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Open abdomen with negative pressure device vs primary abdominal closure for the management of surgical abdominal sepsis: a retrospective review



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Abstract

BACKGROUND: Open abdomen with temporary abdominal closure remains a controversial management strategy for surgical abdominal sepsis compared with primary abdominal closure (PAC) and on-demand laparotomy. The primary objective was to compare mortality between PAC and open abdomen with vacuum assisted closure (VAC).

METHODS: Retrospective review of a tertiary center intensive care unit database (2006 to 2010) including suspected/diagnosed severe abdominal sepsis/septic shock requiring source control laparotomy. Groups were categorized according to closure method at index source control laparotomy. APACHE-IV was used as a measure of disease severity.

RESULTS: Of 211 patients, 75 PAC and 136 VAC cases were included. Controlling for disease severity, adjusted odds ratio of mortality for VAC was .41 95% confidence interval (.21, .81; $P = .01$) compared with PAC. PAC and VAC APACHE-IV predicted mortality rate were both 45%. VAC mortality was lower than PAC (22.8% vs 38.6%; $P = .012$).

CONCLUSIONS: Open abdomen with VAC is associated with significantly improved survival compared with PAC in abdominal sepsis requiring laparotomy.

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Sepsis accounts for approximately 20% of intensive care unit (ICU) admissions and is the primary cause of death noncardiac ICUs, with mortality rates ranging from

25% to 50%.¹⁻³ Large sepsis trials tend to include medical and surgical disease⁴ across multiple anatomic sites,⁵ despite evidence that site-specific research may lend more detailed insight.⁶ There is a lack of data describing optimal surgical techniques for the management of catastrophic abdominal sepsis.⁷ Many studies are limited by significant population heterogeneity, and a previous meta-analysis of surgical abdominal sepsis did not identify a significant difference in outcome between planned and on-demand approaches.⁸

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Traditional teaching in emergency general surgery emphasizes a single-stage operation with primary abdominal closure and on-demand laparotomy for clinical deterioration. Practice of damage control surgery⁹ was initially introduced in trauma and has transitioned to abdominal sepsis with the main objective of optimizing patient outcomes¹⁰ with deranged physiology.¹¹ Principles of efficient control of contamination and delay of definitive procedure and fascial closure for the management of abdominal sepsis¹² have become prevalent yet remain controversial.¹³ Despite few prospective randomized studies, there is increasing recognition that the damage control approach can be employed to address the physiologic derangements observed in septic shock, especially in situations where source control (SC) cannot be satisfactorily obtained at the index operation.

In the 1990s, Wittmann explored the role of index SC procedure with a temporary bridging fascial closure technique followed by reassessment of the peritoneal cavity 48 to 72 hours later for abdominal sepsis. On reassessment, decisions were made regarding the need for additional lavage, debridement, and/or definitive closure. Wittmann identified that open abdomen and a staged approach was associated with improved survival compared with primary closure and relaparotomy on-demand (28.1% vs 44.2% respectively), with mortality rates below those predicted by the APACHE-II score.¹⁴

The aims of this study were to primarily compare in-hospital mortality rates in abdominal sepsis patients who undergo open abdomen with temporary negative pressure dressing closure, vacuum assisted closure (VAC), vs single-stage operation with primary fascial closure (PAC). Secondly, quantify the impact of VAC on mortality while adjusting for disease severity as measured by the APACHE-IV score.

We hypothesized that use of open abdomen with temporary negative pressure dressing was associated with better survival compared with single-stage definitive procedure.

Methods

Ethics approval was obtained from the University of British Columbia Research Ethics Board.

Study design

Retrospective chart review of consecutive adult ICU admissions between the years of 2006 to 2010 at a tertiary care hospital, performed between 2011 and 2013. The ICU was a combined medical and surgical unit. Patients were identified through a prospectively collected ICU database of all admissions from January 1, 2006 to December 31, 2010 coded with the diagnosis of “open abdomen” or “abdominal sepsis”. All charts were screened using inclusion and exclusion criteria. Eligible cases were reviewed in full.

Inclusion criteria

Patients with evidence of preoperative severe sepsis or septic shock with a suspected or known abdominal source of infection requiring urgent or emergent laparotomy for SC, otherwise known as, surgical abdominal sepsis (SABS). Severe sepsis was defined as at least one clinical finding of systemic inflammatory response syndrome criteria (WBC $4 <$ or $> 12 \times 10^3/\mu\text{L}$, T $36 <$ or > 38.2 °C, heart rate > 90 bpm, respiratory rate > 20 /minute) along with evidence of organ dysfunction, altered mental status, arterial hypoxemia ($\text{PaO}_2/\text{FiO}_2 < 300$), urine output less than .5 mL/kg/hour, creatinine increase greater than .5 mg/dL, ileus, platelets less than 100,000, hypoperfusion (lactate > 1 mmol/L, “mottling”), or hypotension (systolic BP < 90 -mm Hg) responsive to fluid resuscitation. Septic shock was defined as hypotension nonresponsive to fluid challenge of 30-mL/kg bolus, MAP less than 60-mm Hg or use of vasopressors.^{3,15} All patients required admission to the ICU either secondary to SABS or developed new onset SABS while in the ICU.

Exclusion criteria

Patients less than 18 years of age, laparoscopy without conversion to laparotomy for SABS, sepsis secondary to trauma, laparotomies for nonseptic indications, and abdominal sepsis managed without laparotomy were excluded. Cases in which the attending surgeon described the degree of abdominal insult observed at the primary SC procedure as nonsurvivable (eg, global visceral ischemia) were excluded, as there would be no differential impact of management technique on survival.

Measures of disease severity

Disease severity was measured using the APACHE-IV score and predicted mortality rate (PMR). This system is a widely used tool for stratifying disease severity and predicting patient mortality in the ICU. The APACHE-IV PMR integrates the patient’s age, diagnosis, physiologic parameters, and laboratory data within the first 24 hours of ICU admission. The PMR was calculated for each patient according to the Cerner protocol.¹⁶

Surgical management definitions

Patients with SABS requiring laparotomy were categorized into 2 groups based on the approach selected at the initial SC laparotomy.

- PAC—after SC procedure (debridement or resection of infected/necrotic tissue, lavage), fascia is reapproximated primarily using sutures. Decision for any subsequent reoperation was based on clinical deterioration or lack of clinical improvement with a likely

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