

INPLASY

Assessing the Effectiveness of Texture and Color Enhancement Imaging (TXI) Versus White-Light Endoscopy (WLE) in Detecting Gastrointestinal Lesions: A Comprehensive Meta-Analysis

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ADMINISTRATIVE INFORMATION

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Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 2 January 2025 and was last updated on 2 January 2025.

INTRODUCTION

Review question / Objective "How does TXI compare to WLI for assessment of gastrointestinal lesions?"

Population: Adults aged 18 years or older undergoing assessment of gastrointestinal lesions.

Intervention: Texture and Color Enhancement Imaging (TXI).

Comparator: White-Light Endoscopy (WLE).

Outcomes:

• Primary

1. Color difference between the lesion and surrounding mucosa

2. Visibility score of the lesion

3. Gastrointestinal lesion detection rate.

• Secondary

1. Mean adenoma detection rate per procedure

2. Visibility scores stratified by lesion characteristics (vessel pattern, surface pattern, margin pattern)

3. Visibility scores for sessile serrated lesions and hyperplastic polyps (colorectal lesions)

4. Colorectal polypoid adenoma detection rate.

Rationale White-light endoscopy often fails to identify small and flat gastrointestinal lesions, leading to delayed diagnoses. Texture and Color Enhancement Imaging (TXI) provides improved visualization of lesions in gastrointestinal diseases ranging from atrophy and metaplasia to cancers of various sites, potentially enhancing diagnostic accuracy. This meta-analysis synthesizes evidence comparing TXI and WLE to offer actionable insights for clinical practice.

Condition being studied Detection and evaluation of gastrointestinal lesions using different endoscopic approaches i.e. TXI and WLI.

METHODS

Search strategy

Databases:

1. Cochrane Central Register of Controlled Trials (CENTRAL)

2. PubMed

3. Embase

4. Web of Science

Keywords:

1. 'Texture and Color Enhancement Imaging'
2. 'TXI'
3. 'White Light Endoscopy'
4. 'WLE'
5. 'Gastrointestinal Lesions'
6. 'Detection Rate'
7. 'Visibility Score'
8. 'Color Difference'.

Participant or population Adults aged 18 and above who are undergoing endoscopic evaluation for gastrointestinal lesions (pharyngeal, esophageal, stomach, small intestine, and colorectal lesions).

Intervention Texture and Color Enhancement Imaging (TXI): An advanced endoscopic imaging technique that uses Retinex theory-based image processing technology to visualize gastrointestinal lesions better.

Comparator White-Light Endoscopy (WLE): A conventional imaging modality used in gastrointestinal endoscopy that uses broad-spectrum light.

Study designs to be included Randomized controlled trials (RCTs) and observational studies (prospective or retrospective cohort studies, case-control studies).

Eligibility criteria

Inclusion:

- Studies comparing TXI and WLE.
- Outcomes reported: gastrointestinal lesion visibility score, detection rate, or color difference between lesion and mucosa.

Exclusion:

- Case reports, case series, single-arm studies, guidelines, conference abstracts, animal studies, duplicate, or review articles.

Information sources Literature search across CENTRAL, PubMed, Embase, and Web of Science.

Main outcome(s) 1. Color Difference: Color difference to be quantified using the CIELAB color space system to evaluate the differences in light/dark (L^*), red/green (a^*), and yellow/blue (b^*) values between lesions and surrounding mucosa. Measure of effect: The mean difference (MD)
2. Visibility Score: It is the detectability of the lesions without magnification. Measurement using a subjective scale from 1 (poor) to 4 (excellent), reflecting the ease of lesion detection.

Measure of effect: The mean difference (MD)

3. Gastrointestinal Lesion Detection Rate

Measure of effect: The odds ratio (OR).

Additional outcome(s)

1. Visibility by Lesion Characteristics: Stratified based on vessel, surface, and margin patterns. The same scale used for visibility scoring as above.

Measure of effect: The mean difference (MD)

2. Visibility scores for specific colorectal lesions (sessile serrated lesions, hyperplastic polyps): The same scale used for visibility scoring as above.

Measure of effect: The mean difference (MD)

3. Mean Adenoma Detection Rate: The number of adenomas detected divided by the total number of colonoscopies performed.

Measure of effect: The mean difference (MD)

4. Colorectal polypoid adenoma detection rate

Measure of effect: The odds ratio (OR).

Data management Data management using Mendeley for duplicate removal and Excel for extraction and synthesis. Extracted data included study characteristics, participant demographics, intervention and comparator details, outcome measures, and duration of follow-up.

Quality assessment / Risk of bias analysis

- RCTs: Assessment using Cochrane RoB 2.0 tool to evaluate risk of bias across domains.
- Observational Studies: Evaluation with Newcastle-Ottawa Scale (NOS) to assess study quality.
- Overall Evidence: GRADE to determine certainty of evidence.

Strategy of data synthesis

- Statistical Methods: A random-effects model pre-specified for meta-analysis. Dichotomous outcomes to be reported as Odds Ratios (ORs), and continuous outcomes as Weighted Mean Differences (WMDs). A p-value less than 0.05 is said to be statistically significant.
- Heterogeneity Assessment: Assessment using Chi-square tests and Higgins I^2 statistic, with thresholds set for low, moderate, and high heterogeneity.

Subgroup analysis • Color difference between the lesion and surrounding mucosa, visibility score of the lesion, and gastrointestinal lesion detection rate are planned to be stratified by lesion location: pharyngeal/esophageal, gastric, colorectal.
• The visibility scores are to be stratified by lesion characteristics: vessel pattern, surface pattern, and margin pattern.

Sensitivity analysis Sensitivity analyses to assess the robustness of the results by excluding studies at high risk of bias.

Language restriction No language restrictions applied.

Country(ies) involved Authors affiliated with institutions in the USA and Pakistan.

Other relevant information The methodology is designed in accordance with PRISMA and Cochrane guidelines to ensure rigorous systematic review standards.

Keywords Texture and Color Enhancement Imaging, TXI, White Light Endoscopy, WLE, Gastrointestinal Lesions, Detection Rate, Visibility Score, Color Difference, Meta-Analysis.

Dissemination plans Findings are to be disseminated through peer-reviewed publication and presentations at gastroenterology conferences.

Contributions of each author

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