A Case Study of a Multiply Injured Patient

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KEYWORDS

- Multiples injuries
- Evaluation
- Pain control
- Management
- Case studies

KEY POINTS

- The initial evaluation of severely injured patients requires an organized, rapid, and thorough evaluation of the patient where life-threatening injuries are identified and treated simultaneously.
- Epidural analgesia is the preferred technique for pain control in adults with severe chest wall injury unless contraindicated. Early use of rib blocks for all rib fractures is another technique to control pain until an epidural catheter can be placed.
- Improving tissue perfusion and correction of acidosis in a trauma patient with hemorrhagic shock is achieved via volume restoration initially with balanced salt solutions and blood as necessary.
- In the hemodynamically normal patient, nonoperative management of splenic injury is successful 90% to 95% of the time. This strategy should be the initial treatment modality of choice, irrespective of the degree of injury.
- All critically injured patients with associated risk factors should receive some form of stress ulcer chemical prophylaxis. There is no difference in efficacy between histamine 2 blockers, proton pump inhibitor, or mucosal protectant agents.
- The multiply injured trauma patient is at high risk for venous thromboembolism. Prophylaxis requires chemical and mechanical methods that should be started as soon as possible after admission. When a brain injury is present but stable based on computed tomography, chemical prophylaxis is safe.

Mr. T is a 50-year-old man who was the unrestrained driver in a motor vehicle crash. He was traveling approximately 65 mph when he lost control, drifted into a ditch, and struck a tree head on. The vehicle had sustained significant intrusion damage into the driver’s compartment, with a fractured windshield and airbag deployment. Mr. T was found unconscious in the field several meters from the vehicle with labored breathing and an obvious lower extremity deformity. His initial vital signs included a heart rate of
137 bpm, blood pressure of 98/62 mm Hg, a respiratory rate of 40 breaths per minute with oxygen saturations at 96%. He arrives to your trauma bay in full spine precautions, a semi-rigid C-collar, a 20-gauge IV in his left hand with 500 mL of 0.9 normal saline hanging, and oxygen via face mask at 10 L/min.

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THE ABCDEs OF TRAUMA EVALUATION

The American College of Surgeons Committee on Trauma devised a systematic approach that recognizes that life threatening injuries must be identified and treated before definitive workup. This approach is outlined in the Advanced Trauma and Life Support course, and has become the gold standard for the evaluation of the injured patient. Principles from the Advanced Trauma and Life Support course emphasize that initial management must focus on 5 initial assessments:

1. Airway maintenance with cervical spine protection;
2. Breathing and ventilation;
3. Circulation with hemorrhage control;
4. Disability and neurologic status; and
5. Exposure/environment: Completely undress the patient and prevent hypothermia.

Our patient is breathing 40 times a minute. The question is whether the patient has an airway or breathing problem. Getting the patient to speak is a quick way to ascertain if his airway is adequate or not. Our patient can speak, although is short of breath. On further inspection he is not expanding his left hemothorax and a clinical diagnosis is made of a left pneumothorax or hemothorax.

This is a decision point regarding interventions. If the patient is normotensive and not hypoxic, a chest x-ray can confirm the clinical suspicion. Alternatively, if blood pressure or oxygenation is abnormal, then immediate placement of the chest tube is appropriate. Based on this patient’s pulse, blood pressure, and falling oxygen saturation, a decision is made to place a left chest tube.

A chest tube is placed in a posterior lateral position and 500 mL of blood returns. A chest x-ray is obtained, which shows the chest tube to be in good position and the lung expanded. It also demonstrates multiple left-sided rib fractures. The patient is noted to have a flail chest on the left and his oxygen saturation is only 90%. Flail chest is defined as segmental fractures of 3 or more adjacent ribs resulting in an unstable segment of chest wall that moves paradoxically during respiration. Another decision now is whether intubation is required or not. Current protocols employ selective intubation along with adequate pain control for most patients with a flail chest.

Management of Rib Fractures and Flail Chest

Chest wall injuries vary significantly in terms of injury severity. Rib fractures represent high-energy trauma to the chest wall and increasing numbers of rib fractures are associated with increasing pulmonary morbidity and mortality. Flail chest is associated with mortality rates between 10% and 20%. Flail chest occurs when at least 3 contiguous ribs are fractured in multiple segments. Paradoxic movement of the chest wall occurs as the patient generates negative intrapleural pressure during inspiration. Although flail chest increases the work of breathing, the greatest source of ventilatory dysfunction occurs from the underlying pulmonary contusion. Contused segments of lung have decreased compliance, increased pulmonary vascular resistance, and increased
capillary leak resulting in hypoxia from ventilation-perfusion mismatch. As a result, current treatment strategies are aimed at reducing pain secondary to the rib fractures, which should allow improved ventilation and oxygenation.

**Principles of pain management**

Immobility of the chest wall as a result of patient splinting is thought to be a major contributor to hypoventilation, atelectasis, pneumonia, and ventilatory failure after severe injury. The mainstay of pain control in trauma patients has been parental narcotics. A patient-controlled analgesia regimen with a fast-acting opioid is an appropriate starting point. Nonsteroidal anti-inflammatory drugs, such as ketorolac and muscle relaxants, are also effective adjuncts for patients with mild to moderate injuries. The doses of pain control agents, particularly opioids, vary among individuals depending on prior narcotic use, injury severity, and patient’s perception of pain. As a result, optimal pain control requires careful monitoring and titration according to individual patient response. Intercostal nerve block using a combination local anesthetic with or without epinephrine involves the administration of 2 to 3 mL of solution into the inferior margin of the rib is also an employed for pain control. A benefit of rib blocks is that they can be given early in the patient’s course and require no special administration techniques. A drawback of rib blocks is that pain control is short limited, lasting up to only 6 hours, and only technically feasible for mid to lower rib fractures.

For patients with severe chest wall injuries (≤4 rib fractures), epidural analgesia (EA) demonstrates promising results for pain control and decreased morbidity and mortality from respiratory complications. The Eastern Association for the Surgery of Trauma has stated that EA is the optimal modality of pain relief for severe, blunt, thoracic trauma. They recommend that all patients over the age of 65 be provided EA unless contraindicated and that younger patients with severe blunt chest injury should also be considered for EA. EA can be administered at the thoracic or lumbar level and analgesic agents are delivered via a bolus, continuous infusion, or a patient-controlled demand system. EA has been shown to increase functional residual capacity and vital capacity, and decrease chest wall paradox in flail segments.

Perhaps the biggest advantage of EA is the ability to accomplish this without the sedative effects of parental narcotics, allowing patients to participate with pulmonary toilet.

EA is the preferred technique for pain control in adults with severe chest wall injury unless contraindicated. Early use of rib blocks for all rib fractures is another technique to control pain until an epidural catheter can be placed. Further evaluation of Mr. T shows him to be alert, yet confused and anxious. He has weak and thready pulses in his upper extremities and lower extremities bilaterally and an open femur fracture. His skin is pale and cool to the touch and his vital signs now read: pulse, 138 bpm; blood pressure, 88/68 mm Hg; respiratory rate, 34 breaths per minute; and oxygen saturation, 99% via facemask. Although his oxygenation problems have been solved, he remains hypotensive with a tachycardia. A diagnosis of hypovolemic shock is most likely.

Treatment of this patient’s shock begins with placement of 2 large-bore IVs and infusion of crystalloid. An infusion of 2 L of a balanced salt solution, such as lactated Ringers, is an appropriate starting point. If he continues to show signs of poor tissue perfusion or shock, blood is indicated. Any external blood loss should be controlled at this time. His femur fracture is an obvious source of blood loss and, unless external bleeding is obvious, placing the injured leg in a traction splint prevents further blood loss and relieves pain associated with any patient movement during the rest of the
evaluation. Pulse assessment before and after splint application is necessary. Open fractures should be covered with a sterile wet dressing and antibiotics should be given. Early fracture fixation improves patient outcomes.

Improving tissue perfusion and correction of acidosis in a trauma patient with hemorrhagic shock is achieved via volume restoration, initially with balanced salt solutions and blood as necessary. Vasopressors, steroids, and sodium bicarbonate are not indicated in the initial resuscitation.\textsuperscript{10}

After infusion of 2 L of lactated Ringers solution and 2 U of packed red blood cells (PRBCs), the patient’s pulse slows to 106 bpm and his blood pressure improves to 110/72 mm Hg. He remains confused, but seems calmer and is able to cooperate with the remainder of the examination. The pulse in his left lower extremity remains palpable after gentle reduction of his femur fracture as preparations are made for a hare traction splint.

Mr. T opens his eyes to speech, localizes to pain, and is confused when answering questions about his crash. Papillary examination reveals 3-mm, symmetric, and reactive pupils bilaterally. A Glasgow Coma Scale (GCS) score is calculated at 12, which indicates a moderate head injury. Exposure does not reveal any further external injuries.

Because the patient is now hemodynamically normal with adequate oxygenation. A complete history and physical is completed without any new findings. A decision regarding imaging studies is needed.

\textbf{Imaging}

Hemodynamically abnormal patients should not be sent for computed tomography (CT) because of the chance that their clinical condition can rapidly deteriorate despite adequate monitoring. Focused Assessment Sonography in Trauma (FAST) and diagnostic peritoneal lavage are important adjuncts used to identify sources of blood loss in hemodynamically abnormal patients and are not discussed further here. Before determining necessary diagnostic studies, it is important to categorize all injuries requiring further evaluation. Our patient’s depressed level of consciousness and possible skull fracture warrant evaluation with a noncontrast head CT.\textsuperscript{11} Alert and awake patients without neurologic or distracting injuries who have no neck pain or tenderness on active range of motion can have their C-collars cleared without the need for cervical spine imaging. Because of this patient’s distracting injuries (GCS 12, femur fracture) a noncontrast cervical spine CT is the screening test of choice. Cervical collars should be removed as soon as possible; this can be safely done after a normal helical cervical CT. Patients with persistent posterior neck pain can be further evaluated with flexion/extension films or magnetic resonance imaging based on physician judgment.\textsuperscript{12,13} A thoracic CT scan is appropriate given his sudden deceleration mechanism and lack of a seatbelt use; there is a 2% chance that he may have a missed great vessel injury despite a normal appearing mediastinum on chest x-ray.\textsuperscript{14,15} Finally, Mr. T’s initial presentation in hypovolemic shock, presence of left upper quadrant abdominal tenderness, and potential need for operative intervention for a lower extremity fracture support the need for abdominal CT.\textsuperscript{16} Our patient also requires imaging of his left wrist, femur, knee, and ankle.

CT of the head, cervical spine, chest, abdomen, and pelvis demonstrate a subdural hematoma without evidence of midline shift, 8 left-sided rib fractures associated with a flail segment, and a pulmonary contusion. The left chest tube is in correct position, with resolution of pneumothorax and minimal residual left pleural blood. Last, a grade III splenic laceration and a comminuted midshaft fracture of the left femur are identified.
Management of his various injuries requires a number of critical care skills to be used. Each injury is discussed separately.

**Management of Closed Head Injuries**

Motor vehicle collisions account for 25% of annual hospitalizations and 34% of annual deaths from traumatic brain injury (TBI). The most common mass lesion identified in these crashes is a subdural hematoma, occurring in 20% to 40% of severely head injured patients. This injury results from sheering of the bridging veins that course between the brain parenchyma to the dural layers. Major morbidity comes from the mass effect of the lesion on the brain as well as the associated cerebral contusion beneath the subdural. However, secondary injury is a major source of both morbidity and mortality, and as such the mainstay of treatment is directed at preventing secondary damage. It is well-established that hypoxia and ischemia are the responsible mechanisms for secondary brain injury. Prospective data collected in the National Trauma Brain Injury data bank demonstrate that mortality is doubled in patients who have a single episode of systolic blood pressure below 90 mm Hg and when combined with oxygen saturations below 90%, have poorer neurologic outcomes.17–19

Our patient requires intensive care unit (ICU) admission without invasive intracranial pressure (ICP) monitoring. Current recommendations for ICP monitoring include a severe brain injury defined as a GCS of 8 or lower and evidence of hematomas, swelling, herniation, or compression of the basal cisterns on axial imaging. Optimization of hemoglobin and hematocrit is important for adequate oxygen delivery. However, increased red cell volume results in greater blood viscosity and potentially decreased microvascular cerebral blood flow. The point at which the benefits of hemodilution outweigh reduced oxygen-carrying capacity is unknown. This is supported by Salim et al,20 who performed a retrospective review of 1,150 patients with TBI after blunt injury. Authors found that anemic patients who were transfused had higher mortality rates (odds ratio [OR], 2.19) and more complications (OR, 3.67) than anemic patients who were not transfused.20 Current recommendations indicate traditional goals of a hematocrit of 30% and a hemoglobin of 10 mg/dL are likely optimal. In the index patient, one can reasonably expect 2 U of blood loss each from the splenic laceration, femur fracture, and rib fractures. Having only received 2 U PRBCs thus far makes close hemodynamic monitoring and a need for future transfusion likely. Correction of coagulopathy with fresh frozen plasma should also coincide with PRBC administration.

**Hypertonic saline and mannitol**

Hyperosmolar therapy works to reduce ICP by 2 mechanisms. First, both therapies create an osmolar gradient that causes water to flow from cells within the brain into the systemic circulation. Second, rapid plasma expansion reduces whole blood viscosity, which in turn results in improved cerebral blood flow.17 Hypertonic saline comes in varying concentrations from 3% to 23.4%, and there is no consensus on a standard concentration that should be used for treatment of increased ICP.17,21 Regardless of the solution used, resuscitating hypovolemia to a normal blood pressure and serum sodium concentration between 155 and 160 mEq/L is appropriate. Mannitol is effective at reducing ICP; however, there is sufficient evidence that administration exacerbates hypotension in an under-resuscitated patient. It is therefore contraindicated in this patient.

**Management of Solid Organ Injury**

In the past, most traumatic splenic injuries were treated with celiotomy and splenectomy regardless of the degree of injury based on the fear of mortality from
exsanguination. Originally attempted in children, nonoperative management (NOM) of splenic injury has become more common in adults and is now the treatment of choice in hemodynamically normal patients.

Several grading systems exist describing splenic injury. Most commonly referenced is the American Association for the Surgery of Trauma scale. Ranging from 0 to 5, this scale uses a CT and intraoperative appearance of splenic injury based on degree of hematoma or laceration and proximity to the splenic hilum. Concern that more severe injuries (grades III–V) are not amendable to NOM has been largely disproved. Multiple retrospective and more recently prospective, noncomparative studies have shown that injury grade, and degree of hemoperitoneum is not predictive of NOM failure.\textsuperscript{22,23} NOM is also possible in the presence of multisystem injuries, including those with neurologic impairment; NOM is safe and effective in pediatric and adult populations.\textsuperscript{24,25} The presence of a blush on CT scan indicates ongoing bleeding and is associated with an increased need for operative intervention. Depending on institutional capability, this scenario may represent an area where angiography and embolization may improve NOM success.\textsuperscript{26,27}

In the hemodynamically normal patient, NOM of splenic injury is successful 90% to 95% of the time. This strategy should be the initial treatment modality of choice, irrespective of the degree of injury.\textsuperscript{26,27}

Serial hematocrits, re-imaging, and activity restrictions

Patients undergoing NOM of grade III or higher splenic injuries likely require observation in an ICU setting. A common practice of measuring serial hematocrits and setting a “cutoff” value that triggers either transfusion or operation is not supported in the literature. Careful hemodynamic monitoring, serial physical examinations, and assessment of endpoints of resuscitation (urine output, base deficit) is likely more effective than relying on any 1 laboratory value in determining need for operation. The presence of hypotension despite adequate resuscitation represents a situation in which celiotomy and splenectomy is appropriate. After successful NOM, follow-up CT is controversial and findings rarely alter management. Potential indications for repeat CT include persistent symptoms 1 week after injury or rare instances when a patient may want to resume contact sports or other high-risk activities.\textsuperscript{28,29} Limited evidence exists on the amount of time required for an injured spleen to recover its normal integrity. Bed rest for longer than 24 hours is not associated with decreased rates of delayed splenic rupture and may be detrimental in terms of the risks of thromboembolic complications and immobility. Best evidence supports avoidance of contact sports or activities that involve contact to the torso for at least 2 to 3 months.

Ventilatory Support

All patients with major blunt chest trauma have some degree of respiratory dysfunction. The use of noninvasive methods of assistance, such as continuous positive airway pressure has been shown to decrease mechanical ventilation rates, infectious complications such as nosocomial pneumonia, and overall mortality. As a result, such methods may now be used as a means to avoid mechanical ventilation. When supplemental oxygen, aggressive pulmonary toilet, and noninvasive means of support fail to provide adequate assistance, mechanical ventilation is necessary. Historically, all patients with an unstable chest wall were treated with mechanical ventilation for “internal support” of the flail segment until the chest wall demonstrated evidence of healing. In the 1980s, this concept was challenged. Shackford et al\textsuperscript{30} found that survival was worse in the obligatory mechanical ventilation group owing to complications from mechanical ventilation. They concluded that mechanical ventilation should
be used to correct abnormalities of gas exchange rather than to treat chest wall instability. Overall use of mechanical ventilation decreased from 74% to 38% and mortality decreased from 14% to 8%.

Once the decision to use mechanical ventilation is made, there are no modes of ventilation that are superior to others. In general, volume-controlled modes, such as synchronized intermittent mechanical ventilation, with traditional tidal volumes of 10 to 12 mL/kg are appropriate starting points. Severe pulmonary contusion can result in noncompliant lungs and ventilator-induced lung injury. In these instances, low tidal volume ventilation (6 mL/kg) reduces iatrogenic injury and improve mortality.31,32 The use of positive end-expiratory pressure in acute respiratory distress syndrome serves to improve oxygenation by increasing functional residual capacity and is a useful adjunct for patients with progressive hypoxemia on traditional ventilation. In severe hypoxia, reverse ratio ventilation (I/E ratio) may improve oxygenation by increasing the time spent in inhalation, recruiting alveoli, and decreasing intrapulmonary shunting. A known side effect of reverse ratio ventilation is hypercarbia, which results from insufficient expiratory times. The resulting respiratory acidosis is generally accepted until an arterial pH of 7.25, where a buffer can be added to prevent worsening acid-base status.

Stress Ulcer Prophylaxis

Pathogenesis of stress ulceration and indications for treatment

Stress ulcers are superficial erosions in the gastric mucosa that are common to patients with acute, life-threatening injuries. Unlike the majority of peptic ulcers, the pathophysiology behind the development of stress ulceration is not related to acid hypersecretion or Helicobacter pylori infection. Systemic hypotension resulting in catecholamine release and inflammatory cytokines results in splanchnic vasoconstriction and resulting hypoperfusion of the gastrointestinal tract. Consequently, stress ulceration result from impaired blood flow, not decreased gastric pH. Our patient has a moderate head injury requiring ICU observation along with multisystem trauma, and as such requires prophylaxis. The initiation of prophylaxis should commence at the onset of risk factors, typically admission to the ICU. Duration of prophylaxis is somewhat controversial. Studies evaluating at least 7 days of prophylaxis have not demonstrated a difference in gastrointestinal bleeding rates or mortality. Most studies now recommend discontinuation of stress ulcer prophylaxis after discharge from the ICU setting.33 Our approach is usually to stop the stress ulcer prophylaxis once feeding is started.

Pharmacologic approach to prophylaxis

Once the decision to start prophylaxis is made, the clinician must choose between proton pump inhibitors, histamine-2 blockers, and mucosal protection agents. There are multiple meta-analyses and randomized, controlled trials comparing pharmaceutical regimens for the prevention of stress ulceration. All agents are effective relative to no prophylaxis in the prevention of clinically significant mucosal ulceration. There is no consensus that a single agent is more effective than another with similar rates of side effects, such as the development of nosocomial pneumonia.34–36 Histamine-2 antagonists and proton pump inhibitors can be given orally or intravenously with a goal of maintaining the gastric pH to greater than 4. Sucralfate is an aluminum salt of sucrose that works by maintaining the structural integrity of gastric mucosa. For maximum efficacy, 5 to 10 mL must be administered orally or via nasogastric tube every 4 to 6 hours. A potential drawback to the use of sucralfate is that it binds and blocks absorption of many common drugs used in an ICU setting. Also, sucralfate should not be used in patients with renal failure, owing to accumulation of aluminum.
All critically injured patients with associated risk factors should receive some form of stress ulcer chemical prophylaxis. There is no difference in efficacy between histamine-2 blockers, proton pump inhibitors, or mucosal protectant agents.

**Venous Thromboembolism**

**Scope of the problem and associated risk factors**

The trauma patient population is at highest risk for developing venous thromboembolic (VTE) complications. Without prophylaxis, up to 60% of trauma patients will develop a deep vein thrombosis. With prophylaxis, the risk of symptomatic VTE ranges from 1% to 7.6%. In fact, pulmonary embolism is the third most common cause of death in trauma patients who survive beyond hospital day 3. Major trauma often precipitates Virchow’s triad: Hypercoagulability, stasis, and endothelial injury. Long bone fractures, pelvic fractures, head injury, prolonged immobilization, and spinal cord injury are the most commonly identified risk factors.

**Methods of prophylaxis**

There are multiple mechanical and chemical modalities available for the prevention of VTE. In the general trauma patient population, chemical prophylaxis with low-dose unfractionated heparin or low molecular weight heparin in conjunction with mechanical prophylaxis is started on admission to the hospital or as soon as bleeding risk is acceptable. Mechanical methods of prophylaxis including sequential compression devices or intermittent pneumatic compression devices are effective relative to no prophylaxis or if chemical methods are contraindicated. However, best practice is to use them in conjunction with chemical prophylaxis when not contraindicated by the presence of a lower extremity injury.

The index case presents an additional consideration in the timing of chemical prophylaxis: Intracranial bleeding. Evidence suggests that among patients with TBI, symptomatic VTE rates may be as high as 15% if prophylaxis is delayed longer than 48 hours. Unfortunately, few studies have examined bleeding risk associated with thromboprophylaxis in the presence of a brain injury. In a prospective study of 525 brain-injured patients who received prophylaxis within 48 hours of admission, 18 had progressive hemorrhagic changes on head CT, resulting in 6 in whom there was a change in management. These findings were echoed in a similar retrospective study in which 402 patients received chemical prophylaxis 24 hours after repeat head CT imaging and did not show evidence of progression of intracranial bleeding. A nonsignificant 11 of 402 patients demonstrated progression of their head bleed versus 26 of 410 patients who did not receive prophylaxis. The conclusion was that VTE prophylaxis can be safely started in this population after 24 hours if CT of the brain shows no further bleeding. This clearly represents an area where further prospective research regarding all modalities of VTE prophylaxis is warranted. Our approach uses these data in a multidisciplinary approach with neurosurgical consultation in determining optimal timing of VTE prophylaxis in TBI patients.

The multiply injured trauma patient is at high risk for VTE. Prophylaxis requires chemical and mechanical methods that should be started as soon as possible after admission. When a brain injury is present but stable based on CT scanning, chemical prophylaxis is safe.

**Chest Tube Management**

Pneumothorax or hemothorax after an injury is sufficiently managed by chest tube drainage in 85% of patients. Most chest tubes are removed within 3 to 7 days. Prolonged drainage or re-accumulation of blood in the pleural space is an indication for
further drainage. Many approaches are used to resolve this retained hemothorax. A recent study compared many different methods and concluded no method is best, but video-assisted thoracoscopic surgery is commonly used with good success. No timing was identified as best either, but it is usually done within 7 days of injury.\textsuperscript{46} CT is done preoperatively to help guide this minimal invasive technique.

Early Rehabilitation Assessment

As the patient recovers in the hospital, early referral to a physician specializing in physical medicine and rehabilitation is important. Acute rehabilitation centers provide up to 5 hours of coordinated therapy whereby injured patients work on mobility, speech, activities of daily living, and vocational training with the ultimate goal of returning to work as a productive member of the community. The rehabilitation team commonly consists of occupational, physical, and speech therapists; psychologists; orthotists; rehabilitation nurses; and social workers and case managers. The coordination of care is lead by a physiatrist who determines a patient’s disability and then prescribes the appropriate treatments. For patients who do not progress during their hospitalization, or for those with limited functional reserve who cannot participate in intensive inpatient rehabilitation, subacute rehabilitation centers may be useful. These centers offer less rigorous therapies, generally for up to 2 hours each day. For patients with decreased endurance, multiple serious medical comorbidities and deconditioning, nursing homes with limited therapies may be the appropriate option for recovery until the patient can participate in more demanding therapy. Case managers and social workers should be involved early in a patient’s hospitalization to optimize resources, and help with financial issues commonly affecting placement decisions.

The majority of multisystem injured patients return to work after injury rehabilitation; however, up to 80% have some level of impairment. For patients with a prolonged stay in the ICU, only 40% return to their former employment and 23% retire or require prolonged sick leave.\textsuperscript{47,48} Interestingly, injury severity is a poor predictor of return to work. The presence of specific injuries including, TBI, spinal cord, and multiple extremity fractures, are more predictive of functional outcome after trauma.\textsuperscript{49}

SUMMARY

Traumatic injury remains a significant cause of morbidity and mortality for patients worldwide. The initial assessment and management is a sequential process in which all life-threatening injuries are identified and treated systematically. For patients who present in hemorrhagic shock, improving tissue perfusion and correction of acidosis is essential and is achieved via volume restoration with balanced salt solutions and blood as necessary. Once the initial resuscitation is complete, careful categorization of each injury and management pitfalls anticipated when treating them is crucial to providing optimal patient care. Commonly, in a polytrauma situation, 1 injured system directly affects the physiology of another. The prevention of hypotension and hypoxia are critical for best outcomes in patients with TBI. Selective intubation, early pain control, and aggressive pulmonary toilet in patients with severe chest trauma are important management techniques. NOM of blunt solid organ injuries is now the standard of care and should be considered in all patients who respond to initial resuscitative efforts. The prevention of common complications, such as VTE and stress ulceration of the gastrointestinal track, should not be overlooked. The final step to recovery is early involvement of a case manager to evaluate the patient’s support system and a rehabilitation specialist. The ultimate goal in rehabilitation of a multiply injured patient is to return each patient to as much independent function and ability to contribute to society as possible.
REFERENCES