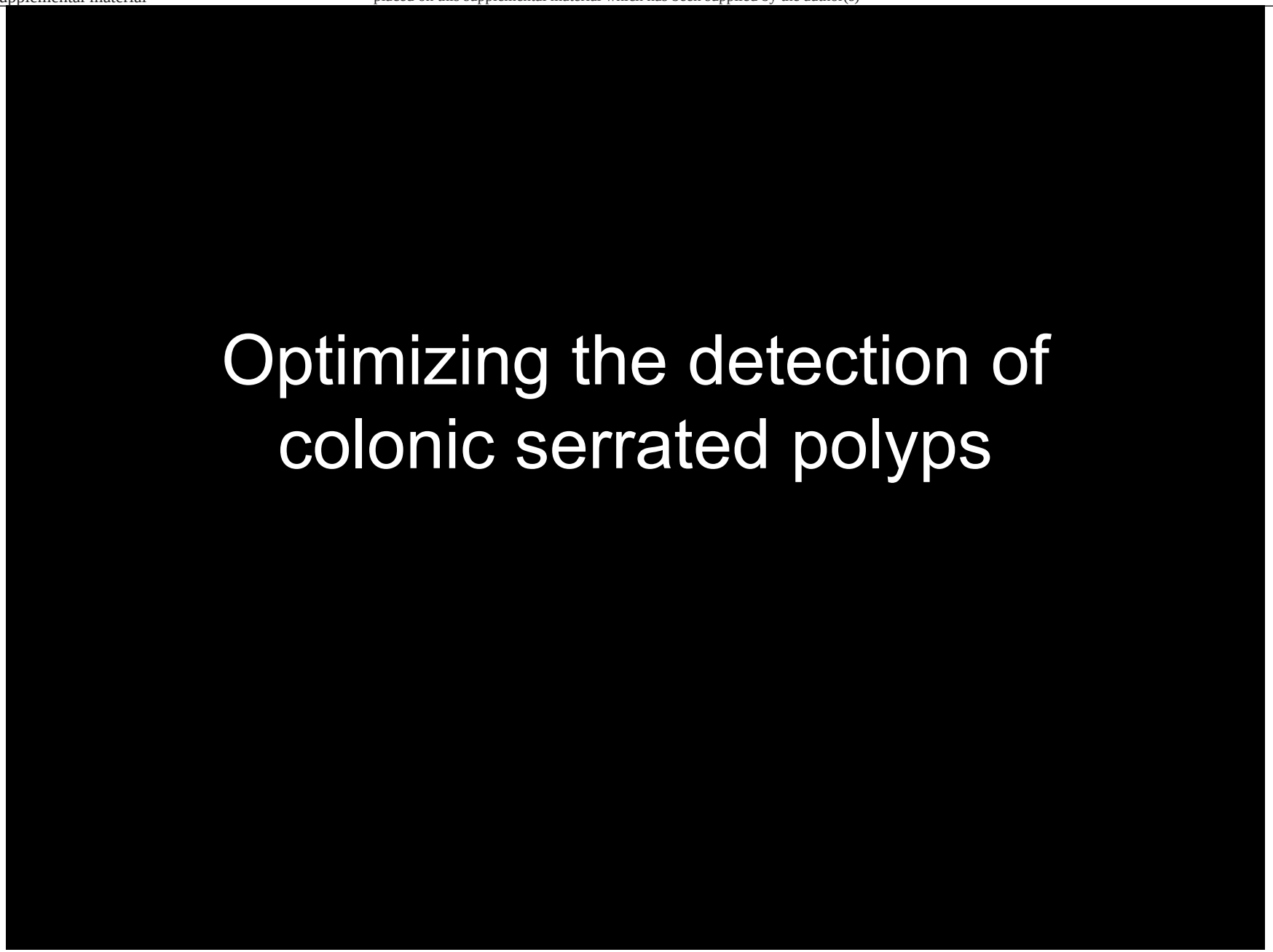
# Serrated polyp awareness training

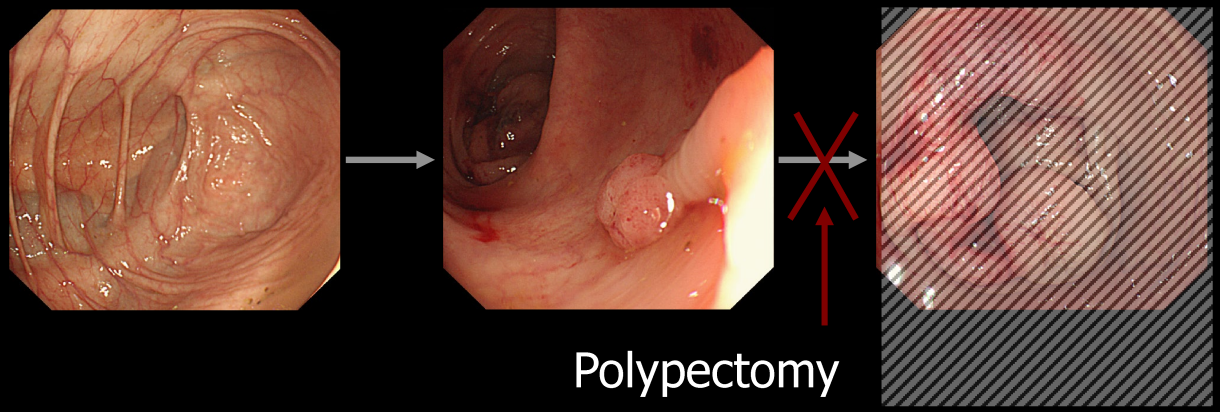
Supplementary material to manuscript entitled:

*"Substantial and sustained improvement of serrated polyp detection after a simple educational intervention – Results from a prospective controlled trial"*

Arne GC Bleijenberg, Monique E. van Leerdam, Marloes Bigirwamungu-Bargeman, Jan Jacob Koornstra, Yasmijn J van Herwaarden, Manon C.W. Spaander, Silvia Sanduleanu, Barbara Bastiaansen, Erik J. Schoon, Niels van Lelyveld, Evelien Dekker, Joep EG IJspeert


Optimizing the detection of
colonic serrated polyps

- Colorectal cancer (CRC) arises from precursor lesions
- Resecting precursor lesions will prevent CRC
- Colonoscopy is the reference standard, but not perfect……




Zauber et al. N Engl J Med 2012

# Colonoscopy protects for left-sided..

*Table 3.* Results of Primary Analysis: Odds Ratio for the Association Between Colonoscopy and Colorectal Cancer Death*

| Model | Odds Ratio (95% CI) | | | |
|---|---|---|---|---|
| | All Cancer | Right-Sided Cancer | Left-Sided Cancer | Undefined Site of Cancer |
| **Attempted colonoscopy** | | | | |
| None | 1.00 | 1.00 | 1.00 | 1.00 |
| Any | 0.69 (0.63–0.74) | 1.07 (0.94–1.21) | 0.39 (0.34–0.45) | 0.90 (0.75–1.08) |
| **Completeness of colonoscopy** | | | | |
| None | 1.00 | 1.00 | 1.00 | 1.00 |
| Complete | 0.63 (0.57–0.69) | 0.99 (0.86–1.14) | 0.33 (0.28–0.39) | 0.90 (0.73–1.10) |
| Incomplete | 0.91 (0.78–1.07) | 1.35 (1.07–1.69) | 0.63 (0.49–0.81) | 0.91 (0.61–1.35) |

* Conditional logistic regression, adjusted for Charlson Comorbidity Index score.

.. but not for right-sided colorectal cancer

Baxter et al. Ann Int Med 2009

# Reasons for right-sided interval cancers:

- Inadequate quality of coloscopy, e.g. no cecal intubation or insufficient bowel preparation
- Inadequate detection and resection of serrated polyps (SPs)

**Table 2. Molecular characteristics of interval vs. non-interval cancers**

| | Interval | Non-interval | *P* value |
|---|---|---|---|
| *CIMP*[a] | | | |
| Positive | 31 (57%) | 33 (33%) | 0.004 |
| Negative | 23 (43%) | 75 (66%) | |

Arain et al. AJGE 2010

# Serrated polyps

| | Shape | Mean Size | Prevalence | Location | Pre-cancerous |
|---|---|---|---|---|---|
| HP | Flat, sessile | Small, often ≤ 5 mm | Very common | Left colon | No |
| SSA/P | Flat, sessile | Larger than HP[a] | Common[b] | Right colon | Yes |
| TSA | Sessile, pedunculated | Larger than HP | Rare | Left colon | Yes |

Rex et al. Am J Gastroenterol 2012; 107:1315–1329

# Prevalence of SPs

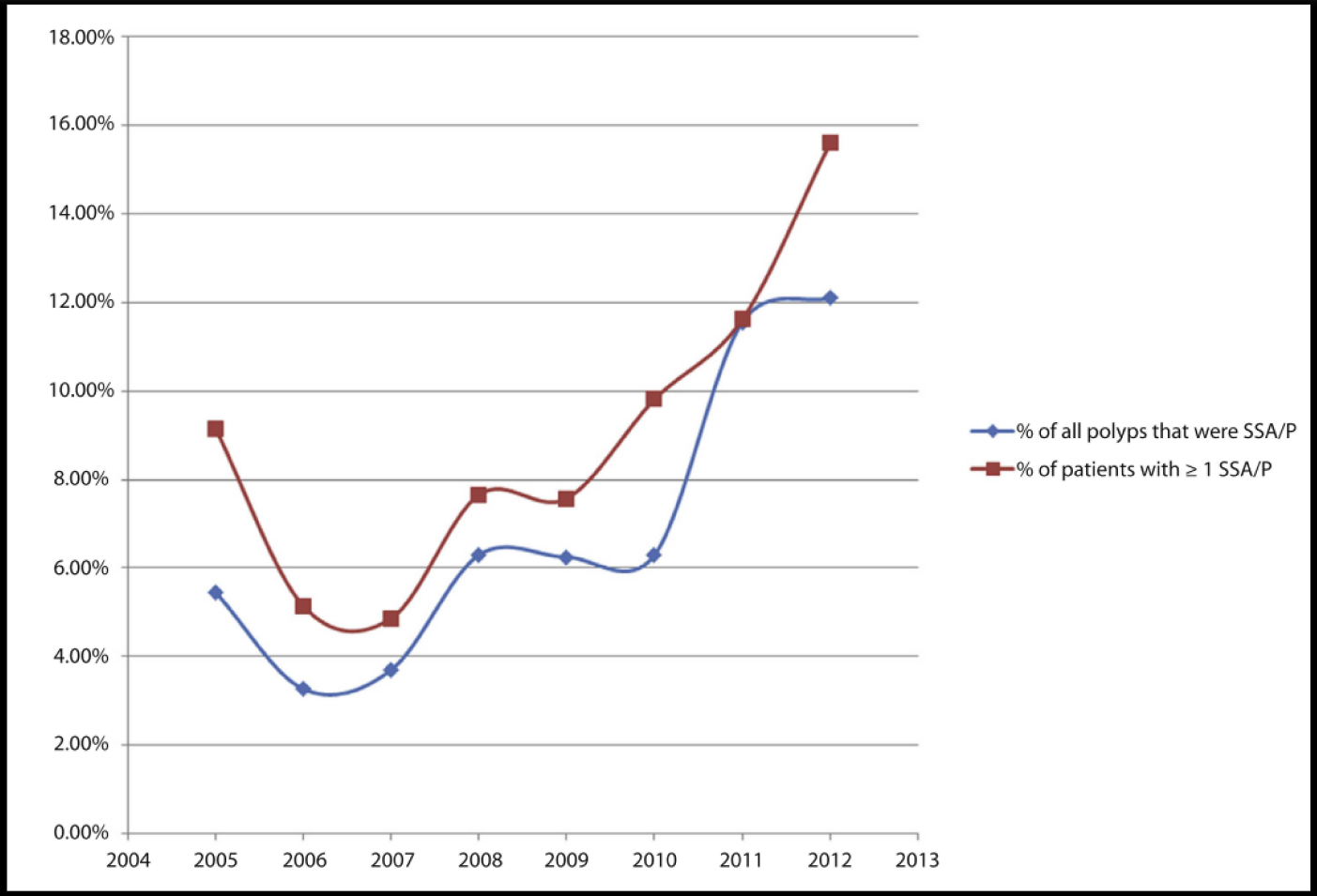
% of asymptomatic patients with at least 1 SP:

| | |
|---|---|
| HP | 23.8 % |
| SSA/P | 4.8% |
| SSA/P +D | 1.5% |
| TSA | 0.1% |

| | Prevalence |
|---|---|
| | Total (n = 1426)[1] |
| **At least 1 serrated polyp, n (%)** | 388 (27.2) |
| Hyperplastic polyp | 339 (23.8) |
| SSA/P | 68 (4.8) |
| TSA | 1 (0.1) |
| **At least 1 proximal serrated polyp, n (%)** | 174 (12.2) |
| Proximal hyperplastic polyp | 127 (8.9) |
| Proximal SSA/P | 51 (3.6) |
| Proximal TSA | 0.0 (0.0) |
| **At least 1 serrated polyp ≥ 10 mm, n (%)** | 37 (2.6) |
| Hyperplastic polyp ≥ 10 mm | 22 (1.5) |
| SSA/P ≥ 10 mm | 16 (1.1) |
| TSA ≥ 10 mm | 0.0 (0.0) |
| **At least 1 serrated polyp with dysplasia, n (%)** | 22 (1.5) |
| SSA/P with dysplasia | 21 (1.5) |
| TSA with dysplasia | 1 (0.1) |

Hazewinkel et al. Endoscopy 2014

# Prevalence of SSA/P




Abdeljawad et al. GIE 2014

# SSA/P more often located in right-sided colon

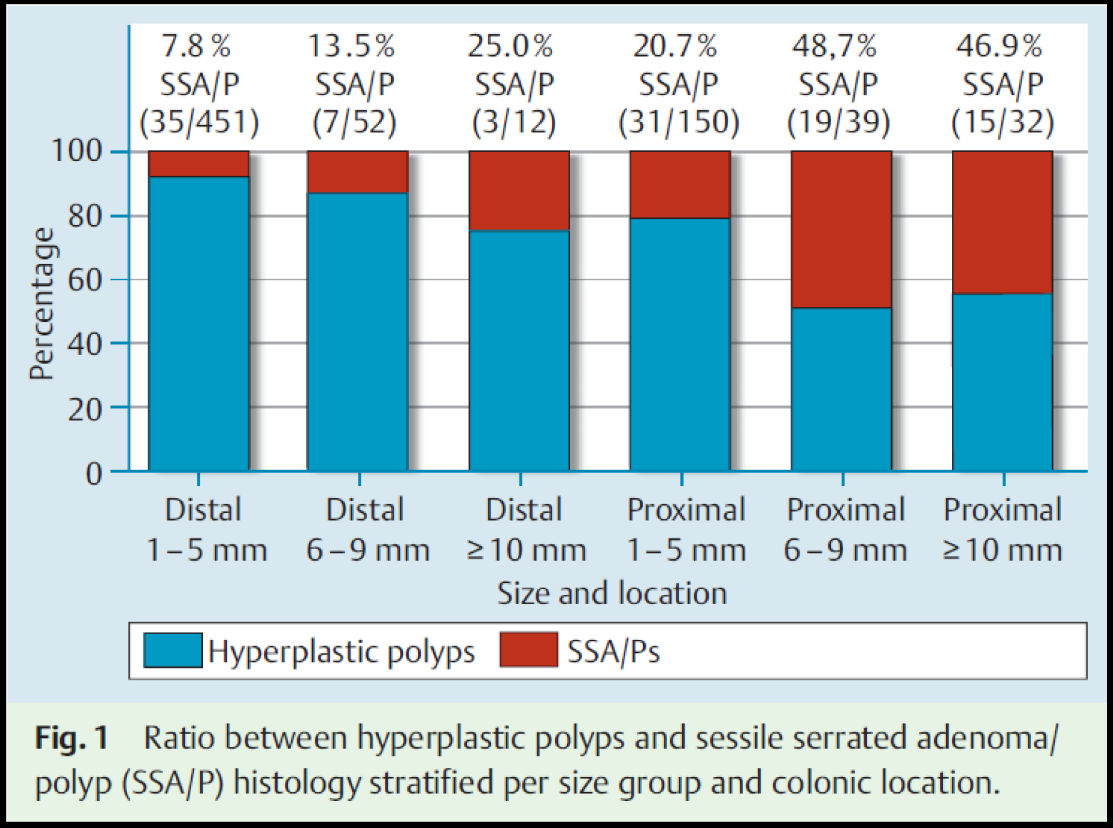
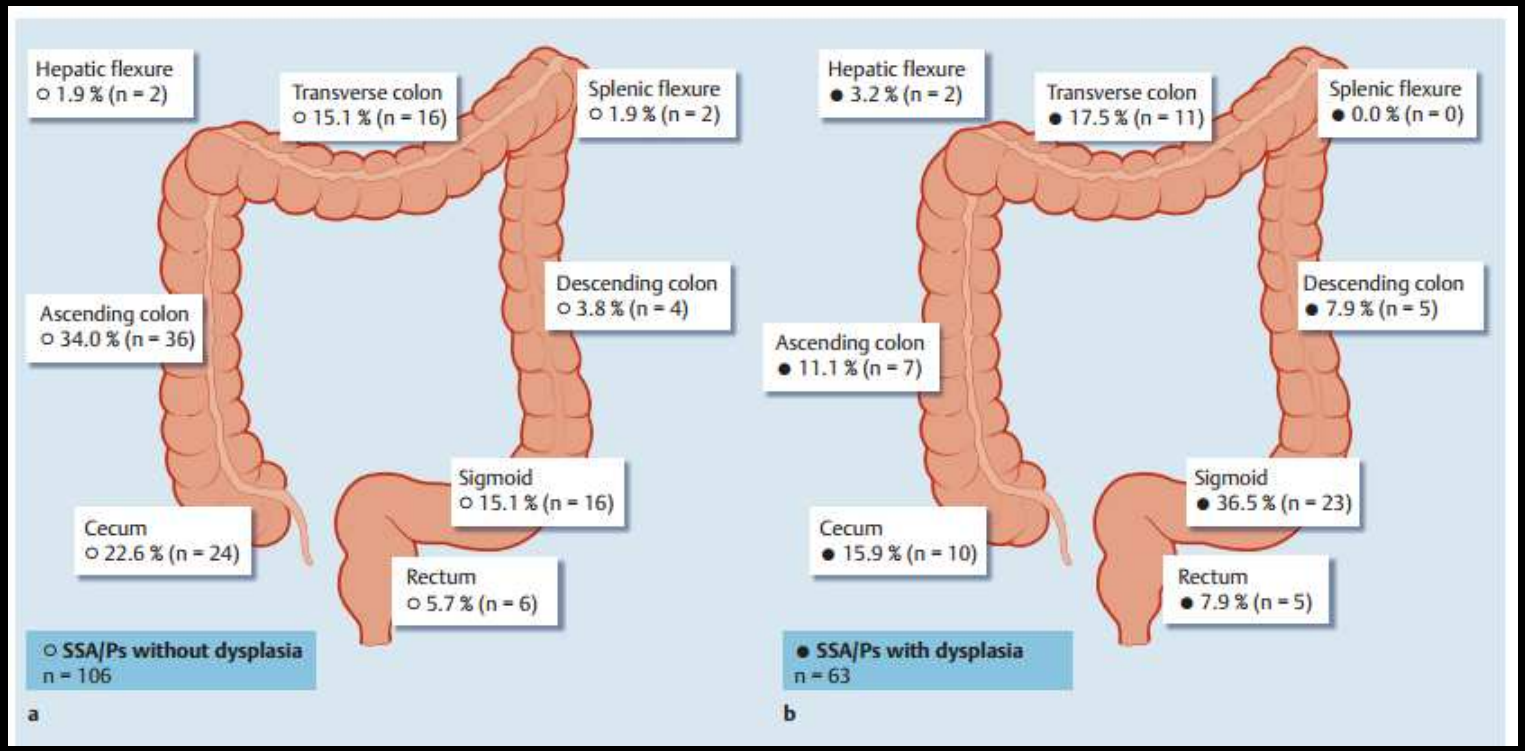



**Fig. 1** Ratio between hyperplastic polyps and sessile serrated adenoma/polyp (SSA/P) histology stratified per size group and colonic location.

Hazewinkel et al. Endoscopy 2013




BUT…

SSA/P with dysplasia located throughout the colon??

Bouwens et al. Endoscopy 2014

# Inadequate detection of SPs

| Endoscopist | Number of colonoscopies | Patient age[a] | Male | ≥1 Adenoma | ≥1 Proximal serrated polyp |
|---|---|---|---|---|---|
| 1 | 3189 | 59.8 ± 8.0 | 52% | 47% | 18% |
| 2 | 154 | 57.8 ± 8.0 | 45% | 31% | 10% |
| 3 | 532 | 57.4 ± 7.3 | 45% | 33% | 6% |
| 4 | 109 | 58.2 ± 7.0 | 46% | 39% | 11% |
| 5 | 331 | 57.4 ± 6.9 | 48% | 40% | 13% |
| 6 | 124 | 58.4 ± 6.9 | 44% | 33% | 8% |
| 7 | 528 | 58.9 ± 7.7 | 41% | 31% | 11% |
| 8 | 56 | 59.2 ± 7.6 | 50% | 46% | 13% |
| 9 | 348 | 57.7 ± 7.5 | 37% | 36% | 12% |
| 10 | 359 | 57.7 ± 7.3 | 53% | 25% | 3% |
| 11 | 90 | 57.7 ± 6.7 | 52% | 17% | 1% |
| 12 | 83 | 59.1 ± 8.3 | 52% | 27% | 2% |
| 13 | 327 | 58.1 ± 7.8 | 60% | 29% | 11% |
| 14 | 297 | 59.5 ± 8.2 | 50% | 21% | 4% |
| 15 | 154 | 57.8 ± 8.0 | 45% | 31% | 10% |
| Combined | 6681 | 58.9 ± 7.8 | 49% | 38% | 13% |

Kahi et al. Clin gastroenterol hepatol 2011

# Inadequate detection of SPs

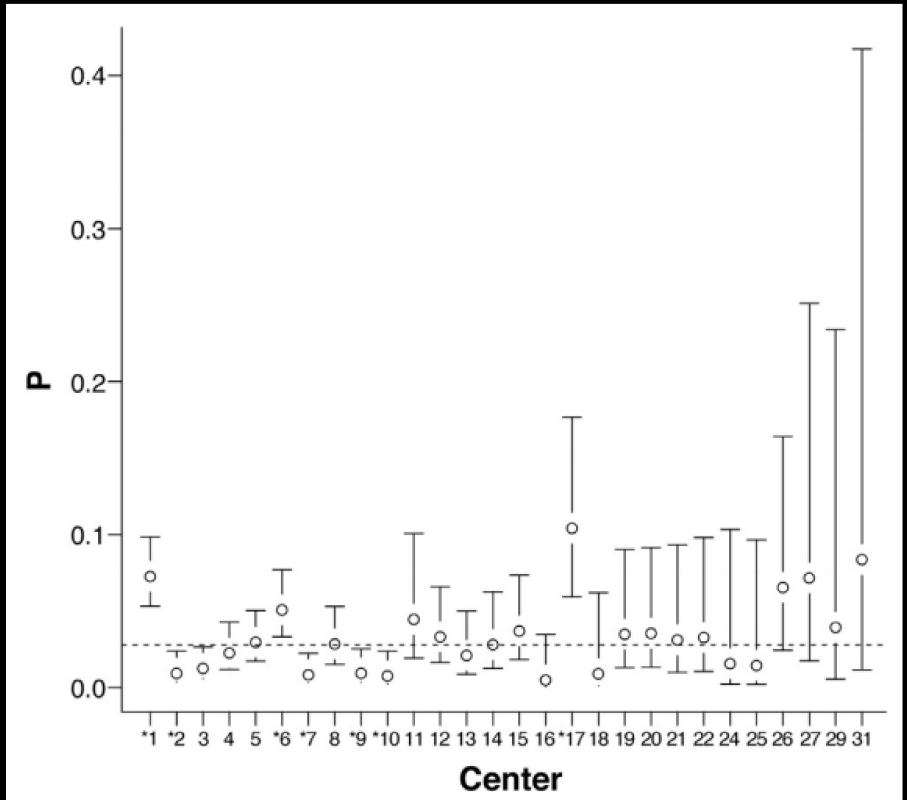



**Figure 1.** Prevalence rates of proximal serrated lesions in 31 centers. The vertical axis (*P*) is the fraction of patients with 1 or more proximal serrated lesions. The average detection rate of 2.8% is designated by the *hashed line*.

Payne et al. Clin Gastro and Hepatol 2014

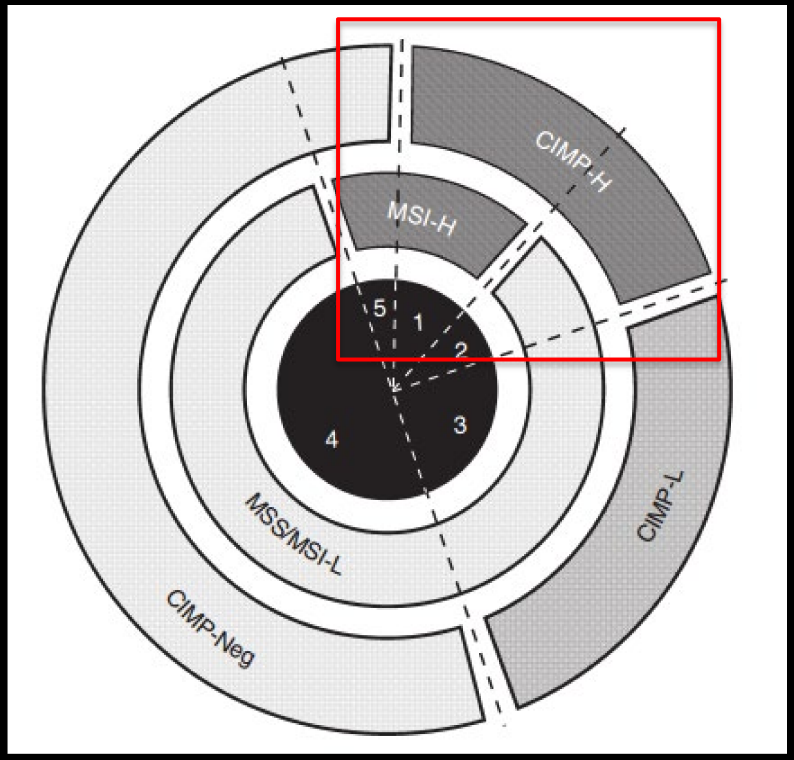
# How to improve serrated polyp detection?

- Improve awareness of malignant potential of SPs
- Improve knowledge of the subtle SP features: know what you are looking for!
- Ensure a high quality colonoscopy
- Use advanced imaging techniques for improved surveillance in case of uncertainty

# Malignant potential of SPs

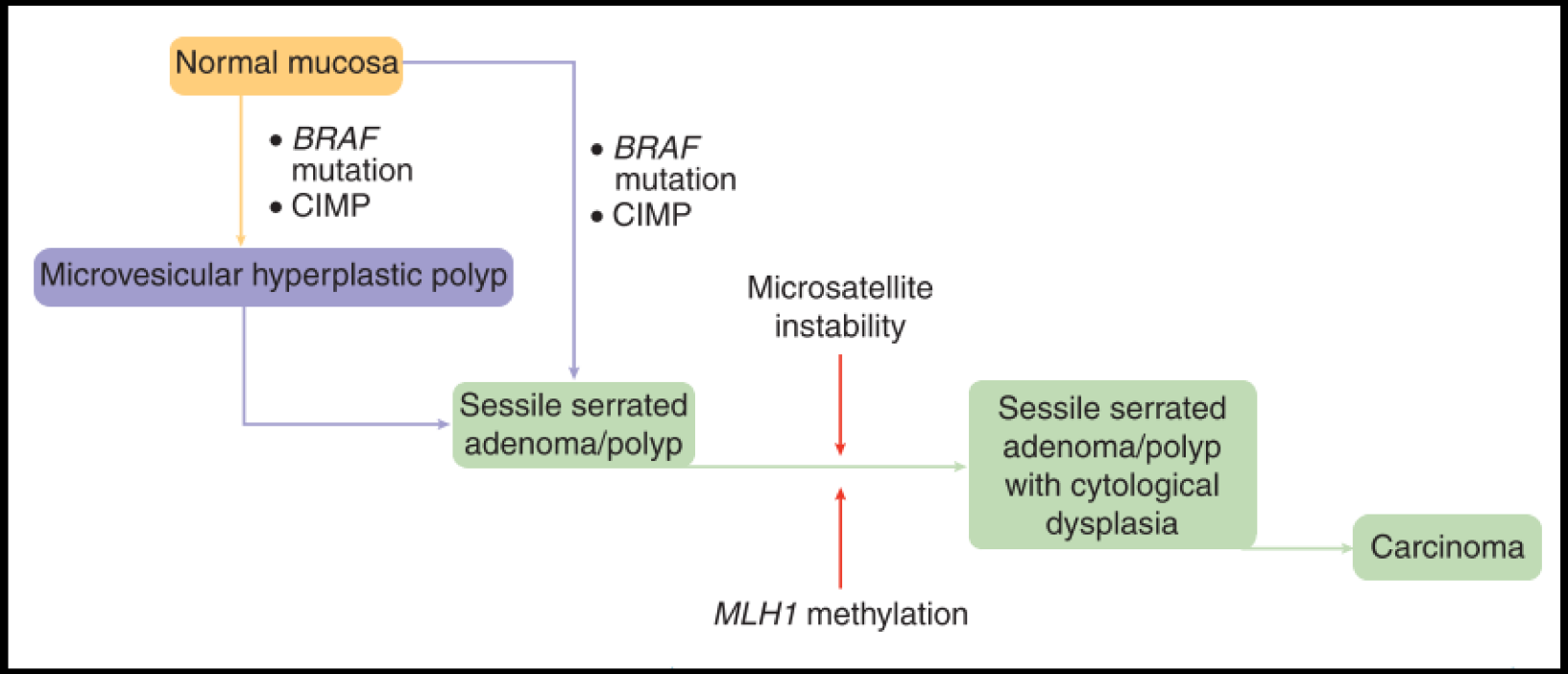
± 20-30% of CRC arises from SPs

Pathogenesis via serrated neoplasia pathway




Jass et al. Histopathology 2006

# Serrated neoplasia pathway

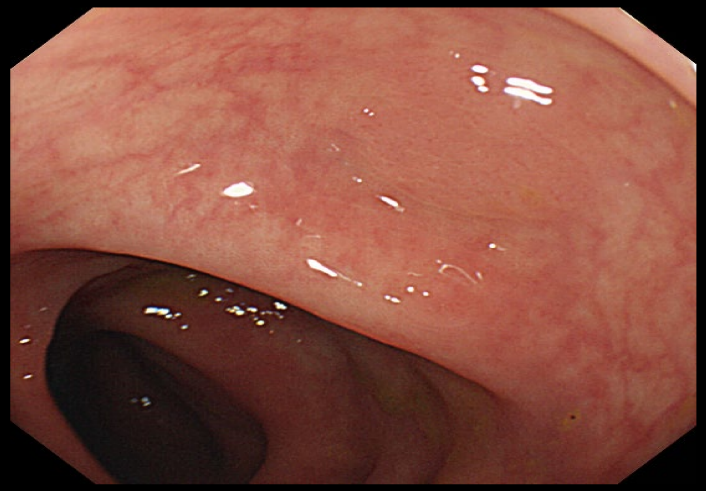



Rex et al. AJGE 2012

# Why are serrated polyps easily missed?

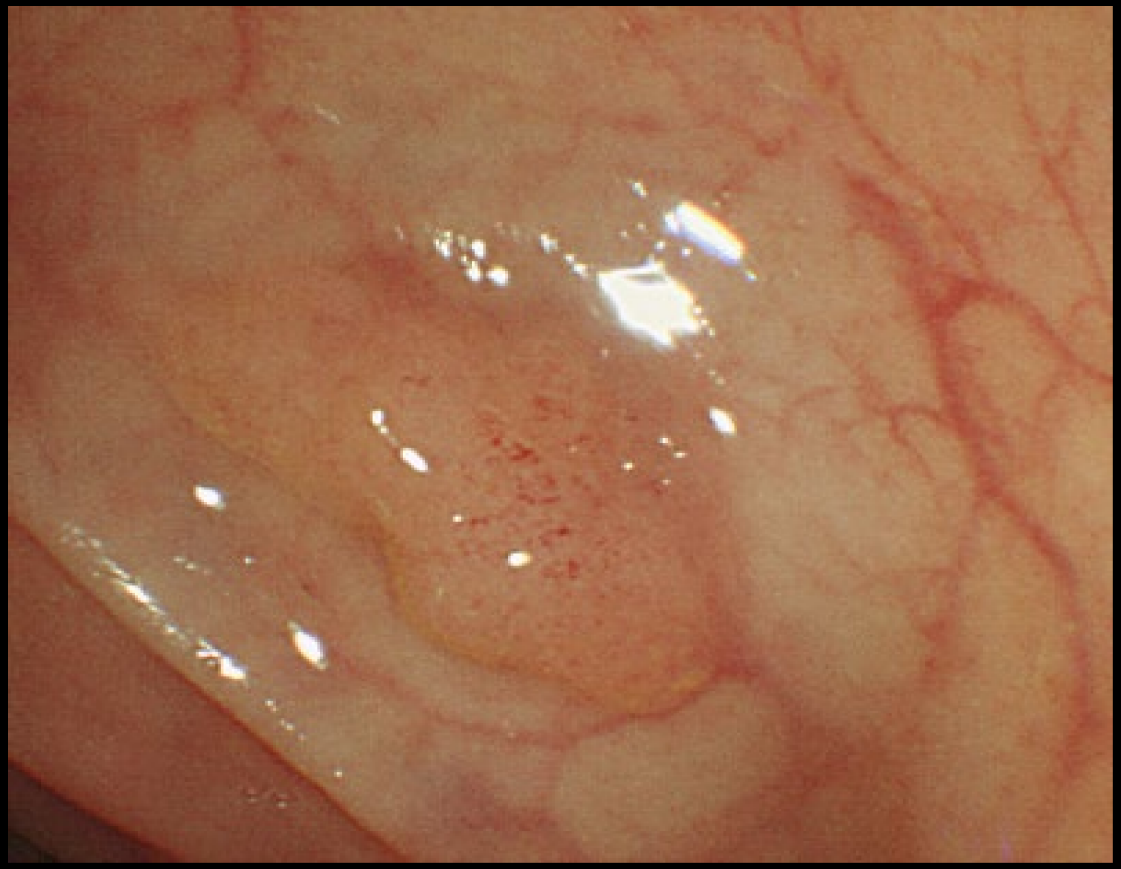
Subtle features of SPs:

- Flat or sessile morphology
- Same color as mucosal wall
- Vague borders

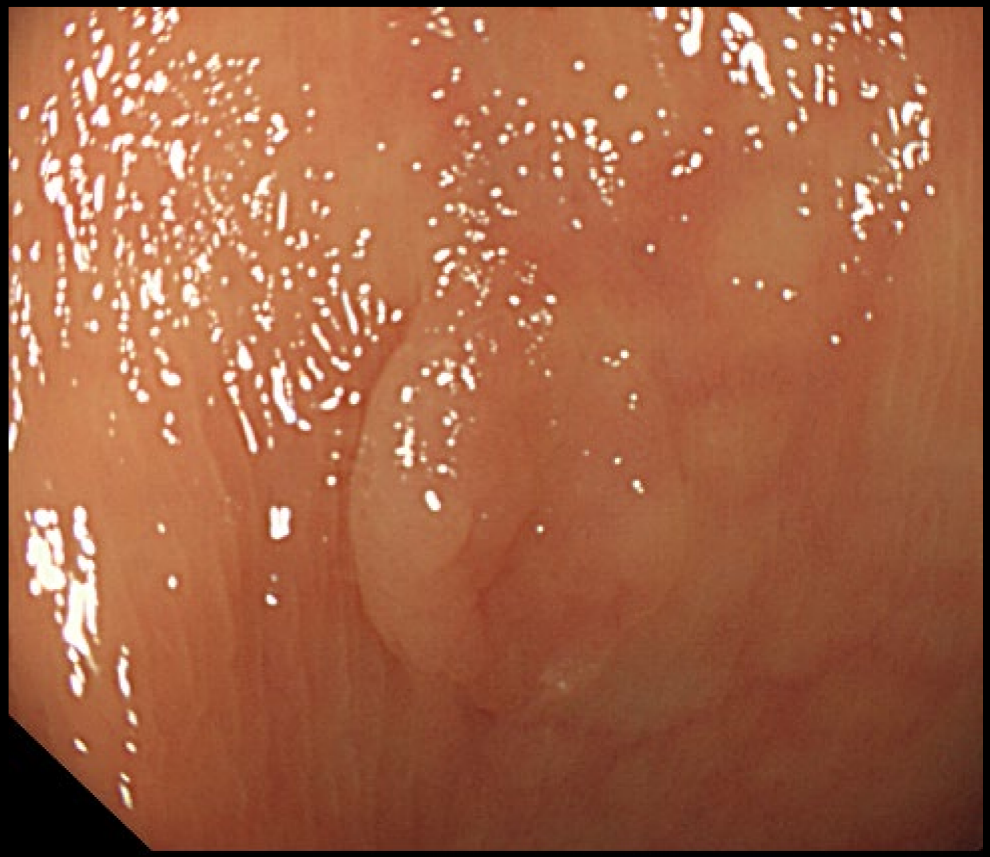


Knowledge of SP features will improve detection!

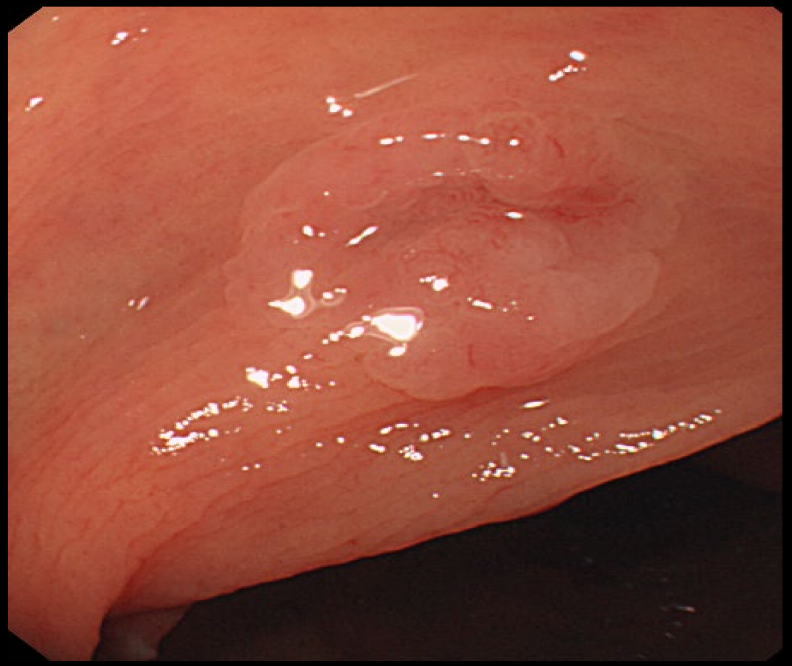
# Know what to look for!

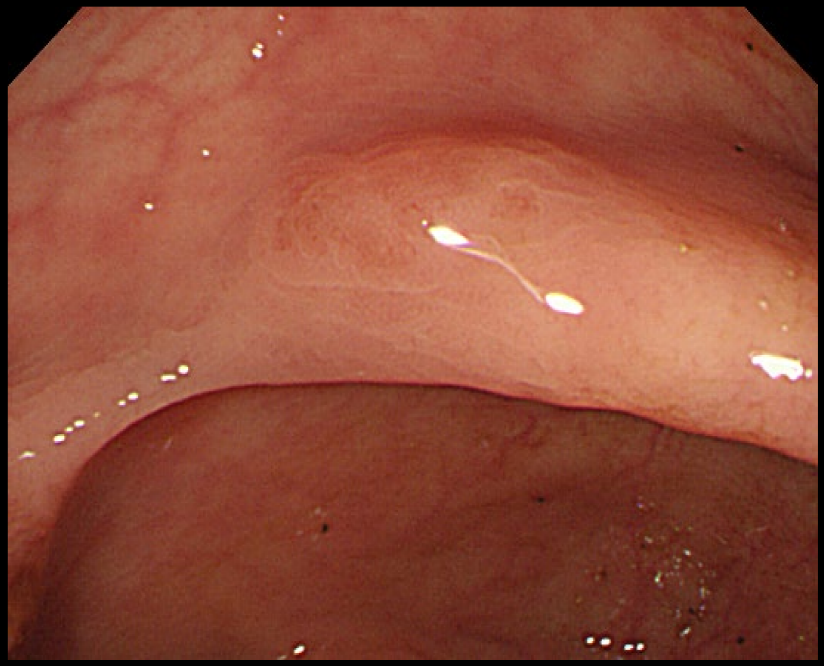


# Know what to look for!



# Know what to look for!





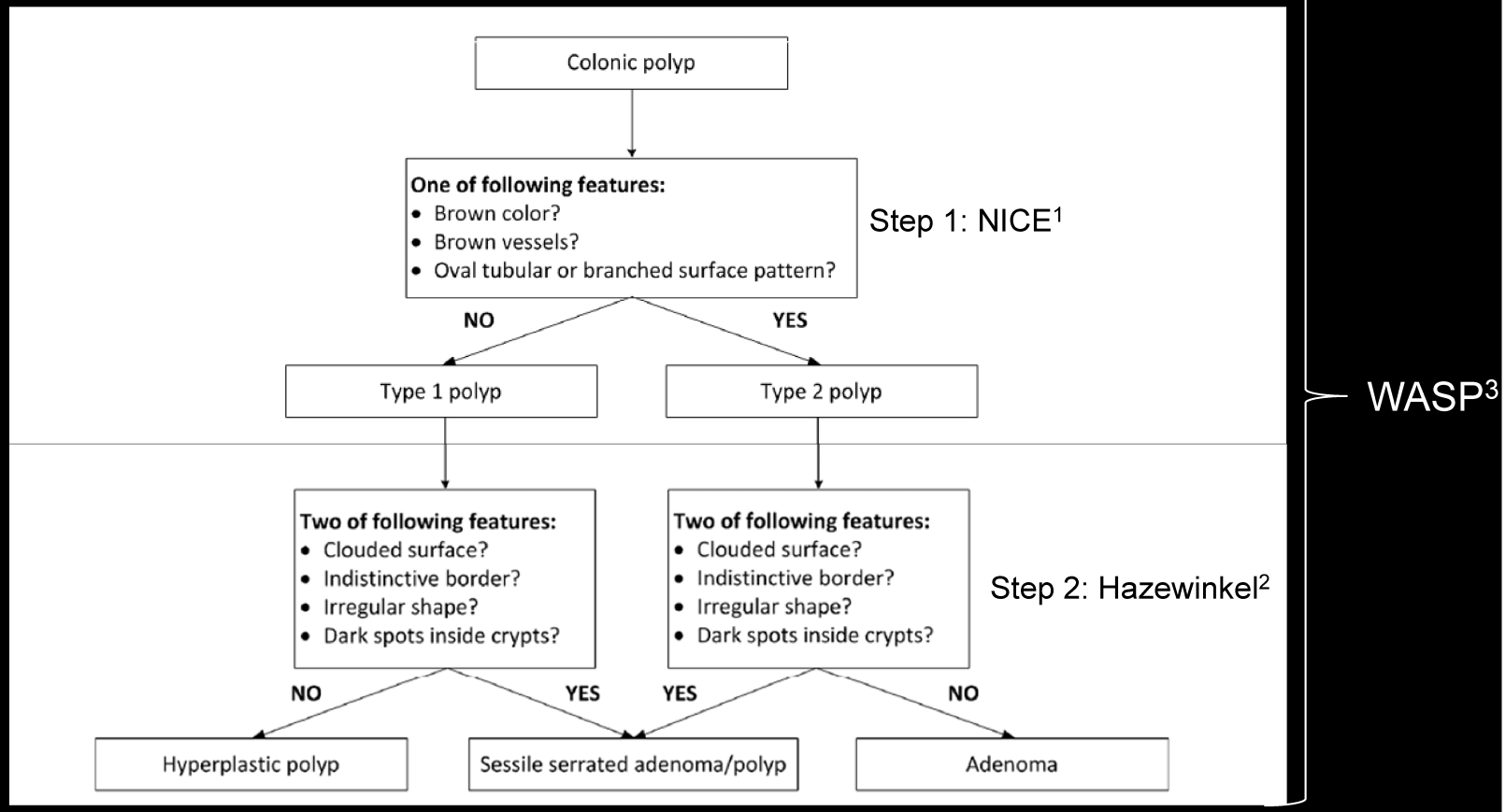
# Optimizing the characterization of colonic serrated polyps

# Characterizing SSA/P

| | SSA/P | HP/Adenoma |
|---|---|---|
| Surface | Clouded | Smooth |
| Borders | Indistinct (vague) | Sharp demarcated |
| Shape | Irregular | Symmetric |
| Crypts | Dark spots inside the crypts | No dark spots inside the crypts |

Hazewinkel et al. GIE 2012

# WASP classification: 2-step differentiation

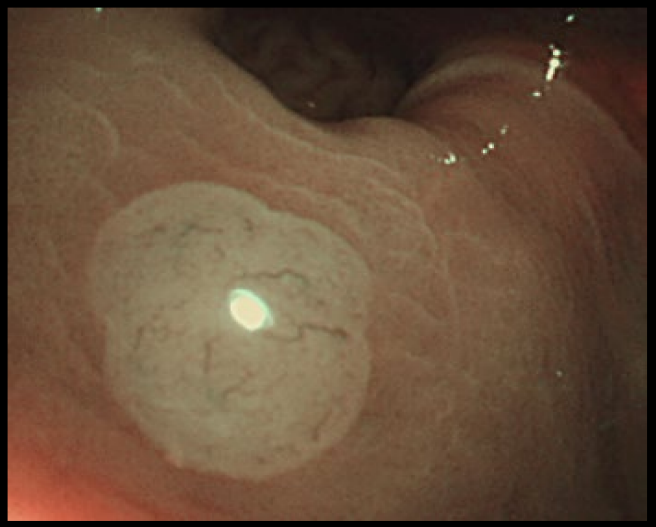


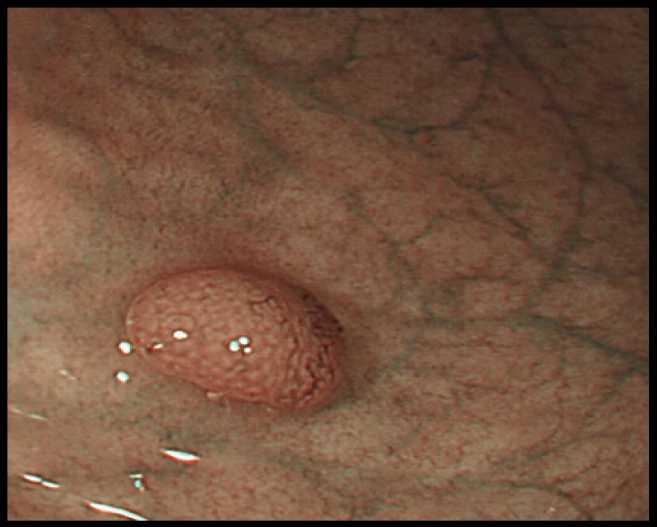

1: Rex et al., *Gastroenterology* 2012
2: Hazewinkel et al., *GIE* 2013
3: IJspeert et al., *Gut* 2016


STEP 1:
NICE CLASSIFICATION

# Characteristic 1: Color

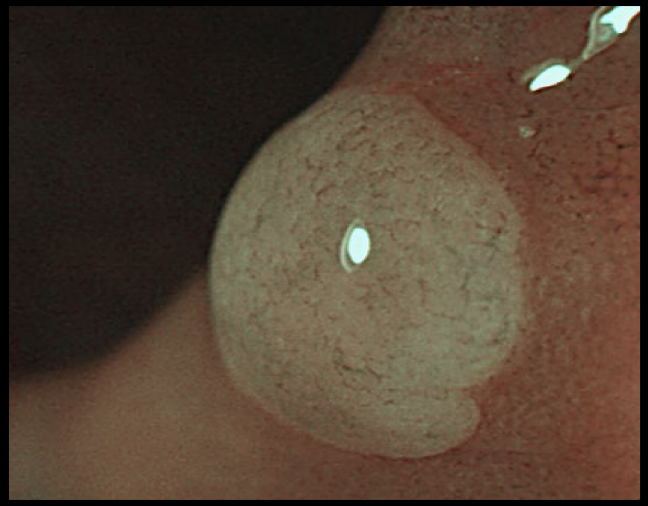
| Hyperplastic polyp | Adenoma |
| --- | --- |
| Same or lighter than background | Browner relative to background |





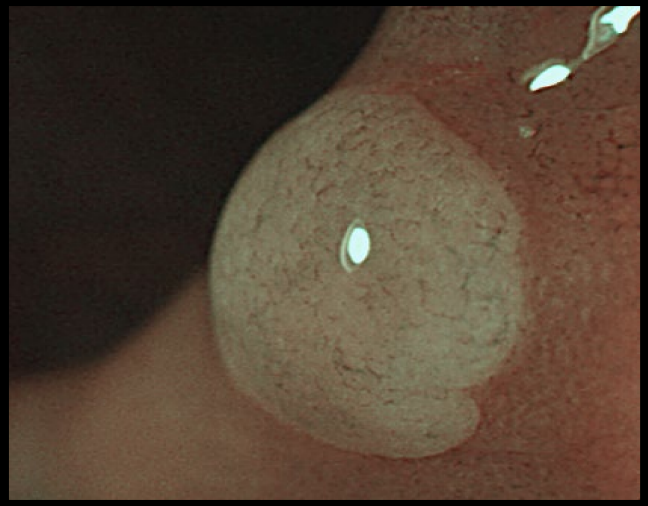
# Characteristic 2: Vessels

| Hyperplastic polyp | Adenoma |
| --- | --- |
| None, or isolated lacy vessels | Brown vessels surrounding white structures |



# Characteristic 3: Surface pattern

| Hyperplastic polyp | Adenoma |
| --- | --- |
| Dark or white spots of uniform size, or homogenous absence of pattern | Oval, tubular or brached white structures surrounded by brown vessels |

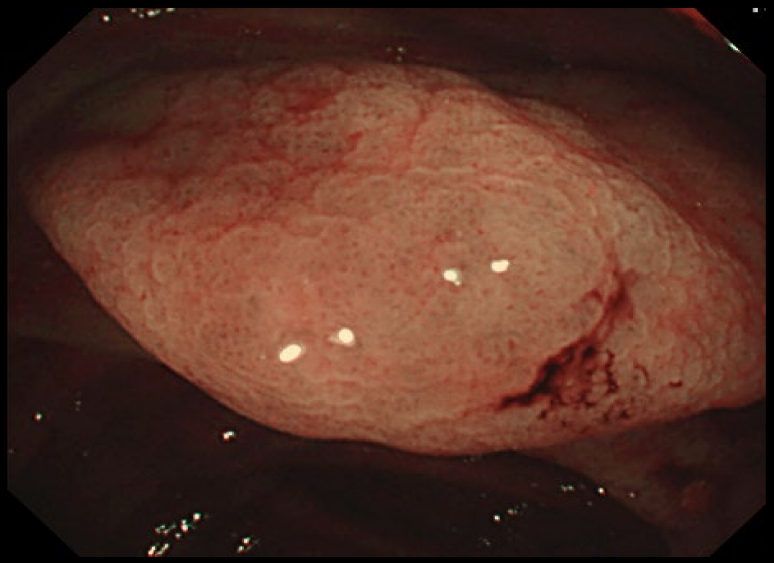


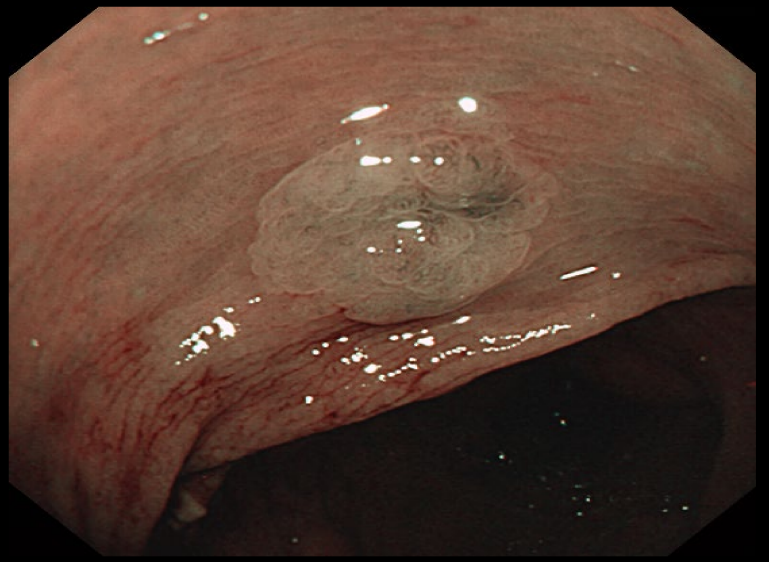
# STEP 2:
# HAZEWINKEL CLASSIFICATION

# Characteristic 1: Surface

Sessile serrated adenoma/polyp

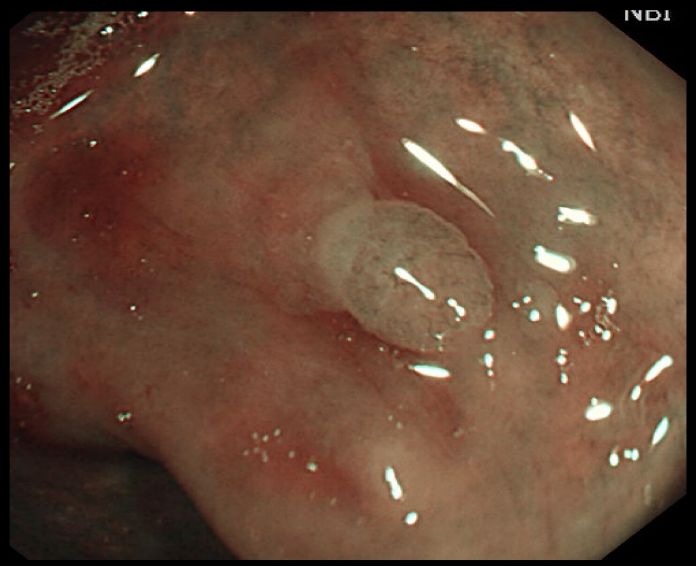
Clouded surface



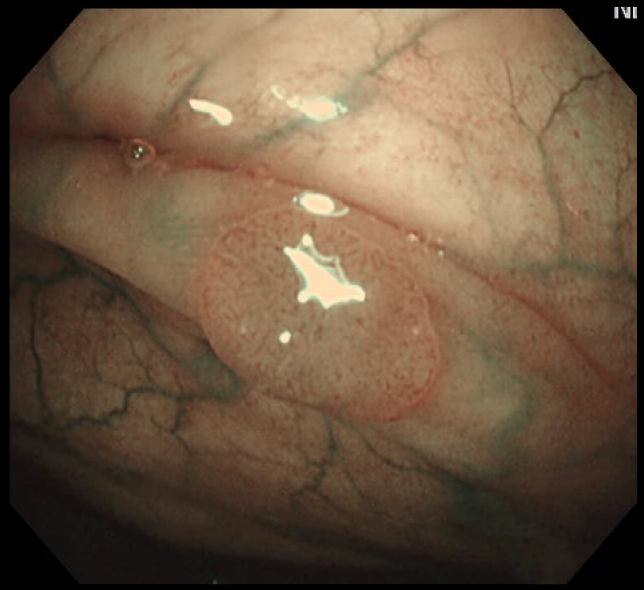


# Characteristic 1: Surface

| Hyperplastic polyp |
| --- |
| Smooth surface |

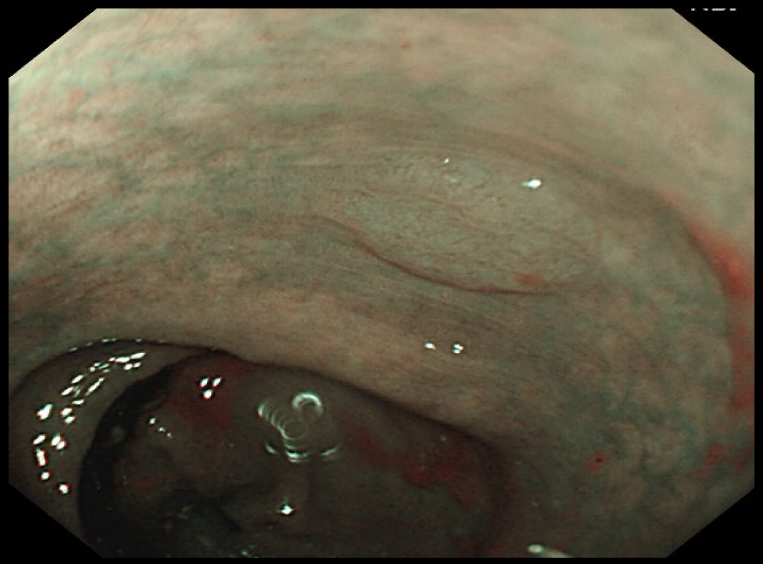



| Adenoma |
| --- |
| Smooth surface |



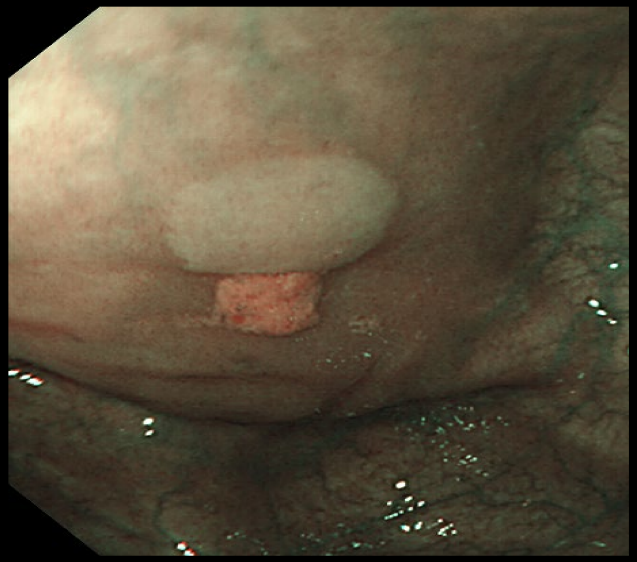
# Characteristic 2: Border

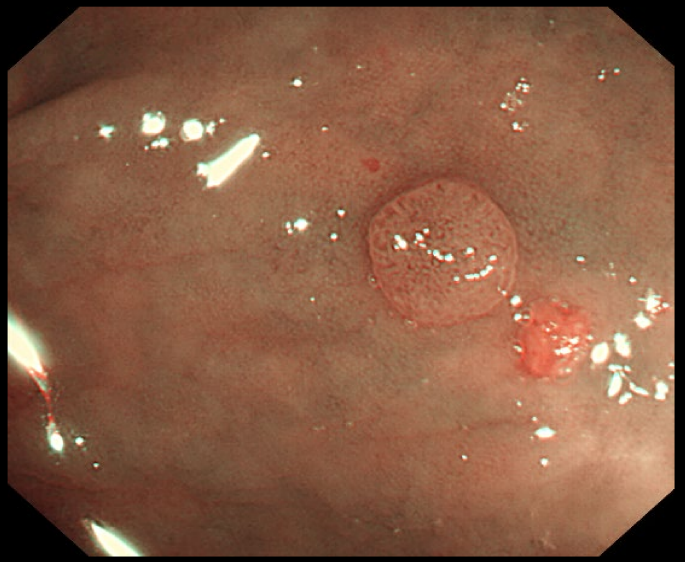
| Sessile serrated adenoma/polyp |
| --- |
| Indistinct (vague) border |



# Characteristic 2: Border

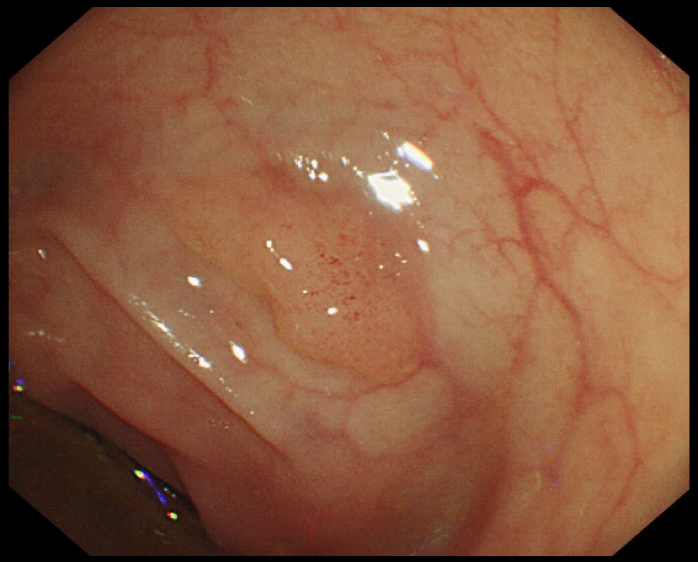
| Hyperplastic polyp | Adenoma |
| --- | --- |
| Sharp demarcated border | Sharp demarcated border |

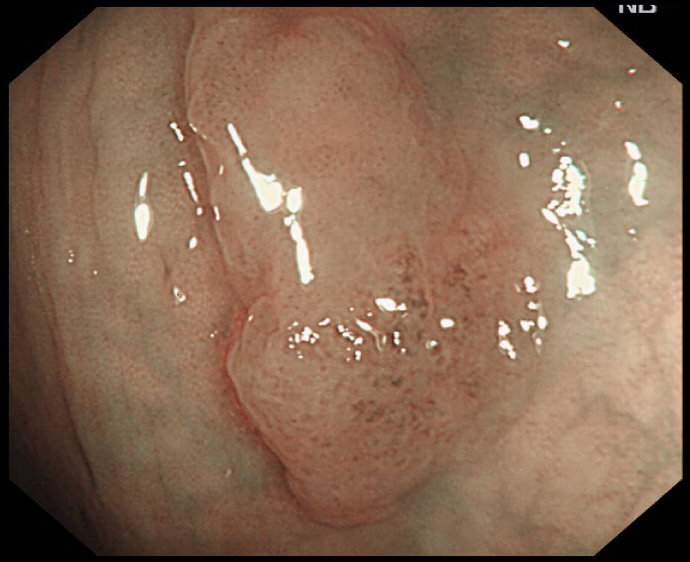




# Characteristic 3: Shape

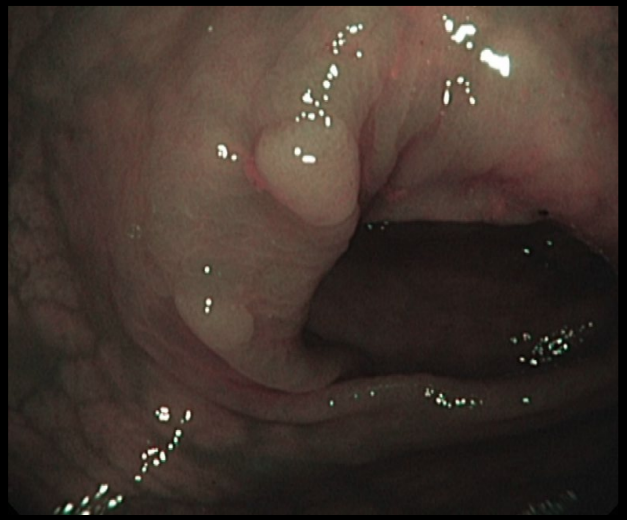
| Sessile serrated adenoma/polyp |
| --- |
| Irregular shape |



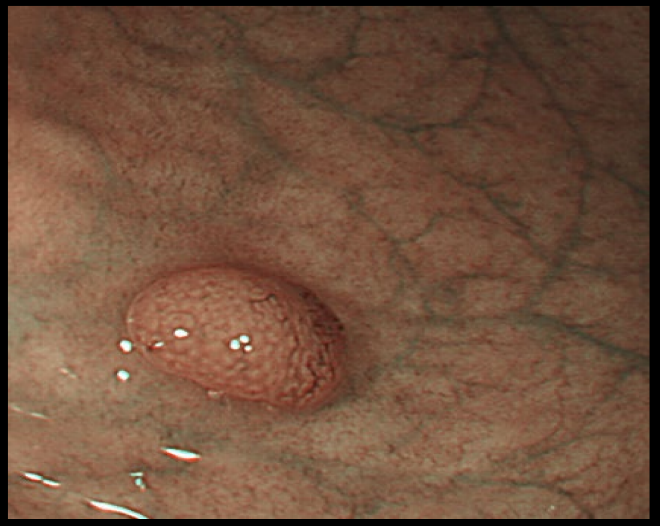


# Characteristic 3: Shape

| Hyperplastic polyp |
| --- |
| Symmetric shape |



| Adenoma |
| --- |
| Symmetric shape |

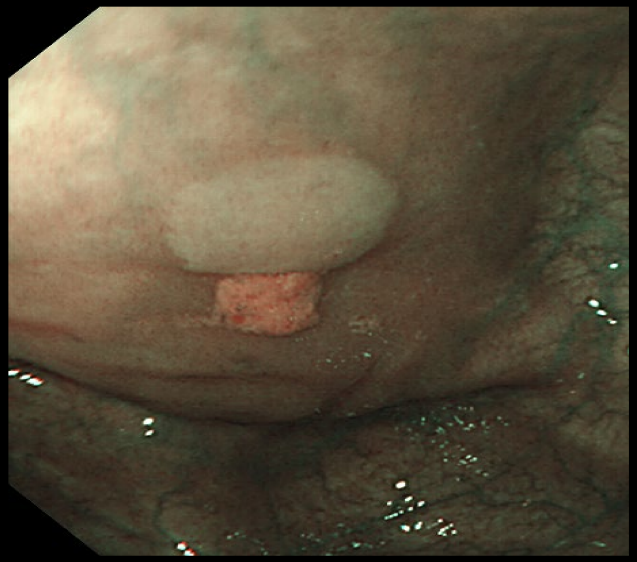


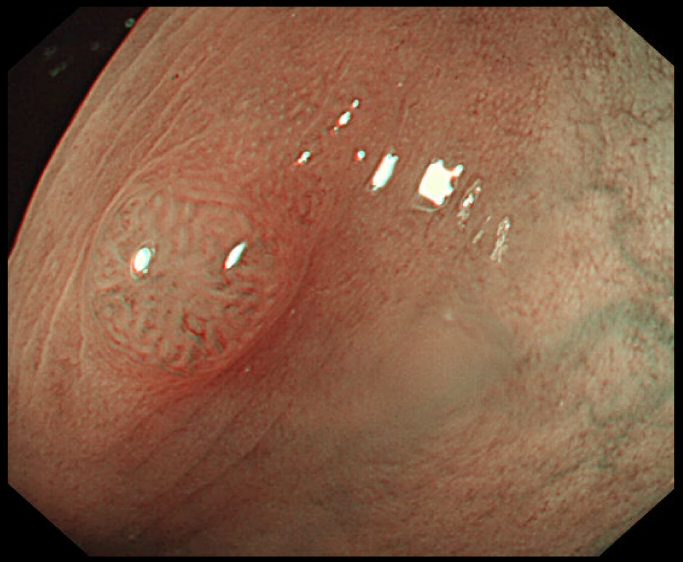
# Characteristic 4: Crypts

| Sessile serrated adenoma/polyp |
| --- |
| Dark spots inside the crypts |

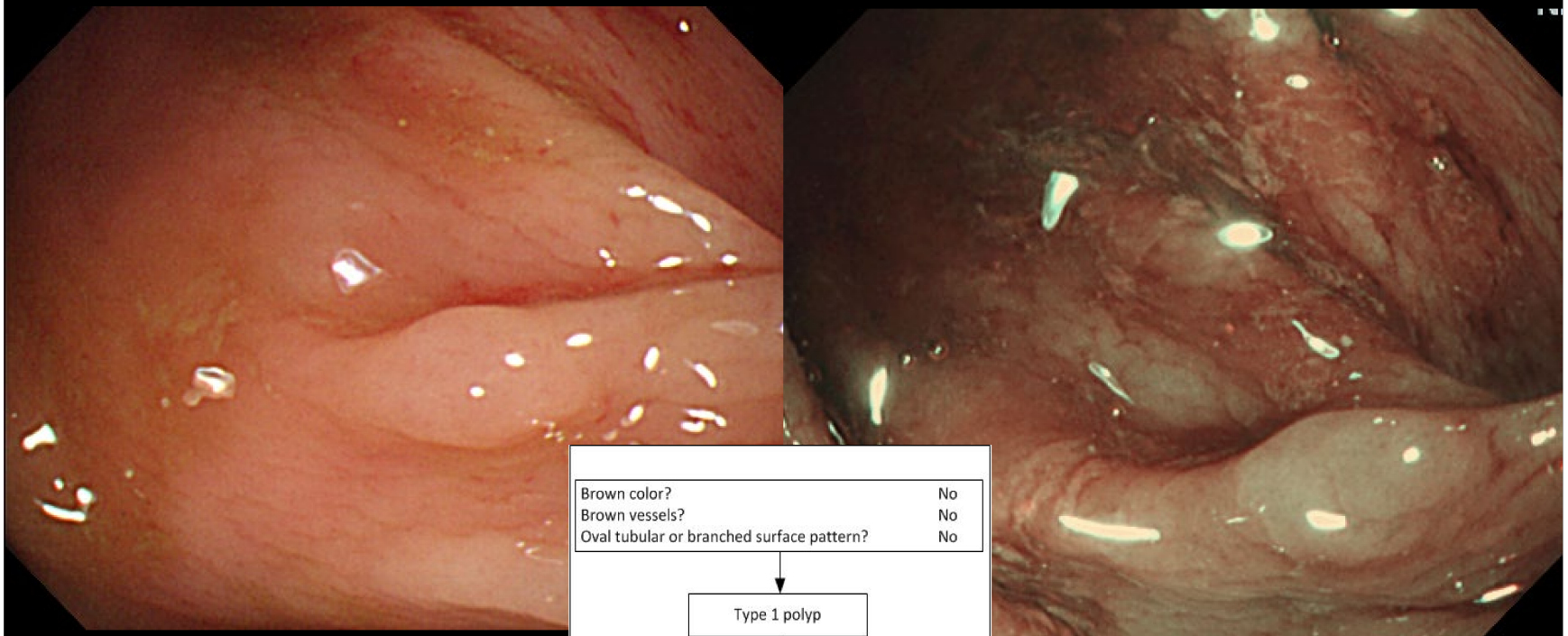
# Characteristic 4: Crypts

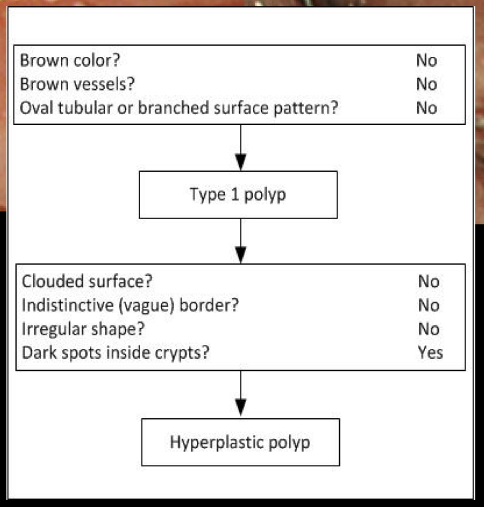
| Hyperplastic polyp | Adenoma |
| --- | --- |
| No dark spots inside the crypts | No dark spots inside the crypts |



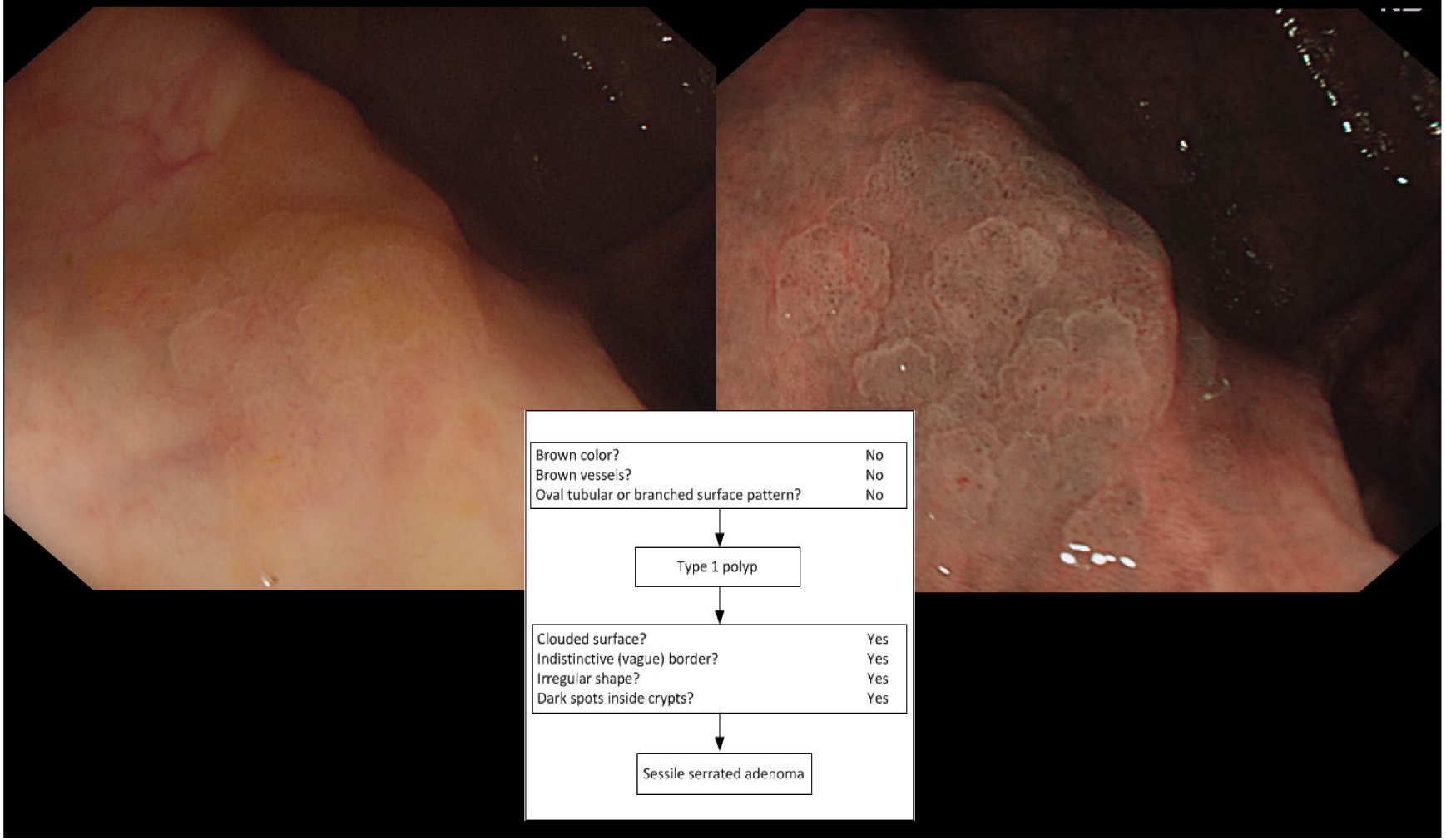


# Example 1

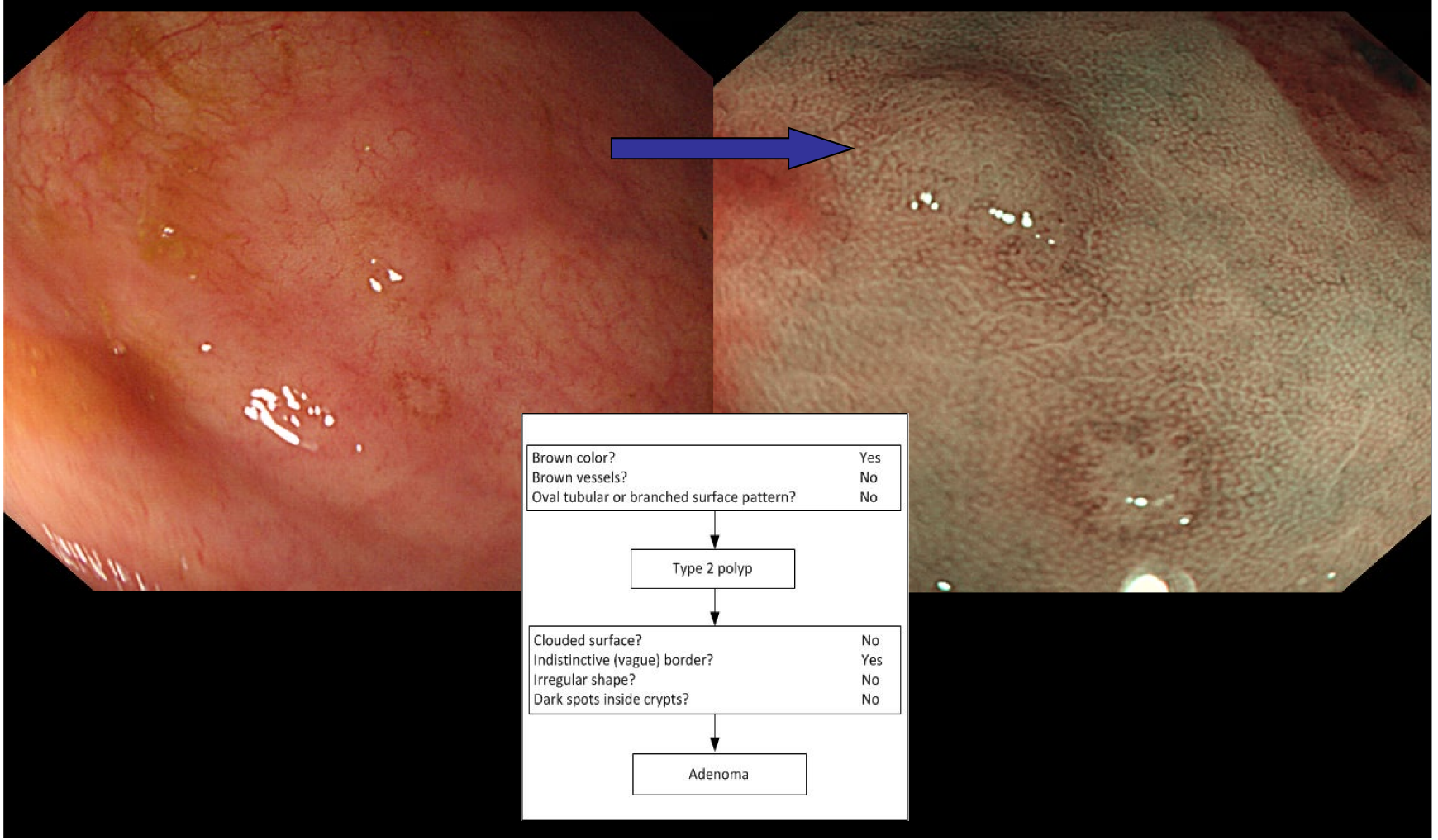



Brown color? No
Brown vessels? No
Oval tubular or branched surface pattern? No
Type 1 polyp
Clouded surface? No
Indistinctive (vague) border? No
Irregular shape? No
Dark spots inside crypts? Yes
Hyperplastic polyp

# Example 2


Brown color? No
Brown vessels? No
Oval tubular or branched surface pattern? No
Type 1 polyp
Clouded surface? Yes
Indistinctive (vague) border? Yes
Irregular shape? Yes
Dark spots inside crypts? Yes
Sessile serrated adenoma

# Example 3

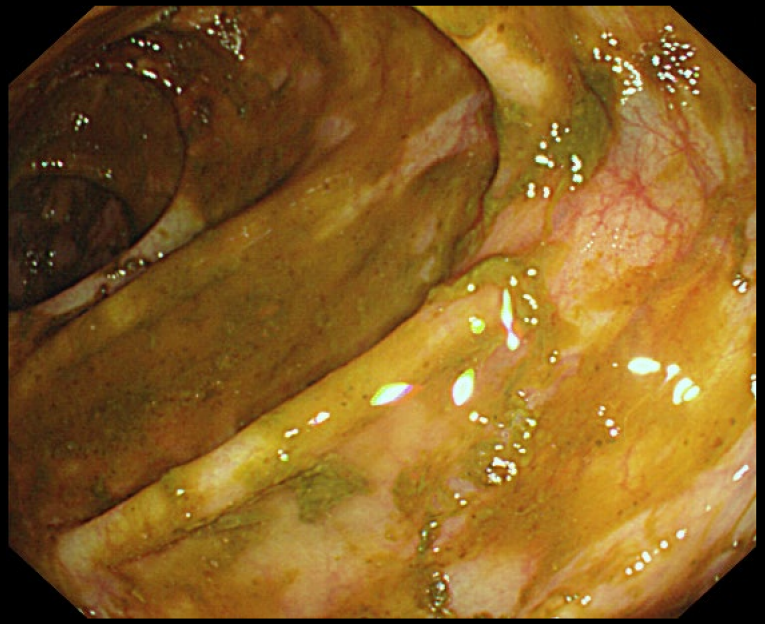

Brown color? Yes
Brown vessels? No
Oval tubular or branched surface pattern? No
Type 2 polyp
Clouded surface? No
Indistinctive (vague) border? Yes
Irregular shape? No
Dark spots inside crypts? No
Adenoma

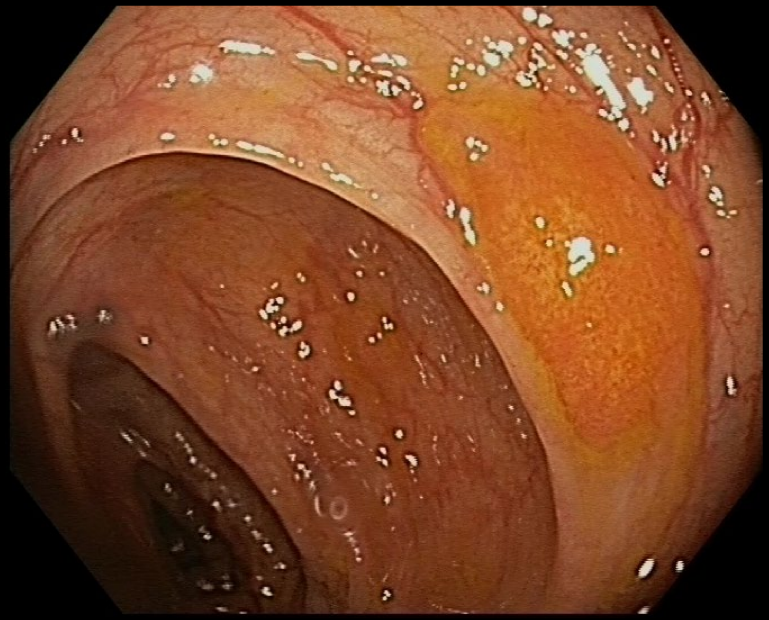
# How to improve serrated polyp detection?

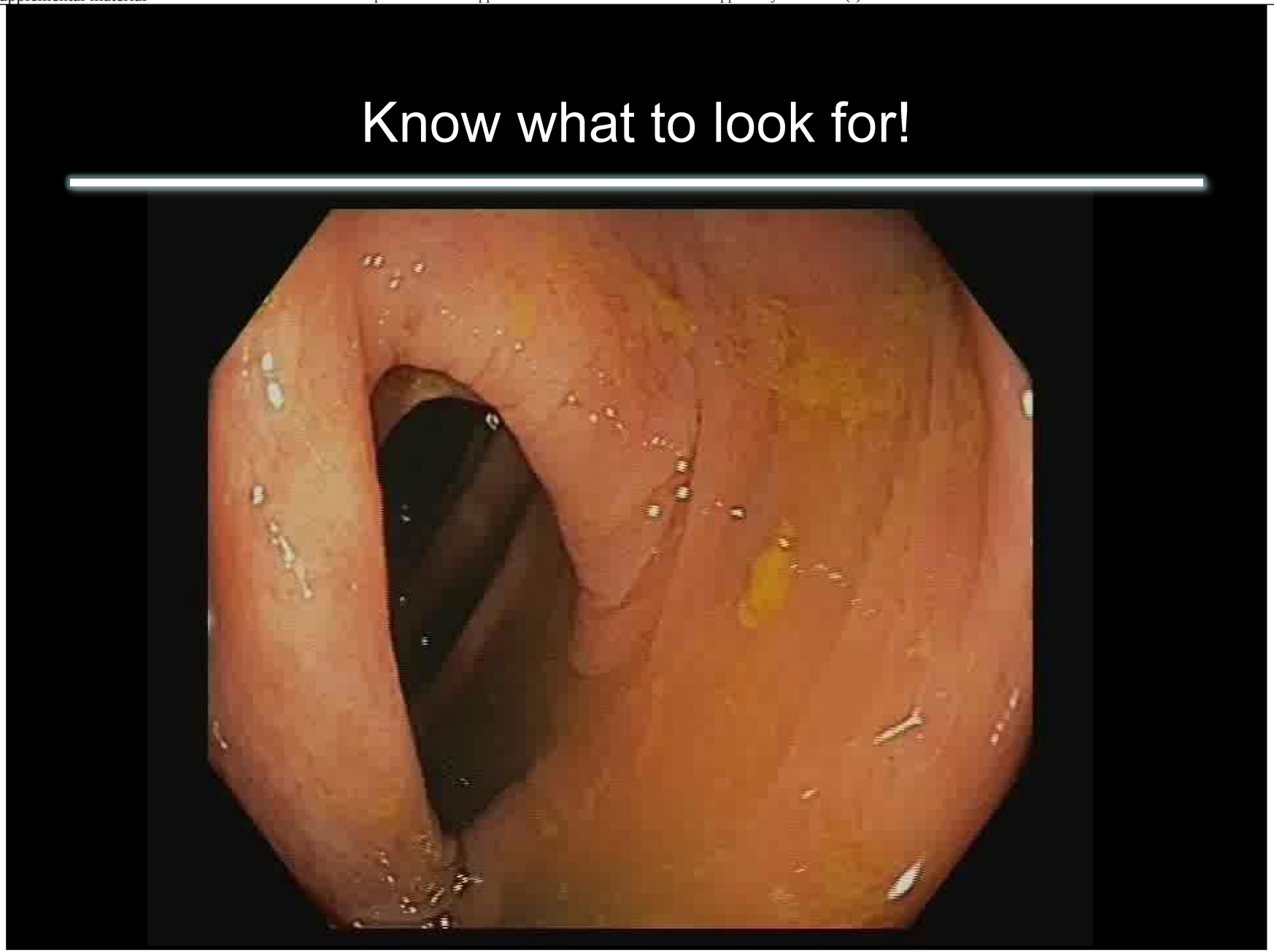

Ensure a high quality colonoscopy!

# Quality of bowel preparation

- Mucus-cap of SP attracts stool causing difficulties in detection
- In clean colon the mucus-cap can help to identify SPs

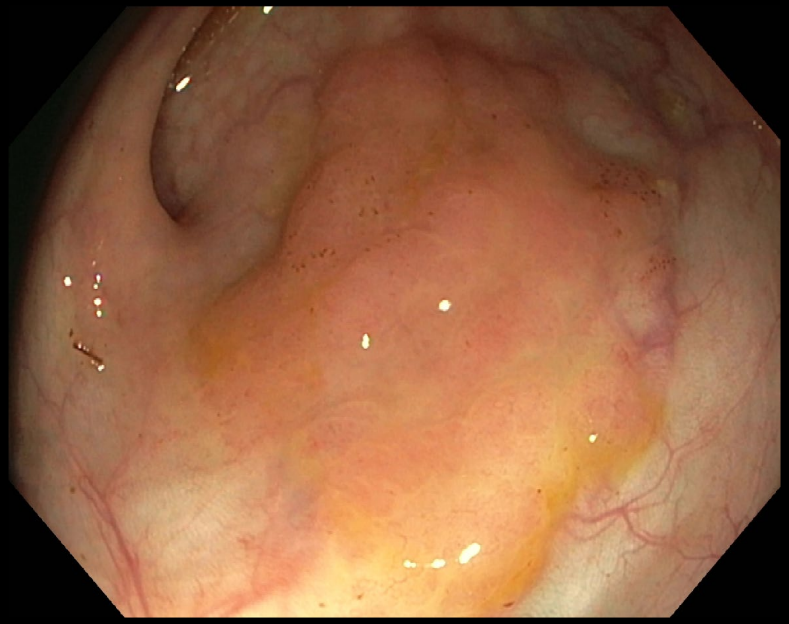


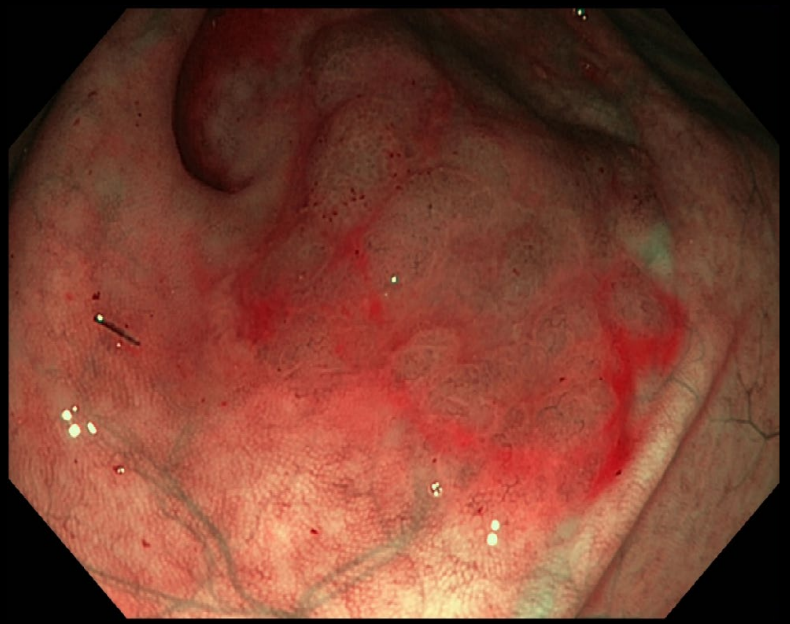



Know what to look for!

# Cecal intubation

- SSA/P are more often located in the proximal colon
- Incomplete colonoscopy will result in substantial amount of missed SPs and subsequent interval CRC

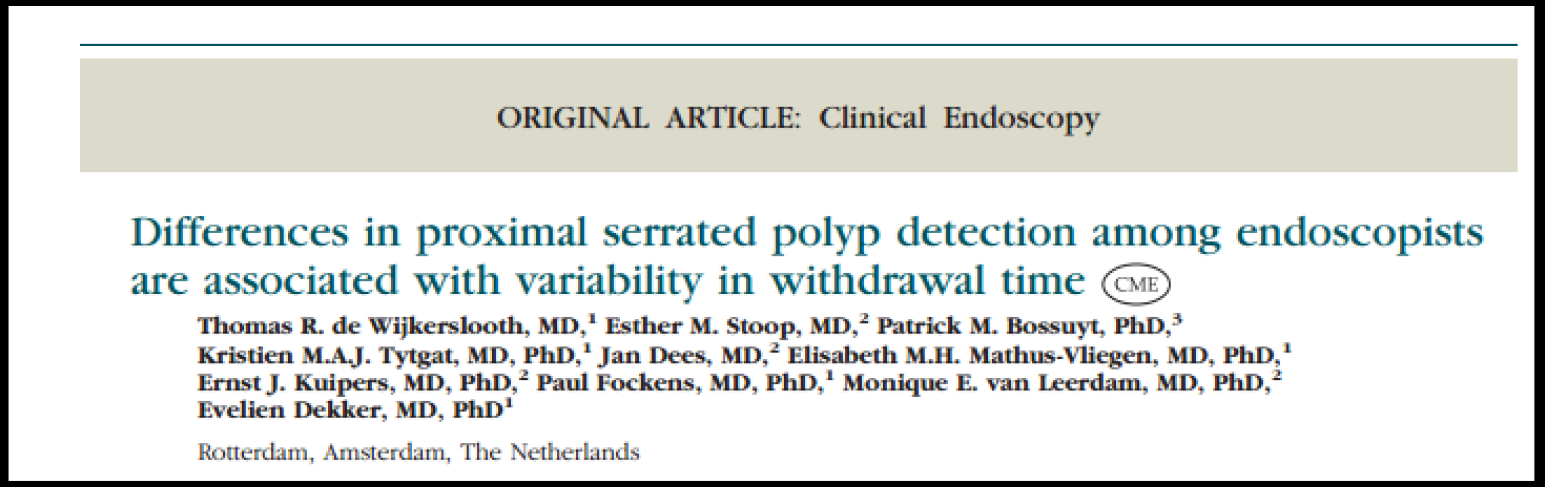




NHS BCSP Endosc Qual Assurance group 2011

# Adequate withdrawal time

- Longer withdrawal time results in higher detection of SP



ORIGINAL ARTICLE: Clinical Endoscopy

Differences in proximal serrated polyp detection among endoscopists are associated with variability in withdrawal time (CME)

Thomas R. de Wijkerslooth, MD,[1] Esther M. Stoop, MD,[2] Patrick M. Bossuyt, PhD,[3] Kristien M.A.J. Tytgat, MD, PhD,[1] Jan Dees, MD,[2] Elisabeth M.H. Mathus-Vliegen, MD, PhD,[1] Ernst J. Kuipers, MD, PhD,[2] Paul Fockens, MD, PhD,[1] Monique E. van Leerdam, MD, PhD,[2] Evelien Dekker, MD, PhD[1]

Rotterdam, Amsterdam, The Netherlands

de Wijkerslooth et al. GIE 2013

# Role of advanced imaging in SP detection

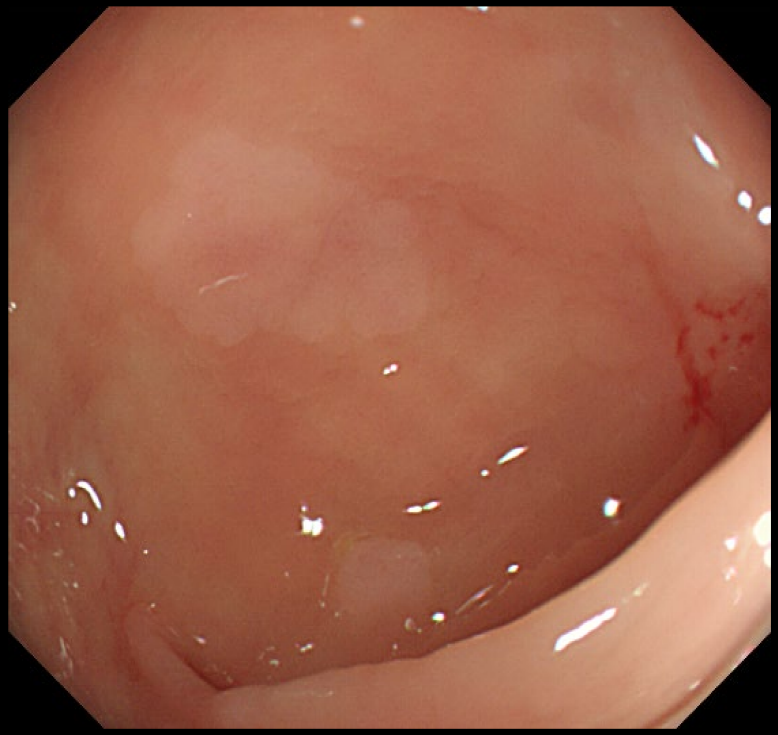
- Narrow Band Imaging (NBI) has no proven additional value in SP detection in SPS patients
- Chromoendoscopy (CE) probably usefull but time consuming
- Advanced imaging usefull to detect SPs in case of uncertainty!

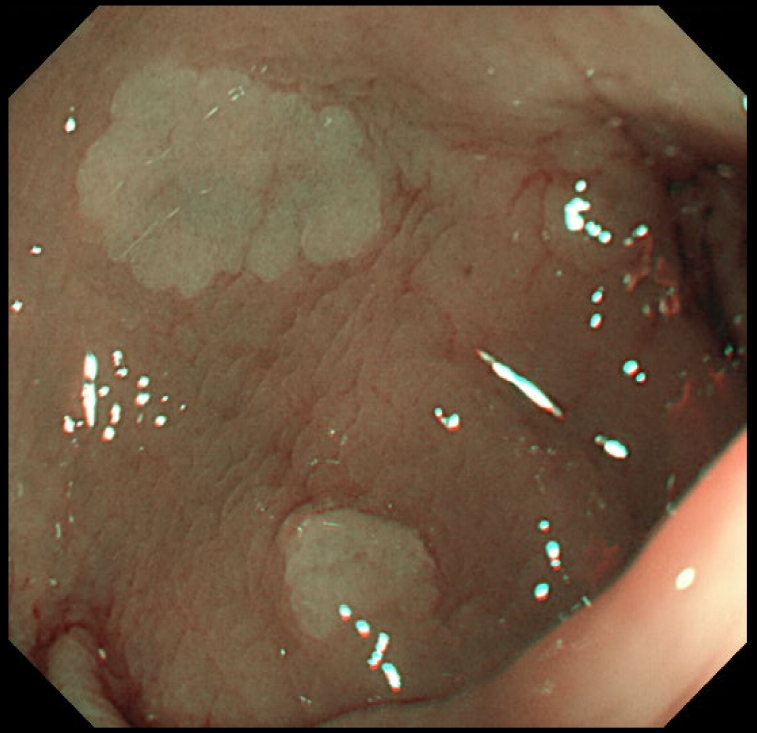
Hazewinkel et al. GIE 2014
Fu et al. Int J Clin Exp Pathol. 2014

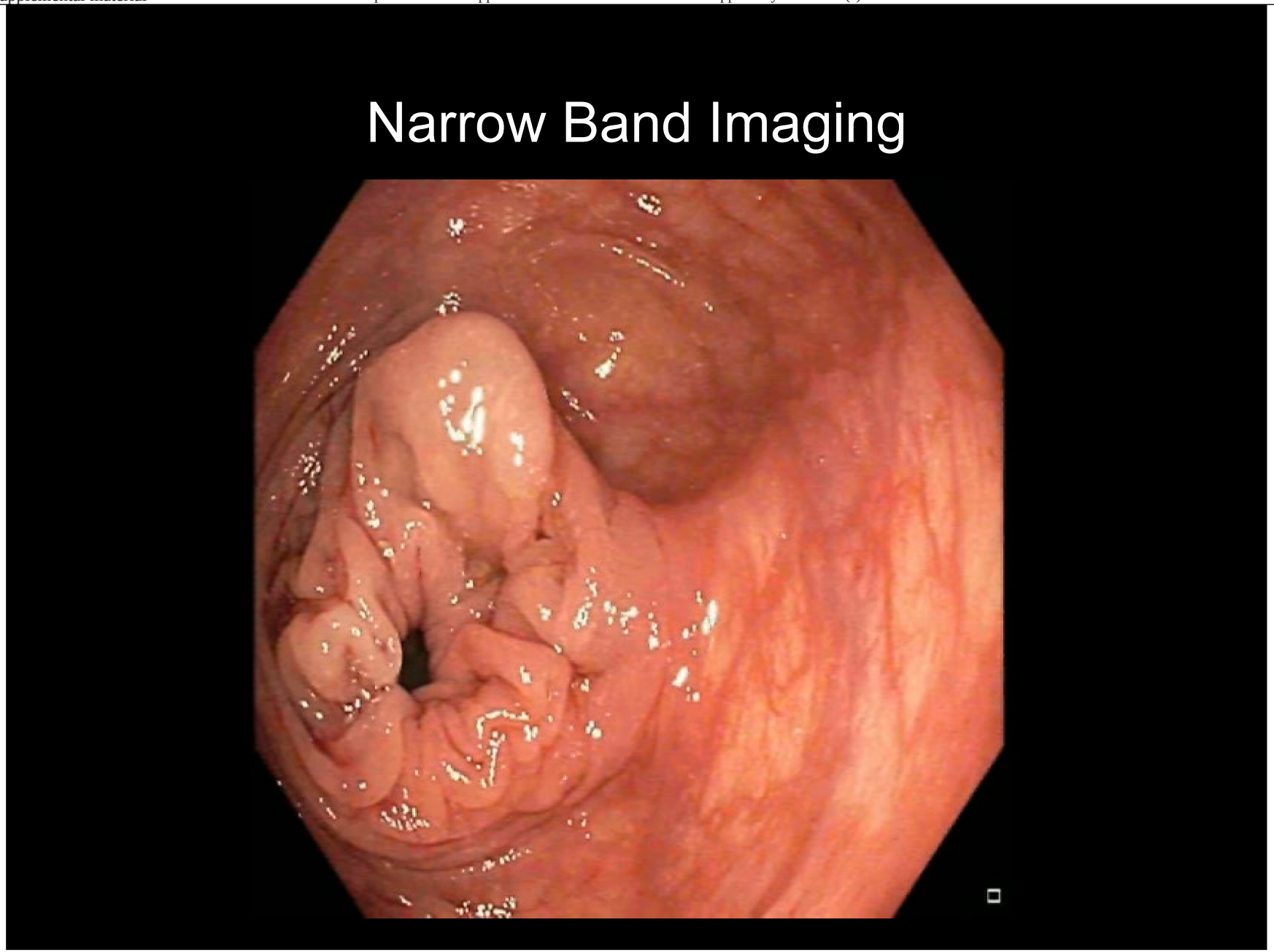
# Narrow Band Imaging

HRE

NBI






Narrow Band Imaging

# Conclusion

- SPs are easily missed during colonoscopy
- Important reason for right-sided interval CRC
- SP detection can be improved by:
  - Awareness of malignant potential SPs
  - Knowledge of subtle SP features
  - High quality colonoscopy
  - Targeted use of advanced imaging techniques