CASE STUDY

A 29-Year-Old With Gunshot Wound to the Spine

Keith Widmeier BA, NRP, FP-C, Andrew Hawk, MD, and Angela Deere, BSN, RN, CCRN, EMT-P

Abstract

A mobile intensive care unit (MICU) was dispatched to transport a critically injured patient with a gunshot wound to the spine from a community hospital to a level I trauma center. The patient transported suffered from a gunshot wound to the left posterior midthoracic region. The patient experienced transient traumatic cardiac arrest before transfer. The MICU crew arrived at the emergency department and found the patient intubated and with a chest tube. Fluid resuscitation was continued, and the patient was transported. At the level I trauma center, the patient was admitted in critical condition. The patient was declared brain-dead on postinjury day 8. Spinal immobilization in penetrating trauma is a controversial topic. This patient met the historic clinical indication for spinal immobilization. The patient's injuries included multiple cervical vertebrae fractures and spinal cord disruption from the penetrating projectile, with the bullet remaining in the patient. Interfacility management by the MICU crew was focused on adequate ventilations and immobilization while continuing to address the patient's shock state. Penetrating injuries to the spinal cord can be devastating. Being aware of the pathophysiology of penetrating spinal injuries, along with current evidence-based practice, will assist providers in making sound clinical decisions for their patients.

A mobile intensive care unit (MICU) was dispatched for an interfacility transport from an urban community hospital coming back to the level 1 trauma center. A 29-year-old man had presented to the emergency department critically injured from a gunshot wound to the upper back. Before arrival of the MICU, he went into cardiac arrest and was resuscitated. The MICU continued patient care and transported him to a level 1 trauma center. On arrival at the level 1 trauma center, the patient was initially evaluated, including radiologic imaging by the trauma service in the emergency department. After continued stabilization, he was admitted to the surgical intensive care unit (SICU). Despite ongoing critical care, the patient succumbed to his injuries and was pronounced brain-dead on postinjury day 8.

Case Report

At approximately 0230 hours, a 29-year-old man presented to an urban community hospital by private vehicle. The patient suffered from a single gunshot wound to the upper, posterior, thoracic region just left of the spinal column. He presented with respiratory arrest and subsequently was noted to be in pulseless electrical activity cardiac arrest. After immediate resuscitative efforts, return of spontaneous circulation was noted. Emergent, resuscitative interventions included cardiopulmonary resuscitation, intubation with an 8.0-mm endotracheal tube, bilateral upper extremity intravenous (IV) access with 18-G intravenous catheters, 2 doses of epinephrine (each one milligram 1:10,000), and multiple liters of normal saline intravenously. In addition, the emergency medicine physician inserted a 28F chest tube into the left pleural space, with minimal blood return into the drainage device. Before MICU arrival, the patient was placed on a ventilator (assist control, respiratory rate = 14, tidal volume = 600 mL, fraction of inspired oxygen = 100%, and positive end-expiratory = 5 cm H_2O). The patient had both a nasogastric tube and urinary catheter placed. During this time, the patient remained comatose. No spontaneous extremity movement was noted.

Timeline: From Injury to Arrival at the Level 1 Trauma Center

0215: Patient suffers gunshot wound to the posterior thoracic cavity
0230: Arrival at urban community hospital with respiratory/PEA cardiac arrest; cardiopulmonary resuscitation et al is initiated
0234: Patient intubated
0238: Return of spontaneous circulation occurs after 2 mg epinephrine and IV fluid boluses
0248: MICU is dispatched to the urban community hospital
0300: MICU crew arrives at bedside for patient assessment and equipment transfer
0315: MICU crew departs referral hospital
0328: MICU arrives at emergency department of level 1 trauma center
0330: MICU crew dispositions patient care to the trauma service

CareFlight Air & Mobile Services, Dayton, OH, USA.

Address for correspondence:
Keith Widmeier, BA, NRP, FP-C, Miami Valley Hospital, CareFlight Air & Mobile Services, 1 Wyoming Avenue, Dayton, OH 45409.
achawk@premierhealth.com

1067-991X/$36.00

http://dx.doi.org/10.1016/j.amj.2015.01.003

With return of circulation, arrangements were made to emergently transfer the patient to the level 1 trauma center approximately 4.5 miles away. Transport was arranged via a hospital-based MICU staffed with a critical care paramedic and flight nurse. Upon MICU arrival, the crew assessed the patient and transitioned the medical equipment for patient transfer. The emergency medicine attending physician informed the crew that the patient had a bullet noted on the bedside portable chest x-ray, possibly at the level of the upper thoracic spine. Discussion arose as to the need for full spinal immobilization of this patient to include a cervical collar (c-collar), cervical immobilization devices, and a long spine board. Ultimately, the decision was made to place a c-collar only, along with using multiple persons to maintain spinal alignment during movement to the MICU cot. However, because of patient body habitus (neck girth/length), the placement of a c-collar was not possible. Therefore, the crew decided to provide cervical immobilization with an alternative approach to include towel rolls and tape.

Before moving the patient onto the transport cot, the crew and bedside staff logrolled the patient while maintaining spinal immobilization. A penetrating wound with active bleeding was noted in the left, midupper thoracic region. Local hemorrhage was controlled with direct pressure. Multiple caregivers were used to move the patient to the transport cot while maintaining manual spinal immobilization. Once the patient was secured to the transport cot and all medical equipment transitioned, the patient was moved to the MICU. The chest tube drainage device and urinary catheter bag were kept below the patient. During transport, the systolic blood pressure remained at 90 to 100, with pulses palpable in all 4 extremities. The cardiac monitor revealed a normal sinus rhythm, borderline tachycardic. No blood was noted in the chest tube or the pleurovac. Because of the complexity of the patient and the short transport time, manual ventilations were maintained throughout transport without difficulty. The pulse oximeter remained at 100%, and there was good waveform end-tidal CO_2 monitoring at 40.

En route to the level 1 trauma center, the crew infused an additional 500 mL normal saline intravenously because of ongoing borderline hypotension. The patient remained nonpharmacologically comatose. Observation for motor movement was continued. Minimal tongue and mouth movement was noted as well as occasional nonpurposeful movement of the right fingers.

On arrival to the level 1 trauma center, patient care was immediately transferred to the awaiting trauma service. Multiple caregivers were used to transfer the patient to the emergency department gurney while maintaining manual spinal immobilization. The patient had received a total of 5 L normal saline and had 150 mL urine output. No measurable blood had drained from the chest tube; minimal secretions were noted from the nasogastric tube. The trauma team continued the resuscitation and evaluation. The bedside-focused assessment with sonography for trauma examination was negative. Multiple computed tomographic (CT) scans discovered no other sources of blood loss. Spinal CT scans showed a bullet lodged in the soft tissue to the right of the spinous process at C2 as well as posterior fractures of C4 through C7 with bony fragments from C5 and C6 entering the central canal (Figs. 1 and 2).

In the SICU, the patient continued to show evidence of neurogenic shock. His heart rate and blood pressure decreased, the latter to a mean arterial pressure of 60. A central IV line and an arterial line were placed. IV fluid resuscitation was continued, and dopamine was added for blood pressure support in the face of neurogenic shock. The patient remained sedated via IV infusions including fentanyl. By day 3, the patient showed continued neurologic decline including decreased deep tendon, cough, and corneal reflexes. Despite full SICU and neurosurgery support including intracranial pressure monitoring, the patient continued to decline clinically. He was declared brain-dead on day 8. After consent from the family, he was placed on the organ donation list.

Discussion

Initial Assessment

Upon arrival at the referring hospital, the MICU crew immediately assessed the patient's airway, breathing, and circulation. The airway was verified by direct clinical examination of the patient and the endotracheal tube, with further and ongoing confirmation provided by continuous end-tidal CO_2 monitoring. The assessment of breathing was reassuring with clear bilateral auscultation on the ventilator. End-tidal CO_2 and pulse oximetry were also used for this parameter. Circulation assessment revealed evidence of less than baseline peripheral perfusion status after resuscitated cardiac arrest. With the penetrating injury, concern for shock etiology was maintained with intervention continued.

By logrolling the patient to maintain spinal immobilization, the crew was able to assess and confirm a single penetrating injury site. This action also allowed the intervention to reduce ongoing, external blood loss. In this case, the posterior thorax wound was still bleeding and required additional focused direct pressure to control the bleeding.

A quick but thorough evaluation by the MICU crew was a key component of this case. Any delay in transfer to a level I trauma center must be avoided. However, prehospital and critical care transport providers must make sure that a time-efficient assessment is completed in all cases; incomplete assessments may lead to incomplete patient care. As was completed in this case, all wounds should be assessed for ongoing blood loss, with hemorrhage control provided as needed.[1]

Immobilization

Spinal immobilization was the next challenge in this case. In retrospect, the patient suffered neurogenic shock. At the time, however, consideration needed to be made for other types of shock, primarily hemorrhagic. Although the mechanism of injury itself is obvious, is it possible that the