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Systematic Review

Timing of Fascial Closure after Damage Control Laparotomy for Trauma: A PRISMA 2020–Compliant Systematic Review and Evidence Synthesis

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Abstract

Background: *Damage control laparotomy (DCL) is a life-saving strategy for critically injured trauma patients but is associated with significant morbidity when the abdomen remains open. Early definitive fascial closure is advocated; however, the optimal timing—particularly closure within 48 hours—remains controversial.*

Objective: *To systematically review and synthesize available evidence evaluating the impact of fascial closure timing, specifically ≤48 hours versus >48 hours, on outcomes following DCL.*

Data Sources: *PubMed/MEDLINE, PubMed Central (PMC), and Google Scholar.*

Study Eligibility Criteria: *Peer-reviewed studies involving adult trauma patients undergoing DCL that reported outcomes related to timing of re-laparotomy or fascial closure.*

Results: *Six studies met inclusion criteria for qualitative synthesis. No included study directly evaluated attempted definitive primary fascial closure ≤48 hours versus >48 hours as the primary exposure of interest, highlighting a critical evidence gap. Registry-based evidence consistently demonstrated that failure to achieve primary fascial closure during index hospitalization was associated with markedly increased mortality and enterocutaneous fistula formation [1,2]. Earlier re-laparotomy (within 24–48 hours) predicted a higher likelihood of successful closure [1]. A recent systematic review and meta-analysis found that planned reoperation ≤48 hours increased re-bleeding risk without mortality benefit.*

Conclusions: *Achieving definitive primary fascial closure is paramount. While early re-laparotomy may facilitate subsequent closure, rigid adherence to a 48-hour threshold for definitive fascial closure is not supported by current evidence. Closure decisions should be physiology-guided. Prospective studies directly evaluating definitive closure timing are needed.*

Keywords: Damage Control Surgery, Open Abdomen, Primary Fascial Closure, Trauma, Reoperation

1. Introduction

Damage control laparotomy (DCL) is an established surgical strategy for critically injured trauma patients presenting with severe physiological derangement, including hypothermia, metabolic acidosis, and coagulopathy. The approach prioritizes rapid hemorrhage and contamination control, followed by temporary abdominal closure (TAC) and delayed definitive repair once physiologic stabilization has been achieved [4]. Although DCL improves early survival, prolonged open abdomen management is associated with significant morbidity, including fluid and protein losses, abdominal sepsis, enterocutaneous fistula (ECF) formation, abdominal compartment syndrome (ACS), and long-term ventral hernia [2-6]. Consequently, definitive primary fascial closure (PFC) has emerged as a critical endpoint in post-DCL care. While early closure is widely advocated, uncertainty

persists regarding the optimal timing of definitive closure, particularly whether closure within 48 hours confers superior outcomes compared with delayed closure. Contemporary trauma practice increasingly emphasizes early re-laparotomy and early closure attempts; however, no dedicated systematic review has isolated the 48-hour cutoff for definitive fascial closure as the primary exposure variable. This systematic review aims to address this gap.

2. Methods

This systematic review was conducted in accordance with the PRISMA 2020 Statement.

2.1. Review Question (PICO)

In adult trauma patients undergoing damage control laparotomy, does attempted definitive primary fascial closure within ≤48 hours, compared with closure attempted after >48 hours, affect:

- Primary fascial closure rates
- Mortality
- Enterocutaneous fistula formation
- Abdominal compartment syndrome

2.2. Eligibility Criteria

Inclusion Criteria

- Adult trauma patients (≥18 years)
- Undergoing damage control laparotomy
- Peer-reviewed observational studies, randomized trials, or systematic reviews
- Reported outcomes related to timing of re-laparotomy or fascial closure
- Published in English

Exclusion Criteria

- Pediatric populations
- Case reports or small case series (<10 patients)
- Non-trauma populations
- Non–peer-reviewed literature

2.3. Information Sources

The following databases were searched.

- PubMed/MEDLINE
- PubMed Central (PMC)
- Google Scholar

The final search was conducted in 2025.

2.4. Search Strategy

Search terms included combinations of:
damage control laparotomy, open abdomen, primary fascial closure, early fascial closure, delayed closure, re-laparotomy, and trauma.
Reference lists of included studies and relevant reviews were manually screened to identify additional articles.

2.5. Study Selection

Titles and abstracts were screened for relevance. Full-text articles were reviewed to confirm eligibility. Discrepancies were resolved through consensus review.

2.6. Data Collection Process

Extracted data included.

- Study design and setting
- Patient population and sample size
- Timing definitions
- Fascial closure outcomes
- Mortality, ECF, and ACS incidence

2.7. Risk of Bias Assessment

Risk of bias for observational studies was formally assessed using the Newcastle–Ottawa Scale (NOS). The NOS evaluates study quality across three domains: selection of study groups (maximum 4 stars), comparability of groups (maximum 2 stars), and outcome assessment (maximum 3 stars). Studies scoring ≥7 stars were considered high quality.

2.8. Synthesis Methods

Due to heterogeneity in study design and absence of direct comparative trials evaluating ≤48-hour versus >48-hour definitive closure, a narrative synthesis was performed.

3. Results

3.1. Study Selection

A total of 798 records were identified through database searching. After removal of 243 duplicate records, 555 records were screened by title and abstract, of which 489 were excluded. Sixty-six full-text reports were assessed for eligibility, and 60 were excluded for predefined reasons. Six studies were included in the qualitative synthesis, and one systematic review and meta-analysis was included for quantitative synthesis (Figure 1).

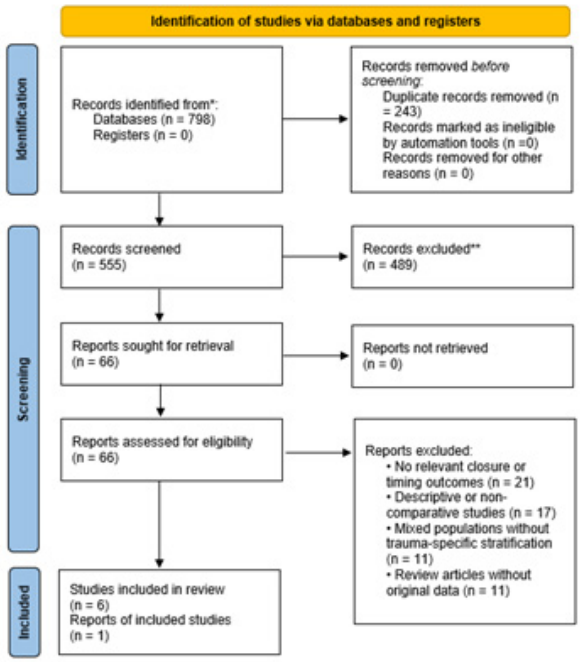

Figure 1: PRISMA 2020 Flow Diagram Illustrating Study Identification, Screening, Eligibility Assessment, and Final Inclusion in the Systematic Review.

3.2. Characteristics of Included Studies

Study	Country	Design	Population	Sample Size	Timing Definition	Outcomes
DuBose et al., 2013	USA	Prospective registry	Trauma DCL	517	Median closure ≈5 Days	PFC, mortality, ECF
Bradley et al., 2013	USA	Registry analysis	Trauma DCL	517	Closure vs no closure	ECF, sepsis
Pommerening et al., 2014	USA	Cohort registry	Trauma DCL	473	Time to first re-laparotomy	PFC
Cheatham et al., 2016	USA	Observational cohort	OA survivors	212	OA duration	Long-term outcomes
Coccolini et al., 2018	International	Guideline	Trauma OA	N/A	Early vs delayed	Closure feasibility
Seo et al., 2025	South Korea	Meta-analysis	Trauma DCL	1,429	≤48 vs >48 h re-op	Re-bleeding, mortality

Table 1: Characteristics of Included Studies

3.3. Failure to Achieve Fascial Closure

The AAST Open Abdomen Registry demonstrated that failure to achieve primary fascial closure during index hospitalization was associated with dramatically worse outcomes. Mortality exceeded 50% among patients who did not achieve closure compared with approximately 12% among those who did [1,2]. further identified failure of closure as an independent predictor of enterocutaneous fistula and abdominal sepsis [2].

3.4. Timing of Re-Laparotomy

Registry-based data demonstrated that increasing time to first re-laparotomy independently predicted failure of primary fascial closure. Patients undergoing re-exploration within approximately 36 hours were significantly more likely to achieve closure [1].

3.5 Evidence Related to the 48-Hour Threshold

Seo et al. compared planned reoperation ≤48 hours versus >48 hours after damage control laparotomy[3]. Early reoperation was associated with significantly increased re-bleeding risk but no reduction in mortality or infectious complications, suggesting that rigid time-based protocols may be harmful in selected patients[3].

Study	Selection (★★★★)	Comparability (★★)	Outcome (★★★)	Total	Quality
DuBose et al., 2013	★★★★	★★	★★★	9/9	High
Bradley et al., 2013	★★★★	★★	★★★	9/9	High
Pommerening et al., 2014	★★★★	★★	★★★	9/9	High
Cheatham et al., 2016	★★★	★	★★★	7/9	High
Coccolini et al., 2018†	N/A	N/A	N/A	N/A	Guideline
Seo et al., 2025‡	N/A	N/A	N/A	N/A	Meta-analysis

Table 2: Newcastle–Ottawa Scale (NOS) Risk of Bias Assessment

• Guidelines are not assessed using the Newcastle–Ottawa Scale.

• Systematic reviews and meta-analyses are not assessed using the Newcastle–Ottawa Scale.

5. Discussion

This PRISMA-compliant systematic review confirms that definitive primary fascial closure is a critical determinant of outcomes following damage control laparotomy. Failure to achieve closure during index hospitalization is consistently associated with markedly increased mortality and enterocutaneous fistula formation. While early re-laparotomy—often within 24–48 hours—may improve the likelihood of achieving closure, this does not equate to a requirement for mandatory definitive fascial closure within 48 hours for all patients. Recent high-level evidence suggests that rigid early reoperation may increase re-bleeding risk without survival benefit, reinforcing the need for individualized, physiology-guided decision-making [3].

6. Limitations

This review is limited by reliance on observational data and lack of randomized trials. Definitions of early closure

varied, and definitive closure timing was rarely the primary exposure variable, and residual confounding related to injury severity and physiological status at the time of closure could not be fully accounted for.

7. Conclusions

Achieving definitive primary fascial closure after damage control laparotomy is paramount. Early re-laparotomy facilitates closure; however, definitive fascial closure should be guided by patient physiology (including hemodynamic stability, correction of acidosis and coagulopathy, and resolution of visceral edema) rather than rigid temporal thresholds. Prospective studies directly comparing ≤48-hour versus >48-hour definitive closure are urgently needed.

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