Medevac: Critical Operations in the Air and on the Ground

By S. CHRISTOPHER SUPRUN JR., NREMT-P

Medevac is more than just whistling down a helicopter. It is a complex operation involving very sick or injured patients, multiple personnel and jurisdictions, sound medical judgment, and a strong dedication to safety. The helicopter, while the most visible part of medevac, cannot do its job without good ground practices on the front end of the call.

Medevacs have been used since the Korean War, where helicopters ferried patients from the front lines to surgical wards just miles from the fighting. Patients on the helicopters were simply loaded onto the skids with special stretchers attached, with whatever care that had been started in the field left in place, for a quick jump to a surgical ward. In a sense, the "Golden Hour" was finding its way into field medicine.

The Golden Hour is important because it isn't measured from when the call comes in, the arrival on scene, or the call for additional units; it's from time of injury. In a perfect world, should an injury occur in front of us, we could call 911 right away. Factor in at least a minute or two to relay information to a dispatcher before responding units start to roll. Add another 5 to 7 minutes before units get to the scene and 5 to 10 more to gather equipment, locate patients, and perform initial assessments. We've already shot 11 to 19 minutes out of our 60—between one-fifth and one-third of the Golden Hour—if everything goes by the book.

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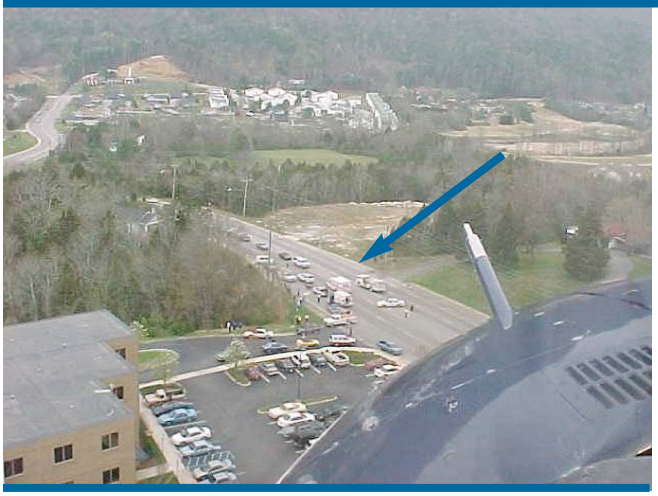
How much longer does it take in an urban environment to secure the scene if this call has potential or known violence associated with it? How much longer does it take in a rural area to get a unit to the scene? No matter where you are, what are the capabilities of the ER to which you transport most frequently? Do they mostly see runny noses and generalized sicknesses, or are they a Level I trauma center with 24/7 staffing to meet the needs of incoming critical patients?



A medevac call is more than a medical run. It's critical that the ground medics pick and secure a safe landing zone—especially since wires are difficult to see from the air. (Top photo by Andy Baley; bottom photo by Paul DeHaven.)

Figure 1. Glascow Coma Scale (GCS)

Best Eye Opening	Best Verbal Response	Best Motor Response
1. No eye opening.	1. No verbal response	1. No motor response.
2. Eye opening to pain.	2. Incomprehensible sounds.	2. Extension to pain.
3. Eye opening to verbal command.	3. Inappropriate words.	3. Flexion to pain.
4. Eyes open spontaneously.	4. Confused.	4. Withdrawal from pain.
	5. Oriented.	5. Localizing pain.
		6. Obeys commands.

Why We Fly

Different fire departments have various categories for use of medevacs, mostly written into their EMS protocols. Essentially, though, helicopters fly for two reasons: multisystem trauma and the need to transport directly to a distant specialty treatment facility.

For trauma, some fire departments use the Glasgow Coma Scale (GCS—Figure 1), others the Revised Trauma Score (Figure 2), and still others use factors such as age of patients and type of mechanism of injury.

The 15-point GCS evaluates patients' neurologic status by measuring their ability to open their eyes, follow commands, and perform basic motor functions. Generally, a score of eight or less means a patient may not have the ability to maintain his own airway; strong consideration should be given to using an endotracheal tube.

The Revised Trauma Score is a predictor of fatal injury, rather than brain injury. GCS is one of three factors that go into computing the Revised Coma Score, along with blood pressure and respiratory rate. The problem with using the Revised Trauma Score in a possible medevac situation is that the trauma assessment developed by the American College of Emergency Physicians' Basic Trauma Life Support teaches that vitals are taken in the unit *on the way* to definitive care. Decisions on "stay and play" or "load and go" are made based on a primary survey of life-threatening injury: Is there a problem with airway, breathing, circulatory status, or level of consciousness? If so, immediate transport—and, depending on the distance to your Level I trauma center, medevac—are warranted.

In Fredericksburg, Virginia, EMS providers determine which patients are flown using a simple algorithm (Figure 3). The medical control physician for the region has issued standing orders that any patient who meets one of the conditions in Column A and two of the conditions in Column B can be flown out from the scene. Even here, though, note that the GCS pops its head up as seen in Column B, criterion 5.

Beyond simple multisystem trauma, medevacs can be used to transport patients to specialty centers, such as pediatric, cardiac, and burn centers. Like the Golden Hour in trauma, there has been an evolution from a door-to-drug time to a door-to-cath time. Consider sending patients directly to a facility that can handle their condition. Ask whether it makes sense to ground-transport a chest pain patient to a local hospital that is going to fly him out in an hour or so for an emergency cath or whether you should start adjunctive therapies and transport the patient directly to the cath lab by helicopter. Along the same lines, what would the local ER do with something more advanced like a left ventricular assist device (LVAD) patient?

Getting the Helicopter to the Scene

Once the decision is made to fly, you'll have to prepare a landing zone (LZ) for the incoming helicopter and activate plans for its approach. Even where medevac helicopters are used regularly and their use is considered routine, helicopters require a great deal of skill; crashes occur too frequently.

On March 21, 2004, a Bell 407 from Medical Center Hospital in Odessa crashed in West Texas, killing four of its passengers. The pilot, Mickey Price, and paramedic Paul Lujan were killed in the crash, along with their 4-month-old patient and his mother. Flight nurse Ronald Stephens, 35, survived with critical injuries.[1] According to Department of Public Safety personnel, this helicopter had just made a course change when it crashed; a cold front, lightning, gusts of wind, and heavy rain had moved into the area where the helicopter was traveling.[2]

Less than two weeks later, a medevac helicopter based in the Canary Islands crashed, killing two patients from a

Figure 2. Revised Trauma Score

Glasgow Coma Scale (SBP)	Systolic Blood Pressure (GCS)	Respiratory Rate (RR)	Coded Value
13-15	>89	10-29	4
9-12	76-89	>29	3
6-8	50-75	6-9	2
4-5	1-49	1-5	1
3	0	0	0

Photo by Andy Baley.

tourist bus crash, the pilot, a nurse, and a physician. Preliminary reports said that the helicopter struck power lines.[3]

Helicopter services use different criteria to determine whether or not they fly. Some systems require visibility of two to three miles at 900 feet; others have stricter or more lenient standards. Many crews use a "three to go, one to stay" method, which requires all three members of their flight crew—pilot, nurse, and paramedic—to agree to take a flight but allows only one person with a safety objection to ground it.

LZ information will be important to the crew. It will include

- The location of the scene and the ground unit handling the LZ.
- The location of the LZ.
- The channel on which their operations are being conducted.
- The number of patients, and their general condition.
- The mechanism of injury.
- Weather conditions at the LZ.

Ground providers should be familiar with their local helicopter and know whether or not it can handle multiple patients. Washington, D.C.'s MedSTAR system, for instance, will only take two patients if neither requires advanced airway stabilization. Other systems will routinely transport two patients and take a ground provider along to assist in patient care. This generally occurs in larger helicopters such as the Bell 412 and similar models.

The medevac crew will want to know the mechanism of injury and any patient report so they can prepare for the injuries they are about to encounter and the treatments they may perform.

The scene report will be vitally important. Some systems may do some circling of the LZ prior to landing, to locate as many hazards as possible and get a better feel for the ground on which the helicopter will land. Providing accurate and informative descriptions of the site will assist the crew in safely touching down. There are many hazards during landing, particularly trees, poles, and wires. Wires are almost invisible killers because they cannot be seen easily from the air. The danger is exacerbated at night; ground crews need to take special care

Figure 3. Medevac Algorithm[4]

COLUMN A	COLUMN B
Fall greater than 15 feet	Patient in hypovolemic shock—defined as: · Capillary refill >2 seconds · BP <90 mmHg · Heart rate >120
Ejected from a vehicle	Respiratory rate > 32/minute or < 10/minute
Pedestrian hit by a car	Paralysis
Death of another passenger in the same accident	Obvious or suspected trauma to two or more organ systems—i.e., head & chest, chest & abdomen
Extrication time greater than 20 minutes	Altered level of consciousness (GCS <10): · Verbal inappropriate words · Motor withdrawal to pain · Eye-opening to pain/open eyes to pain
Transport time greater than 30 minutes to the nearest hospital	Burns > 25% of BSA
Patient's age <5 or >55	

handling these threats to the air crew.

The LZ report should include a specific location of where to land the helicopter, how it is marked off, the surface for touchdown—is it grass? asphalt?—any general hazards, and special considerations such as strong winds.

The LZ itself can be marked in any number of ways, from using traffic cones on their sides to commercial LZ light kits. One method to light an LZ at night is to use cones on their side with box lights placed inside. This clearly defines the landing area for air and ground personnel. Some medevac systems suggest not only the four landing zone markers but also a fifth marker to show wind direction. Other fire departments not only light the LZ and wind direction but also place markers near buildings. This is something to consider if you have the resources, but preplanning with your specific EMS helicopters can help determine their preferences and needs.

The size of the LZ is important, too. In general, a daytime landing zone needs to be anywhere from 60 by 60 feet for a small helicopter to 120 feet square for larger helicopters. At night, these dimensions grow to 200 feet square. Ensuring an adequate space for the LZ is only the first in a line of important steps to protect the helicopter's approach, landing, and takeoff.

During the helicopter's approach to the landing zone, the pilot will likely inform ground crews that they are "on final" and are headed toward the ground. This is a time to eliminate radio traffic and vehicle movement. Once the helicopter is on the ground, the LZ needs to be secured, keeping the public at least 200 feet away from the helicopter. Fire and EMS responders not directly involved with moving the patient to the helicopter should be kept 100 feet away.

Never walk toward or approach a helicopter's tail rotor while it is spinning. Temporarily taking your attention away from it can be lethal. If you need to approach the helicopter, try to do it at a 45-degree angle from the cockpit. This will increase the chance that someone will see you and you will avoid injury.

Ensuring the helicopter lands and takes off safely is as important as the EMS operation itself. Medevac is the tool by which the most injured patients can receive advanced care within the Golden Hour.

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