CIVILIAN FIELD SURGERY IN THE RURAL TRAUMA SETTING: A PROPOSAL FOR PROVIDING OPTIMAL CARE

M. Beth Foil, MD, Paul R.G. Cunningham, MD, John C. Hale, MD, Nicholas H. Benson, MD, and Starr Treurniet, RN, CEN, EMTP
Greenville, North Carolina

Rural trauma presents unique problems for surgical care. While military surgeons are prepared to provide care at or near the scene of battle, civilian literature is devoid of reports for care provided by surgeons at sites of injury occurrences. Although these injuries are infrequent, they are more likely to occur in rural trauma settings. This article describes two cases of extremity injury that required amputation at the scene and presents a proposal for swift mobilization of appropriately trained surgeons to the scene with adequate instrumentation and lighting, which can significantly reduce the morbidity and mortality of these victims. (*J Natl Med Assoc.* 1992;84:787-789.)

Key words • rural trauma • extremity injury • field surgery

The rural trauma environment is unique and presents unusual difficulties for surgical care. Pitt County Memorial Hospital Regional Level I Trauma Center serves a 29-county area in eastern North Carolina. Unlike urban trauma centers where the majority of injuries occur within a 20-minute transport time to a hospital, patients in this large geographic area are often hours away from medical care.[1] This article describes two cases of extremity injury that required amputation at the scene of the injury.

From the Department of Surgery, School of Medicine, East Carolina University, Greenville, North Carolina. Presented at the 94th Annual Convention and Scientific Assembly of the National Association, July 15-20, 1989, Orlando, Florida. Requests for reprints should be addressed to Dr. M. Beth Foil, Department of Surgery, School of Medicine, East Carolina University, Greenville, NC 27858-4354.

CASE REPORTS

Case 1

Patient A was caught by his left arm in an auger. The machinery was bolted to a cement floor and could not be disassembled to free the extremity. A surgical team from the Pitt County Memorial Hospital trauma center was notified late morning about the injury. The attending surgeon and a chief resident obtained an orthopedic instrument set from the operating room and were transported by ambulance for the 60-mile ride to the patient. The speed of transport was approximately 90 mph. All of the crossroads were blocked by the sheriff's department and state troopers.

At the scene, a local physician was present with the patient. A peripheral intravenous line had been started, and the patient had received 25 mg to 35 mg of morphine intravenously for pain. The patient was lying on the floor with his left arm buried up to the shoulder in the auger. The auger was a screw-like device that was used to carry chicken feed shoveled into it from the floor up overhead to another part of the chicken feed factory. The auger could only be partially dismantled to improve access to the patient.

The patient's hand was almost completely severed at the wrist, attached only by a couple of extensor tendons, and his forearm was almost completely severed just below the elbow. The distal humerus was wedged in the side of the auger holding the patient in position on the floor. By working from above and below, a Gigli saw was eventually placed around the distal humerus, which was then transected. The patient was extricated from the

machine by morselizing the distal forearm. There was minimal bleeding because the brachial artery was completely crushed. The patient was then transported to Pitt County Memorial Hospital for definitive care.

Case 2

Patient B was a 50-year-old male trapped for 5 hours by a grain silo that collapsed on him. Extrication of the victim was complicated by the structural instability of the silo and the entrapment of his left arm and right leg. A trauma surgeon was flown by helicopter to the silo approximately 45 miles from the trauma center. Access to the patient was obtained from a ramp approximately 10′ above ground level, applying counter traction on the crumpled structure using tractors with winches and chains and a hydrolic extrication device. The fourth and fifth digits of the left hand were amputated in order to release the left arm and provide further access to the patient. The flight team nurses and the rescue personnel were able to release the patient's leg from the collapsed silo.

In addition to the difficulties in accessing the patient, the scene posed unusual problems. There were carbon monoxide gas fumes from poorly vented gasoline powered generators. Several rescue personnel reported headaches that may have been partially caused by breathing these noxious fumes. Other scene dangers existed from the sparks emitted from these generators in close proximity to the exposed dry grain. Crowd control was minimal, and many bystanders were smoking near this flammable material.

Once the patient was removed, he was transported by air to Pitt County Memorial Hospital where he underwent revision of his amputation sites and right leg four compartment fasciotomies.

DISCUSSION AND RECOMMENDATIONS

Since the time of Dominique Jean Larrey, surgeon to Napoleon who cared for wounded battle victims, military surgeons have been prepared to provide care at or near the scene of battle.[2] Larrey also improved on field transportation by developing the "Flying Ambulances" to transport surgeons to the battle fields and to carry victims to relative safety.[3] Civilian literature is devoid of reports of surgical care provided at the scene of injury. Although these injuries are infrequent, they are more likely to occur in rural trauma settings where geographic locations may place victims at a location remote from medical aid.

There are many logistical and surgical hurdles that must be overcome to provide optimal care to these patients. When an urgent call is received that a patient is trapped in machinery or in an unstable structure, it is difficult to predetermine the severity or nature of the injury, possible associated injuries, access to the patient, surgical tools necessary for all procedures that might need to be performed, risks to rescue personnel and the attending surgeon, security at the scene, and environmental factors that could affect the rescue. In addition, there may be difficulty in obtaining informed consent.

In order to be appropriately prepared, we recommend a systematic approach. A well-stocked transport pack provides all necessary supplies in a readily available, portable system. The contents of the pack need to be checked daily for sterility, function, and completeness. We suggest that the pack contain Betadine (povidone-iodine 10%, Purdue Frederick Co, Norwalk, Connecticut) solution spray bottles and a battery-operated headlight. This pack also should contain selected surgical instruments such as a Gigli wire saw, a knife handle and blades, rubber tubing for tourniquets, Crile hemostats, silk ligatures, syringes, 18-ga and 25-ga needles, towels and towel clips, and specimen containers. These should be sterilized in peel packs for individual access. Local anesthetics also should be included and kept up to date on the daily checks. A minimal supply of sponges, 4×4s, and dressing changes also need to be packed as flight teams and rescue personnel routinely stock these supplies. Because the roles of ground transport teams vary, intravenous tubing, angiocatheters, and lactated Ringer's solution should be standard components of the rescue pack. Injectable analgesics may be checked out from the pharmacy prior to departure, eliminating the problems of daily record keeping. Antibiotics and tetanus prophylaxis must not be forgotten; however, these can be administered in route to the trauma center or after arrival at the hospital.

The exigency of the situation should not distract the surgeon in charge from taking the time to secure the scene. This may require heavy winches and metal cutting machinery to stabilize heavy metal structures so they do not contribute to damage or cause injury to rescue personnel. Local help can be enthusiastic but overzealous, and crowd control may become an important issue. Additionally, precautions must be taken to protect personnel from noxious or flammable fumes or gas, and live electrical wires should be disconnected. The primary goal is to provide rescue aid without undue risk or injury to others.

The question of informed consent in an awake,

unsedated, hemodynamically stable patient is not likely to be a problem. However, if the patient is unable to give consent for an emergency amputation, this can be handled in most instances by two physicians noting in the patient's permanent medical record that the operative procedures were of an emergent, lifesaving nature and that the patient or next of kin were not able to give consent. It should be noted that the urgency of the situation may dictate the administration of surgical care without appropriate consent.

SUMMARY

Experience with rural field surgery has indicated that thoughtful preparation will provide a more controlled and efficient approach to caring for these injured victims. As with any surgical procedure, preparation will provide the best possible care for the victims undergoing field care and rapid transport. Steps should be taken to minimize the risks at the scene for both the patient and rescuers.

Literature Cited

1. Baker CC. Epidemiology of trauma: the civilian perspective. *Ann Emerg Med.* 1986;15:1389-1391.
2. Larrey DJ. *Memoirs of Military Surgery.* Vol I. Birmingham, Ala: The Classics of Surgery Library; 1985.
3. Wangensteen OH, Wangensteen SD. *The Rise of Surgery: From Empiric Craft to Scientific Discipline.* Minneapolis, Minn: University of Minnesota Press; 1978:497-525.