

Second Thoughts on Second Looks: Physiologic Predictors of Mortality and Ischemic Progression Following Emergency Surgery for Colonic Ischemia

Hope Werenski

Atrium Health Wake Forest Baptist

Elizabeth Wood

Atrium Health Wake Forest Baptist

Heather Ots

Atrium Health Wake Forest Baptist

Brando Rotelli

Atrium Health Wake Forest Baptist

Bonnie Laingen

Wake Forest University School of Medicine

Mary Alyce McCullough

Atrium Health Wake Forest Baptist

Preston Miller

Atrium Health Wake Forest Baptist

Matthew Painter

Matthew.Painter@Advocatehealth.org

Atrium Health Wake Forest Baptist

Research Article

Keywords: colonic ischemia, damage control surgery, second-look laparotomy, bowel viability, emergency general surgery

Posted Date: September 15th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10398781/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Background:

Damage control surgery (DCS) with planned second-look laparotomy is commonly used in patients with intestinal ischemia when bowel viability is uncertain or physiologic instability is present. However, patients most likely to benefit from this staged operative approach remain poorly defined. This study aimed to evaluate outcomes in patients undergoing emergency surgery for colonic ischemia and identify physiologic factors associated with mortality.

Methods:

We performed a retrospective cohort study of adults undergoing emergency surgery for colonic ischemia between 2013 and 2022. Patients were stratified by operative strategy (DCS vs non-DCS). Demographic, physiologic, operative, and postoperative variables were compared. Multivariable logistic regression identified factors independently associated with mortality.

Results:

Among the 116 patients undergoing emergency surgery for colonic ischemia, 85 (73.3%) underwent DCS. Compared with non-DCS patients, those selected for DCS had higher ASA class (5 vs 4, $p < 0.001$), more frequent preoperative vasopressor use (57.6% vs 19.4%, $p < 0.001$), and higher preoperative lactate levels (3.6 vs 1.9 mmol/L, $p < 0.001$). Among DCS patients, 41% required additional bowel resection at planned second-look laparotomy, whereas 46% died before definitive reconstruction. Mortality was higher in the DCS cohort (64.7% vs 29.0%, $p < 0.001$). In multivariable analysis, the Charlson Comorbidity Index, preoperative lactate, and degree of intra-abdominal contamination were independently associated with mortality, whereas DCS was not.

Conclusions:

Planned second-look laparotomy remains important in the management of selected patients with colonic ischemia. Physiologic factors, rather than operative strategy alone, were independently associated with mortality. A physiology-driven approach may better inform selection for staged operative management.

Background

Acute mesenteric ischemia remains one of the most lethal surgical emergencies, with mortality rates exceeding 50% despite advances in diagnostic imaging, critical care, and operative management.^{1–3} Colonic ischemia presents unique operative challenges because bowel viability may be difficult to

determine at the index operation, and progression of ischemia can occur despite apparently adequate resection. Missed ischemia or anastomotic failure may have catastrophic consequences, particularly in patients with significant physiologic instability. Accordingly, damage control surgery (DCS) with planned second-look laparotomy has become a widely accepted strategy to reassess bowel viability, identify progressive ischemia, and facilitate delayed definitive reconstruction when appropriate. Most studies evaluating staged operative management combine colonic ischemia with other forms of mesenteric ischemia, despite important differences in disease progression, operative management, and reconstructive strategies. However, evidence specific to isolated colonic ischemia remains limited.

The World Society of Emergency Surgery guidelines recommend a staged operative approach in selected patients with intestinal ischemia, emphasizing temporary abdominal closure and planned second-look laparotomy when bowel viability is uncertain or physiologic instability persists.^{1,2} These recommendations are supported primarily by retrospective studies demonstrating that progressive ischemia requiring additional bowel resection is frequently identified at planned re-exploration.^{4–11} However, the evidence remains largely retrospective and heterogeneous, offering limited guidance regarding which patients with colonic ischemia are most likely to benefit from staged operative management.

Although planned second-look laparotomy may reduce the risk of missed ischemia, routine staged operative management exposes patients to the morbidity of prolonged open abdomen therapy, additional operations, and extended critical care without consistently improving survival.^{12–14} Consequently, identifying patients most likely to benefit from staged operative management remains an important clinical challenge. Increasing evidence suggests that physiologic variables, including lactate elevation, vasopressor requirements, metabolic acidosis, and intra-abdominal contamination, may better predict irreversible ischemic injury and clinical outcomes than bowel appearance alone.¹⁵ Consistent with these findings, studies of damage control surgery in trauma and emergency general surgery populations have demonstrated that patient physiology, rather than bowel appearance alone, should guide operative strategy, including the timing of definitive reconstruction.¹³

Despite widespread adoption of DCS and planned second-look laparotomy, few studies have specifically evaluated physiologic predictors of mortality and progression of ischemia in patients with isolated colonic ischemia. This study evaluated outcomes following emergency surgery for colonic ischemia and physiologic factors associated with mortality and progression of ischemia requiring additional bowel resection. We hypothesized that physiologic factors, rather than operative strategy alone, would better predict mortality and the need for additional bowel resection.

Methods

We performed a retrospective cohort study of adults undergoing emergency surgery for colonic ischemia at a single tertiary academic medical center between January 2013 and December 2022. Eligible patients were identified through institutional operative case logs and administrative databases

using diagnostic and procedural codes for colonic ischemia and ischemic colitis. Patients undergoing elective operations or surgery for non-ischemic indications were excluded. The study was approved by the institutional review board prior to study initiation.

Beginning in 2017, our institution implemented a standardized protocol favoring DCS for patients with colonic ischemia who demonstrated physiologic instability or uncertain bowel viability. The protocol emphasized bowel resection without immediate reconstruction, temporary abdominal closure when indicated, and planned second-look laparotomy to reassess bowel viability, determine the need for additional bowel resection, and assess suitability for definitive reconstruction.

Demographic variables included age, sex, and Charlson Comorbidity Index (CCI). Physiologic variables included American Society of Anesthesiologists (ASA) classification, preoperative lactate level, vasopressor requirements, and degree of intra-abdominal contamination. Operative variables included the extent and location of ischemia, operative strategy (DCS vs non-DCS), restoration of bowel continuity, and stoma creation. The primary outcome was perioperative mortality. Secondary outcomes included the need for additional bowel resection at planned second-look laparotomy and postoperative complications.

Continuous variables were compared using Student's t-test or the Mann-Whitney U test, as appropriate for univariate analysis. Categorical variables were compared using the chi-square test or Fisher's exact test. Multivariate logistic regression was then performed to evaluate factors associated with mortality. The primary model was a multivariable logistic regression using complete cases. Because of the modest sample size and multiple categorical predictors with sparse levels, a Firth-penalized logistic regression model was also fitted using the same set of predictors. A separate Firth-penalized logistic regression model was fit among patients who underwent damage-control surgery to evaluate predictors of delayed resection. Model discrimination was evaluated using the apparent area under the receiver operating characteristic curve (AUC). Internal optimism was estimated using 1000 bootstrap resamples, and an optimism-corrected AUC was calculated. Calibration of the primary mortality model was summarized using five equal-sized bins of predicted risk with observed mortality rates and exact binomial confidence intervals. Statistical significance was defined as $p < 0.05$.

Results

A total of 116 patients underwent emergency surgery for colonic ischemia during the study period. Of these, 85 (73%) underwent DCS and 31 (27%) underwent definitive surgery (non-DCS) at the index operation. Compared with non-DCS patients, those undergoing DCS had higher ASA class, higher preoperative lactate levels (3.6 vs 1.9 mmol/L, $p < 0.001$), and more frequent preoperative vasopressor requirements. Patients undergoing DCS had lower CCI scores (4 vs 6, $p = 0.01$). Patient demographics, ischemic etiology, and anatomic extent of ischemia were otherwise similar between groups (Table 1).

Table 1
Demographic and Pre-operative characteristics. ASA=American Society of Anesthesiologists. BMI=body mass index. CCI=Charlson Comorbidity Index. NDCS = Non-Damage Control Surgery. DCS=Damage Control Surgery

Age	NDCS (n = 31)	DCS (n = 85)	p-value
	70.6 (60.9,74.3)	64.8 (55.1,72.2)	0.149
BMI	29.1 (24.3,33.5)	28.2 (22.2,35.8)	0.810
Gender			1
Male	54.8%	45.1%	
Female	56.5%	43.5%	
ASA			0.001
3	16.1%	7.1%	
4	61.3%	31.8%	
5	22.6%	61.2%	
CCI	6 (4,7)	4 (3,6)	0.010
Pre-Op Vasopressor Use	19.4%	57.6%	< 0.001
Pre-Op Lactate	1.9 (1.2,2.6)	3.6 (1.8,7.5)	< 0.001

Intraoperatively, the distribution of intra-abdominal contamination differed between groups, with DCS patients demonstrating a greater proportion of severe contamination, whereas ischemic etiology, vascular intervention, and extent of resection were similar between groups. End colostomy was less frequently performed in the DCS group (32% vs 68%, $p < 0.001$). Among patients undergoing DCS, 41% required additional bowel resection at planned second-look laparotomy (Table 2).

Table 2
Operative Characteristics. AKI=acute kidney injury. NDCS = Non-Damage Control Surgery. DCS=Damage Control Surgery

Intra-Op Vasopressor Use	NDCS (n = 31)	DCS (n = 85)	p-value
	77.4%	96.5%	0.004
Post-Op Vasopressor Use	35.4%	88.2%	< 0.001
Degree of Contamination			0.004
<i>None</i>	12.9%	37.6%	
<i>Minimal</i>	67.7%	34.1%	
<i>Severe</i>	19.4%	28.2%	
Ischemia Type			0.569
<i>Arterial</i>	32.2%	30.6%	
<i>Venous</i>	0%	3.5%	
<i>Nonocclusive</i>	67.7%	65.9%	
Procedure Type			< 0.001
<i>Resection/Anastomosis</i>	29.0%	1.2%	
<i>Resection/Colostomy</i>	67.7%	2.4%	
<i>Resection/Anastomosis/Ileostomy</i>	3.2%	0%	
<i>Resection/Discontinuity</i>	0%	95.3%	
Definitive Procedure Type if DCS			
<i>Resection/Anastomosis</i>		17.3%	
<i>Resection/Colostomy</i>		4.9%	
<i>Resection/Anastomosis/Ileostomy</i>		32.1%	
<i>No Definitive Operation</i>		45.7%	
Vascular Intervention	6.5%	17.6%	0.233
Most Distal Resection			0.182
<i>Ascending</i>	48.4%	31.8%	
<i>Transverse</i>	16.1%	17.6%	
<i>Descending</i>	9.7%	8.2%	
<i>Sigmoid</i>	25.8%	28.2%	

Intra-Op Vasopressor Use	NDCS (n = 31)	DCS (n = 85)	p-value
	77.4%	96.5%	0.004
<i>Rectum</i>	0%	14.1%	
Delayed Resection	9.7%	41.2%	0.001
Operative Complications	54.8%	65.9%	0.287
<i>Abscess</i>	9.7%	11.8%	1
<i>AKI</i>	32.3%	41.2%	0.519
<i>Anastomotic Leak</i>	3.2%	5.9%	1
<i>Ileus</i>	22.6%	3.5%	0.004
<i>Fascial Dehiscence</i>	3.2%	1.2%	0.465
<i>Ostomy Necrosis</i>	9.7%	1.2%	0.058
<i>Sepsis</i>	22.6%	41.2%	0.082
<i>Surgical Site Infection</i>	6.5%	5.9%	1
Mortality	29.0%	64.7%	< 0.001

Overall postoperative complications were similar between groups (65.9% DCS vs 54.8% non-DCS, $p = 0.287$). Rates of surgical site infection, anastomotic leak, and fascial dehiscence were similar between groups. Ileus occurred less frequently in the DCS group (3.5% DCS vs 22.6% non-DCS, $p = 0.004$). Ostomy necrosis (1.2% DCS vs 9.7% non-DCS, $p = 0.058$) and sepsis (41.2% DCS vs 22.6% non-DCS, $p = 0.082$) differed numerically between groups but did not reach statistical significance (Table 2).

Overall perioperative mortality was higher in the DCS group than the non-DCS group (64.7% vs 29.0%, $p < 0.001$). Multivariable logistic regression identified CCI (OR 1.62 per point; 95% CI 1.26–2.17; $p < 0.001$), preoperative lactate (OR 1.39 per unit; 95% CI 1.13–1.79; $p = 0.004$), and severe contamination (OR 8.53; 95% CI 1.78–51.9; $p = 0.012$) as independent predictors of mortality (Table 3). The Firth-penalized model confirmed that CCI (OR 1.48; 95% CI 1.18–1.91; $p < 0.001$), preoperative lactate (OR 1.30; 95% CI 1.08–1.62; $p = 0.003$), and severe contamination (OR 5.48; 95% CI 1.35–27.2; $p = 0.016$) remained associated with mortality. Damage-control surgery was not independently associated with mortality in the Firth model (OR 2.20; 95% CI 0.636–8.19; $p = 0.213$) (Table 4). Among DCS patients, 41.2% required delayed resection at planned re-exploration, although no preoperative or intraoperative variable independently predicted delayed resection (Table 5).

Table 3
Standard Multivariable Logistic Regression Analysis for Mortality.
ASA=American Society of Anesthesiologists. CCI=Charlson
Comorbidity Index. CI=confidence interval. OR=odds ratio.

Variable	OR (95% CI)	P value
ASA class	2.42 (0.998–6.33)	0.059
CCI	1.62 (1.26–2.17)	< 0.001
Preoperative lactate	1.39 (1.13–1.79)	0.004
Preoperative vasopressor use	1.03 (0.32–3.26)	0.961
Intraoperative vasopressor use	0.508 (0.0762-3.67)	0.483
Contamination		
Minimal	0.801 (0.217–2.93)	0.735
Severe	8.53 (1.78–51.9)	0.011
Resection Location		
Transverse Colon	6.41 (0.344-206)	0.223
Descending Colon	0.348 (0.0115-5.81)	0.480
Sigmoid Colon	2.79 (0.476–17.1)	0.252
Extended Right Colon	2.51 (0.445–15.4)	0.300
Extended Left Colon	1.79 (0.355–9.27)	0.477
Total colectomy	1.21 (0.245–6.54)	0.814
Right/Left Colon	0.559 (0.0358-8.58)	0.671
Damage-control surgery	2.6 (0.652–11.3)	0.184

Table 4

Firth penalized logistic regression model for mortality.
 ASA=American Society of Anesthesiologists. CCI=Charlson
 Comorbidity Index. CI=confidence interval. OR=odds ratio.

Variable	OR (95% CI)	P value
ASA class	2.02 (0.915–4.81)	0.083
CCI	1.48 (1.18–1.91)	< 0.001
Preoperative lactate	1.3 (1.08–1.62)	0.003
Preoperative vasopressor use	1.06 (0.371-3)	0.911
Intraoperative vasopressor use	0.568 (0.104–3.29)	0.514
Contamination		
Minimal	0.814 (0.249–2.65)	0.730
Severe	5.48 (1.35–27.2)	0.016
Resection Location		
Transverse Colon	4.2 (0.344-68)	0.257
Descending Colon	0.482 (0.0306-5.62)	0.566
Sigmoid Colon	2.32 (0.465–11.9)	0.301
Extended Right Colon	2.1 (0.446–10.5)	0.347
Extended Left Colon	1.63 (0.377–7.13)	0.510
Total colectomy	1.22 (0.282–5.69)	0.789
Right/Left Colon	0.633 (0.0527-7.09)	0.709
Damage-control surgery	2.2 (0.636–8.19)	0.213

Table 5

Firth penalized logistic regression for delayed resection among damage-control surgery patients. ASA=American Society of Anesthesiologists. CCI=Charlson Comorbidity Index. CI=confidence interval. OR=odds ratio.

Variable	OR (95% CI)	P value
ASA class	0.956 (0.412-2.2)	0.915
CCI	0.935 (0.76–1.14)	0.512
Preoperative lactate	0.934 (0.815–1.05)	0.269
Preoperative vasopressor use	0.825 (0.304–2.23)	0.703
Intraoperative vasopressor use	1.83 (0.2–22.9)	0.589
Contamination		
Minimal	1.2 (0.413–3.56)	0.739
Severe	1.03 (0.293–3.54)	0.963
Resection Location		
Transverse Colon	0.825 (0.0548-12.4)	0.881
Descending Colon	1.68 (0.202–19.6)	0.627
Sigmoid Colon	0.415 (0.0653-2.08)	0.290
Extended Right Colon	0.583 (0.121–2.46)	0.467
Extended Left Colon	1.44 (0.345–6.39)	0.617
Total colectomy	0.456 (0.11–1.68)	0.242
Right/Left Colon	0.11 (7.48e-04-1.5)	0.105

The primary mortality model had strong apparent discrimination with an AUC of 0.862. Bootstrap optimism was 0.099, yielding an optimism-corrected AUC of 0.763 based on 948 valid bootstrap resamples (Fig. 1). The Firth mortality model had a similar apparent AUC of 0.861. Five-bin calibration showed close agreement between predicted and observed mortality rates across risk strata: observed mortality was 13.6%, 36.4%, 54.5%, 77.3%, and 100% across ascending predicted-risk bins, compared with mean predicted risks of 12.1%, 33.5%, 58.7%, 80.4%, and 97.0% (Fig. 2).

Discussion

In this retrospective study of patients undergoing emergency surgery for colonic ischemia, DCS was performed in nearly three-quarters of patients, and 41% of those managed with DCS required additional bowel resection at planned second-look laparotomy. Although patients managed with DCS experienced higher unadjusted perioperative mortality, DCS was not independently associated with perioperative

mortality after multivariable adjustment. Instead, perioperative mortality was independently associated with markers of physiologic derangement, including comorbidity burden, preoperative lactate level, and degree of intra-abdominal contamination. These findings suggest that patient physiology, rather than operative strategy alone, is the principal determinant of mortality outcomes in patients with isolated colonic ischemia.

Planned re-exploration has historically been advocated in intestinal ischemia because bowel viability may continue to evolve following the index operation, resulting in delayed demarcation of ischemic bowel and progression of necrosis despite apparently adequate initial resection.¹⁰ Current World Society of Emergency Surgery guidelines similarly recommend staged operative management when bowel viability is uncertain or physiologic instability precludes definitive reconstruction.^{1,2} In our cohort, progression of ischemia requiring additional bowel resection occurred in 41% of patients undergoing DCS, demonstrating that ischemic progression remained common despite initial operative management and supporting the continued role of staged operative management in appropriately selected patients. However, these benefits must be balanced against the morbidity associated with temporary abdominal closure, repeated laparotomy, prolonged critical care, and delayed fascial closure.¹²⁻¹⁵ Previous studies, including Hansraj et al., have questioned whether routine second-look laparotomy provides sufficient benefit to justify these additional burdens in all patients.¹²⁻¹⁵ Our findings add to this discussion. Although 41% of patients undergoing DCS experienced progression of ischemia requiring additional bowel resection, nearly half died before definitive reconstruction could be performed. Together, these findings suggest that while DCS remains an essential strategy when bowel viability is uncertain, its benefits are unlikely to be uniform across all patients with colonic ischemia. Further, this dataset was unable to determine reliable predictors of which patients would require a delayed resection. This could be due to the smaller sample size or because other non-quantified variables better predict the need for additional resection.

Rather than questioning the role of DCS itself, our findings suggest that the more important clinical question is which patients are most likely to benefit from staged operative management. Patients managed without DCS demonstrated less physiologic derangement and substantially lower perioperative mortality, suggesting that surgeons appropriately selected patients with greater physiologic compromise for staged operative management. However, operative strategy was not independently associated with perioperative mortality after adjustment for patient characteristics. Instead, elevated lactate levels, increasing comorbidity burden, and greater intra-abdominal contamination independently predicted mortality. While these physiologic variables predicted mortality rather than progression of ischemia requiring additional bowel resection, they raise the possibility that physiologic severity may ultimately help refine patient selection for DCS. Future studies should focus on identifying predictors of ischemic progression requiring additional bowel resection and determining whether a more selective, physiology-guided approach to staged operative management can maximize benefit while minimizing unnecessary open abdomen-related morbidity.

An additional finding of this study was the higher rate of restoration of intestinal continuity among patients managed with DCS. This observation should be interpreted cautiously, as survivorship bias likely contributed, since only patients surviving to definitive reconstruction were eligible for delayed anastomosis. Nevertheless, staged operative management may allow selected patients to undergo reconstruction under more favorable physiologic conditions, potentially avoiding permanent fecal diversion. Previous studies have also suggested that ostomy creation may adversely affect fascial closure following open-abdomen management, further emphasizing the complex trade-offs involved in operative decision-making.¹⁵

This study has several limitations. Its retrospective, single-center design introduces the potential for selection bias and limits generalizability. In addition, implementation of a departmental protocol favoring DCS during the study period may have influenced operative decision-making. Although multivariable adjustment was performed, residual confounding cannot be excluded. Finally, survivorship bias is inherent in analyses of delayed reconstruction, as a substantial proportion of patients undergoing DCS died before definitive reconstruction could be considered.

Conclusions

DCS remains an important component of the operative management of selected patients with colonic ischemia, particularly when bowel viability is uncertain. However, perioperative mortality appears to be driven primarily by physiologic derangement rather than operative strategy. These findings suggest that the future of DCS in colonic ischemia may lie not in its routine application, but in more selective patient selection guided by physiologic severity and the anticipated risk of ischemic progression. Larger prospective studies are needed to better define these predictors and determine which patients derive the greatest benefit from staged operative management.

Abbreviations

DCS – damage control surgery

CCI – Charlson Comorbidity Index

ASA – American Society of Anesthesiologists

AUC - Area under the curve

OR – Odds ratio

BMI – Body mass index

NDCS – Non-damage control

AKI – Acute kidney injury

Declarations

Ethics approval and consent to participate: This retrospective study was approved by the Institutional Review Board. The requirement for informed consent was waived by the Institutional Review Board due to the retrospective nature of the study.

Consent for publication: Not applicable.

Availability of data and materials: The datasets generated and/or analyzed during the current study are not publicly available due to patient privacy and confidentiality considerations, but are available from the corresponding author on reasonable request.

Competing interests: The authors declare no competing interests.

Funding: The authors received no specific funding for this work.

Authors' contributions

HW: Concept and study design, data acquisition, interpretation of the data, manuscript drafting, manuscript revisions

EW: Concept and study design, data acquisition, statistical analysis, interpretation of the data, manuscript revisions

HO: Data acquisition, manuscript revisions

BR: Data acquisition, manuscript drafting, manuscript revisions

BL: Data acquisition, manuscript revisions

MAM: Concept and study design, manuscript revisions

PM: Concept and study design, manuscript revisions

MP: Concept and study design, statistical analysis, interpretation of the data, manuscript drafting, manuscript revisions

Acknowledgments: Not applicable.

References

1. Bala M, Catena F, Kashuk J, et al. Acute mesenteric ischemia: updated guidelines of the World Society of Emergency Surgery. World J Emerg Surg. 2022;17(1):54. 10.1186/s13017-022-00443-x.

2. Bala M, Kashuk J, Moore EE, et al. Acute mesenteric ischemia: guidelines of the World Society of Emergency Surgery. *World J Emerg Surg.* 2017;12:38. 10.1186/s13017-017-0150-5.
3. Tamme K, Blaser AR, Laisaar KT, et al. Incidence and outcomes of acute mesenteric ischaemia: a systematic review and meta-analysis. *BMJ Open.* 2022;12(10):e062846. 10.1136/bmjopen-2022-062846.
4. Park WM, Gloviczki P, Cherry KJ, et al. Contemporary management of acute mesenteric ischemia: Factors associated with survival. *J Vasc Surg.* 2002;35(3):445–52. 10.1067/mva.2002.120373.
5. Ward D, Vernava AM, Kaminski DL et al. Improved outcome by identification of high-risk nonocclusive mesenteric ischemia, aggressive reexploration, and delayed anastomosis. *Am J Surg.* 1995;170(6):577–580; discussion 580–581. 10.1016/s0002-9610(99)80019-1
6. Hanisch E, Schmandra TC, Encke A. Surgical strategies – anastomosis or stoma, second look – when and why? *Langenbeck's Arch Surg.* 1999;384(3):239–42. 10.1007/s004230050198.
7. Yanar H, Taviloglu K, Ertekin C, et al. Planned second-look laparoscopy in the management of acute mesenteric ischemia. *World J Gastroenterol.* 2007;13(24):3350–3. 10.3748/wjg.v13.i24.3350.
8. Anadol AZ, Ersoy E, Taneri F, Tekin EH. Laparoscopic second-look in the management of mesenteric ischemia. *Surg Laparosc Endosc Percutan Tech.* 2004;14(4):191–3. 10.1097/01.sle.0000136677.39377.62.
9. Girard E, Abba J, Boussat B, et al. Damage Control Surgery for Non-traumatic Abdominal Emergencies. *World J Surg.* 2018;42(4):965–73. 10.1007/s00268-017-4262-6.
10. Brilliantino A, Lanza M, Antropoli M, et al. Usefulness of damage control approach in patients with limited acute mesenteric ischemia: a prospective study of 85 patients. *Updates Surg.* 2022;74(1):337–42. 10.1007/s13304-021-01192-3.
11. Ding W, Wang K, Liu B, et al. Open Abdomen Improves Survival in Patients With Peritonitis Secondary to Acute Superior Mesenteric Artery Occlusion. *J Clin Gastroenterol.* 2017;51(9):e77–82. 10.1097/MCG.0000000000000799.
12. Kaminsky O, Yampolski I, Aranovich D, Gnessin E, Greif F. Does a second-look operation improve survival in patients with peritonitis due to acute mesenteric ischemia? A five-year retrospective experience. *World J Surg.* 2005;29(5):645–8. 10.1007/s00268-005-7380-5.
13. Hansraj N, Pasley AM, Pasley JD, Harris DG, Diaz JJ, Bruns BR. Second-look laparotomy: warranted, or contributor to excessive open abdomens? *Eur J Trauma Emerg Surg.* 2019;45(4):705–11. 10.1007/s00068-018-0968-x.
14. Proaño-Zamudio JA, Argandykov D, Renne A, et al. Revisiting abdominal closure in mesenteric ischemia: is there an association with outcome? *Eur J Trauma Emerg Surg.* 2023;49(5):2017–24. 10.1007/s00068-022-02199-0.
15. Bertelsen CA, Fabricius R, Kleif J, Kristensen B, Gögenur I. Outcome of negative-pressure wound therapy for open abdomen treatment after nontraumatic lower gastrointestinal surgery: analysis of factors affecting delayed fascial closure in 101 patients. *World J Surg.* 2014;38(4):774–81. 10.1007/s00268-013-2360-7.

Figures

Figures

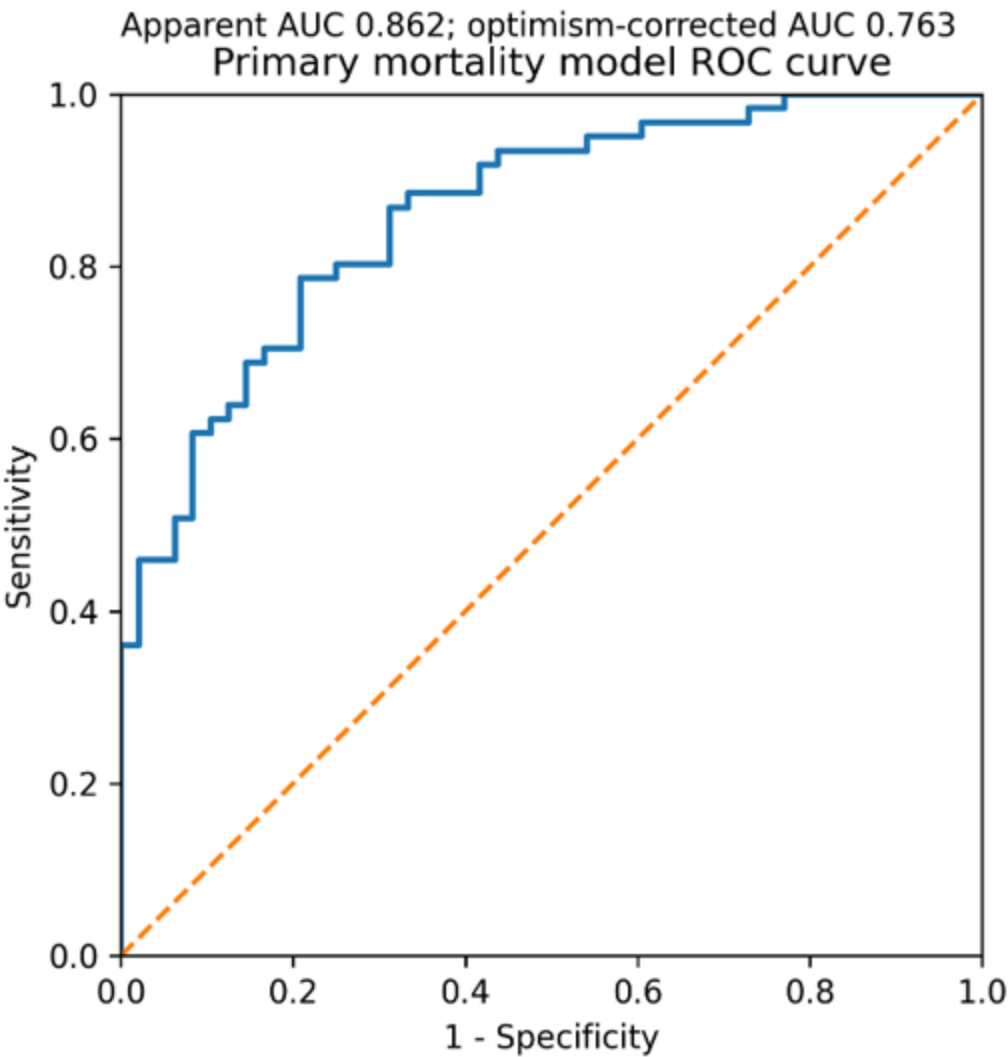


Figure 1

Multivariate model mortality ROC curve.

Figures

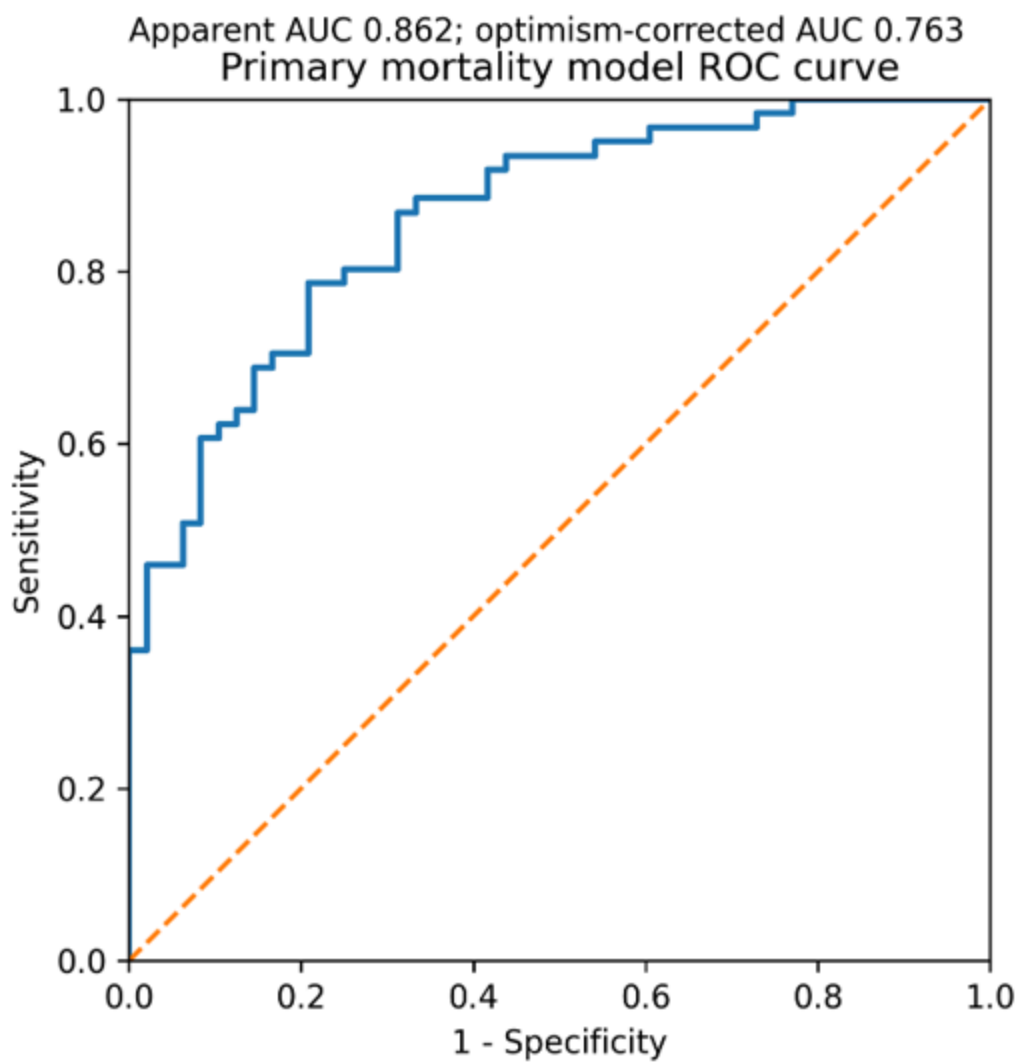


Figure 1

Multivariate model mortality ROC curve.

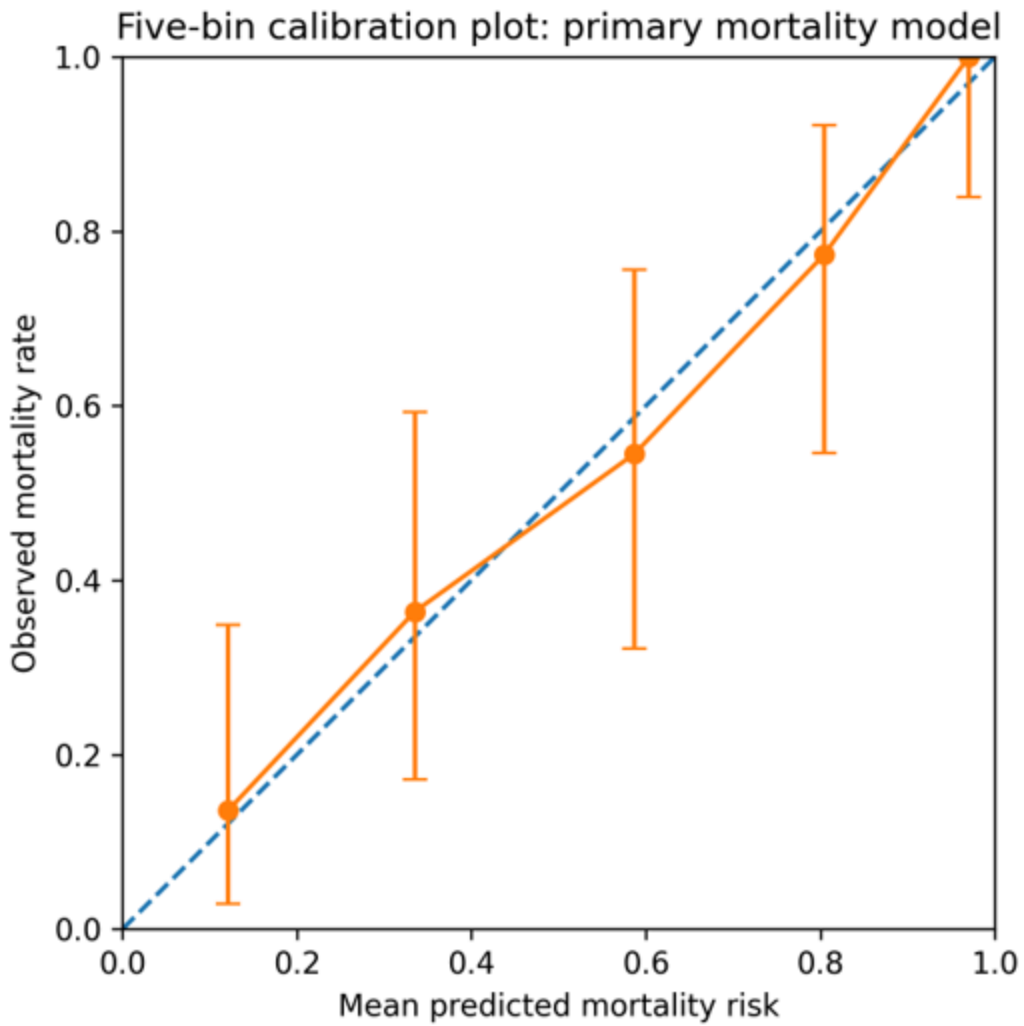


Figure 2

Five-bin calibration plot for the primary mortality model.

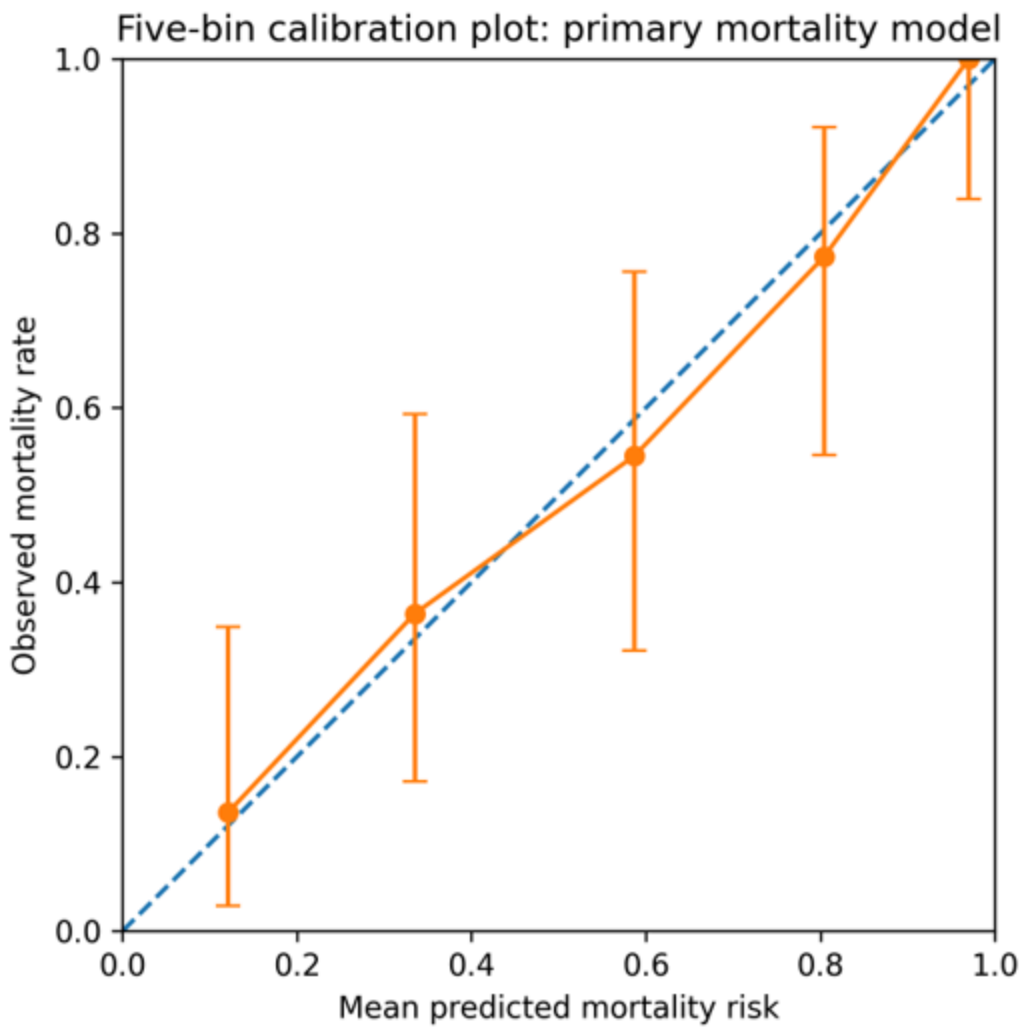


Figure 2

Five-bin calibration plot for the primary mortality model.