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Original research

Experience of damage control trauma laparotomy in a limited resource healthcare setting: A retrospective Cohort Study

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HIGHLIGHTS

- Damage control surgery is an effective way of managing severely injured patients in lesser developed countries.
- 55% of the patients survived to discharge.
- Majority of the patients died in the second resuscitating phase.
- Increasing number of transfusions and vascular injury are independent predictors of mortality.

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ABSTRACT

Introduction: Damage control surgery (DCS) is an established option for managing severely injured trauma patients. However, its role in the management of similar patients in the developing world is debatable. The purpose of this study is to describe characteristics and outcomes of patients undergoing DCS.

Methods: All trauma patients requiring laparotomies from 1996 to 2011 at a tertiary care hospital in South Asia were reviewed. DCS was defined in a patient who underwent a truncated laparotomy where the fascia was primarily left open, with the intention of physiological optimization in the Intensive Care Unit, followed by definitive surgery. The primary outcome was in-hospital mortality. Multivariate logistic regression was used to determine the independent predictors of mortality after adjustment for potential confounders.

Results: Of 258 patients, 47 underwent DCS. 40% patients were transferred from other hospitals. The time between injury and operation was 152 minutes (IQR: 90–330). Intra-operative laboratory parameters revealed a median pH of 7.16 (IQR: 7.10–7.27), median temperature of 34.7 (IQR: 34.0–35.4) and median PT of 15.9 (IQR: 12.4–21.2). 55% of the patients survived to discharge from hospital. Of those who died, 86% died before the first take back operation. Packed red blood cell transfusion and vascular injury were independently associated with mortality.

Discussion: Damage control surgery is feasible in developing countries, with more than 50% survival reported at one hospital. Future research should focus on critical care management.

Conclusion: Damage Control trauma laparotomy is feasible in tertiary care hospitals with multidisciplinary trauma teams in lesser-developed countries.

1. Introduction

Damage control surgery (DCS) is a widely accepted surgical approach to manage trauma patients in extremis, as a temporising measure to salvage otherwise non-survivable patients [1]. Credited

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with improving survival in up to 50% of the patients [1,2], DCS involves pausing an operation to achieve physiologic optimisation after control of surgical bleeding in an exsanguinating patient when ongoing blood loss is from hypothermia, acidosis and coagulopathy. An attempt to reverse the lethal triad of death in the critically ill patient is made in the intensive care unit, and the patient is then taken back for definitive and reconstructive operation [3].

DCS relies on optimal resources for pre-hospital in-transit care, intra-operative treatment, interval stabilization and post-operative care. Most studies in literature describe outcomes of DCS in resource-rich healthcare settings [2,4]. However, there is paucity of literature describing the application and outcomes of damage control surgery in resource poor countries. The spectrum of injury and outcomes of trauma care in resource-poor settings are affected by several barriers including limited en-route resuscitation, lack of efficient transport, limited resuscitation resources in the trauma bay, increased time to assemble operating teams and limited resources for intensive care before the take-back operation [5–7]. Hence, the presentation and operative care of patients treated with DCS in these settings are expected to be different from experiences reported in resource-rich environments. The primary objective of this study is to describe demographic, injury characteristics and in-hospital outcomes of patients undergoing damage control surgery and their outcomes at a tertiary care hospital in Pakistan.

2. Materials and methods

2.1. Study setting

The Aga Khan University Hospital (AKUH) is a tertiary care hospital located in the metropolitan city of Karachi, Pakistan. It serves an estimated population of 15.5 million people in Karachi as well as northern Pakistan and Eastern Afghanistan [8–10]. Patients managed at AKUH are considered representative of the patient population throughout the region [8–10]. The Aga Khan University Hospital serves as a primary and referral trauma center, equipped with trauma resuscitation room, diagnostic radiology, dedicated emergency operating room, and a multidisciplinary trauma team [11]. This hospital has a total capacity of 577 beds distributed over 15 inpatient units. Approximately 10% (55/577) of the beds are critical care. AKUH is the largest privately owned hospital in Pakistan with a pay-for-service model of health care delivery [12].

Currently, there are 63 full-time and 23 part-time faculty members in the department of surgery. Surgical expertise of five surgeons was employed in this study. All surgeons have completed certified post-graduate training in general surgery. In 2002, trauma quality improvement (TQI) initiatives were implemented. Important TQI initiatives in this context included: 1) Establishing a multidisciplinary trauma team, 2) Training of faculty and residents using adapted American College of Surgeons (ACS) Advanced Trauma Life Support protocols, 3) Establishing an Emergency Room trauma rush call generation protocol, 24-h availability of dedicated trauma resuscitation, operating rooms and computed tomography scanning, 4) Collaborating with Interventional Radiology to perform angio-embolization, 5) Availability of modern intra-operative surgical devices, 6) Collaborating with Hematology to setup a massive transfusion protocol, 7) Improving post-operative care with dedicated trauma care nurses [13,14].

2.2. Data collection and statistical analysis

A retrospective review of medical records of all trauma patients admitted to AKUH who underwent a laparotomy from January 1, 1996 to July 31, 2011 was conducted. The inclusion criteria were all patients who underwent DCS at AKU. In this study, DCS was defined as a patient who was in extremis and undergoing a truncated laparotomy (DCS part 1) followed by a plan for physiological optimization in the ICU (DCS part 2) and further definitive management at a later, second operation (DCS part 3). Different techniques (towel clips, Op-Site and home-made vacuum dressing) were used for closure at the time of the initial operation for temporary abdominal wall closure. The medical records of these selected patients were reviewed by a trauma fellow or senior surgical resident.

Information was recorded on a standardized questionnaire. Data was collected on: demographic details (age, gender), transfer status, injury characteristics (type of injury, Injury Severity Score (ISS), Revised Trauma Score (RTS), vitals on arrival to the ED, Glasgow coma scale score, associated injuries), laboratory parameters at admission (hemoglobin, PT, pH, core temperature), transfusion details, DCS and definitive surgery characteristics (vitals, hemoglobin, PT, pH, core temperature, blood loss, transfusions, bowel, solid viscera and vascular injury and procedures), ICU management (fluids, transfusions, inotropic support, ventilator parameters), short-term post-operative complications and in-hospital mortality (Fig. 1). The Injury Severity Score is an anatomical scoring system that provides an overall score for patients with multiple injuries. Each injury is assigned an Abbreviated Injury Scale (AIS) score. AIS divides the body into six regions (head and neck, face, chest, abdomen, pelvis, and extremities and general) and classifies the severity of injuries in each region based on clinical experience (1 = minor; 2 = moderate; 3 = severe, not life-threatening; 4 = severe, life threatening, survival probable; 5 = critical, survival uncertain; 6 = fatal). The ISS score is defined as the sum of the squares of the single highest AIS scores in each of the three most severely injured body regions (score 0–75) [15]. Injury-ED time and ED-OR times were also calculated based on time of injury, time of arrival to ED and OR.

The primary outcome of this study was mortality. Student's t test was used to compare continuous variables. If the assumptions of this test were not met (Shapiro-Wilk normality test), the Mann-Whitney U test was used. Fisher's exact analysis was used to compare categorical variables (Expected value in cell less than five). Multivariate logistic regression was used to determine the independent predictors of mortality and their effect sizes after adjustment for potential confounders. Only variables which were found to be significant on univariate analysis ($p < 0.05$) were included in the final model. The final mortality model included the following variables: hypotension on arrival to ED, Injury Severity Score, number of pRBC transfusions and presence of vascular injury. Temperature on arrival to ED was not included in the final model due to the high missing rate (24/47 patients). All analysis was done

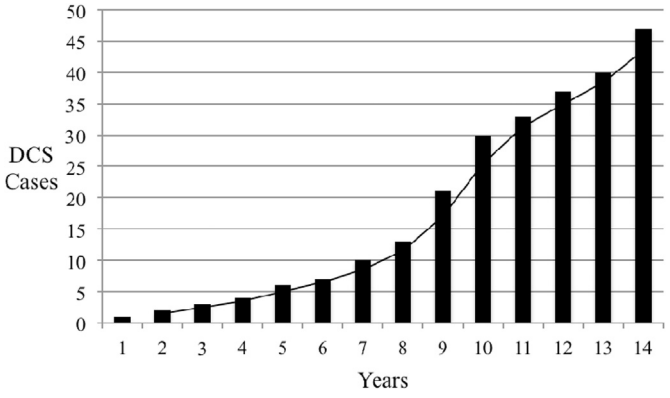

Fig. 1. Cumulative distribution of patients undergoing DCS from 1996 to 2011. Solid line represents moving average.