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Emergent laparotomy and temporary abdominal closure for the cirrhotic patient

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ABSTRACT

Background: Temporary abdominal closure (TAC) may be performed on cirrhotic patients undergoing emergent laparotomy. The effects of cirrhosis on physiologic parameters, resuscitation requirements, and outcomes following TAC are unknown. We hypothesized that cirrhotic TAC patients would have different resuscitation requirements and worse outcomes than noncirrhotic patients.

Methods: We performed a 3-year retrospective cohort analysis of 231 patients managed with TAC following emergent laparotomy for sepsis, trauma, or abdominal compartment syndrome. All patients were initially managed with negative pressure wound therapy (NPWT) TAC with intention for planned relaparotomy and sequential abdominal closure attempts at 24- to 48-h interval.

Results: At presentation, cirrhotic patients had higher incidence of acidosis (33% *versus* 17%) and coagulopathy (87% *versus* 54%) than noncirrhotic patients. Forty-eight hours after presentation, cirrhotic patients had a persistently higher incidence of coagulopathy (77% *versus* 44%) despite receiving more fresh frozen plasma (10.8 units *versus* 4.4 units). Cirrhotic patients had higher NPWT output (4427 mL *versus* 2375 mL) and developed higher vasopressor infusion rates (57% *versus* 29%). Cirrhotic patients had fewer intensive care unit-free days (2.3 *versus* 7.6 days) and higher rates of multiple organ failure (64% *versus* 34%), in-hospital mortality (67% *versus* 21%), and long-term mortality (80% *versus* 34%) than noncirrhotic patients.

Conclusions: Cirrhotic patients managed with TAC are susceptible to early acidosis, persistent coagulopathy, large NPWT fluid losses, prolonged vasopressor requirements, multiple organ failure, and early mortality. Future research should seek to determine whether TAC provides an advantage over primary fascial closure for cirrhotic patients undergoing emergency laparotomy.

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Introduction

Cirrhotic patients who undergo abdominal surgery have poor outcomes. Following trauma laparotomy, cirrhotic patients have higher mortality than noncirrhotic patients (45% *versus* 24%) when controlling for age, gender, mechanism of injury, and injury severity.[1] Although cirrhosis does not appear to increase the likelihood of failing nonoperative management of blunt liver injury, cirrhotic patients who fail nonoperative management and require a laparotomy have higher mortality than noncirrhotic counterparts.[2] Emergency general surgery is also hazardous in the cirrhotic patient.[3] A review of non-injured patients with cirrhosis undergoing laparotomy reports 46% mortality for nonelective cases compared to 12% for elective cases.[4] Urgent and emergent abdominal wall herniorraphy among cirrhotic patients has been independently associated with increased morbidity (OR 7.3, 95% CI: 1.4-38) and mortality (OR 10.8, 95% CI: 1.3-91).[5]

Damage control laparotomy has become a preferred management strategy for patients with severely deranged physiology who require emergency abdominal surgery. This includes the utilization of temporary abdominal closure (TAC) techniques which utilize a protective barrier over the viscera, negative pressure wound therapy (NPWT), and techniques to prevent lateral retraction of the fascia while the abdomen remains open.[6-8] Definitive surgical repair is deferred to facilitate physiologic resuscitation to minimize the chances of progression to multiple organ failure.[9-12] In patients with intra-abdominal sepsis, TAC may facilitate early diagnosis and treatment of residual infection, remove cytokine-rich peritoneal fluid, and defer anastomosis until physiologic optimization.[13,14] Among injured patients, TAC may be appropriate following administration of more than 10 units of packed red blood cells, more than 15 L of crystalloid, and presence of acidosis, coagulopathy, and hypothermia.[9,11,12,15-17] Prevention and treatment of abdominal compartment syndrome (ACS) may involve decompressive laparotomy followed by TAC if immediate primary fascial closure is not safe or feasible.[18]

Data regarding the utilization of damage control management and TAC in cirrhotic patients are limited to a report of nine patients with posttraumatic ACS, which included two cirrhotic patients.[19] One cirrhotic patient underwent primary fascial closure and survived, and the other was managed with absorbable mesh bridge placement and had persistent drainage of ascites for 6 wk before succumbing to sepsis and pulmonary failure.[19] Owing to the paucity of literature regarding TAC in cirrhotic patients, management strategies must be extrapolated from studies that may not be generalizable to this population. The purpose of this study was to characterize the effects of cirrhosis on physiologic parameters and outcomes for TAC patients. We hypothesized that cirrhotic TAC patients would have different resuscitation requirements and worse outcomes than noncirrhotic TAC patients.

Methods

We performed a retrospective analysis of patients managed with TAC for intraabdominal sepsis, traumatic injury, or ACS at our institution during a 3-year period ending June 2015. Institutional Review Board approval was obtained. Patients were identified by CPT code modifiers 58 (planned reoperation) and 78 (unplanned reoperation) for all surgeons in the Division of Trauma and Acute Care Surgery. Inclusion criteria were age ≥18, by TAC with NPWT for intraabdominal sepsis, traumatic injury, or ACS, and survival for at least 24 hours following presentation. Patients who had their initial exploratory laparotomy at an outside facility and those with preexisting intestinal fistulas were excluded. Cases of necrotizing pancreatitis were excluded to avoid the confounding effects of significant differences in the preoperative and postoperative courses for this disease process.

All patients were initially managed with TAC per surgeon discretion with intention for planned relaparotomy and sequential abdominal closure attempts at 24- to 48-hour interval. Both commercial and vacuum pack dressings were used for NPWT. Critical care management decisions were at the discretion of the attending surgeon and attending intensivist. If primary fascial closure was not safe or feasible following completion of diagnostic and therapeutic objectives, the fascia was sequentially closed with simple interrupted or figure-of-eight sutures placed at the cranial and caudal portions of the fasciotomy until further closure would result in excessive fascial tension or pathologically elevated airway pressures.

Hypothermia was defined as T_{min} <35.0°C. Acidosis was defined as pH < 7.20. Lactic acidosis was defined as lactic acid >4 mmol/L. Coagulopathy was defined as international normalized ratio (INR) > 1.5 or coagulopathy on thromboelastograph (TEG) (rapid TEG with at least 2 of 4 conditions: activated clotting time [ACT] > 142 seconds [s], clot formation [K] time >143 s, alpha angle <64°, and maximum amplitude [MA] <52 mm; or standard TEG with at least 2 of 4 conditions: reaction time >600 s, K time >180 s, alpha angle <53°, and MA <50 mm).[20] Patients were classified as cirrhotic if they had any of the following: biopsy proven cirrhosis, liver nodularity on imaging studies or intraoperative exploration in conjunction with laboratory value evidence of cirrhosis (elevated INR and thrombocytopenia), or cirrhosis noted as an active disease in the electronic medical record. Model for End-stage Liver Disease (MELD) scores were calculated for cirrhotic patients on presentation and 48 h later as defined by the Organ Procurement and Transplantation Network. The Child-Pugh score could not be calculated because it was difficult to consistently and accurately determine whether NPWT output was composed of blood, ascites, or both based on review of the electronic medical record. Acute respiratory distress syndrome was defined according to Berlin criteria.[21] Acute kidney injury (AKI) was defined as a 2-fold increase in serum creatinine.[22] Multiple organ failure (MOF) was defined as dysfunction or failure of at least two organ systems such that homeostasis could not be maintained without intervention.[23,24] Long-term follow-up was restricted to post-admission clinic visits and hospitalizations at our institution (follow-up range 3 months-3 years).

Statistical analysis was performed using SPSS version 23 (IBM, Armonk, NY) to calculate one-way analysis of variance, Fisher's Exact test, and the Kruskal–Wallis test as appropriate