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John C. Mayberry and Martin A. Schreiber

**Initial Management of the Trauma Patient** 1  
Christopher F. Richards and John C. Mayberry

Critical care specialists should be familiar with the initial management of injured patients. Dividing the evaluation and treatment of the patient into the primary, secondary, and tertiary surveys ensures that the multiply injured patient is managed expeditiously. The primary survey identifies the acute life-threatening problems that must be managed before proceeding. The secondary survey identifies the remaining major injuries and sets priorities for definitive management. The tertiary survey identifies occult injuries before they become missed injuries.

**Coagulation Defects in Trauma Patients: Etiology, Recognition, and Therapy** 13  
Thomas G. DeLoughery

Hemostatic complications are common in trauma patients. These coagulation defects may be related to many processes, ranging from pre-existing disease to complications of therapy. The coagulation defects that occur in trauma patients are complex in origin and are caused by many, often interacting factors, including dilution of hemostatic factors by fluid or blood resuscitation, hypothermia, tissue damage from trauma, and effects of underlying diseases. Although empiric therapy may be warranted, a rational approach to laboratory testing and product replacement is important. Therapy is directed at correcting the coagulation defects, treatment of related problems such as underlying bleeding disorders, and therapy for complications such as hypothermia.

## **Management of Brain and Spine Injuries**

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Randall M. Chesnut

The aspects of care of central nervous system injury with the most potential for maximizing recovery are maintaining a high index of suspicion of brain and spine injury in all trauma patients, expeditious imaging, prompt and full resuscitation, avoidance of secondary insults, and meticulous critical care. The importance of the roles of prehospital care providers and the trauma team cannot be overemphasized. Optimizing perfusion is paramount in spine and brain injury, accomplished by volume resuscitation and maintaining oxygen carrying capacity. Monitoring intracranial pressure in all severe brain injuries is mandatory and should be initiated as soon as possible. Treating intracranial hypertension requires conscientious critical care, supplemented by a physiology-based, hands-on treatment approach. Careful attention to detail is primarily responsible for the significant advances made in improving outcome from spinal and brain injuries over the last several decades.

## **Blunt Cardiac Injury**

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Jess M. Schultz and Donald D. Trunkey

The incidence of blunt cardiac injury (BCI) following blunt thoracic trauma has been reported to be greater than 20%. No gold standard exists to diagnose BCI. If a concern for BCI arises, diagnostic tests should be used to identify those patients who are at risk of developing cardiac complications as a result of BCI. The prognosis and outcome following BCI is encouraging.

## **Blunt Thoracic Trauma: Flail Chest, Pulmonary Contusion, and Blast Injury**

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Sandra Wanek and John C. Mayberry

Blunt thoracic trauma can result in significant morbidity in injured patients. Both chest wall and the intrathoracic visceral injuries can lead to life-threatening complications if not anticipated and treated. Pain control, aggressive pulmonary toilet, and mechanical ventilation when necessary are the mainstays of supportive treatment. The elderly with blunt chest trauma are especially at risk for pulmonary deterioration in the several days postinjury, and they should be monitored carefully regardless of their initial presentation. Blunt thoracic trauma is also a marker for associated injuries, including severe head and abdominal injuries.

## **Management of Post Traumatic Respiratory Failure**

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Andrew J. Michaels

Acute respiratory distress syndrome (ARDS) is a severe and common complication of major trauma. The most important early

management principle is to identify the inciting event and remove the ongoing insult aggressively. It is important to immediately resuscitate the patients and prepare them for a complex and difficult hospitalization. Avoiding secondary insults is the cornerstone of supportive care, and this is based primarily on aggressive immune surveillance, full nutrition, and unrelenting oxygen delivery. The use of aggressive immune surveillance, nutritional support, and fluid management is critical to support ventilator management for oxygenation and ventilation. In general, although essential, the ventilator has great potential for harm in patients who are compromised seriously with ARDS. Physicians must establish reasonable therapeutic goals based on oxygen delivery rather than arbitrary normal values of blood gas measurement. The impact of the ventilator should be limited with regard to aspiratory pressure, tidal volume, inspired oxygen, and levels of expiratory end expiratory pressure. Use of pulmonary toilet, including therapeutic bronchoscopy; patient positioning, including intermittent prone positioning, and recruitment maneuvers are useful therapeutic complements for maintaining functional residual capacity and decreasing shunt. Overall, ARDS represents a clear indication that the patient is failing to meet the demands of their stress and without prompt attention likely will die. It is a challenge and an opportunity to identify the underlying situation and to manage the patient while not causing additional harm as the patient's intrinsic resources can bring about the healing necessary to recover from the situation of extremis.

## **Damage Control Surgery**

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Martin A. Schreiber

Damage control is a staged approach to severely injured patients predicated on treatment priorities. Initially, life-threatening injuries are addressed expediently, and procedures are truncated. Normal physiology is restored in the ICU, and patients subsequently are returned to the operating room for definitive management. This strategy attenuates the bloody vicious cycle and results in improved outcomes. Novel technologies contribute to the effectiveness of damage control.

## **Critical Concepts in Abdominal Injury**

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S. Rob Todd

Missed intra-abdominal injuries are one of the most frequent causes of potentially preventable trauma deaths. The evaluation and management of abdominal trauma are dependant on multiple factors, including mechanism of injury, location of injury, hemodynamic status of the patient, neurologic status of the patient, associated injuries, and institutional resources.

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D. Sue Slone

The understanding of the importance of nutrition, particularly in the critically ill and injured patient, is based on known physiologic consequences of malnutrition and includes respiratory muscle function, cardiac function, the coagulation cascade balance, electrolyte and hormonal balance, and renal function. Nutrition affects emotional and behavioral responses, functional recovery and the overall cost of health care. Identifying and treating malnourished or potentially malnourished patients is critical.

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The management of polytrauma patients is clinically challenging and requires a multi-disciplinary team approach. Early stabilization of fractures in these patients represents the optimal treatment for polytrauma patients with orthopedic injuries. Early orthopedic intervention in long bone fractures and pelvic ring injuries has been shown to decrease pulmonary complications, improve hemodynamic stability, reduce ventilator time, and facilitate early patient mobilization. These factors decrease mortality and improve outcomes for patients with multiple injuries.

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Darren J. Malinoski, Matthew S. Slater, and Richard J. Mullins

Crush injuries resulting in traumatic rhabdomyolysis are an important cause of acute renal failure. Ischemia–reperfusion is the main mechanism of muscle injury. Intravascular volume depletion and renal hypoperfusion, combined with myoglobinuria, result in renal dysfunction. The infusion of intravenous fluids prior to extrication or soon after injury may lessen the severity of the crush syndrome. Serum creatine kinase levels can be used to screen patients with crush injuries to determine the severity of injury. Once intravascular volume has been stabilized, and the presence of urine flow has been confirmed, a forced mannitol–alkaline diuresis for prophylaxis against hyperkalemia and acute renal failure should be instituted. If an extremity compartment syndrome is suspected, one should have a low threshold for checking the intracompartmental pressures. Further studies are needed to demonstrate if any treatment regimen is truly superior to early, aggressive crystalloid infusion.

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