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Research Article

Rotterdam Risk Score and Perioperative Predictors of Abdominal Wound Dehiscence after Abdominal Surgery: A Hospital-Based Observational Study

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ABSTRACT
Background: Abdominal wound dehiscence remains a difficult postoperative complication because it usually reflects the convergence of patient frailty, respiratory stress, contamination, nutrition, urgency of surgery, and tissue healing failure. A practical perioperative score can help the anaesthesia and surgical teams recognize high-risk patients early.
Objective: To assess the association of the Rotterdam risk score and selected perioperative variables with abdominal wound dehiscence among patients undergoing abdominal surgery.
Materials and Methods: This hospital-based observational study was conducted from June 2025 to February 2026 and included 60 patients undergoing abdominal surgery. Demographic factors, comorbidities, biochemical and operative variables, wound class, abdominal drain placement, duration of surgery, Rotterdam score, and postoperative wound dehiscence status were analysed. Continuous variables were compared using the Mann-Whitney U test. Categorical variables were assessed using Fisher's exact test or chi-square test as appropriate. Discriminative ability of the Rotterdam score was assessed using receiver operating characteristic analysis.
Results: Abdominal wound dehiscence occurred in 8/60 patients (13.33%). Among affected patients, dehiscence occurred at a mean of 8.12 ± 2.23 postoperative days. Patients who developed dehiscence were older (77.50 ± 8.35 vs 66.27 ± 11.89 years, $p=0.013$), had lower serum albumin (3.23 ± 0.36 vs 3.63 ± 0.51 g/dL, $p=0.029$), longer surgeries (161.88 ± 32.06 vs 128.17 ± 44.25 min, $p=0.042$), and higher Rotterdam scores (15.62 ± 5.37 vs 5.79 ± 6.41, $p<0.001$). Emergency surgery (38.9% vs 2.4%, $p<0.001$), COPD (45.5% vs 6.1%, $p=0.004$), jaundice (66.7% vs 10.5%, $p=0.044$), and anemia (31.8% vs 2.6%, $p=0.003$) were significantly associated with dehiscence. The Rotterdam score showed good discrimination, with an area under the curve of 0.869 (95% CI 0.742-0.971).
Conclusion: A higher Rotterdam score was strongly associated with postoperative abdominal wound dehiscence. Emergency surgery, COPD, anemia, jaundice, lower albumin, and longer operative duration were clinically important warning signals. In routine perioperative practice, especially in resource-pressured surgical units, Rotterdam-based stratification may support closer surveillance and early optimization, although larger prospective validation is required.

Keywords: Abdominal Wound Dehiscence, Rotterdam Score, Perioperative Risk, Abdominal Surgery, Hypoalbuminemia, Emergency Surgery.

INTRODUCTION

Abdominal wound dehiscence is one of those postoperative events that looks like a surgical endpoint but is, in truth, a perioperative failure of several systems at once. The fascial repair gives way when local wound biology, tissue tension, respiratory stress, intra-abdominal pressure, contamination, nutritional depletion, and systemic illness overwhelm the strength of the healing abdominal wall. The complication is clinically unsettling because it may range from partial separation to burst abdomen with evisceration, need for reoperation, prolonged hospitalization, sepsis risk, and later incisional hernia. Classic surgical literature has therefore treated acute wound failure as a serious marker of both technical and biological vulnerability rather than a simple wound problem [1].

The risk is not distributed evenly across abdominal surgery patients. The burden is heavier after emergency laparotomy, contaminated or dirty procedures, lower gastrointestinal surgery, peritonitis, pulmonary disease, anemia, malnutrition, and hypoalbuminemia. Surgical site infection further weakens the wound by intensifying collagen breakdown and delaying tensile strength acquisition. Prevention guidelines from infection-control bodies emphasize that surgical wound complications are shaped by preoperative, intraoperative, and postoperative practices, from antimicrobial timing and asepsis to postoperative surveillance [2,3].

From an anaesthesiology perspective, abdominal wound dehiscence is not outside the perioperative frame. Pulmonary disease, coughing, inadequate analgesia, prolonged operative time, sepsis physiology, anemia, fluid shifts, and poor nutritional reserve all intersect with anaesthetic planning and postoperative care. Patients in Indian teaching hospitals may arrive late, often after emergency surgical indications have evolved over several days. In that setting, a simple risk score is attractive because it can convert a scattered clinical impression into a bedside warning signal before the wound declares itself.

Several predictive approaches have been proposed. The Veterans Affairs risk index and subsequent models attempted to quantify dehiscence risk after laparotomy using clinical and perioperative variables [4]. The Rotterdam model, developed and validated by van Ramshorst and colleagues, incorporated patient-related, operation-related, and postoperative variables such as age, pulmonary disease, ascites, jaundice, anemia, emergency surgery, and type of surgery; it demonstrated meaningful separation between patients with and without dehiscence in the original validation work [5]. Later validation studies showed that such scores are useful but imperfect, partly because risk expression varies across populations, surgical case-mix, and perioperative workflows [6].

Alongside numerical risk scores, surgical wound classification remains a practical shorthand for contamination burden, while published risk-factor literature continues to identify nutrition, emergency status, infection, pulmonary disease, and systemic illness as recurring domains of abdominal wound failure [7,8].

That uncertainty creates a practical research gap. If the Rotterdam score is to be used in routine perioperative care, it should be tested against local clinical outcomes rather than assumed to perform identically across hospitals. The present study, therefore, evaluated the association of the Rotterdam score and selected perioperative variables with abdominal wound dehiscence among patients undergoing abdominal surgery. The objective was not to replace clinical judgment, but to examine whether a structured score could help identify the patients who deserve closer perioperative surveillance and earlier optimization.

MATERIALS AND METHODS

Study design and setting

This was a hospital-based observational study conducted from June 2025 to February 2026 in the perioperative care setting of the Department of Anaesthesiology.

Study Population

The study included 60 adult patients undergoing abdominal surgery. Each patient had documented demographic details, comorbidities, operative details, Rotterdam score, and postoperative wound outcome.

Inclusion Criteria

Adult patients undergoing abdominal surgery with complete documentation of perioperative risk variables, wound class, surgery duration, Rotterdam score, and abdominal wound dehiscence outcome were included.

Exclusion Criteria

Patients with incomplete outcome documentation or missing core perioperative variables were excluded from analysis.

Variables Assessed

The variables assessed were age, gender, body mass index, smoking status, diabetes mellitus, chronic obstructive pulmonary disease, ascites, jaundice, anemia, serum albumin, steroid use, emergency surgery, type of surgery, wound class, abdominal drain placement, duration of surgery, Rotterdam score, occurrence of wound dehiscence, and day of dehiscence when present.

Outcome Measure

The primary outcome was postoperative abdominal wound dehiscence, recorded as present or absent. Among patients who developed dehiscence, the postoperative day of occurrence was summarized.

Statistical Analysis

Continuous variables were summarized as mean ± standard deviation and compared using the Mann-Whitney U test because the number of dehiscence events was small. Categorical variables were summarized as frequency and percentage; Fisher's exact test was used for 2 × 2 comparisons, and the chi-square test was used for multi-category variables. Unadjusted odds ratios with 95% confidence intervals were calculated for binary risk factors. Discriminative ability of the Rotterdam score was assessed using receiver operating characteristic analysis, and the area under the curve was reported with a bootstrap 95% confidence interval. Because only eight dehiscence events were observed, multivariable regression was deliberately avoided to prevent unstable estimates. All p-values were exploratory, and no correction for multiplicity was applied.

RESULTS

Baseline and Perioperative Profile

The study included 60 patients, of whom 30 were male and 30 were female. The overall mean age was 67.77 ± 12.05 years. Abdominal wound dehiscence occurred in 8 patients, giving an observed incidence of 13.33%. The mean postoperative day of dehiscence among affected patients was 8.12 ± 2.23 days, with a range from day 5 to day 12. As shown in Table 1, patients with dehiscence were older and had lower serum albumin, longer surgery duration, and higher Rotterdam scores than those without dehiscence. The incidence of wound dehiscence is displayed in Figure 1.

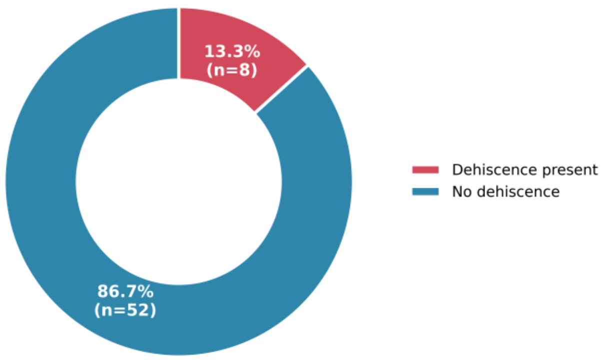

Figure 1. Incidence of Abdominal Wound Dehiscence in the Study Cohort
Donut chart shows the proportion and count of patients with and without wound dehiscence.

Table 1. Baseline and Perioperative Continuous Variables According To Wound Dehiscence Status.

Variable	Overall (n=60)	Dehiscence present (n=8)	No dehiscence (n=52)	p-value
Age (years)	67.77 ± 12.05	77.50 ± 8.35	66.27 ± 11.89	0.013
BMI (kg/m²)	28.17 ± 3.69	27.55 ± 3.66	28.26 ± 3.72	0.656
Serum albumin (g/dL)	3.57 ± 0.51	3.23 ± 0.36	3.62 ± 0.51	0.029
Surgery duration (min)	132.67 ± 44.13	161.88 ± 32.06	128.17 ± 44.25	0.042
Rotterdam score	7.10 ± 7.09	15.62 ± 5.37	5.79 ± 6.41	<0.001

Values are expressed as mean ± SD. p-values were calculated using the Mann-Whitney U test.

Clinical Risk Factors

On univariate analysis, COPD, jaundice, anemia, and emergency surgery showed statistically significant associations with postoperative wound dehiscence (Table 2). Dehiscence occurred in 5 of 11 patients with COPD (45.5%) compared with 3 of 49 patients without COPD (6.1%). Similarly, anemia was present in 7 of 8 patients who developed dehiscence. Emergency surgery showed the strongest categorical association: 7 of 18 emergency cases developed dehiscence, whereas only 1 of 42 elective cases did so. The contrast in selected clinical risk factors is shown in Figure 3, and the corresponding unadjusted odds ratios are presented visually in Figure 4.

Table 2. Clinical Risk Factors and Their Association with Abdominal Wound Dehiscence

Risk factor	Risk present: dehiscence n/N (%)	Risk absent: dehiscence n/N (%)	Unadjusted OR (95% CI)	p-value

Age ≥70 years	6/28 (21.4)	2/32 (6.2)	4.09 (0.75-22.22)	0.130
Male sex	5/30 (16.7)	3/30 (10.0)	1.80 (0.39-8.32)	0.706
BMI ≥30 kg/m²	2/18 (11.1)	6/42 (14.3)	0.75 (0.14-4.13)	1.000
Smoking	4/24 (16.7)	4/36 (11.1)	1.60 (0.36-7.13)	0.702
Diabetes mellitus	5/19 (26.3)	3/41 (7.3)	4.52 (0.95-21.46)	0.095
COPD	5/11 (45.5)	3/49 (6.1)	12.78 (2.42-67.55)	0.004
Ascites	2/4 (50.0)	6/56 (10.7)	8.33 (0.99-70.48)	0.082
Jaundice	2/3 (66.7)	6/57 (10.5)	17.00 (1.33-216.68)	0.044
Anemia	7/22 (31.8)	1/38 (2.6)	17.27 (1.95-152.67)	0.003
Serum albumin <3.5 g/dL	6/26 (23.1)	2/34 (5.9)	4.80 (0.88-26.15)	0.067
Steroid use	2/5 (40.0)	6/55 (10.9)	5.44 (0.75-39.43)	0.128
Emergency surgery	7/18 (38.9)	1/42 (2.4)	26.09 (2.90-235.11)	<0.001
Abdominal drain placed	6/28 (21.4)	2/32 (6.2)	4.09 (0.75-22.22)	0.130
Surgery duration >150 min	4/21 (19.0)	4/39 (10.3)	2.06 (0.46-9.25)	0.433

OR: odds ratio; CI: confidence interval; COPD: chronic obstructive pulmonary disease. Fisher's exact test was used for p-values.

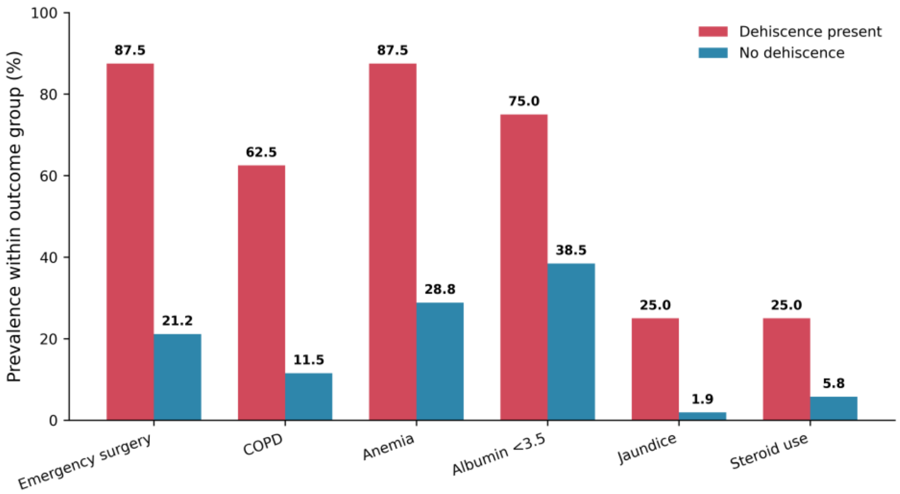

Figure 3. Prevalence of Selected Risk Factors According To Wound Outcome

Grouped bars show percentage prevalence within the dehiscence and non-dehiscence groups; values are percentages.

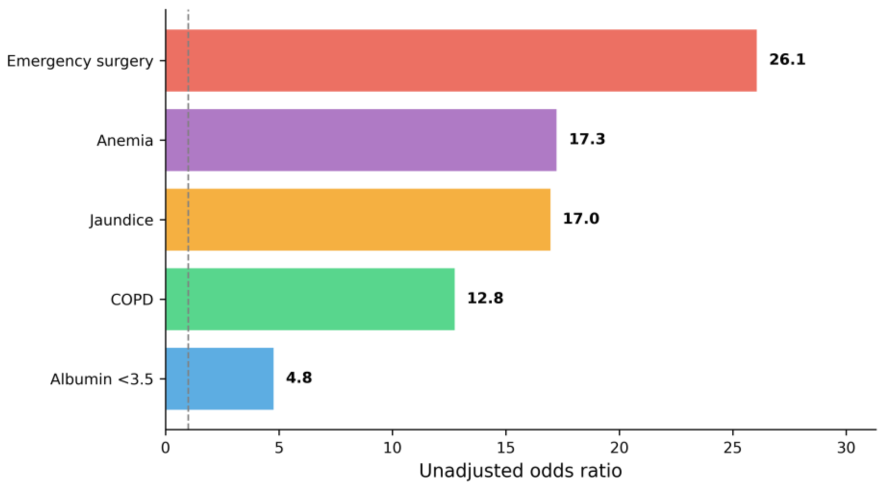

Figure 4. Unadjusted Odds Ratios for Major Categorical Predictors

Bars represent unadjusted odds ratios for selected risk factors. Estimates are exploratory because of the small number of events.

Surgical Characteristics and Wound Class

Lower gastrointestinal surgery formed the largest surgical subgroup, followed by other abdominal procedures, upper gastrointestinal procedures, and hepatopancreatobiliary procedures. Although the type of surgery did not show a statistically significant association with dehiscence in this cohort, dehiscence was not observed among patients classified under the 'Other' surgical category. Wound class demonstrated a graded clinical pattern: dehiscence occurred in 1 of 28 clean wounds (3.6%), 2 of 14 clean-contaminated wounds (14.3%), 2 of 9 contaminated wounds (22.2%), and 3 of 9 dirty wounds (33.3%), although the multi-category comparison did not reach conventional statistical significance (Table 3).

Table 3. Surgical Category and Wound Class Distribution with Dehiscence Incidence

Variable	Category	Total n	Dehiscence n (%)	p-value
Type of surgery	HPB	9	2 (22.2)	0.255
	Lower GI	22	4 (18.2)	
	Other	18	0 (0.0)	
	Upper GI	11	2 (18.2)	
Wound class	Clean	28	1 (3.6)	0.109
	Clean-contaminated	14	2 (14.3)	
	Contaminated	9	2 (22.2)	
	Dirty	9	3 (33.3)	

p-values were calculated using the chi-square test for multi-category comparisons.

Rotterdam Score and Dehiscence Prediction

The Rotterdam score was markedly higher among patients who developed dehiscence (15.62 ± 5.37) than among those who did not (5.79 ± 6.41), with a statistically significant difference ($p<0.001$). Score-stratified analysis showed that no patient with a score of 0-5 developed dehiscence, whereas 5 of 10 patients with scores ≥16 developed dehiscence (Table 4 and Figure 2). The Rotterdam score demonstrated good discrimination with an area under the curve of 0.869 (95% CI 0.742-0.971). At a cut-off of ≥10, sensitivity was 87.5%, specificity was 73.1%, and negative predictive value was 97.4%, suggesting reasonable rule-out utility in this cohort. At a higher cut-off of ≥16, specificity increased to 90.4%, although sensitivity fell to 62.5%.

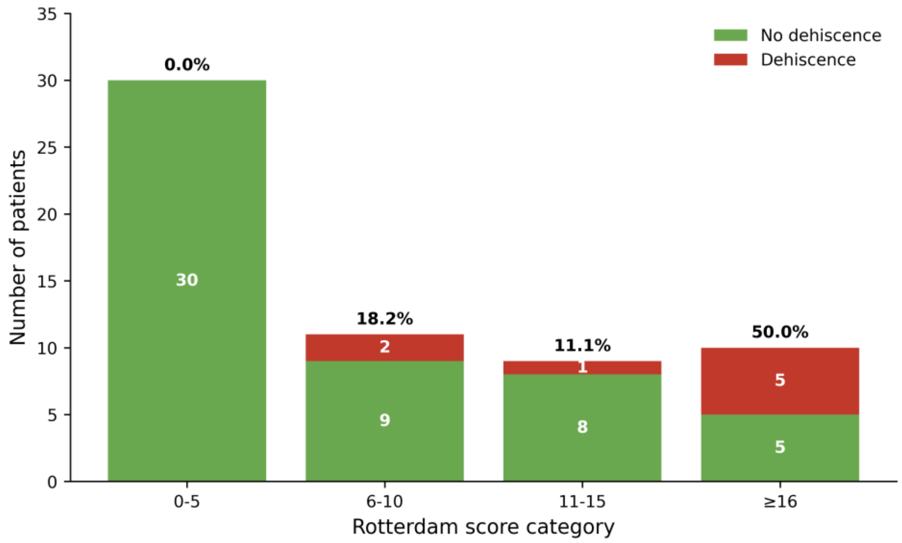

Figure 2. Wound Dehiscence across Rotterdam Score Categories

Stacked bars show the number of patients with and without dehiscence in each score category; percentages above bars indicate dehiscence incidence.

Table 4A. Rotterdam Score Categories and Observed Dehiscence Incidence.

Rotterdam score category	Total n	Dehiscence n (%)
0-5	30	0 (0.0)
6-10	11	2 (18.2)
11-15	9	1 (11.1)
≥16	10	5 (50.0)

Association across score categories: chi-square p=<0.001. Categories were used for descriptive risk stratification.

Table 4B. Diagnostic Performance of Selected Rotterdam Score Cut-Offs

Cut-off	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
≥7	100.0	59.6	27.6	100.0	65.0
≥10	87.5	73.1	33.3	97.4	75.0
≥16	62.5	90.4	50.0	94.0	86.7

AUC for continuous Rotterdam score: 0.869 (95% CI 0.742-0.971). PPV: positive predictive value; NPV: negative predictive value.

DISCUSSION

The present study found that abdominal wound dehiscence occurred in 13.33% of patients undergoing abdominal surgery. The affected group had a clear risk-concentrated profile: older age, lower serum albumin, longer operative duration, and a higher Rotterdam score. The dehiscence events also clustered around clinically recognizable stressors, particularly emergency surgery, COPD, jaundice, and anemia. These findings are biologically plausible. They describe patients in whom tissue oxygen delivery, collagen synthesis, abdominal wall tension, and postoperative respiratory mechanics are likely to be compromised at the same time.

The timing of dehiscence in this cohort is also clinically meaningful. Events occurred between postoperative days 5 and 12, with a mean around day 8. This overlaps with the recognized vulnerable phase when collagen deposition remains immature, and the abdominal wall has not yet acquired meaningful tensile strength. Spiliotis et al. similarly emphasized that wound dehiscence continues to be a relevant surgical problem in contemporary practice despite improvements in technique and perioperative care [9]. For anaesthesiologists, this timewindow has practical implications: analgesia, cough control, bronchodilator optimization, early mobilization, nutrition, sepsis control, and postoperative monitoring cannot be treated as separate silos.

COPD emerged as one of the strongest signals in this cohort. Five of eleven patients with COPD developed dehiscence. This association is more than statistical. COPD contributes through cough-related surges in intra-abdominal pressure, impaired oxygenation, steroid exposure in some patients, catabolic reserve, and a higher probability of postoperative pulmonary complications. Aksamija et al. and other laparotomy-based series have also identified systemic depletion, anemia, peritonitis, or pulmonary vulnerability as recurring elements in wound failure [10]. Here, COPD should be seen as a perioperative warning label: these patients may require optimized bronchodilator therapy, careful extubation planning, effective epidural or multimodal analgesia where appropriate, chest physiotherapy, and low-threshold escalation if coughing becomes severe.

Anemia and low albumin were also prominent. Seven of eight dehiscence patients were anemic, and the mean serum albumin was significantly lower in the dehiscence group. This pattern agrees with the broader wound literature, where impaired oxygen-carrying capacity and protein depletion repeatedly appear as barriers to collagen synthesis and wound maturation [11,12]. In Indian public-sector and teaching-hospital settings, this has particular relevance. Many patients undergoing emergency abdominal surgery have nutritional depletion that is neither easily reversible nor always documented with nuance. A simple perioperative risk score may therefore help identify those who need more deliberate postoperative nutritional attention, even when urgent surgery cannot be delayed.

Emergency surgery showed the strongest categorical association. Only one elective case developed dehiscence, whereas seven emergency cases did so. Emergency procedures typically compress the window for optimization. They are also more likely to be associated with peritoneal contamination, bowel pathology, sepsis physiology, anemia, dehydration, and prolonged surgery. Walming et al. demonstrated that wound infection and high-risk surgical contexts are closely linked with subsequent wound complications, reinforcing the value of early risk recognition rather than waiting for superficial wound changes to appear [13].

The graded rise in dehiscence from clean to dirty wounds was clinically consistent, even though the multi-category comparison did not reach statistical significance. This may be a sample-size issue. Dirty wounds had the highest observed dehiscence incidence, and contaminated wounds also showed a higher proportion than clean wounds. The pattern is aligned with the known role of bacterial burden and tissue inflammation in delayed healing. In practice, wound class should not be read as an isolated surgical label; it should alter the intensity of perioperative surveillance.

The Rotterdam score performed well in this cohort, with an AUC of 0.869. A score of 0-5 was associated with no observed dehiscence, while scores ≥16 carried a 50% dehiscence rate. The cut-off of ≥10 provided high sensitivity and a strong negative predictive value, making it useful for identifying patients less likely to dehisce in this small sample. The higher threshold of ≥16 was more specific and may be clinically helpful for flagging a smaller group needing closer follow-up. Still, this should not be overread. Gómez Díaz et al. showed that external validation of the Rotterdam model can yield more limited usefulness than the original development study, especially when applied to different operative settings and populations [14]. The value of the score lies in disciplined risk stratification, not mechanical decision-making.

Another important observation is that several individual factors did not reach statistical significance despite plausible clinical relevance. Diabetes, steroid use, abdominal drain placement, and higher BMI showed no statistically significant association here. The absence of significance should not be interpreted as the absence of risk. Only eight events occurred, and the study was not powered to detect modest associations. Rosen and colleagues summarize dehiscence as a multifactorial outcome in which age, hypoalbuminemia, emergency surgery, steroid use, cancer, and infection may combine rather than act alone [15].

The study has clear strengths. It uses patient-level perioperative data, includes both clinical and operative variables, presents wound outcome timing, and evaluates the Rotterdam score not merely as a label but as a discriminative tool. It is also useful for perioperative teams because it connects risk factors to actions: pulmonary optimization, nutritional attention, anemia correction when feasible, cautious fluid and oxygen delivery strategies, and closer wound surveillance in emergency contaminated cases.

There are limitations. The sample size was small, and only eight dehiscence events occurred. This prevented reliable multivariable modelling. The study did not include all possible postoperative determinants, such as surgical site infection grading, cough severity, postoperative vomiting, transfusion, suture technique, closure ratio, reoperation, mortality, or length of hospital stay. Some variables were likely interrelated, for example, emergency surgery, dirty wound class, and longer operative duration. The findings should therefore be interpreted as hypothesis-strengthening rather than definitive causality. Larger prospective studies with standardized wound follow-up and complete postoperative complication tracking would better define the score threshold most suitable for local practice.

CONCLUSION

In this cohort of 60 abdominal surgery patients, postoperative abdominal wound dehiscence occurred in 13.33%. A higher Rotterdam score showed a strong association and good discrimination for dehiscence. Emergency surgery, COPD, anemia, jaundice, lower serum albumin, and longer operative duration were the most clinically relevant perioperative warning signs. Rotterdam score-based stratification can support early recognition and closer postoperative surveillance, particularly in high-risk emergency abdominal surgery, but it should be applied as an adjunct to clinical judgment rather than as a stand-alone decision tool.

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