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Resuscitation of Combat Casualties

Unique Challenges and Lessons Learned

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ABSTRACT

Resuscitation and trauma anesthesia of combat casualties is very similar to trauma care in any US hospital—except for the setting. Using case examples, this article describes the principles of trauma anesthesia and resuscitation and the lessons learned regarding the modifications required when caring for a combat casualty. Examples of a massive trauma resuscitation (>10 units of packed red blood cells in 24 hours) and burn resuscitation are presented.

Keywords: Afghanistan, burns, massive transfusion, military, resuscitation, war

Afghanistan

From the shortest and darkest day of the year through the longest and brightest day of the year, the author, a certified registered nurse anesthetist from the US Air Force Reserve, was deployed to Craig Joint Theater Hospital (CJTH), Bagram Airfield, Afghanistan. This article presents his perspective on resuscitation of casualties from combat and noncombat causes.

Craig Joint Theater Hospital is located at Bagram Air Base, approximately 25 miles north of the capital, Kabul (Figure 1). The base, which serves as the main air hub for coalition troops and equipment into and out of the country, was built and maintained by the Soviets between 1979 and 1989. After the Soviets left, Bagram was the main base for the Afghan Air Force. Since October 2001, Bagram has grown, such that its population now rivals that of many small towns in the United States. There has been a US military medical and surgical presence at Bagram since 2001. Initially a US Army Combat Support Hospital, the mission was assumed by the US Air Force in 2007, and CJTH was designated as an Air Force Theater Hospital.

Improvements in body armor and combat vehicles and the advent of damage control surgery have increased survival from combat wounds to 95%.[1,2] One factor contributing to this high rate of survival is understanding the mechanism of injury and implementing standardized evidence-based resuscitation strategies.

Basic Principles of Trauma Resuscitation

The equipment and supplies available in the Anesthesia Department at CJTH are much the same as any stateside medical center. All the anesthesia providers at CJTH worked on the principle that "it's not the anesthesia … it's the setting." In other words, trauma anesthesia in Afghanistan is very similar to trauma

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Figure 1: SSG Heathe N. Craig Joint Theater Hospital, Bagram Airfield, Afghanistan. The hospital, which was opened in 2006, is named for Army Staff Sgt. Heathe N. Craig, a medic with the 159th Medical Company, 10th Mountain Division. SSG Keith was holding desperately to a patient as they were both being hoisted from a ridgeline by a Blackhawk helicopter. Halfway to the chopper, the line snapped, and Craig and his patient fell to their deaths.

anesthesia anywhere else. The setting was the unique part.

Airway and Breathing

Regardless of the setting, it is important to realize that the ABCs (Airway, Breathing, Circulation) are first and foremost. Although every patient should have oxygen administered, not all casualties will require instrumentation of the airway. However, a low threshold for stabilizing the airway should be maintained. Any casualty for whom the mechanism of injury is not known should be suspected of having cervical spine instability until it is proven radiographically and clinically. Emergency department staff and anesthesia providers need to have a working knowledge of and experience with various airway adjuncts (Table 1).[3] Spontaneous ventilatory effort is desirable; however, because of injuries and sequelae, not every patient will be able to maintain adequate effort.

Many casualties arrived at CJTH having already been intubated at a forward surgical team, level II hospital or on board a helicopter (MEDEVAC). If a casualty requires endotracheal intubation, the largest endotracheal tube possible should be inserted to accommodate bronchoscopy, should that become necessary. For most patients, a postoperative goal of extubation is desirable.

The modern anesthesia ventilator is typically capable of various mixes of oxygen-air-nitrous oxide. In a deployed setting, medical-grade compressed air and nitrous oxide are not available; therefore, oxygen as close to 100% is used. However, the use of 100% oxygen presents a potential safety problem when a surgical tracheostomy is performed in the oxygen-enriched airway. Surgical cautery may cause a catastrophic airway fire. Coordination with the surgeon is a priority, and providing the patient with room-air ventilation (with bag-valve-tube) as the cautery is used decreases the possibility of airway fire. As the tracheostomy tube is inserted, the endotracheal tube is withdrawn and the oxygen flow is reestablished via the tracheostomy tube.

Table 1: Common Airway Adjuncts
Oropharyngeal and nasopharyngeal airways
Straight (Miller) and curved (MacIntosh) laryngoscope blades
Eschmann stylet or Gum Elastic Bougie (stylet used to add stiffness or curvature to endotracheal tube for difficult intubations)
Lighted stylet (Lite Wand or Trach Light)
Laryngeal Mask Airway (LMA) (inflatable cuff that is inserted into the pharynx—not endotracheal intubation)
Intubating Laryngeal Mask Airway (a rigid silicone-coated steel airway with the cuff placed into the pharynx, which is used for blind intubation—not endotracheal intubation)
King LT-D (a disposable supraglottic airway created as an alternative to tracheal intubation or mask ventilation)
Combitube (used primarily in the prehospital setting for blind intubation; alternative to LMA)
Air-Q Intubating Laryngeal Airway (a supraglottic intubation device)
Fast-track Laryngeal Mask Airway (used for difficult intubations)
Flexible fiberscope

Circulation

Every casualty will require fluid resuscitation to some extent. Even with bottled water available, combat casualties arrive relatively volume contracted. Evaporation accounts for a large amount of fluid loss. Carrying a combat load of 50 lb or more at the altitudes in Afghanistan (5000–10 000 ft) causes perspiration even on the coldest days. Additionally, in an effort to lighten the carried load, water is sometimes sacrificed, and casualties may arrive having ingested as little as 1 L of water over a period of hours. Blood loss will further dehydrate the casualty. Keep in mind that blood loss may be occult (ie, closed long bone fractures).

Immediate vascular access is a requirement.[4] In the event an intravenous (IV) catheter cannot be placed, the intraosseous (IO) device should be placed. For children, the preferred IO site is just slightly distal to the tibial tuberosity. In adults and children older than 12 years, IO infusion systems offer rapid access into the sternum for any fluid (including blood products) that can be infused with standard IV fluid sets. Infusion rates through an IO device are as high as 150 to 165 mL/min, and fluids administered reach the central circulation within 30 seconds.[5,6]

When IV catheters are placed, short large-bore catheters offer advantages over long central catheters, including rate of administration and ease of insertion. Infusion rates of up to 230 mL/min are possible with the 16-g, 1.16-in IV catheter, and 340 mL/min with the 14-g, 2-in IV catheter. Conversely, a single lumen central line catheter of 16 g and 8 inches will allow a maximum of 57 mL/min. The 7F introducer sheath will accommodate up to 800 mL/min[7]; however, special skill is required to place this access device. In the initial resuscitation of the combat casualty, two peripheral IV catheters will usually suffice. Pressure bags inflated to 300 mm Hg will enhance flow; however, the flow will obviously not exceed the capacity of the catheter. In the burn patient, peripheral IV access may be impossible, and central catheters may then become a necessity.[8]

Fluid Infusion

Rapid infusion of blood products and fluids is best accomplished with a designed rapid infuser, such as the Belmont Rapid Infuser (Belmont Instrument Corporation, Billerica, Massachusetts) or the Level 1 Infuser (Smith's Medical, Dublin, Ohio). Both systems have warming capability, air-in-line detection, and large-volume infusion capacity. A comparison of both systems found slight advantages with the Belmont system.[7] The combination of a short, large-bore IV catheter and a rapid infuser will allow massive fluid and blood product resuscitation.

The crystalloid fluid of choice for trauma resuscitation is 0.9% sodium chloride, otherwise known as normal saline. Blood and blood products can be infused in the same catheter as normal saline, as can most IV medications. When using crystalloid fluid for blood loss replacement, a 3:1 ratio is used. For example, if 150 mL of blood loss is being replaced, 450 mL of crystalloid is infused. Lactated Ringer's (LR) solution is also available, but it is not compatible with blood products. Blood cells infused in the same catheter with LR will hemolyze, which will potentially lead to electrolyte disturbances and will abolish the oxygen-carrying capacity of the infused blood cells.

Colloid fluid available for volume expansion includes Hextend or Hespan and 2 different concentrations of albumin (5% and 25%). Colloid products offer volume expansion far superior to crystalloids. The reason for this is that the crystalloids will move from the intravascular space into the interstitial space quite readily.[9] Colloids stay in the intravascular space for more than 6 hours.

Hetastarch (6% hetastarch) is a colloidal fluid useful for volume expansion in the patient who is volume contracted resulting from insensible losses, such as those seen with dehydration (common in a combat environment) or an extended period of vomiting. Hextend (Hospira, Inc, Lake Forest, Illinois) is an LR-based solution, whereas Hespan is a normal saline-based solution. Hespan, but not Hextend, can be infused into the same catheter as blood products. The maximum volume of either of these expanders is 28 mL/kg[10]; however, the typical scenario involved the infusion of 500 to 1000 mL to the adult casualty over 30 to 60 minutes once he or she was in the operating room.

The choice of crystalloid versus colloid for resuscitation has been the subject of discussion in the literature for many years.[11] The extent and duration of hemorrhage will dictate the type and amount of fluid used. Because crystalloid stays in the intravascular space for only a short time, one may end up "chasing one's tail." Only approximately 250 mL of 1000 mL of infused crystalloid will remain intravascular after 1 hour. On the other hand, 500 mL of 6% hetastarch will expand intravascular volume by approximately 800 mL after 1 hour, and the effect will be sustained for more than 6 hours.[12] Although the immediate volume effects are different, there are no differences in long-term outcomes for patients who receive crystalloids versus colloids. A meta-analysis[13] of 65 randomized controlled trials compared the use of colloid and crystalloid. The analysis found no significant differences in outcomes (rate of infection, length of hospital stay, mortality) when colloid was compared with crystalloid in patients who had experienced trauma or burns, or who were undergoing major abdominal surgery. In 2007, additional studies were added to the meta-analysis,[14] and again there were no significant differences in outcomes.

Availability of blood and blood products depends on a logistics chain to supply these products in a timely fashion, mostly related to their respective shelf life. Typical products in the Air Force Theater Hospital and the Combat Support Hospital include whole blood (WB), packed red blood cells (PRBCs), fresh frozen plasma (FFP), platelets, and cryoprecipitate. When the trauma team is summoned to the trauma bay, one of the laboratory staff responds with a cooler of PRBC units, type O-negative. In the event blood is required before a crossmatch, O-negative blood can be administered. Once the crossmatch is completed, type-specific products are transfused.

Massive Transfusion

Massive transfusion, by definition more than 10 units PRBCs in 24 hours, is likely to be needed for those patients with large trunk, axillary, neck, or groin injuries.[15] Recent analysis of resuscitation efforts in Iraq and Afghanistan has shown that patients with serious injury and risk factors of (1) systolic blood pressure < 110 mm Hg, (2) heart rate > 105 beats per minute, (3) hematocrit < 32%, and (4) pH < 7.25 have an 85% chance of requiring a massive transfusion. A 1:1 ratio of PRBC unit to plasma unit is desired, with 1 unit apheresis platelets (1 apheresis unit = 5–6 packs of platelets) given after every six PRBC and plasma units. The PRBC to plasma ratio has historically been 4:1; however, recent studies have shown better survival advantage with a 1:1 ratio[16,17] (see Bridges and Biever's[18] article in this issue for further discussion of the evidence for 1:1:1 transfusion). An example of a massive transfusion protocol from the Joint Theater Trauma System (JTTS) Clinical Practice Guideline (CPG) is provided in Table 2.[15] The potential benefit of a standardized approach to damage-control resuscitation—which includes massive transfusions concurrent with the correction of coagulopathy, acidosis, and hypothermia—was demonstrated in the evaluation of mortality in casualties receiving a massive transfusion. Before the implementation of the CPG, mortality was 32% compared with 20% after implementation (CPG compliance = 85%).[2] Current long-term survival rates in US and coalition patients who have received a massive transfusion are more than 95%, in contrast to civilian trauma, with survival rates of 40% to 70%.[19] See Case Study 1 for an example of a massive resuscitation.

In the combat casualty, newly banked blood is preferred. Recent developments in critical care and trauma resuscitation medicine, as well as casualty data from the current conflicts in Iraq and Afghanistan, have shown that older banked blood may develop what has come to be known as a "storage lesion." This lesion portends detrimental effects from red blood cells that have undergone metabolic, biochemical, and molecular changes[20] and may predispose patients to multiple organ failure, wound infections, and pneumonia.

Burn Resuscitation

Burn casualties require special resuscitation. Fluid resuscitation of the burn casualty follows the Brooke Army Medical Center standard (JTTS CPG: Burn Care),[21] and the resuscitation is documented on a separate flow sheet (Figure 2) to allow for consistent care as the casualty is evacuated to Germany and on to the United States for definitive burn care. Fluid resuscitation of the burn casualty is a narrow corridor (Table 3). It is important to avoid overresuscitation, as this may cause abdominal compartment syndrome. The use of this standardized approach to resuscitation across the continuum of care significantly decreases mortality and the incidence of abdominal compartment syndrome.[2,22] See Case Study 2 for an example of the initial resuscitation of a casualty with severe extremity trauma and extensive burns.

Patient Characteristics

Many casualties arrive at the Theater Hospital already having undergone lifesaving or limb-preserving surgery. Smaller hospitals (level II) and surgically intensive teams who are forward

Table 2: Example of a Massive Transfusion Protocol at a Central Command Level III Facility

Joint Theater Trauma System Clinical Practice Guideline[a]

(Guideline only—not a substitute for clinical judgment)

Massive transfusion (MT) protocol: A flexible protocol for use in the emergency department (ED), operating room (OR), and intensive care unit (ICU) that can be initiated or ceased by the site-specific provider as dictated by the patient's needs when in that specific venue. It consists of batches as defined below, which vary in composition, but are directed toward approximating a 1:1:1:1 of packed red blood cells (PRBCs), fresh frozen plasma (FFP), platelets, and cryoprecipitate (cryo).

Pack One: 4 units PRBCs and 4 units FFP, should consider 6-pack platelets, cryo, and ± Factor VII

Pack Two: 4 units PRBCs and 4 units FFP

Pack Three: 4 units PRBCs, 4 units FFP, 6-pack platelets, cryo, and ± Factor VII

Pack Four: 4 units PRBCs and 4 units FFP

Pack Five: 4 units PRBCs, 4 units FFP, 6-pack platelets, and cryo

A reassessment of the progress of the resuscitation, hemostasis, and the need to continue the MT protocol should be conducted between the providers taking care of the patient at that time.

Packs Six and Seven are identical to Packs Four and Five

Packs Eight and Nine are identical to Packs Four and Five

Definitions

Emergency release: Uncrossmatched 4 units PRBCs (2 units O+ and 2 units O−) and 4 units AB FFP

Pack: A single group of type-specific, crossmatched 4 units PRBCs and 4 units FFP, which later in the protocol may include cryo, platelets, and/or Factor VII

Flow/order of resuscitation using MT protocol

1. Patient arrives in ED. Initial survey, securing of airway, and resuscitation are initiated by ED provider. Trauma team begins consideration of blood transfusion needs.
2. Surgeon who will be taking the patient to the OR decides:
   —Blood is not needed at the present time
   —Only use "emergency release" of uncrossmatched 4 units PRBCs and 4 units FFP
   —Initiate MT protocol: 4 units PRBCs and 4 units FFP immediately, blood bank begins creating Batch One (emergency release can be used to start but is not counted as Pack One)
3. In the OR, the anesthesia provider, in ongoing evaluation of hemodynamics, lab studies, and hemostatic control as per the operating surgeon, decides to continue the MT protocol, initiate if it was not already done in the ED, or terminate it and notify the blood bank of that decision if the patient has remained stable.
4. Once in the ICU, the critical care provider now has the responsibility for initiating, continuing, or terminating the MT protocol (and notifying the blood bank as appropriate) as the patient's condition and labs dictate.

[a] Joint Theater Trauma System.[15]

deployed in areas may perform damage control operations and initial damage control resuscitation. The Theater Hospital (level III) provides a definitive level of care for the casualty.[23,24] US and coalition casualties stay at the Theater Hospital for only a short period before they are evacuated out of Afghanistan. For host nationals (Afghan civilians, National Army, and National Police), the Theater Hospital is the most definitive level of care that they will

Tx Site/ Team	HR from burn	Local Time	Crystalloid (ml) / Colloid	TOTAL	UOP	Base Deficit	BP	MAP (>55) / CVP	Pressors (Vasopressin 0.04
	1st								
	2nd								
	3rd								
	4th								

Figure 2: Joint Theater Trauma System burn resuscitation flow sheet.
Abbreviations: BP, blood pressure; CVP, central venous pressure; MAP, mean arterial pressure; UOP, urine output.
From the Joint Theater Trauma System. JTTS Clinical Practice Guideline: Burn Care. http://www.usaisr.amedd.army.mil/cpgs/Burn%20Care.pdf. Updated November 21, 2008. Accessed April 2, 2010.

Table 3: Example of Recommendations for Initial Fluid Resuscitation for Burn Casualty[a,b]

Guidelines for Coalition Casualties Who Can Be Evacuated Out of Country

a. Protect airway early using as large-sized an endotracheal tube as possible; 8 mm is strongly preferred, especially if inhalation injury is suspected or noted on bronchoscopy. A large endotracheal tube ensures ease of bronchoscopy and facilitates pulmonary suction, which are critical with inhalation injuries.

b. Calculate burn size using a Lund and Browder chart.

c. Initiate resuscitation using a standard burn formula (1–2 mL/kg/% body surface area [BSA]) (see Burn Resuscitation Flow Sheet), and avoid boluses if possible; preference is given to increasing the rate of intravenous fluids to maintain adequate urine output (UOP), as described later.

d. Monitor UOP closely and decrease or increase the Lactated Ringer's infusion 20% per hour to maintain a UOP of 30–50 mL/hour.

1) Overresuscitation is as harmful as underresuscitation; patients who receive >6 mL/kg/% BSA burn are susceptible to severe complications (acute lung injury/acute respiratory distress syndrome/multiple organ dysfunction syndrome/abdominal compartment syndrome).

2) Hour-to-hour fluid management is critical, particularly during the first 24 hours.

3) Use of the Burn Resuscitation Flow Sheet to record fluid intake and UOP is mandatory.

[a]See complete Clinical Practice Guideline.
[b]Joint Theater Trauma System.[21]

experience. Although there are Afghan hospitals, their care is primarily rehabilitative in nature. Many Afghan casualties are discharged from the Theater Hospital to the care of their family.

In the author's experience, the majority of injuries suffered by the Afghan National Army (ANA) soldiers and Afghan National Police (ANP) officers were caused by improvised explosive devices (IEDs). The vehicle of choice for the ANA and ANP is a simple pickup truck, which is unarmored and not well suited as a combat vehicle. An IED, with as little as 20 pounds of explosives, can destroy a vehicle. Because of this risk, extremity injuries are prevalent (Figure 3). Additionally, even though ballistic goggles were available, they were seldom worn by the ANA and ANP, which may leave them susceptible to ocular injuries. The author's surgical case logbook records open globe injuries to 16 ANA/ANP casualties and only 1 US soldier.

Figure 3: Improvised explosive device–induced severe extremity trauma was a common injury pattern.

Although combat casualty care accounts for a majority of patients, the anesthesia provider also needs to be prepared to assist with the acute management of nonbattle and industrial injuries and acute medical emergencies. Crush injuries and falls are common. Additionally, gall bladder disease, appendicitis, impacted teeth, esophageal foreign bodies, hemorrhoids, sports injuries, and even ectopic pregnancies bring soldiers and civilians alike to the facility. Because of the altitude and cold wet weather, frostbite is an ever-present possibility. In addition, reactive airway disease caused by or coupled with inhaled dust, environmental pollutants, and various industrial fumes may require emergent intubation in the acute setting.

Conclusion

The current conflicts in Iraq and Afghanistan have led to advances in the ways in which combat operations are undertaken. As weapon systems have advanced, so too have medical systems and standards that accompany the combatant into the theater of operations. The combat casualty today receives care almost immediately at the incident scene and is evacuated expeditiously to increasing echelons of care. Less than 10% of those wounded in combat succumb to their wounds, either immediately or during recovery. The use of evidence-based resuscitation recommendations is associated with improved outcomes for these complex patients.

Case Study 1

A 30-year-old US Army soldier sustained a right lower extremity open fracture and fragmentary penetrating trauma to the right midabdomen following an IED blast. An IV was started and his wounds dressed by a combat medic at the scene of the blast. He was evacuated by helicopter (MEDEVAC) to the Joint Theater Hospital. On arrival to the trauma bay, 2 new large-bore IVs were placed, and normal saline was started wide open. His respiratory effort was inconsistent at best, and his arterial blood gas analysis revealed acute respiratory acidosis (pH 7.08; Pa_{CO_2} 52 mm Hg; base deficit [−]8). Blood pressure was 78/palpated, heart rate 127 beats per minute. His extremity wound was bleeding profusely, and his abdomen was taut.

Clinical decisions at this juncture focus primarily on the immediate ABCs. It should be obvious that this casualty is headed into the operating room for lifesaving surgery and continued resuscitation.

Anesthesia was induced in the trauma bay. A rapid sequence induction and intubation were performed. The patient received 100 mg of propofol followed immediately with 100 mg of succinylcholine, and then an 8.0 oral endotracheal tube was placed. Hand ventilation with bag-valve-mask was initiated until he could be placed on a ventilator.

Three units of uncrossmatched, emergency-release, PRBCs were transfused over the next 8 minutes using the Belmont rapid infuser at a forward pressure of 75 to 100 mm Hg and a rate of 125 to 150 mL/min. As long as bleeding is ongoing, blood loss needs to be replaced. Once a crossmatch was completed, type-specific products were administered. Alternating packed red blood cells and FFP were given so that oxygen-carrying capacity and clotting factors were replenished and maintained.

Immediately on the patient's arrival into the OR, while surgical prep and draping were being done, a left radial arterial catheter was placed. While not a necessity, an arterial catheter is strongly suggested. This affords beat-to-beat blood pressure measurement and multiple, rapid blood draws, both of which will help guide the resuscitative effort.

While the trauma surgeons were doing a laparotomy, the orthopedic surgeons were placing external fixation to the lower extremity fracture. From initial incision to final closure, these 2 procedures took less than 45 minutes. During the surgical procedures, resuscitation continued.

Crystalloid, colloid, and blood product resuscitation were used to "fill the tank," while vasopressors (epinephrine, phenylephrine, and vasopressin) were used to make the tank (ie, the intravascular space) smaller, and calcium chloride was administered to maintain cardiac contractility.

During this approximately 90-minute resuscitation, more than 30 units of blood products were administered. IV fluids were <4 L. Too much IV fluid will potentially increase intravascular pressure to the point to which clots are broken away, thereby exacerbating blood loss.

Following the surgical procedures and resuscitation, this casualty was admitted to the ICU and subsequently evacuated out of the theater.

Case Study 2

A 22-year-old US service member was severely burned over his torso, head, neck, and both right extremities when his vehicle was destroyed by a roadside bomb. Combat medics at the scene were able to place an IV catheter and start normal saline fluid replacement. A helicopter MEDEVAC was requested. Before transporting the patient, the flight medics (in this case, National Guard members and civilian firefighter paramedics) intubated him because of their concern for airway edema secondary to his head and neck burns.

For the intubation, an RSII (rapid sequence induction and intubation) technique was used. After administering 5 mg midazolam for sedation, the patient received 10 mg etomidate and 100 mg succinylcholine, after which an 8.0 oral endotracheal tube was placed. Subsequent to the placement of the endotracheal tube, when spontaneous ventilation was returning, chemical paralysis in the form of 50 mg rocuronium was administered. This paralysis helped to facilitate mechanical ventilation and kept the patient from fighting the tube.

The patient arrived at the Joint Theater Hospital via helicopter within 45 minutes of the explosion. In the trauma bay, a primary survey revealed partial- and full-thickness burns over approximately 45% body surface area. The JTTS Clinical Practice Guideline for Burn Care[21] was initiated, with its incumbent flow sheet to guide fluid resuscitation. Fluid was changed from normal saline to LR in accordance with burn resuscitation guidelines. Endotracheal tube placement was confirmed.

A secondary survey in the trauma bay revealed an open fracture of the right leg, approximately midshaft of the tibia, with a large amount of blood loss. No other injuries were found.

The patient was taken to the OR to address the wound of the right leg and for burn débridement and further resuscitation. A radial arterial catheter was placed, and a left internal jugular 7F introducer was placed using ultrasound guidance.

Damage control assessment of the leg determined that the fracture and surrounding tissue trauma were devastating, and the leg was subsequently amputated below the knee. Because of the blood loss associated with this injury, 4 units of type-specific PRBCs were transfused. Further fluids were required, and to avoid overhydrating, albumin was administered. Hypotension was a concern, so a vasopressin infusion was initiated and continued into the ICU admission.

Escharotomy of the right arm and the right side of the trunk was performed to allow circulation to the underlying tissue. In addition to the aforementioned surgical procedures, a urinary catheter was placed.

Because of the inhalation injury, a bronchoscopy was done to assess the extent of damage. The bronchoscopy also allowed removal of inhaled environmental particulate.

The patient was admitted to the ICU for further care and subsequently flown via Critical Care Air Transport Team to the US Army Burn Center at Brooke Army Medical Center, San Antonio, Texas.

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