Not All Visual Data Acquired During Withdrawal Phase (WP) of Colonoscopy is Interpretable: Introducing the Concept of "Effective" Withdrawal Time

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Introduction

- CRC is second most cause of cancer related deaths in USA in both men and women.
- Colonoscopy yield is dependant on adenoma detection rate (ADR) and low ADR is linked to development of interval colon cancer due to missed lesions.
- Endoscopist related factors can influence the ADR
- Longer withdrawal phase time is associated with higher ADR.
- Six minutes or longer WP time has been recommended and is one of the quality indicators.
- Not all the visual data obtained during WP is interpretable. We wanted to investigate how much of withdrawal time is actually spent on quality inspection as opposed to uninterpretable visual data.
- We wanted to test a novel image-based approach in assessing meaningful adequate information acquired during withdrawal phase.
- We call this adequate visual data as the "effective" WP time

Study Aim

- Report amount of visual data acquired during withdrawal phase that is not meaningful.
- Report intra-observer and inter-observer variability in interpretation of visual data acquired during colonoscopy withdrawal phase.

Methods

- 10 randomly selected withdrawal phase videos of screening colonoscopy that had adequate cleansing preparation score were selected.
- To make the study feasible, from thousands of images comprising each video, every 200th image was selected to represent the entire visual data acquired during withdrawal.
- Biomedical informatics department from ASU facilitated extracting static images from dynamic videos.
- Each image was classified as
  - Adequate(Figure 1): >75% of image was interpretable
  - Inadequate(Figure 2): < 50% interpretable
  - Ambiguous: >50% but < 75%.
- 2 readers in a blinded manner analyzed each image independently and each ambiguous image was analyzed twice.
- Both endoscopist have more than 15 years of experience.
- Kappa statistics were used for agreement scores

Results

- 1005 individual images from WP of 10 colonoscopies were analyzed.
- On average for each video for reader 1, 32% of acquired visual data was inadequate 57% adequate and 11% ambiguous.
- Second reader: 27% inadequate, 61% adequate 12% ambiguous
- Inter-observer agreement scores between two readers for inadequate images was good (Kappa Score 0.64, $p < 0.001$).
- Intra-observer agreement score for inadequate images was excellent (Kappa 0.8 and 0.81) for each reader ($p < 0.001$).

Figure 1: Adequate Images

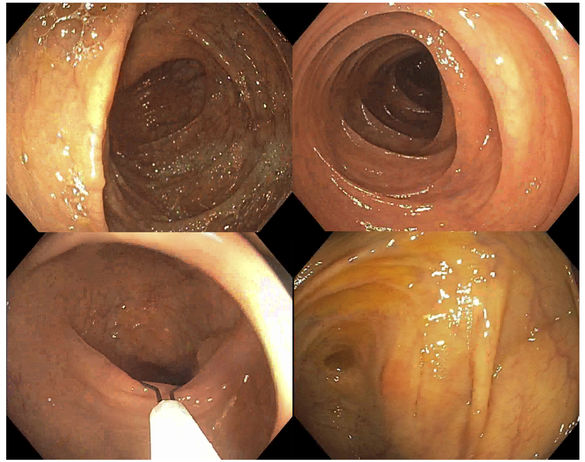

Figure 2: Inadequate Images

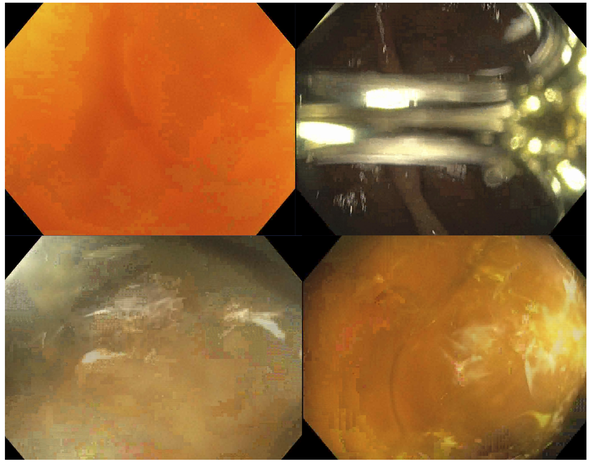

Table 1

	Reader 1	Reader 2
Video #	Inadequate%	Inadequate%
1	32	18
2	38	25
3	35	19
4	34	22
5	17	25
6	29	30
7	26	26
8	45	38
9	24	35
10	44	32

Conclusions

- Not all visual data acquired during withdrawal is adequate for visual interpretation.
- In our study, up to 32% of the WP images were inadequate, introducing the concept of "effective" withdrawal time.
- This is a feasibility study for collaboration with ASU for development of an image analyzing software that can be employed to track this particular indicator.
- The effective WP time can be used as a new improvement tool for endoscopists with low ADRs or could be used to objectively follow the progress of fellows longitudinally during their training.
- Several approaches, including training programs for better hand-eye coordination can be employed to reduce the inadequate data and maximize the effective time during the withdrawal.

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