

BRIEF REPORT**Modern Trauma Care: Damage Control Surgery and Damage Control Resuscitation-Brief report**

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ABSTRACT

Damage control surgery strategy (DCS) rested on rapid control of bleeding, containing abdominal contamination, resuscitating patient and performing definitive surgery on stabilized injured patients. Initially described and evolved in liver trauma surgery, the DCS implementation has resulted in improving the critically injured patient survival leading to its widespread use in intra and extra-abdominal trauma and acute abdominal emergencies. Currently, the DCS strategy has become the standard practice for severely injured patients. However, the evolu-

tion of the DCS research has led to the development of the concept of damage control resuscitation (DCR) which includes early and massive blood transfusion, fluid restriction and permissive hypotension. The DCS and DCR form conjointly modern trauma care for critically injured patients.

KEYWORDS

damage control surgery, damage control resuscitation, permissive hypotension, outcomes.

INTRODUCTION

Haemorrhage remains the leading and major preventable primary cause of death in traumatic injury.⁽¹⁾ Definitive surgery in severely injured patients is detrimental to outcomes resulting in aggravating the injury and physiologic disorders.⁽²⁻⁴⁾ Hence, the main preoccupation of trauma surgeons was the early, rapid and effective control of bleeding to allow patient resuscitation and decreasing mortality. Subsequently, the continued research in trauma care has first led to the development of damage control surgery concept (DCS) followed by the damage control resuscitation (DCR) which is considered as the best recent achievement in severe trauma injury.⁽³⁾ The combined use of DCS with DCR forms the modern trauma care, leading to increased improvement of survival and outcomes in injured patients with physiologic derangement.^(3, 5)

DAMAGE CONTROL SURGERY

Initially described in liver trauma management with favorable outcomes,⁽⁶⁻⁸⁾ the damage control surgery concept (DCS) has been rapidly endorsed by the surgical emergency community of different specialties as a treatment strategy for critically trauma injured patients.⁽³⁾ The DCS concept is principally rested on early and rapid control of bleeding, containing abdominal infection, delaying definitive surgery and allowing patient resuscitation in severe injury with

physiologic disorders.⁽³⁾ So, staged surgery, restoration of patient physiology and performing definitive surgery on the resuscitated patient are the fundamental of DCS strategy.^(4, 5, 8-10) When appropriately implemented, the DCS strategy benefits on survival and outcomes has been demonstrated over time.^(5, 8-11) However, the DCS approach is associated with prolonged hospital stay length, high costs and increased care resources use. Additionally, the patient treated with DCS is subjected to multiple iterative surgeries.⁽¹²⁾ Therefore, it is so important to make the right decision regarding the DCS strategy use. Initially, the indication of DCS strategy was based on clinical experiences,⁽¹³⁾ however, to limit the overuse; some thresholds have been adopted as indicators for DCS including the pre and intraoperative fluid administration (> 10 units of RBCs or 12 liters of blood products and crystalloids), uncontrollable bleeding, physiologic derangement, severe multiple injuries (ISS \geq 25), prolonged operative time (> 90 minutes), partial response to resuscitation measures, and difficulties to make an appropriate treatment decision. Overall, the DCS indication must be based on the intraoperative dynamic response to resuscitation rather than the preoperative physiologic conditions.^(12, 13) The proved benefits of DCS strategy has led to the extent use of this treatment method in the acute surgical abdominal and

extra-abdominal emergencies.⁽¹⁴⁻¹⁶⁾ However, the reduced number of published studies cannot allow conclusion regarding the definitions and principles of DSC strategy in the context of acute surgical emergencies

DAMAGE CONTROL RESUSCITATION

Resuscitation remains a crucial step in the management of severely injured patients and it should be started in the emergency room and continued intra and postoperatively. However the high volume resuscitation resulted in the development of pulmonary and intestinal edema, and subsequent abdominal compartment syndrome (ACS) with a high associated mortality rate.^(9, 17) The continued research on trauma care has led to the adoption of a new concept of damage control resuscitation (DCR). The DCR incorporates early and massive blood product transfusion, restriction of crystalloid administration and permissive hypotension.⁽¹⁸⁾ So, DCR aims principally to allow rapid and early correction of physiologic derangement and post-traumatic bloody vicious cycle.⁽¹⁹⁻²²⁾ When correctly implemented, combined use of DCR with DCS showed a clear benefit on survival with reducing mortality,⁽²³⁾ decreasing hospital stay length and need for DCS strategy,⁽²²⁾ and increasing definitive surgery rate during the first operation.⁽²⁴⁾ This shift towards performing complete surgery was associated with significant reductions in health care costs and resource utilization with increasing primary abdominal closure.⁽²⁵⁾ More recently, the DCR strategy has reduced the need for surgical hemostasis in severe liver trauma by directly addressing the trauma-induced coagulopathy.⁽²⁶⁾ Therefore, the DCR combined with DCS forms the current modern trauma care.⁽²⁷⁾

PERMISSIVE HYPOTENSION

Described in 1994,⁽²⁷⁾ permissive hypotension (PH) concept is a major topic of recent trauma research and a component of DCR. PH aims to decrease bleeding from injured tissue or operative site and facilitating surgical hemostasis.^(28, 29) The PH implementation allows easily complete bleeding control resulting in reducing blood product crystalloid administration and, decreasing postoperative coagulopathy and early mortality.^(28, 30-32) Currently, there is no consensus on when and how to implement permissive hypotension during resuscitation and its duration. However, Hypotensive strategy can be applied perioperatively, and once control bleeding obtained, the blood pressure should be maintained to a normal level. Also, PH can be implemented in the preoperative setting and in a severely injured patient who responds to resuscitation measures or needs transfer to the trauma care center

CONCLUSION

Damage control surgery and damage control resuscitation is the great documented achievement of trauma research

and forms the current modern trauma care. When appropriately implemented, the DCS combined with DCR has resulted in improving patient survival and outcomes.

Conflict of interest statement: none declared.

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