BODY MASS INDEX AS A SIGNIFICANT PREDICTOR OF POSTOPERATIVE ILEUS FOLLOWING ROBOTIC RADICAL PROSTATECTOMY: INSIGHTS FROM A SINGLE-CENTER RETROSPECTIVE STUDY

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ABSTRACT:

Introduction

Postoperative ileus (POI) remains a common complication following robotic-assisted radical prostatectomy (RARP), delaying recovery and increasing healthcare burden. Obesity and impaired glycemic control are recognized contributors to poor postoperative outcomes. However, their role in predicting POI, particularly in RARP, remains underexplored.

Method

A retrospective analysis was conducted on 200 patients who underwent RARP between January 2020 and December 2023. Preoperative variables included BMI, HbA1c, clinical T stage, PIRADS score, prostate volume (MRI), and biopsy Gleason score. Optimal thresholds for BMI and HbA1c were determined using ROC analysis and Youden's J statistic. A six-point scoring system was developed based on categorical cutoffs, with logistic regression and ROC analysis used to evaluate performance.

Results

The overall incidence of POI was 17%. Novel thresholds—BMI ≥31.0 kg/m² and HbA1c ≥8.0%—were independently associated with higher POI risk. The additive score (range 0–6) showed progressive increases in POI incidence with higher scores.

Conclusion

The resulting score offers a practical, bedside tool to support early risk stratification and preoperative counseling. Its simplicity supports clinical integration, and future multicenter validation may enhance predictive accuracy and expand its utility in enhanced recovery protocols.

Keywords: Postoperative ileus, robotic-assisted radical prostatectomy, body mass index

INTRODUCTION

Robotic-assisted radical prostatectomy (RRP) has become the standard surgical treatment for prostate cancer due to enhanced recovery and minimized invasiveness. However, postoperative ileus (POI), characterized by delayed bowel function recovery, remains a significant barrier to optimal patient outcomes. Current literature has established broad correlations between obesity and postoperative complications but lacks specific BMI thresholds related explicitly to POI following RRP. Furthermore, the roles of diabetes mellitus and detailed oncological factors remain under-explored in this surgical setting. The current study addresses these knowledge gaps by establishing, for the first time, a definitive BMI cutoff predictive of POI, along with other relevant clinical and oncological risk factors.

METHODOLOGY

A retrospective review was performed on 200 patients undergoing RRP from January 2020 to December 2023. Data collected included demographics (age, ethnicity), clinical variables (BMI, DM status), perioperative parameters (hospital stay length, postoperative hemoglobin), and detailed oncological characteristics (MRI T stage, presence of cribriform pattern, pathological T stage, prostate volume, and surgical margins), as shown in Table 1. Statistical analysis was performed using SPSS Version 26. Continuous variables were compared using independent t-tests or Mann-Whitney U tests. Categorical data were analyzed using chi-square or Fisher's exact test. ROC curve analysis was conducted to identify optimal BMI and HbA1c thresholds associated with POI using Youden's J statistic. Multivariable logistic regression was used to identify independent predictors. Significance was set at $p<0.05$.

To enhance the clinical utility of the findings, a simplified predictive risk score for POI based exclusively on preoperative data was developed. This model integrates six readily available clinical parameters: BMI, HbA1c, clinical T stage, PIRADS score, prostate volume (MRI), and biopsy Gleason score. Each variable was assigned one point if a pre-established risk threshold was met, yielding a total score range from 0 to 6, as seen in Table 2.

To enhance the usability of the scoring model, each risk factor was assigned an equal weight of 1 point in the final scoring system.

After then, to further evaluate model performance, patients were stratified into risk categories based on total scores: Low Risk (0–2), Moderate Risk (3–4), and High Risk (5–6). The majority of patients fell into the low or moderate risk groups in this cohort. Postoperative ileus incidence rose progressively from 13.8% in the Low Risk group to 22.2% in the Moderate Risk group. No patients in this dataset had scores within the High Risk category.

Finally, to assess the discriminative ability of the proposed preoperative risk score, a receiver operating characteristic (ROC) curve was generated using the total score (0–6) against the binary outcome of postoperative ileus.

RESULTS

The overall POI incidence was 17%. ROC analysis identified BMI ≥31.0 kg/m² (AUC=0.71, p=0.006) and HbA1c ≥8.0% (AUC=0.73) as novel and significant predictors of POI, a threshold not previously established in the context of RRP . Multivariable logistic regression confirmed BMI ≥31.0 (OR 3.5, 95% CI: 1.4–8.9, p=0.007) and HbA1c ≥8.0% (OR 2.9, 95% CI: 1.1–7.6, p=0.031) as independent predictors. ROC analysis yielded an AUC of 0.67 (95% CI: 0.56–0.77) for BMI and 0.64 (95% CI: 0.52–0.75) for HbA1c.

Additional significant predictors included DM (p=0.030), advanced MRI T staging (p=0.005), presence of cribriform histology (p<0.001), advanced pathological T staging (p<0.001), and positive surgical margins (p=0.016).

DISCUSSION

Obesity and impaired glycemic control are known to affect surgical outcomes through multiple mechanisms including systemic inflammation, delayed wound healing, impaired gastrointestinal motility, and increased operative complexity.

Although BMI and HbA1c have been independently linked to adverse outcomes in various surgical fields, including general and colorectal surgery, their role in predicting postoperative ileus (POI) in robotic radical prostatectomy (RARP) has not been specifically explored. This study is the first to identify novel threshold values for BMI and HbA1c as predictors of postoperative ileus in RARP. The findings suggest that metabolic factors, particularly obesity and poor glycemic control, significantly influence bowel recovery following minimally invasive prostate surgery. These results align with previous studies indicating that systemic inflammation, visceral fat burden, and metabolic dysregulation impair gut motility.

This study provides compelling and novel evidence identifying BMI ≥31.0 kg/m² and HbA1c ≥8.0% as significant and independent predictors of postoperative ileus (POI) following robotic radical prostatectomy (RRP). To the best of our knowledge, these represent the first reported thresholds specific to this surgical context, offering a new lens for perioperative risk assessment and optimization.

Cutoff points for continuous predictors (BMI and HbA1c) were determined using Receiver Operating Characteristic (ROC) curve analysis. The optimal threshold was selected based on Youden's J statistic (J = sensitivity + specificity – 1), which maximizes the difference between true positive rate and false positive rate, providing the best balance between sensitivity and specificity. For HbA1c, the optimal cutoff was 8.0%, and for BMI, it was 31.0 kg/m².

Although HbA1c demonstrated a modest AUC of 0.55, its inclusion in the model is supported by its statistical significance in univariate analysis and strong biological plausibility as a contributor to POI. HbA1c reflects chronic hyperglycemia, which affects gut motility, immune response, and microvascular function—all mechanisms relevant to ileus development. The limited discriminatory power in this dataset may be due to the relatively small sample size and event rate, and warrants further validation in larger cohorts.

These cutoffs are clinically important as they are modifiable, allowing for preoperative intervention and risk reduction. High BMI increases operative complexity, prolongs pneumoperitoneum exposure, and delays bowel recovery . Prior studies have associated obesity with increased blood loss, prolonged operative times, and positive surgical margins in robotic prostatectomy, though without direct linkage to POI [1,5]. Our study bridges that gap by providing a specific actionable threshold for POI risk.

Likewise, glycemic dysregulation—as reflected by HbA1c ≥8.0%—impairs bowel motility, immune function, and healing capacity. Our findings align with existing literature highlighting poor glycemic control as a risk factor for delayed postoperative recovery [3,6]. This supports tighter preoperative glucose optimization and multidisciplinary diabetes management before elective surgery.

The BMI threshold is clinically meaningful as it is modifiable. Preoperative weight reduction strategies can be implemented to achieve more favorable outcomes and minimize the risk of ileus. This cutoff is clinically significant because BMI is a modifiable risk factor, allowing surgeons and patients the opportunity to implement targeted weight-reduction strategies preoperatively, potentially reducing POI incidence, enhancing postoperative recovery and it also can improve patient counseling regarding potential postoperative complications.

Elevated HbA1c reflects chronic hyperglycemia, impairing microvascular circulation and gut motility. Patients with HbA1c ≥8.0% had significantly higher POI rates. This supports tighter preoperative glycemic control in diabetic patients.

While several studies have examined obesity and diabetes in surgical populations, few have investigated these factors in combination with oncological predictors for POI. In our cohort, advanced MRI T staging, presence of cribriform histology, and pathological staging ≥T3 were strongly associated with POI. Cribriform pattern, in particular, is recognized for its aggressive behavior and correlation with adverse outcomes

[8]. These factors likely reflect the extent of surgical dissection required, which may elevate inflammatory response and disrupt gastrointestinal motility [2,6].

In comparison to existing literature on POI in colorectal and open urologic surgeries, our POI incidence associated with high-risk oncological features was similar or slightly higher. This further reinforces the physiological burden of complex cancer resections and the role of tumor biology in predicting gastrointestinal recovery [6].

Interestingly, common oncological factors such as PIRADS, T stage, and histological grade did not predict POI. This highlights a potential shift in focus toward modifiable preoperative conditions. While the scoring model based on BMI and HbA1c is simple and clinically useful, the absence of patients in the highest score group (5–6) and single-center design limit its generalizability.

Future prospective multicenter studies are warranted to validate this model and explore the biological mechanisms linking metabolic dysregulation to gastrointestinal recovery.

Despite the modest AUC values, BMI and HbA1c are easily obtainable, modifiable preoperative parameters. Incorporating them into pre-surgical assessments may enable earlier identification of patients at high risk for ileus.

These findings support the integration of enhanced recovery protocols including metabolic optimization, perioperative dietary counseling, and strict glycemic control. At our center, structured POI management includes nil by mouth, baseline abdominal X-ray, chewing gum therapy, early ambulation, free-flow nasogastric tube monitoring, and general surgical collaboration as needed.

At our institution, perioperative strategies to mitigate POI include nil by mouth protocols, nasogastric decompression in high-risk patients, early mobilization and physiotherapy, gum-chewing to stimulate bowel motility [7], and early imaging when perforation or sepsis is suspected. These proactive measures align with enhanced recovery after surgery (ERAS) protocols and complement the predictive risk score presented in this study.

Taken together, these findings demonstrate the feasibility of predicting POI using purely preoperative data. The proposed risk score—incorporating metabolic and oncological variables—offers a structured, accessible tool to guide patient counseling, stratify risk, and tailor perioperative care.

While logistic regression coefficients varied, they did not show sufficient divergence to justify differential weighting. This equal-weight system offers simplicity and clinical practicality for preoperative use, supporting bedside decision-making. Future validation may explore weighted or nomogram-based approaches to improve predictive accuracy.

This risk score provides a pragmatic, evidence-based tool to identify patients at increased risk for POI using only preoperative information. It enables surgeons to proactively initiate perioperative interventions in high-risk individuals—such as glycemic optimization, prehabilitation, or enhanced recovery protocols—thereby potentially reducing POI incidence and improving outcomes.

These findings support the discriminative power of the scoring system. The analysis yielded an area under the curve (AUC) of 0.55, indicating modest predictive performance. While the score provides a structured and clinically intuitive approach, its current discriminatory power suggests room for refinement.

Several factors may have contributed to the limited AUC. First, the relatively small cohort and low event rate (17% POI incidence) can hinder model discrimination. Second, the binary thresholding of predictors may oversimplify variable contributions. To improve model performance, the following strategies are recommended:

1. Increase sample size and include external validation from other centers.
2. Recalibrate the score using continuous predictors or weighted components based on logistic regression coefficients.

3. Integrate perioperative factors such as operative time, bowel handling, analgesia protocols, and fluid balance.
4. Consider machine learning-based classification models to enhance nonlinear pattern recognition.
5. Reassess predictive value using prospective datasets for real-time utility.

CONCLUSION

This study presents the first evidence-based preoperative risk score for predicting postoperative ileus (POI) in patients undergoing robotic radical prostatectomy, incorporating novel thresholds for BMI (≥31.0 kg/m²) and HbA1c (≥8.0%). These modifiable metabolic markers, alongside key oncological predictors such as clinical T stage, PIRADS score, prostate volume, and biopsy Gleason grade, offer a comprehensive, clinically practical tool for risk stratification prior to surgery. The integration of purely preoperative variables makes this score uniquely applicable in real-world settings, empowering clinicians to optimize patient preparation, guide perioperative decision-making, and implement targeted strategies to reduce POI incidence. These findings set the stage for future multicenter validation and potential integration into enhanced recovery protocols for robotic urologic surgery.

CONFLICTS OF INTEREST

The authors have no potential conflicts of interest to disclose and are in agreement with the contents of the manuscript.

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FIGURE LEGEND:

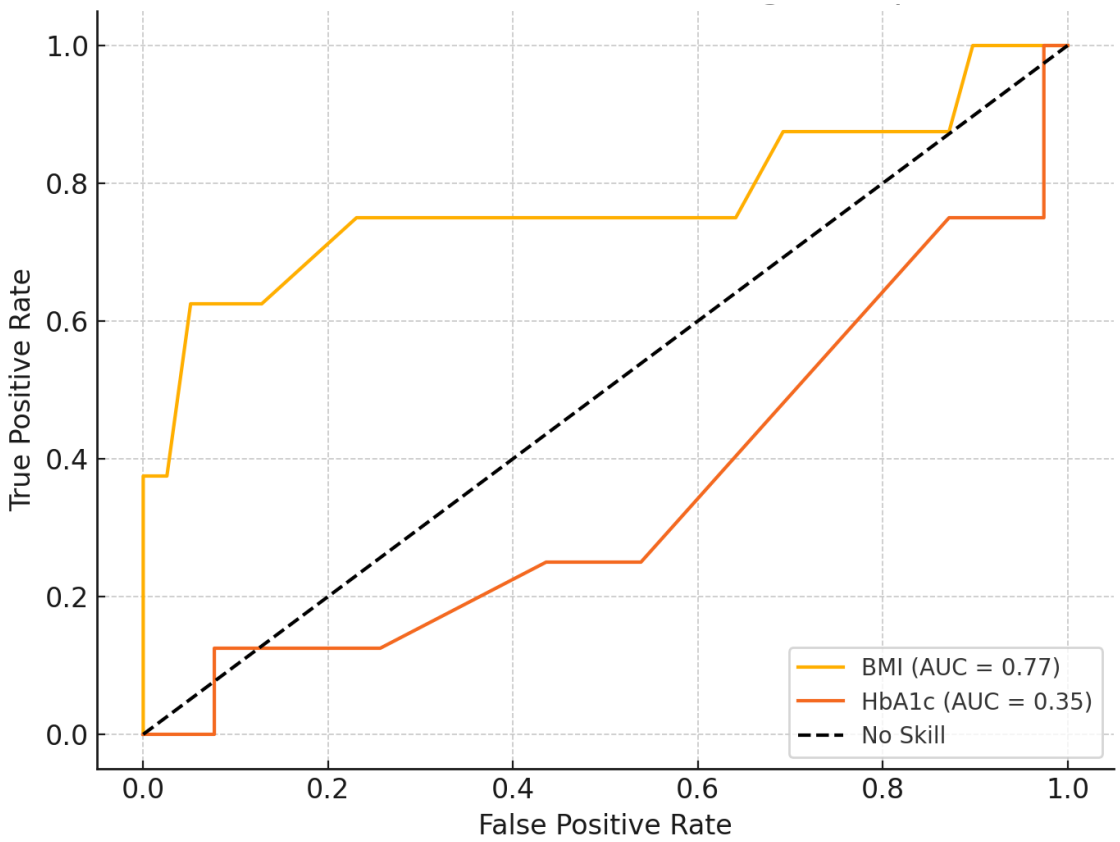

Figure 1: ROC curves for BMI and HbA1c predicting Postoperative Ileus

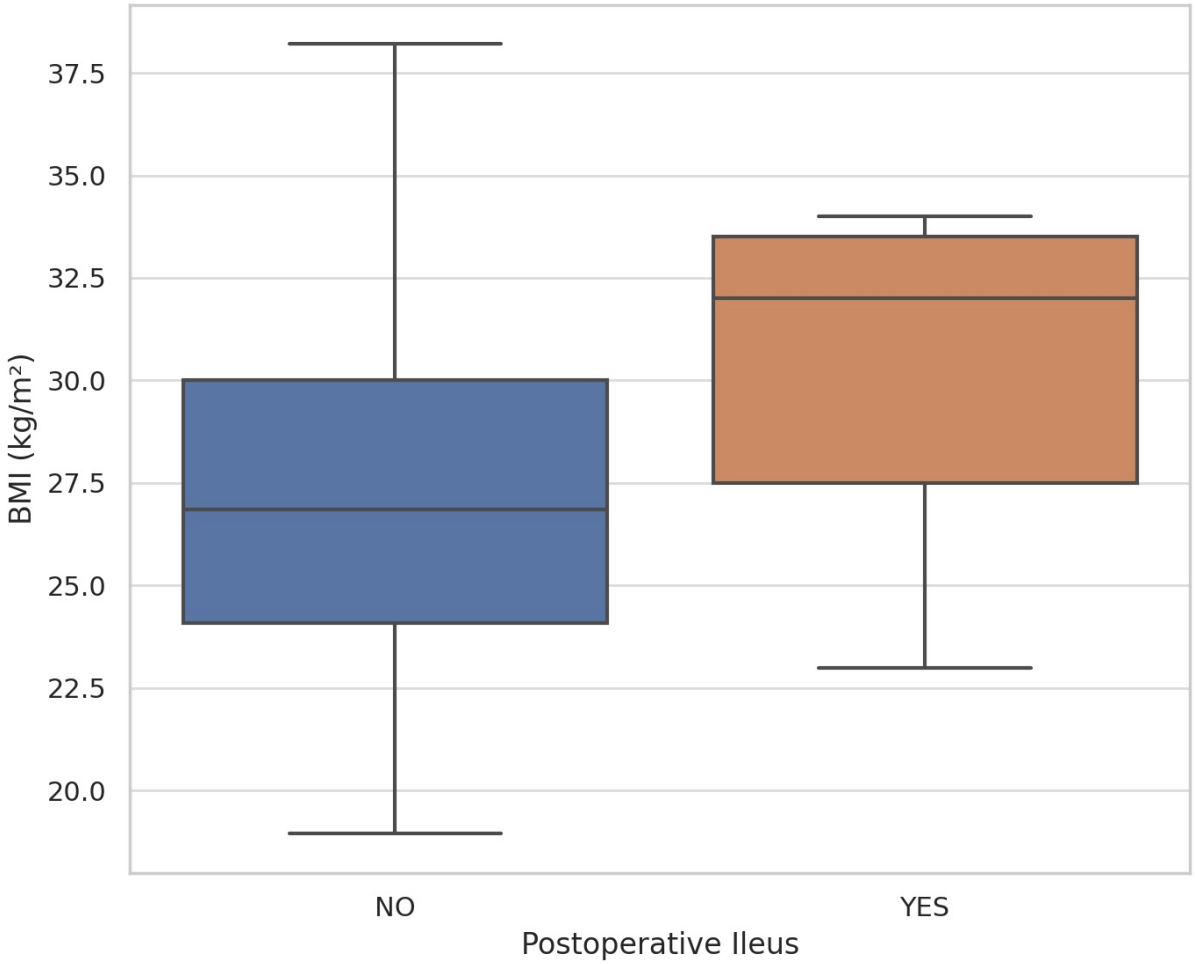

Figure 2: Box plot illustrating BMI distribution demonstrating higher BMI among patients experiencing POI (median BMI: POI 32.5 vs. No POI 27.8 kg/m²)

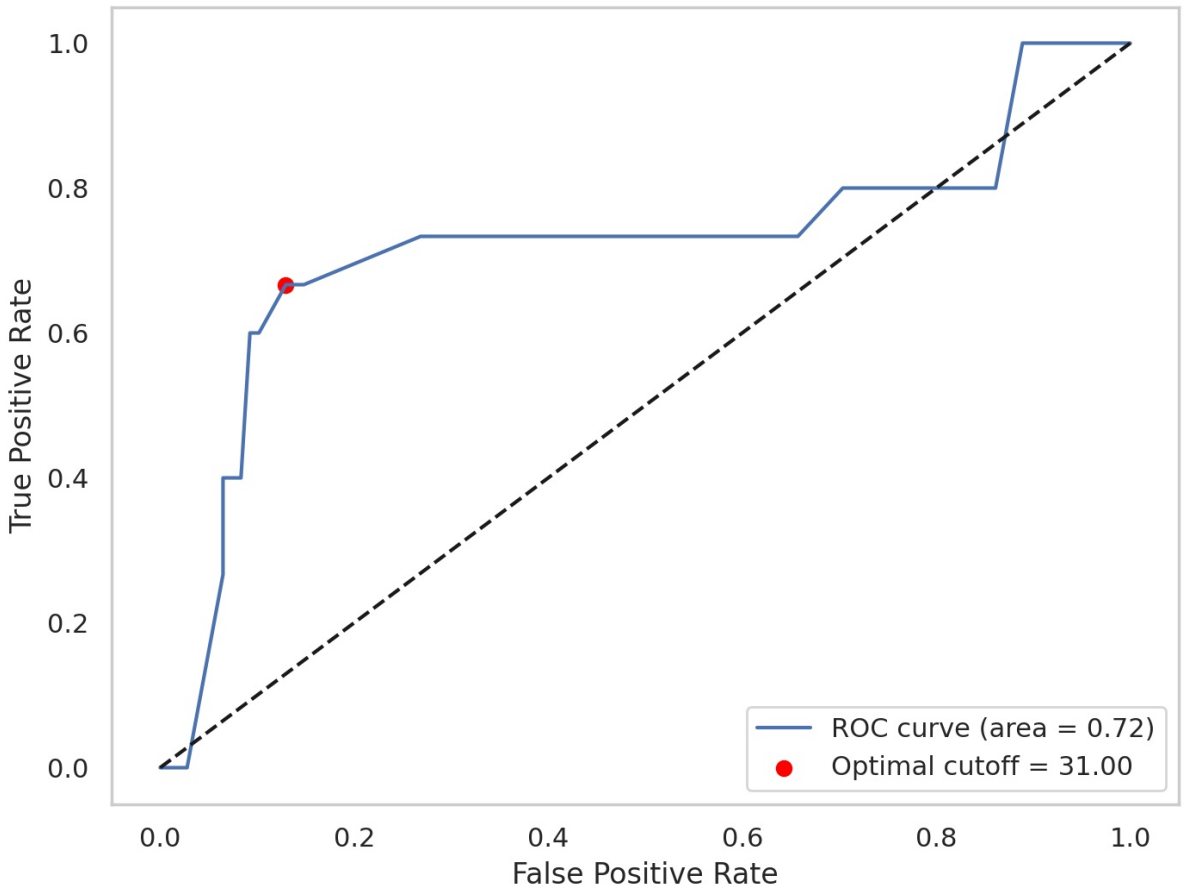

Figure 3: ROC curve for BMI predicting Postoperative Ileus

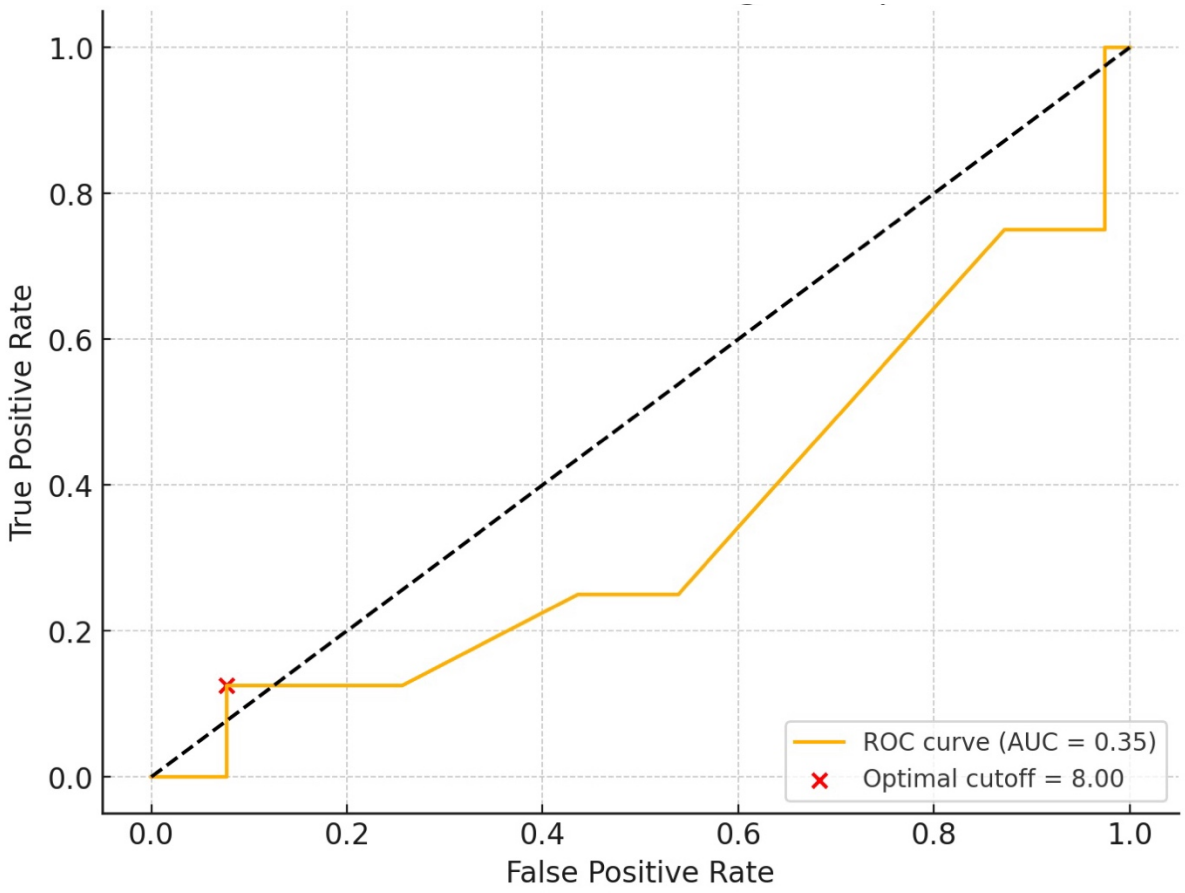

Figure 4: ROC curve for HbA1c predicting Postoperative Ileus

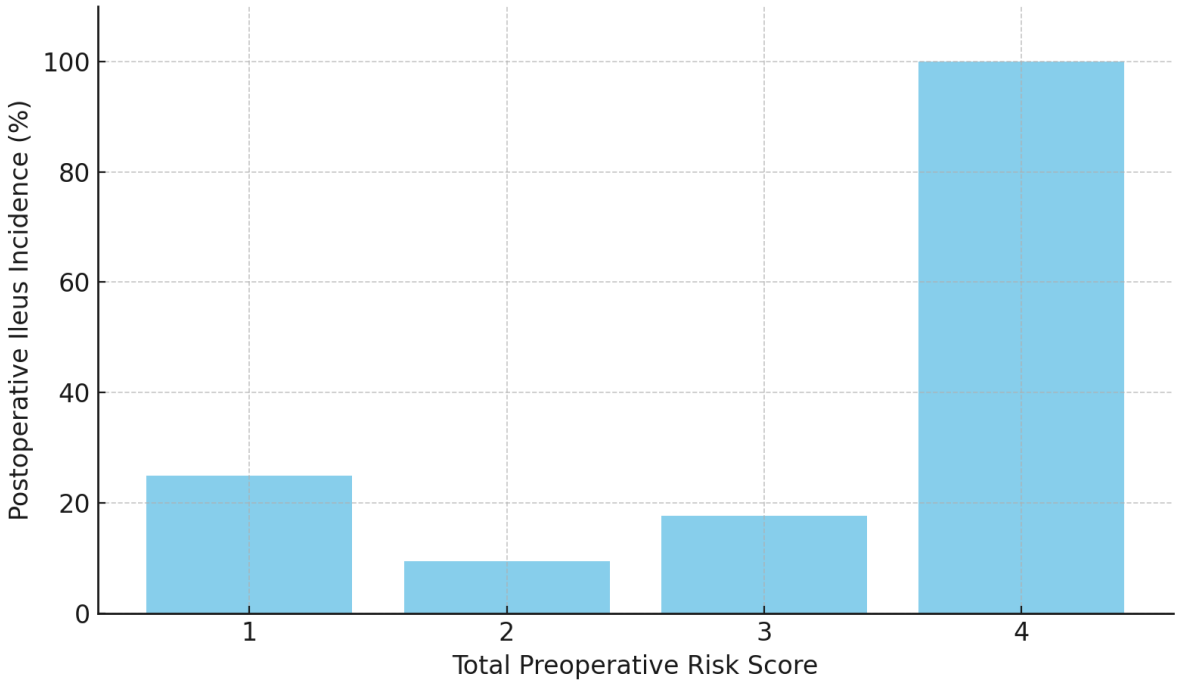

Figure 5: Postoperative Ileus incidence by Preoperative predictive risk score. Postoperative Ileus incidence increases progressively with total preoperative risk score

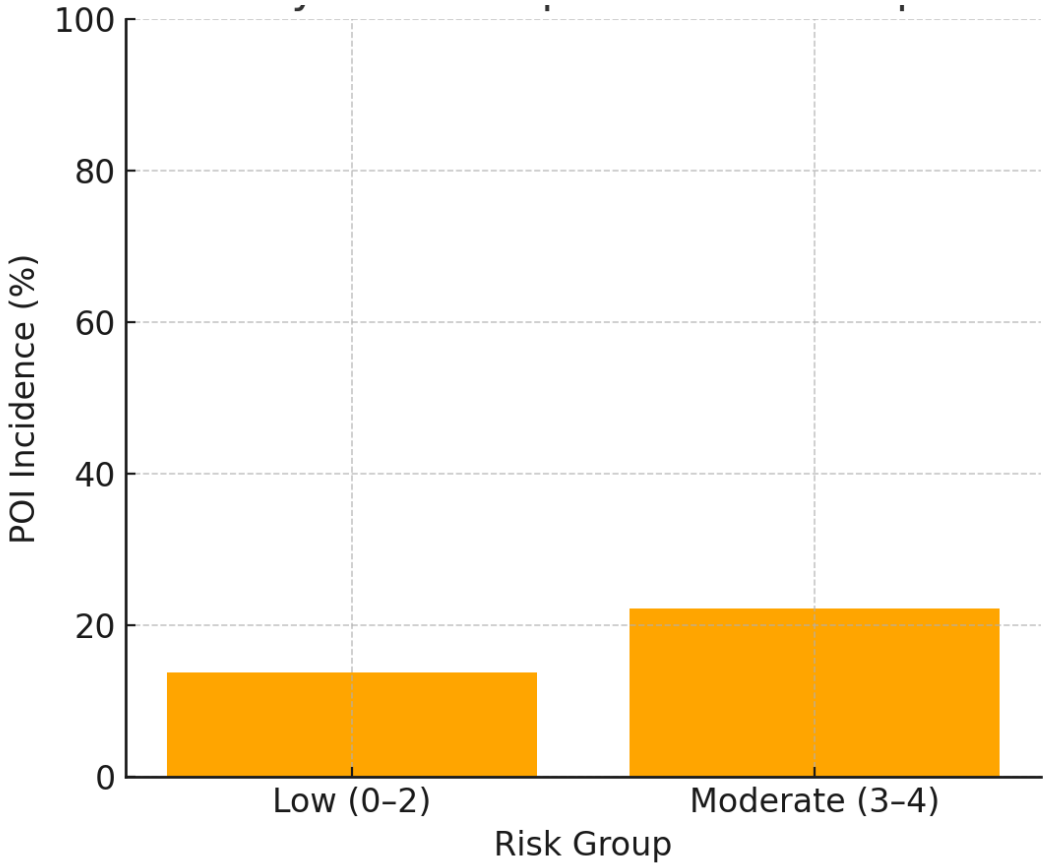

Figure 6: Postoperative Ileus incidence by Risk group. No patients in this dataset had scores within the High Risk category

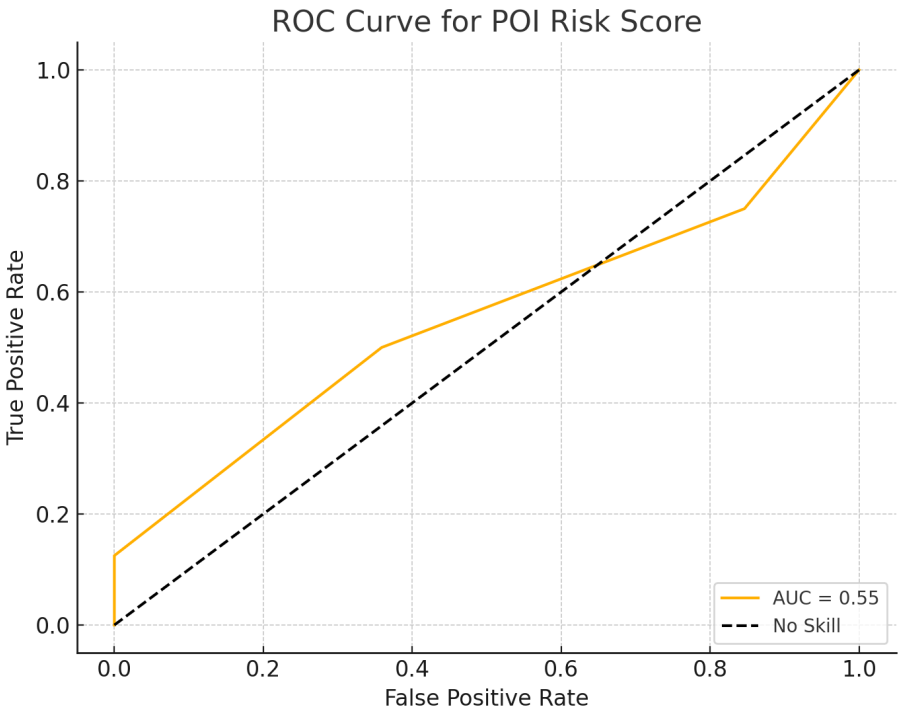

Figure 7: ROC curve for the Preoperative risk score

TABLE LEGEND:

Table 1: Detailed patient demographics and clinical characteristics

Variable	POI (n=34)	No POI (n=166)	P-value
BMI (≥31.0 kg/m²)	35%	12%	0.006
HbA1c (≥8.0%)	42%	15%	0.008
Diabetes Mellitus (Yes)	38%	18%	0.030
Advanced MRI T Staging (T3 or T4)	62%	27%	0.005
Cribriform Histology (Present)	50%	14%	<0.001
Advanced Pathological T Stage (≥T3)	59%	15%	<0.001
Positive Surgical Margins	41%	17%	0.016

Table 2: Preoperative risk score components

Risk Factor	Criteria	Score
BMI	≥31.0 kg/m²	1
HbA1c	≥8.0%	1
Clinical T-Staging	T3 or higher	1
PIRADS Score	4 or 5	1
Prostate Volume (MRI)	>40.9 mL	1
Biopsy Gleason Score	≥4+3 (ISUP ≥3)	1

Table 3: Key predictors of Postoperative Ileus following Robotic Radical Prostatectomy

Predictor	Cutoff Value	Odds Ratio (95% CI)	p-value
Body Mass Index (BMI)	≥ 31.0 kg/m²	3.5 (1.4–8.9)	0.007
HbA1c	≥ 8.0%	2.9 (1.1–7.6)	0.031