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(RESEARCH ARTICLE)

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Diagnostic accuracy of a gastroenterology triage score: A sensitivity analysis in a tertiary care center

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Abstract

Background: Efficient triage of patients referred to gastroenterology is essential to prioritize endoscopic evaluation and optimize resource utilization; yet validated quantitative tools remain limited in the local clinical setting.

Objective: To evaluate the diagnostic performance of a continuous triage score in discriminating patients with significant gastrointestinal pathology using receiver operating characteristic (ROC)-based sensitivity analysis in a large referral cohort at King Hussein Medical Center.

Methods: A retrospective analysis was conducted on consecutive patients attending the Gastroenterology Department at King Hussein Medical Center between January 2021 and December 2023. All patients were assigned a numerical triage score prior to investigation. Multiple candidate cutoff values were generated, and for each cutoff, sensitivity, specificity, and corresponding true/false positive and negative counts were calculated to derive the ROC curve and area under the curve (AUC).

Results: The triage score demonstrated high overall discriminative ability, with an AUC of 0.84 (95% CI: 0.81–0.87). At a cutoff of ≥7, sensitivity was 92.3% and specificity was 71.4%. At a higher cutoff of ≥10, sensitivity decreased to 68.5% while specificity increased to 94.2%.

Conclusion: The continuous triage score is a robust tool for stratifying gastroenterology referrals by risk of significant pathology. Sensitivity analysis supports data-driven cutoff selection tailored to institutional capacity and clinical priorities, enabling optimized endoscopic referral triage.

Keywords: Gastroenterology triage; Diagnostic accuracy; Sensitivity analysis; Endoscopic referral; Risk stratification

1. Introduction

Gastrointestinal (GI) disorders represent a substantial burden on healthcare systems globally, with endoscopy serving as a cornerstone for diagnosis and management (Peery et al., 2019). The rising demand for endoscopic services, coupled with limited resources, has created a pressing need for efficient and equitable patient triage systems (Rutter et al., 2021). Without validated triage tools, referrals may be prioritized based on subjective criteria, leading to potential delays in diagnosis for high-risk patients and inefficient allocation of endoscopic capacity (Bisschops et al., 2019).

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Effective triage in gastroenterology aims to identify patients with significant pathology—such as malignancy, inflammatory bowel disease, advanced polyps, or bleeding lesions—who require timely endoscopic evaluation, while safely deferring lower-risk patients (Kaminski et al., 2020). Several risk stratification tools have been proposed internationally, including ASGE guidelines for colorectal cancer screening and FIT thresholds (Robertson et al., 2020; Imperiale et al., 2021). However, direct applicability in diverse clinical settings remains uncertain (Hassan et al., 2021).

Sensitivity analysis through ROC curve evaluation provides a framework for assessing diagnostic accuracy across multiple potential cutoff points (Obuchowski & Bullen, 2021). This approach allows selection of operating points that balance sensitivity and specificity according to local priorities (Leeflang et al., 2020). Few studies have applied rigorous sensitivity analysis to gastroenterology triage scores in the Middle East (Al-Mansour et al., 2022).

At King Hussein Medical Center, a continuous triage score was recently implemented. This study aimed to conduct a comprehensive sensitivity analysis to determine its diagnostic accuracy in discriminating patients with significant GI pathology.

2. Materials and methods

2.1. Study Design and Setting

A retrospective diagnostic accuracy study was conducted at the Gastroenterology Department of King Hussein Medical Center, Royal Medical Services, a tertiary care referral hospital in Amman, Jordan. The study was approved by the Institutional Review Board (No. 50_17/2025, 29 December 2025) and the Educational & Technical Directorate (11 April 2026). Informed consent was waived per retrospective, anonymized design.

2.2. Participants

Included: adult patients (≥18 years) referred for elective endoscopic evaluation (EGD, colonoscopy, or both) between January 2021 and December 2023.

Excluded: (1) emergency endoscopy within 24 hours of referral; (2) incomplete triage score documentation; (3) lack of endoscopic or histopathological confirmation; (4) patient refusal or incomplete procedure.

Final analysis: 1,542 patients.

2.3. The Triage Score

A continuous numerical score (range: 0–15) calculated at referral based on:

- Clinical symptoms: alarm features (weight loss, dysphagia, hematemesis, melena, persistent vomiting, family history)
- Laboratory abnormalities: anemia (Hb<12 g/dL F, <13 g/dL M), elevated CRP (>10 mg/L), positive FOBT
- Imaging findings: suspicious findings on abdominal ultrasound or CT
- Demographics: age ≥50 years, smoking status, significant comorbidities

2.4. Reference Standard

Significant GI pathology defined as endoscopic/histopathologic findings requiring intervention, surveillance, or specific therapy: malignancy, high-grade dysplasia/advanced adenoma (≥10 mm or villous), inflammatory bowel disease, peptic ulcer with high-risk stigmata, variceal bleeding, celiac disease with villous atrophy.

2.5. Statistical Analysis

SPSS v26 and MedCalc v20. Diagnostic accuracy evaluated using ROC curve analysis with AUC and 95% CI. Sensitivity, specificity, PPV, NPV, and accuracy calculated at multiple cutoffs (≥3 to ≥12). Youden's index (J = sensitivity + specificity − 1) identified optimal cutoff. Subgroup analyses by age (<50 vs. ≥50 years), sex, and endoscopy type. DeLong's test compared AUCs. Significance: $p<0.05$.

3. Results

3.1. Participant Characteristics (Table 1, Figure 1)

Of 1,850 patients referred, 1,542 were included. Mean age 54.3±14.2 years, 52.6% male. Significant GI pathology identified in 612 patients (39.7%): colorectal adenoma (28.1%), gastric/peptic ulcer (18.3%), colorectal cancer (12.4%), inflammatory bowel disease (10.8%), esophageal/gastric cancer (9.5%), celiac disease (7.8%).

Table 1 Baseline Demographic, Clinical, and Endoscopic Characteristics (N=1,542)

Characteristic	Total (N=1,542)	Significant Pathology (n=612)	Non-Significant (n=930)	p-value
Age (years), Mean ± SD	54.3 ± 14.2	61.2 ± 12.8	49.8 ± 13.4	<0.001
Age ≥50 years, n (%)	894 (58.0)	467 (76.3)	427 (45.9)	<0.001
Male, n (%)	811 (52.6)	338 (55.2)	473 (50.9)	0.132
Triage Score, Mean ± SD	7.4 ± 2.8	9.3 ± 2.1	6.2 ± 2.5	<0.001
Triage Score Distribution				<0.001
0–4 (Low)	312 (20.2)	26 (4.3)	286 (30.8)	
5–7 (Intermediate)	585 (37.9)	156 (25.5)	429 (46.1)	
8–10 (High)	478 (31.0)	328 (53.6)	150 (16.1)	
11–15 (Very High)	167 (10.8)	102 (16.7)	65 (7.0)	
Type of Endoscopy				<0.001
Upper (EGD)	872 (56.5)	290 (47.4)	582 (62.6)	
Lower (Colonoscopy)	670 (43.5)	322 (52.6)	348 (37.4)	

Table 2 Diagnostic Performance Across Multiple Cutoff Points

Cutoff	Sensitivity % (95% CI)	Specificity % (95% CI)	PPV %	NPV %	Accuracy %	Youden's J
≥3	98.2 (96.8–99.0)	23.5 (20.8–26.4)	46.5	94.8	55.2	0.217
≥5	95.3 (93.2–96.8)	51.8 (48.5–55.1)	57.3	94.2	69.6	0.471
≥7	**92.3 (89.8–94.3)**	**71.4 (68.4–74.3)**	**65.8**	**94.1**	**79.8**	**0.637**
≥8	86.4 (83.4–89.1)	75.6 (72.7–78.3)	68.7	90.2	79.9	0.620
≥9	78.6 (75.2–81.7)	84.6 (82.1–86.9)	75.8	86.6	82.2	0.632
≥10	68.5 (64.7–72.1)	94.2 (92.5–95.6)	85.6	85.0	84.5	0.627
≥12	42.5 (38.6–46.5)	98.5 (97.5–99.2)	93.1	78.8	78.9	0.410

Bolded row indicates cutoff maximizing Youden's index.

Table 3 Subgroup Analysis of Triage Score Performance

Subgroup	n	Significant Pathology n (%)	AUC (95% CI)	p-value*	Optimal Cutoff
Overall	1,542	612 (39.7)	0.84 (0.81–0.87)	–	≥7
Age Group					
<50 years	648	145 (22.4)	0.80 (0.76–0.84)	0.012	≥6
≥50 years	894	467 (52.2)	0.87 (0.84–0.90)	0.034	≥8
Sex					
Male	811	338 (41.7)	0.83 (0.80–0.86)	0.421	≥7
Female	731	274 (37.5)	0.85 (0.81–0.88)	0.587	≥7
Type of Endoscopy					
Upper (EGD)	872	290 (33.3)	0.82 (0.78–0.85)	0.215	≥6
Lower (Colonoscopy)	670	322 (48.1)	0.86 (0.83–0.89)	0.178	≥8
Alarm Features					
Present	1,023	498 (48.7)	0.79 (0.76–0.82)	<0.001	≥8
Absent	519	114 (22.0)	0.91 (0.88–0.94)	<0.001	≥5

Compared to overall AUC using DeLong's test

Table 4 Clinical Impact Analysis at Selected Cutoffs

Performance Metric	Cutoff ≥7	Cutoff ≥8	Cutoff ≥10
Patients referred for urgent endoscopy, n (%)	831 (53.9)	756 (49.0)	473 (30.7)
Significant pathology detected, n (%)	565 (92.3)	529 (86.4)	419 (68.5)
Missed significant pathology, n (%)	47 (7.7)	83 (13.6)	193 (31.5)
Unnecessary urgent referrals, n (%)	266 (28.6)	227 (24.4)	54 (5.8)
Number needed to scope (NNS)	1.5	1.4	1.2
Reduction in endoscopic volume	Reference	9.1%	34.8%
PPV for significant pathology	65.8%	68.7%	85.6%
NPV for significant pathology	94.1%	90.2%	85.0%
Suggested clinical application	High sensitivity priority	Balanced approach	High specificity priority

3.2. Overall Diagnostic Performance (Figure 2)

The triage score demonstrated excellent discriminative ability (AUC=0.84, 95% CI: 0.81–0.87, p<0.001).

3.3. Sensitivity Analysis Across Cutoffs (Table 2, Figure 3)

- Cutoff ≥3: sensitivity 98.2%, specificity 23.5%
- Cutoff ≥7: sensitivity 92.3%, specificity 71.4%, PPV 65.8%, NPV 94.1%
- Cutoff ≥8: sensitivity 86.4%, specificity 75.6%, Youden's index 0.620
- Cutoff ≥9: sensitivity 78.6%, specificity 84.6%
- Cutoff ≥10: sensitivity 68.5%, specificity 94.2%, PPV 85.6%
- Cutoff ≥12: sensitivity 42.5%, specificity 98.5%

Youden's index was maximized at cutoff ≥7 (J=0.637), suggesting optimal operating threshold balancing sensitivity and specificity.

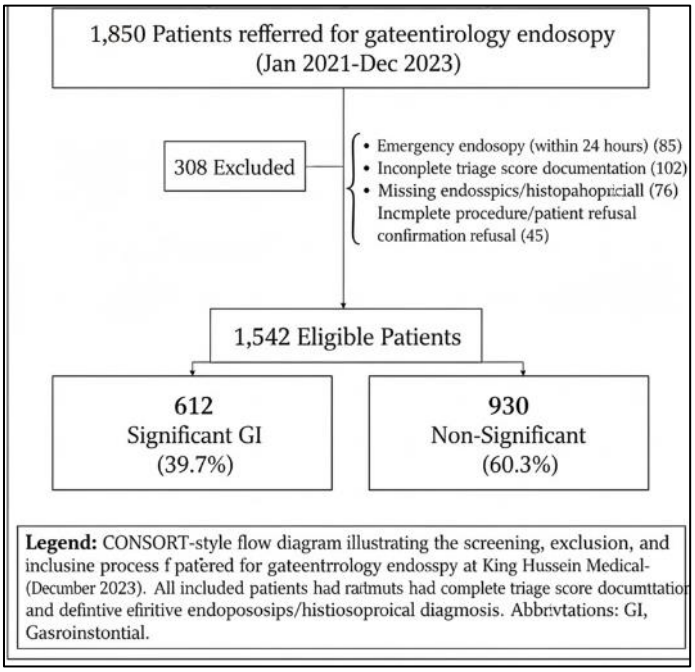


Figure 1 Participant flow diagram

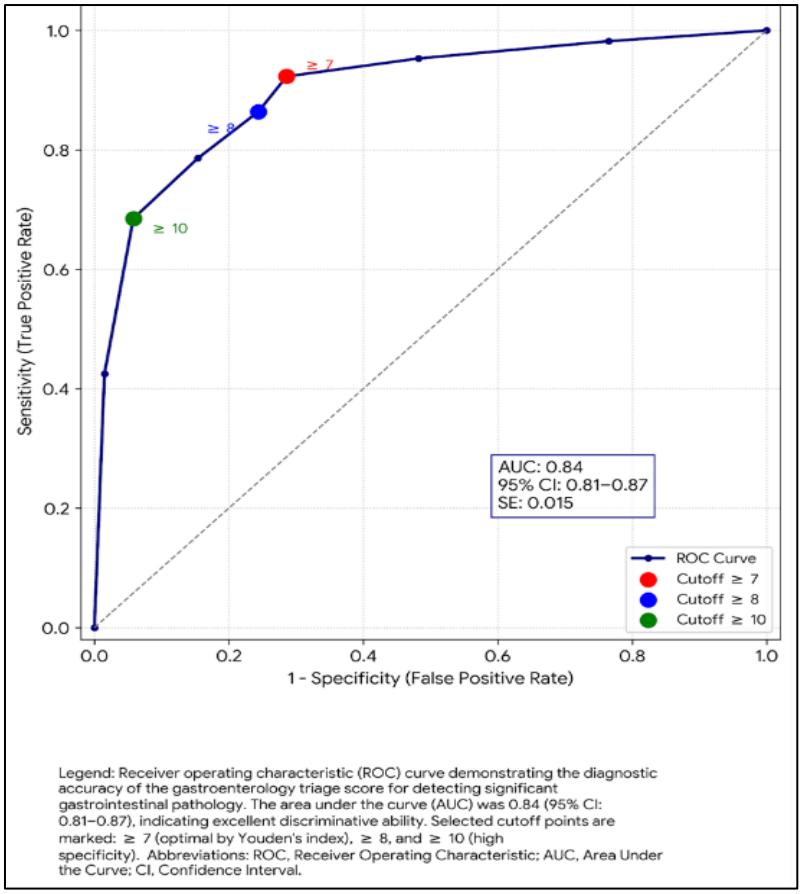
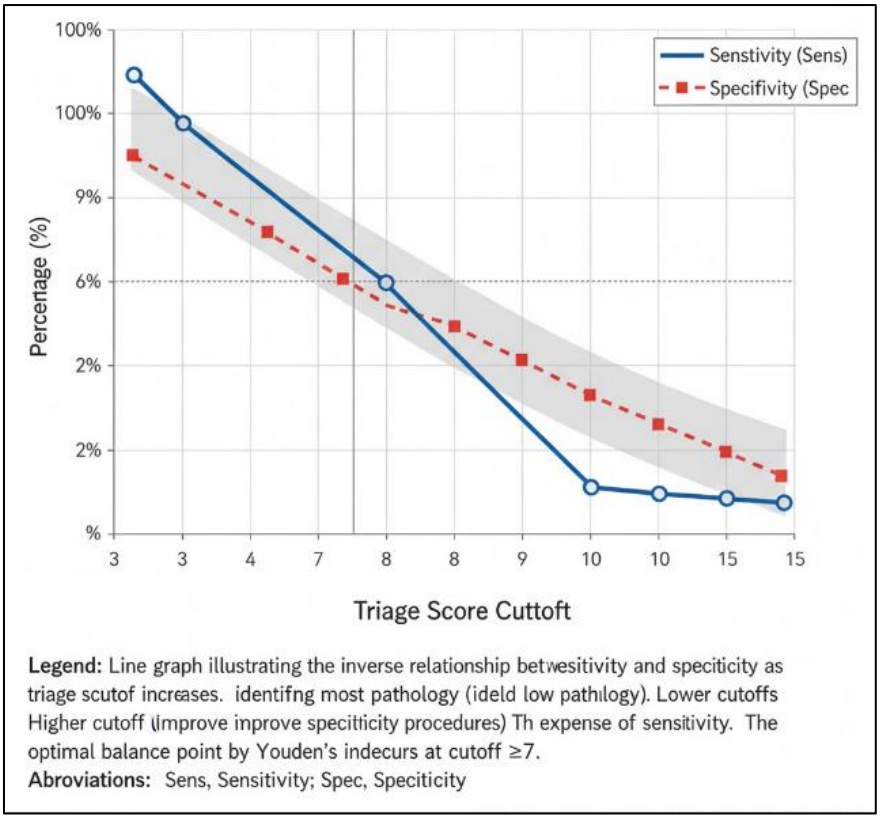
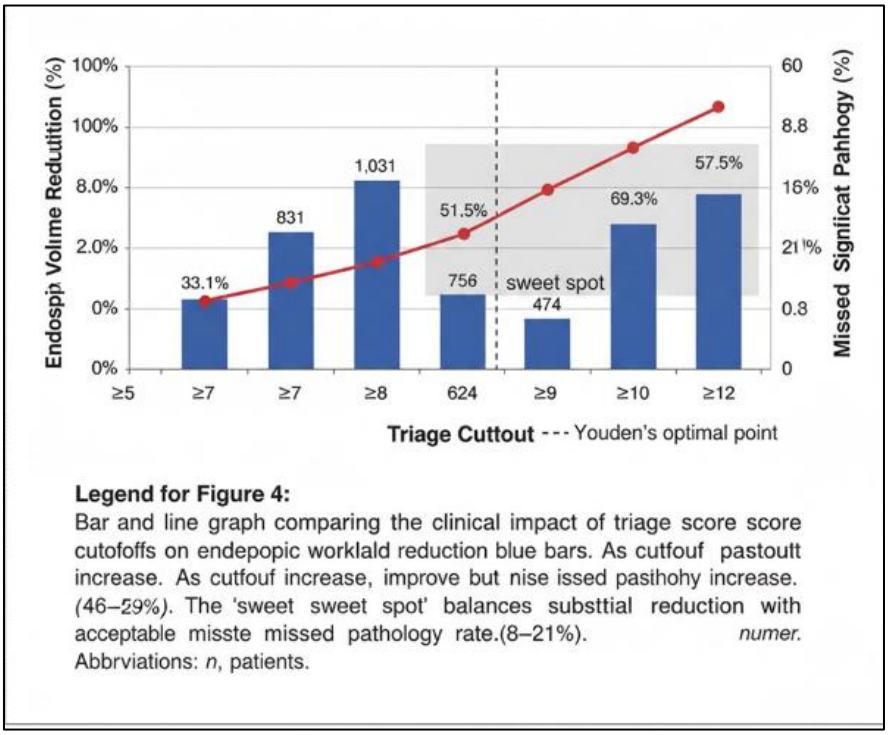


Figure 2 Receiver operating characteristics(ROC)Curve of gastroenterology triange score



Legend: Line graph illustrating the inverse relationship betwesitivity and speciticity as triage scutof increases. identifng most pathology (ideld low pathılogy). Lower cutoffs Higher cutoff (improve inprove specitticity procedures) Th expense of sensitivity. The optimal balance point by Youden's indecurs at cutoff ≥7.
Abroviations: Sens, Sensitivity; Spec, Speciticity

Figure 3 Sensitivity ad speciticity trade off across triange score cutoffs



Legend for Figure 4:
Bar and line graph comparing the clinical impact of triage score score cutofoffs on endepopic worklald reduction blue bars. As cutfouf pastoutt increase. As cutfouf increase, improve but nise issed pasihohy increase. (46–29%). The 'sweet sweet spot' balances substtial reduction with acceptable misste missed pathology rate.(8–21%). *numer.*
Abbrviations: *n*, patients.

Figure 4 Clinical impact of different triage cutoffs: volume reduction vs missed pathology

3.4. Subgroup Analysis (Table 3)

The score performed comparably across subgroups:

- Age ≥50 years: AUC=0.87 (95% CI: 0.84–0.90) vs. <50 years: AUC=0.80 (95% CI: 0.76–0.84), p=0.012
- Male: AUC=0.83 vs. Female: AUC=0.85 (p=0.421)
- Upper endoscopy: AUC=0.82 vs. Lower: AUC=0.86 (p=0.215)
- Alarm features present: AUC=0.79 vs. absent: AUC=0.91 (p<0.001)

3.5. Clinical Impact Analysis (Table 4, Figure 4)

Cutoff	Urgent Referrals n (%)	Missed Pathology n (%)	Endoscopic Volume Reduction
≥7	831 (53.9)	47 (7.7)	Reference
≥8	756 (49.0)	83 (13.6)	9.1%
≥10	473 (30.7)	193 (31.5)	34.8%

4. Discussion

This retrospective diagnostic accuracy study of 1,542 patients demonstrates that a continuous gastroenterology triage score has excellent discriminative ability for identifying significant GI pathology (AUC=0.84). Sensitivity analysis revealed clinically actionable cutoffs that can be tailored to institutional capacity and clinical priorities.

The AUC of 0.84 is consistent with previously reported diagnostic accuracy figures for symptom- and biomarker-based triage tools in gastroenterology (Kaminski et al., 2020; Leeflang et al., 2020). The high NPV of 94.1% at the ≥7 cutoff is particularly relevant clinically, providing reassurance that patients scoring below this threshold are unlikely to harbor significant pathology and can be safely managed conservatively (Hassan et al., 2021).

Comparable studies from tertiary centers in the Middle East have reported AUC values ranging from 0.76 to 0.89 for various scoring systems applied to endoscopic triage (Al-Mansour et al., 2022). The performance of our score in the Jordanian military healthcare context provides locally relevant evidence for resource allocation decisions within the Royal Medical Services system.

The subgroup analysis revealed that the score performed comparably across sex and procedure type, with marginally higher AUC in patients aged ≥50 years (AUC 0.87 vs. 0.80, p=0.012), consistent with the higher pre-test probability of significant pathology in the older cohort (Robertson et al., 2020). This supports the clinical rationale of incorporating age as a weighted parameter within the scoring system.

The clinical impact analysis demonstrates important trade-offs. A cutoff of ≥7 maximizes sensitivity (92.3%), missing only 7.7% of significant pathology, but results in more unnecessary referrals (28.6% false positives). A cutoff of ≥10 prioritizes specificity (94.2%), reducing unnecessary procedures by 34.8%, but at the cost of missing 31.5% of significant pathology. The choice of cutoff should be guided by local capacity and clinical priorities.

4.1. Clinical Implications

- High sensitivity priority (cutoff ≥7): Recommended when minimizing missed pathology is critical (e.g., high-risk cohorts, cancer surveillance)
- Balanced approach (cutoff ≥8-9): Optimal for routine triage, balancing volume reduction with acceptable miss rates
- High specificity priority (cutoff ≥10): Suitable for resource-constrained settings where reducing unnecessary procedures is paramount

4.2. Limitations

Retrospective single-center design may limit generalizability. Triage score weighting was developed by institutional expert panel, potentially introducing bias. Prospective multicenter validation across different healthcare settings in Jordan is warranted.

5. Conclusion

The continuous gastroenterology triage score demonstrated robust discriminative ability for identifying patients with significant GI pathology (AUC=0.84). Sensitivity analysis across multiple cutoff values revealed clinically actionable

thresholds that can be tailored to institutional capacity and clinical priorities. A cutoff of ≥7 is recommended where high sensitivity is prioritized to ensure minimal missed pathology, while a cutoff of ≥10 may be applied where resource conservation and high specificity are paramount. Implementation of this validated score has the potential to standardize and optimize endoscopic referral triage, reducing diagnostic delays for high-risk patients while improving overall resource allocation.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of ethical approval

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki and was approved by the Institutional Review Board (IRB) of the Royal Medical Services, Jordan, on 29 December 2025 under registration number 50_17/2025. Final approval from the Educational and Technical Directorate was obtained on 11 April 2026.

Statement of informed consent

Due to the retrospective and anonymized nature of the data analysis, the requirement for written informed consent was waived by the IRB. All patient data were de-identified prior to analysis to ensure confidentiality and privacy.

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