyps as seen by magnification has been proved to be related to the histopathological type of the lesion.
- Kudo's Classification (I-V):**
 - Hyperplastic** – round pits (I,II);
 - Adenomatous** – dendritic or tubular pits (III,IV)
 - Cancerous** – Irregular arrangement and sizes of pit or loss of pit pattern (V)

I		Round pit (normal pit)		Normal mucosa
II		Asteroid pit		Type II pit pattern is specific for hyperplasia. Also, superficial type serrated adenoma and SSA/P show this pit like pattern.
III _s		Tubular of round pit that is smaller than the normal pit (type I)		Regular pattern → intramucosal lesion
III _L		Tubular of round pit that is larger than the normal pit (type I)		
IV		Dendritic or gyrus-like pit		
V _i		Irregular arrangement and sizes of III _s , III _L , IV type pit pattern		Irregular pattern → mucosal-submucosal deep invasion
V _N		Loss or decrease of pits with an amorphous structure		Nonstructure pattern → Submucosal deep invasion

However...

Polyp Morphology: An Interobserver Evaluation for the Paris Classification Among International Experts

Sascha C. van Doorn, MD¹, Y. Hazewinkel, MD¹, James E. East, MD², Monique E. van Leerdam, MD, PhD³, Amit Rastogi, MD⁴, Maria Pellisé, MD, PhD⁵, Silvia Sanduleanu-Dascalescu, MD, PhD⁶, Barbara A.J. Bastiaansen, MD¹, Paul Fockens, MD, PhD¹ and Evelien Dekker, MD, PhD¹

- AJG, 2015



- 7 expert endoscopists
- Shown 85 still photos of various polyps
- Asked to classify each according to size and Paris classification
- then trained using a 30 minute presentation and re-tested

Table 3. Interobserver agreement (n=7)

	Number of polyps assessed	Fleiss kappa
Paris classification		
Prior to training	85	0.42 (95% CI 0.38–0.46)
Post training	85	0.38 (95% CI 0.35–0.41)
Polypoid (Ip, Isp, Is) vs. non-polypoid (IIa, IIb, IIc, III)	85	0.43 (95% CI 0.38–0.49)
Diminutive lesions (1–5 mm)	43 ^a	0.27 (95% CI 0.20–0.33)
Small lesions (6–9 mm)	21 ^a	0.38 (95% CI 0.32–0.44)
Large lesions (>9 mm)	7 ^a	0.54 (95% CI 0.44–0.64)

SAVE THE DATE!

Queen's Optical Diagnostic Course, April 11-13, 2025 Delta Waterfront Hotel, Kingston

This immersive two-and-a-half-day course offers GI fellows unparalleled education on the fundamentals of endoscope technologies from leading endoscope vendors in Canada. Hands-on sessions will feature magnifying endoscopes, covering essential topics in endoscopic examination from the hypopharynx to the colon, along with advanced optical diagnostic techniques.

This Year's guest Faculty is Dr. Yusuke Fujiyoshi, The Ottawa Hospital.

If you are interested in attending or sponsoring the 2025 course please contact:

Trina Mellon, Program Coordinator

trina@tallgirlconferenceplanning.com | 403.993.8025

AI assisted colonoscopy ... a Multi-centre RCT

- 6 centres in Hong Kong, China, and Singapore
- Patients were average risk screening and FIT positive
- Stratified according to endoscopist expertise
- expert (>5000 case) and non expert (<5000)
- Primary outcome ADR
- 3059 patients in ITT analysis

Results

- Similar cecal intubation, BBPS, mix of indications
- Insertion and Withdrawal times longer in the AI group
- AI assisted ADR significantly higher in both expert and non expert groups

AI assisted colonoscopy ... a Multi-centre RCT

	Expert AI (n=1519)	Expert CC (n=1540)	Non expert AI (n=1238)	Non expert CC (n=1289)	p value
ADR	39.9		32.4		<0.001
ADR	42.3	32.8	37.5	32.1	<0.05
APC	0.59 +/- 0.97		0.45 +/- 0.81		<0.001

Xu et al, CGH, 2023

AI assisted colonoscopy ... a Multi-centre RCT

	AI (n=1519)		CC (n=1289)		p value
Advanced adenoma	39.9		32.4		<0.001
SSL	42.3	32.8	37.5	32.1	<0.05
Adenoma > 10mm	0.59 +/- 0.97		0.45 +/- 0.81		<0.001

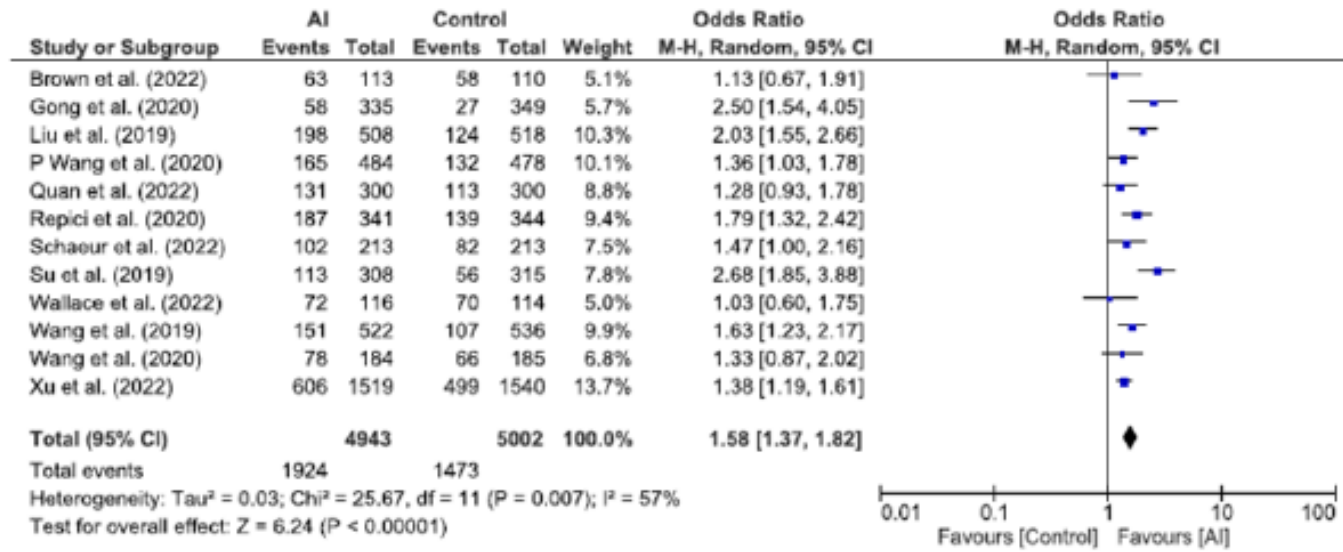


Figure 3. Meta-Analysis of ADR

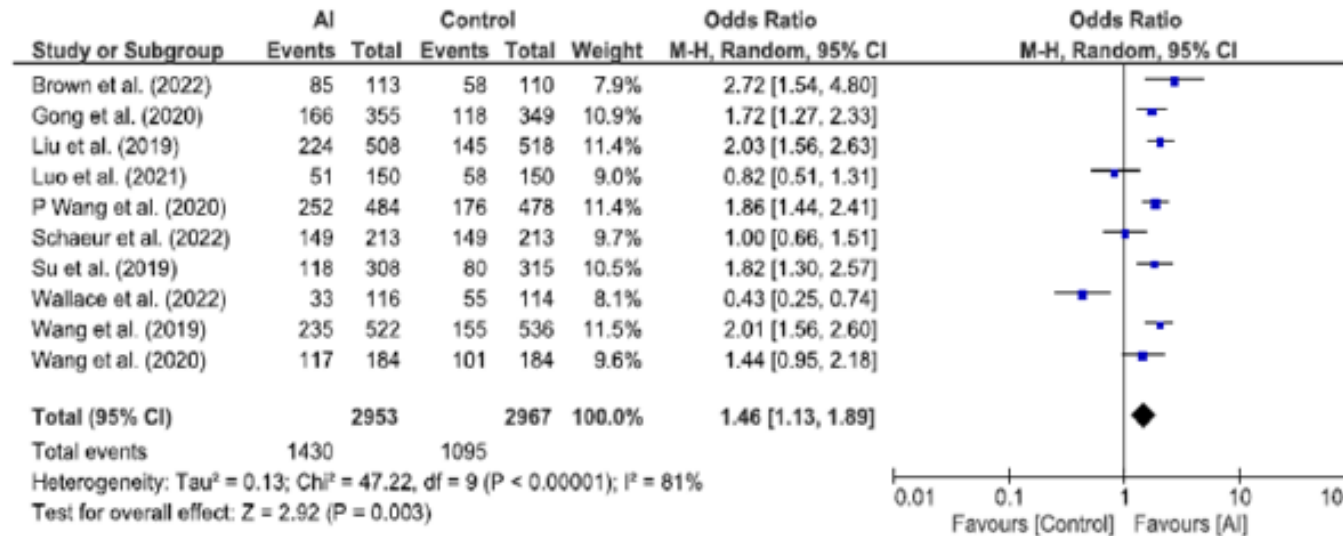


Figure 4. Meta-Analysis of PDR

How do I use it?

- Need a clean bowel, and flat
- Use CADe in every withdrawal, turn on and off when doing polypectomy
- Try CADx when in doubt, still exploring utility
- Not all members of group using, we are exploring why

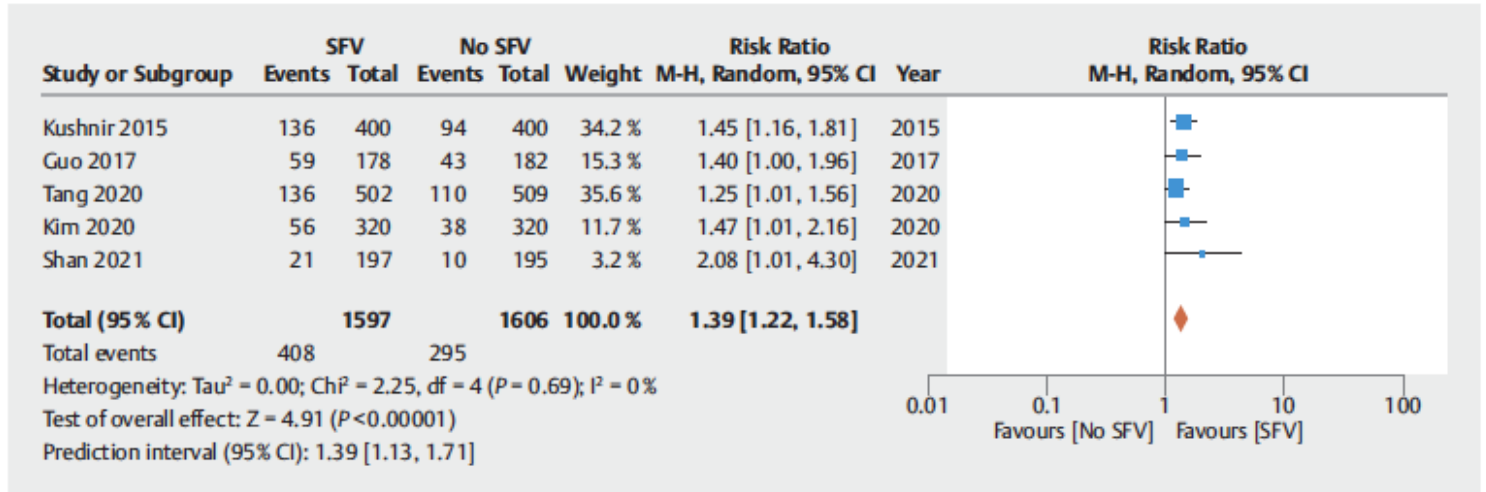


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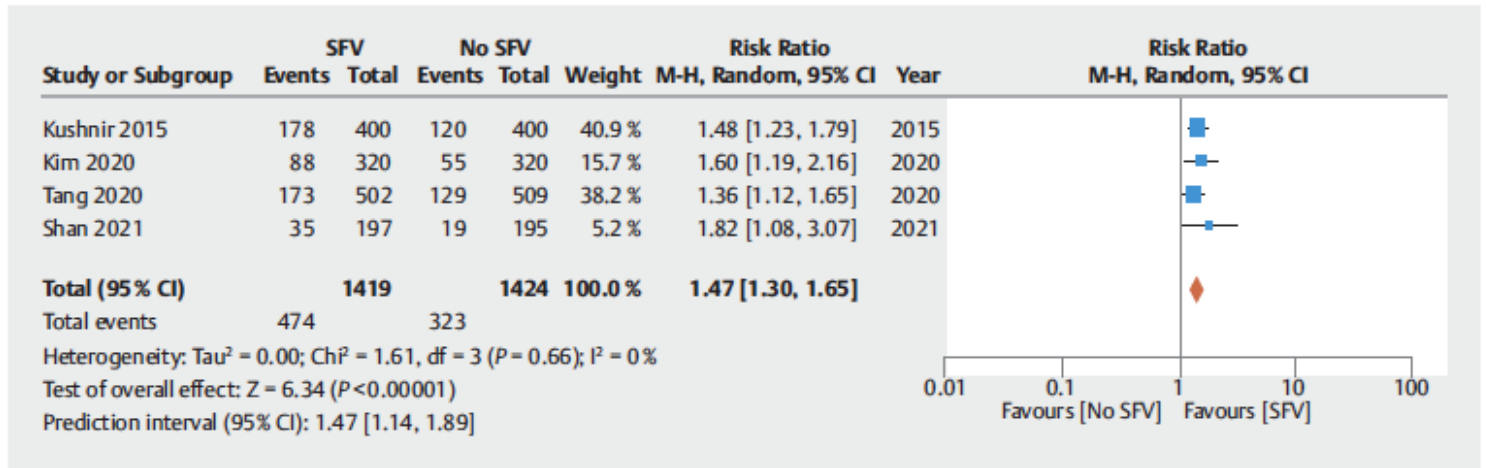
Second look

- Mainly aimed at right colon
- Some Second look studies with twists- caps, devices, third eye etc
- We almost had a Canadian RCT! Would have been the best one:
true control group

Second look studies with either Straight view or Retroflexed



► Fig. 2 Forest plot comparing right colon ADR between SFV and no SFV groups.



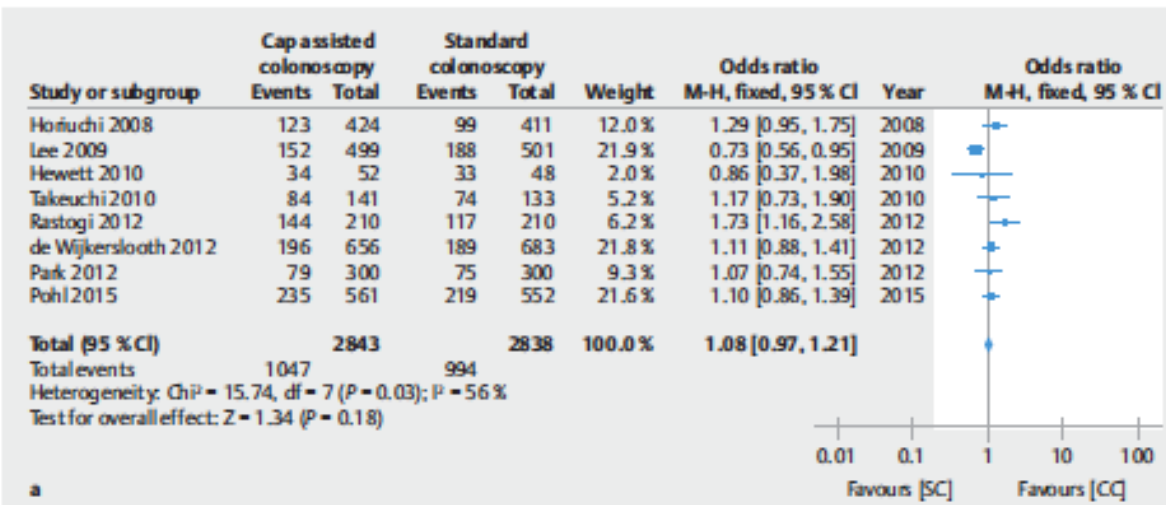
► Fig. 3 Forest plot comparing right colon PDR between SFV and no SFV groups.

Distal attachments

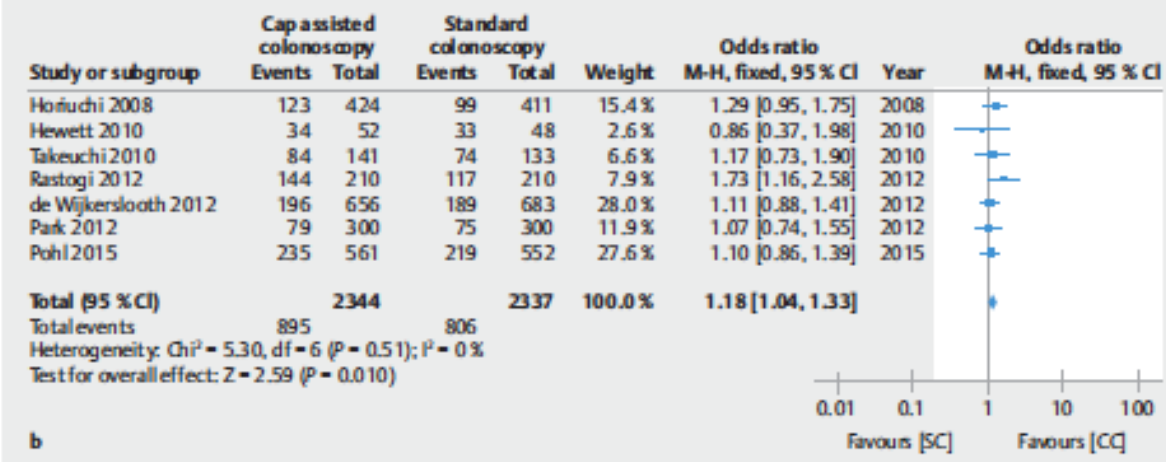


Simple Caps

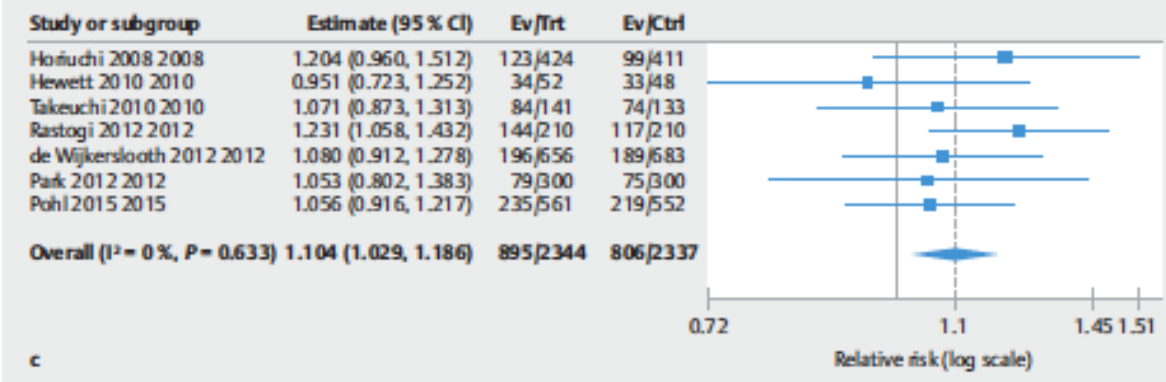




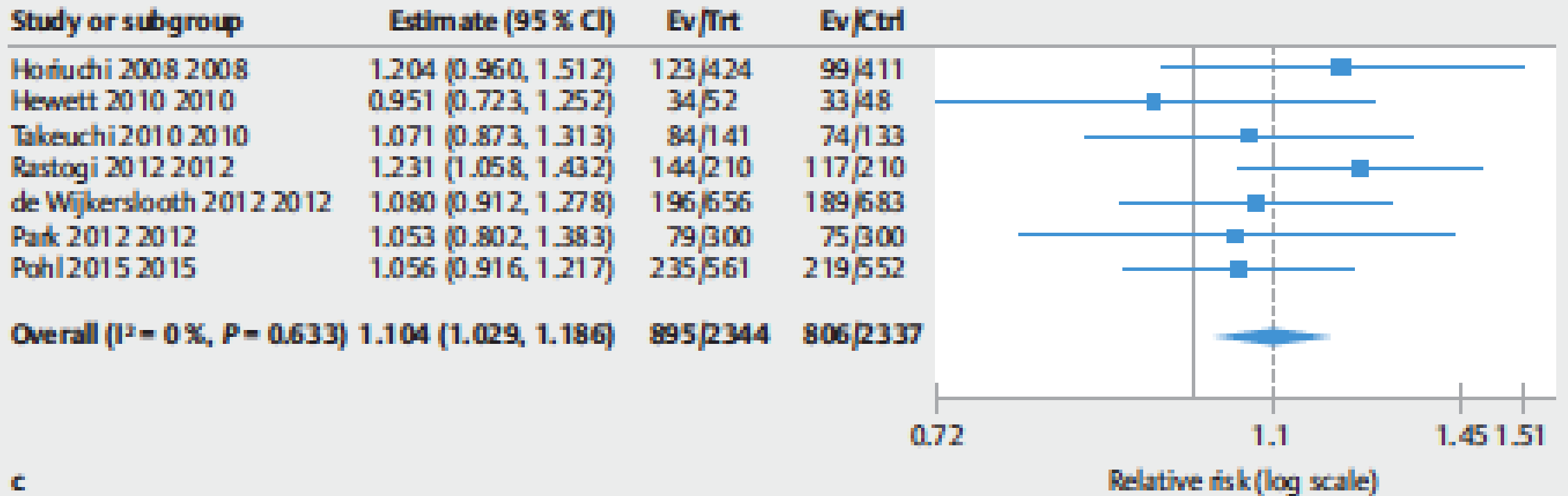
a



b



c



► Fig. 2 Forest plot of pooled estimates of adenoma detection rate using cap-assisted colonoscopy compared to standard colonoscopy. **a** Results with all eligible studies. **b** Results with only high-quality studies (Jadad score ≥ 3). **c** Results with only high-quality studies using random effects.

Fancy Caps



Fancy Caps



Endocuff

Endoscopy



ORIGINAL ARTICLE

Improved adenoma detection with Endocuff Vision: the ADENOMA randomised controlled trial

Wee Sing Ngu,¹ Roisin Bevan,² Zacharias P Tsiamoulos,³ Paul Bassett,⁴ Zoë Hoare,⁵
Matthew D Rutter,² Gayle Clifford,¹ Nicola Totton,⁵ Thomas J Lee,⁶ Arvind Ramadas,⁷
John G Silcock,⁸ John Painter,⁹ Laura J Neilson,¹ Brian P Saunders,³ Colin J Rees^{1,10}

Analysis	Adenoma detection	SC N (%)	EAC N (%)	% Difference (one-sided 95% CI)	One-sided P value
Intention to treat	No adenoma	564 (63.8%)	525 (59.1%)		
	1+ adenomas	320 (36.2%)	363 (40.9%)	4.7% (0.9% to ∞)	0.02

Table 10 Patient risk group

Patient group	Risk	SC N (%)	EAC N (%)	Two-sided P value
All patients	No adenoma	564 (63.8%)	525 (59.1%)	0.03
	Low	205 (23.2%)	225 (25.3%)	
	Intermediate	87 (9.8%)	95 (10.7%)	
	High	28 (3.2%)	43 (4.8%)	
Non-BCSP	No adenoma	366 (76.1%)	374 (75.7%)	0.78
	Low	93 (19.3%)	89 (18.0%)	
	Intermediate	18 (3.7%)	25 (5.1%)	
	High	4 (0.8%)	6 (1.2%)	
BCSP	No adenoma	198 (49.1%)	151 (38.3%)	0.004
	Low	112 (27.8%)	136 (34.5%)	
	Intermediate	69 (17.1%)	70 (17.8%)	
	High	24 (6.0%)	37 (9.4%)	

BCSP, Bowel Cancer Screening Programme; EAC, EV-assisted colonoscopy; SC, standard colonoscopy.

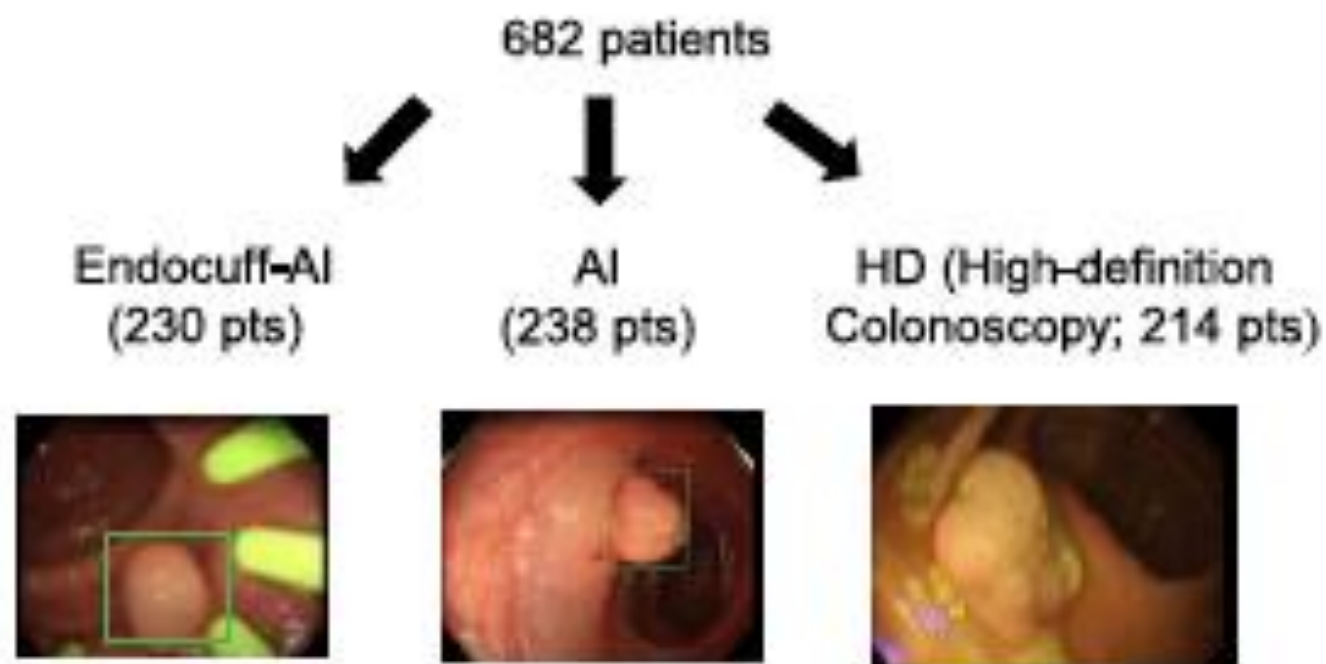
Make it a combo!



Endocuff With or Without Artificial Intelligence-Assisted Colonoscopy in Detection of Colorectal Adenoma: A Randomized Colonoscopy Trial

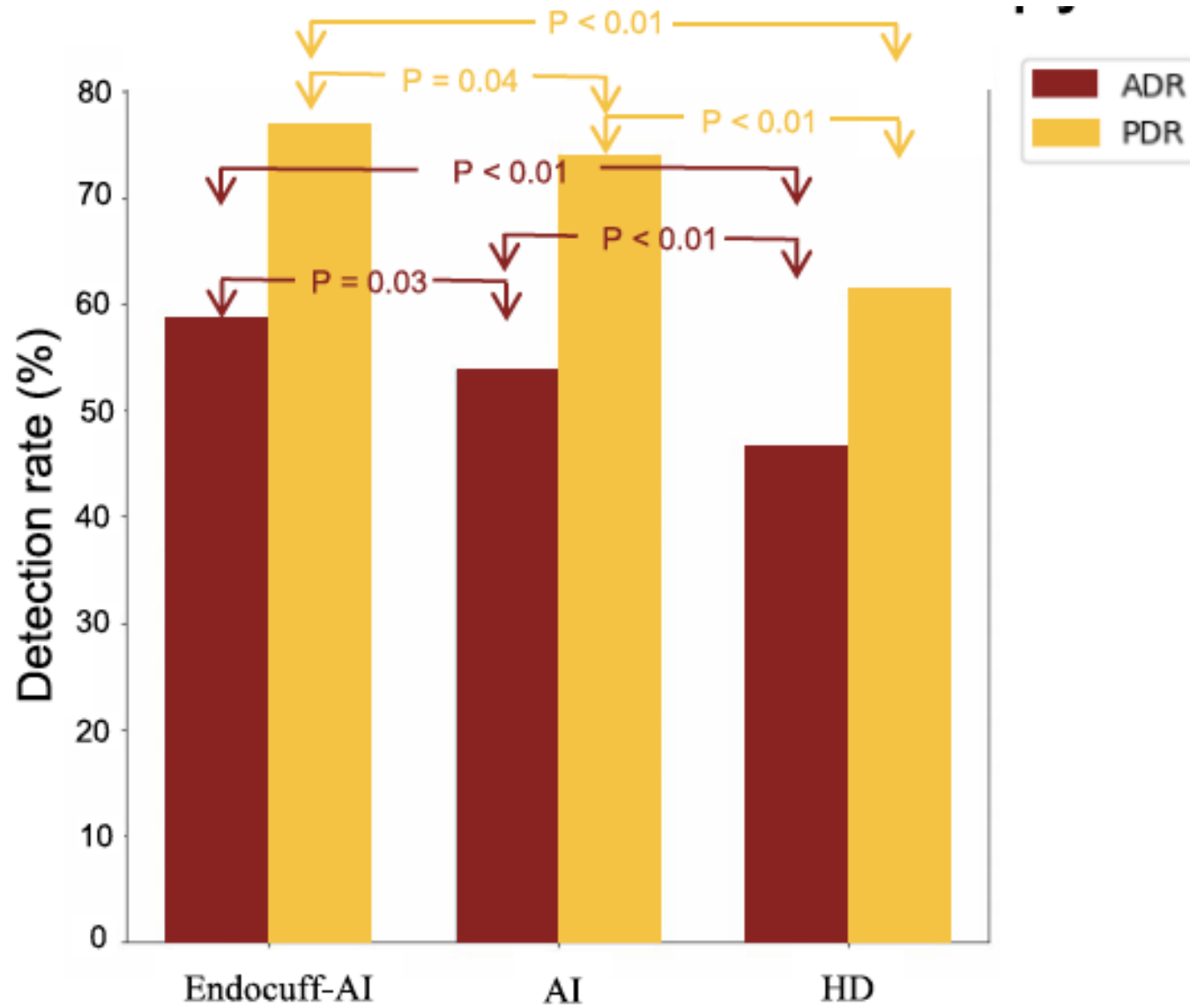
Thomas Ka-Luen Lui, MMedSc^{1,2}, Carla Pui-Mei Lam, MBBS², Elvis Wai-Pan To, MBBS^{2,3}, Michael Kwan-Lung Ko, MBBS², Vivien Wai Man Tsui, MBBS², Kevin Sze-Hang Liu, MBChB², Cynthia Ka-Yin Hui, MBBS², Michael Ka-Shing Cheung, MD^{1,2}, Loey Lung-Yi Mak, MD^{1,2}, Rex Wan-Hin Hui, MBBS², Siu-Yin Wong, MBBS², Wai Kay Seto, MD^{1,2} and Wai K. Leung, MD^{1,2}

Lui et al, ALG, 2024



Primary outcome: Adenoma detection rate (ADR)
Secondary outcome: Polyp detection rate (PDR)

-
- Lui et al, ALG, 2024



What doesn't work

Hyoscine n- butylbromide

Warm water

Warm air



Madhoun et al, Dig endo, 2015

Patel et al, Endo int open, 2017

Objectives

At the end of this session you should be able to:

1. Discuss the differences and relative merits of ADR, PDR, SSAD, and APC
2. List three proven interventions for improving ADR
3. Outline two challenges when designing colonoscopy polyp detection trials

Thank You

