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Control the damage: morbidity and mortality after emergent trauma laparotomy

John A. Harvin, M.D.*, Curtis J. Wray, M.D., Joshua Steward, B.A., Ryan A. Lawless, M.D., Michelle K. McNutt, M.D., Joseph D. Love, D.O., Laura J. Moore, M.D., Charles E. Wade, Ph.D., Bryan A. Cotton, M.D., M.P.H., John B. Holcomb, M.D.

Department of Surgery and the Center for Translational Injury Research, The University of Texas Health Science Center, 6431 Fannin Street, MSB 4.264, Houston, TX 77030, USA

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Abstract

BACKGROUND: Damage control laparotomy (DCL) is performed for physiologically deranged patients. Recent studies suggest overutilization of DCL, which may be associated with potentially iatrogenic complications.

METHODS: We conducted a retrospective study of trauma patients over a 2-year period that underwent an emergent laparotomy and received preoperative blood products. The group was divided into definitive laparotomy and DCL.

RESULTS: A total of 237 received were included: 78 in definitive laparotomy group, 144 in the DCL group, and 15 who died in the operating room. The DCL group was more severely injured and required more transfusions. After propensity score matching, DCL was associated with an 18% increase in hospital mortality, a 13% increase in ileus, and a 7% increase in enteric suture line failure, an 11% increase in fascial dehiscence, and a 19% increase in superficial surgical site infection.

CONCLUSIONS: The potential overuse of DCL unnecessarily exposes patients to increased morbidity and mortality.

In select, severely injured, and physiologically deranged patients, damage control laparotomy (DCL) is associated with improved survival.[1,2] The utilization of DCL revolutionized trauma care and, undoubtedly, saved the lives of many injured military and civilian patients.

The complications associated with the open abdomen necessitated by DCL have been well described. These include high rates of planned ventral hernia, with recent multicenter studies showing hernia rates of 30% to 34%.[3,4] Enterocutaneous fistulas, whereas uncommon, are more likely to develop in patients with an open abdomen, continue to create substantial morbidity, and are extraordinarily costly.[5–7] The open abdomen is also associated with intra-abdominal abscess formation, ventilator-associated pneumonia, bacteremia, sepsis, and organ failure.[8] Although these complications have long been recognized, they were felt to be diseases of survivorship.

The initial indications for DCL were relatively strict–onset of coagulopathy during primary laparotomy or a

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* Corresponding author. Tel.: +1-713-500-6362; fax: +1-713-500-0651.

E-mail address: john.harvin@uth.tmc.edu

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major vascular injury combined with 2 visceral injuries in a massively transfused patient.[1,2] As comfort with the open abdomen increased, the criteria for abbreviating the laparotomy devolved into more liberal and subjective, as evidence by rates of DCL approaching 30% to 36%.[9–11] The purpose of this study is to determine the effect of DCL on mortality and potentially iatrogenic morbidity in patients with truncal hemorrhage.

Methods

After approval from the institutional review board of the University of Texas Health Science Center at Houston, the Memorial Hermann Hospital trauma registry was queried for all patients admitted during the 3-year period from January 1, 2011 and December 31, 2013 who met the following criteria: (1) underwent emergent laparotomy–defined as admission to the operating room (OR) directly from the emergency department (ED), (2) spent less than 90 minutes in the ED, (3) received any prehospital or ED blood products, and (4) were greater than 15 years of age. The patients were then separated into 2 groups: those who underwent definitive laparotomy (DEF, all portions of laparotomy completed and fascia closed) and those who underwent DCL (laparotomy abbreviated and fascia left open with temporary abdominal closure). Patients who died in the OR were excluded.

Patient demographics, injury characteristics, perioperative data, and postoperative outcomes were recorded from the patients' medical records. The primary outcome for the study was in-hospital mortality. Secondary outcomes were postoperative complications, including ileus, suture line failure, fascial dehiscence, and superficial surgical site infection.

Univariate analysis was performed to compare the DEF and DCL groups. Continuous data are presented as medians with 25th and 75th interquartile ranges (IQR) with comparisons between groups performed using Wilcoxon rank sum test. Categorical data are reported as proportions and tested for significance using Chi squared or Fisher's exact test, where appropriate.

After univariate analysis, a propensity score was generated for each patient to account for the probability of DCL. After matching, a logistic regression model estimated the average treatment effect of DCL for each subject on the outcomes. This was done using the "teffects psmatch" of STATA with the outcome variable as the complication of interest, the treatment variable as DCL, and the covariates chosen as clinically significant variables available to the surgeon before the determination of DCL–gestalt of anatomic burden of injury (injury severity score), age, gender, mechanism of injury, ED-systolic blood pressure (SBP), ED-Glasgow Coma Scale, ED-base excess (BE), ED-activated clotting time, ED-percent lysis at 30 minutes (LY30), ED red blood cell (RBC) transfusion, time in ED, final OR temperature, final OR SBP, total OR RBCs, final OR pH, final OR BE, and final OR lactic acid (LA). The treatment effect was presented as at percentage with 95% confidence interval and *P* value.

All analyses were performed using STATA statistical software (version 13.1; Stata Corporation, College Station, TX).

Results

During the 3-year period, there were 13,656 patients admitted to the Texas Trauma Institute (Table 1). Of these, 625 (4.6%) underwent emergent laparotomy—367 (59%) underwent DEF, 239 (38%) underwent DCL, and 19 (3%) died in the OR. A total of 222 patients met inclusion criteria and comprised the patients of interest—78 (35%) in the DEF group and 144 (65%) in the DCL group.

There were no significant differences in demographics between the 2 groups (Table 2). As expected, the DCL group was more severely injured, as evidenced by a higher abbreviated injury scale abdomen and injury severity score. There were no differences in abbreviated injury scale head or chest.

The DCL group was also more physiologic deranged upon ED arrival, as evidenced by a lower ED-Glasgow Coma Scale, ED-SBP, and lower ED-BE and a higher ED lactate, ED-activated clotting time, and ED lysis at 30 minutes (Table 3). The DCL group was more likely to have a positive focused assessment with sonography for trauma examination and to receive tranexamic acid. The DCL group was less likely to undergo computed tomography in the ED. Time in ED was shorter (DCL group median 31 minutes, IQR 20, 45 vs DEF group median 35 minutes, IQR 21, 65, $P = .05$). The DCL group also received more RBC transfusions in the ED.

In the OR, the DCL group had lower initial SBP, initial pH, and initial BE and higher initial HR and initial LA (Table 4). The DCL group received more transfusions of RBCs, fresh frozen plasma, platelets, and cryoprecipitate

Table 1 Trauma admissions and laparotomies

Variable	
Trauma admissions	13,656
Emergent laparotomy	625 (4.6%)
Damage control laparotomy	239 (38%)
Definitive laparotomy	367 (59%)
OR deaths	19 (3%)
Excluded patients	
No preoperative transfusions	153
ED to OR ≥ 90 min	120
Both	111
Included patients	237
Damage control laparotomy	144 (61%)
Definitive laparotomy	78 (33%)
OR deaths	15 (6%)

ED = emergency department; OR = operating room.