TRANSPORT MONITORING:

Mobile Patient Assessment

by Steven E. Sittig, RRT

The transport of patients has its origin in the needs of the military to evacuate wounded soldiers from the battlefield to a hospital. During the Siege of Paris in 1870, casualties were airlifted to hospitals by hot air balloons. In the early 1950s during the Korean conflict, the helicopter was introduced as a means to provide rapid transport of wounded soldiers from the battlefield over rough terrain. These patients were flown to the now-popularized Mobile Army Surgical Hospital (MASH), as seen in the classic movie or in reruns of the popular television program. This proved to be an important improvement in care of the critical patient.

In the 1960s and early 1970s, the lessons learned in Korea were applied, refined, and improved in the treatment of battlefield injuries of soldiers in the Vietnam conflict. About this time in history, the ground ambulance also underwent a significant metamorphosis. An ambulance of this era had an eerie physical resemblance to a modern-day hearse. The care patients received en route was very basic; and patient monitoring was not much more than observation, feeling for a pulse, and administering oxygen and intravenous fluids. This was quite a long way from today's sophisticated air and ground intensive care units (ICUs).

The transport environment

Significant improvements in patient care en route have been realized due to improvements in the concept of critical care; the development of reliable, compact, and lightweight monitoring systems with extended battery life; and in available transport vehicles. Interhospital transport of critically ill patients has its own set of unique problems in accurately monitoring the patient during transport. Severe complications such as loss of artificial airway, or intravenous line, arterial blood gas, and blood pressure changes and arrhythmias or cardiac arrest have been reported.[1]

Air transport has all of the above potential complications along with its own special obstacles to overcome in patient monitoring. Whether the transport vehicle is rotor wing or fixed wing, space is at a premium and so, too, is payload capacity. Transport monitoring equipment must be durable and easily secured in the transport vehicle.

The noise level in many helicopters can exceed 100 decibels; therefore, even a basic assessment tool, such as auscultation of lung sounds, is impossible. The transport team must instead rely on accurate monitoring, whether it be noninvasive or invasive. Respiratory therapists involved in transport need to modify their assessment skills and be aware of the capabilities and limitations of monitoring equipment in this mobile environment.

Transport monitoring

Standard monitoring used in transport can include pulse oximetry, end tidal carbon dioxide (CO_2) monitors, and cardiac monitors. The team should try to attain the same level of monitoring during transport that the patient would receive in the ICU.

Pulse oximetry is an easy and widely accepted form of noninvasive monitoring, but the use of this modality in transport has certain inherent limitations. The biggest problem encountered with pulse oximetry in transport is the problem of motion artifact. Due to motion artifact the oximeter may not be able to accurately track a patient's oxygen saturation. Newer pulse oximeters such as the Masimo SET and Nellcor N 3000 have lower false-alarm rates. Early literature shows a promising improvement in accurate saturation readings.[2,3]

Pulse oximetry has also been used as a method for assessing blood pressure in-flight. This method involves placing the blood pressure cuff on the patient's arm and the pulse oximeter probe on the ipsilateral finger. The cuff is inflated to a level greater than the systolic blood pressure, which is shown by the disappearance of the plethysmographic waveform of the pulse oximeter. The cuff is slowly deflated at a rate of about 2–3 mm Hg per second until the pulse waveform reappears. The pressure at which the waveform reappears is the estimated systolic blood pressure.

The maintenance of the artificial airway is of primary importance in transport of the critically ill patient. The ability to quickly assess patency and function of the artificial airway dur-

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additional reading

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ing transport is provided by end tidal CO_2 monitors or by using disposable devices such as the Nellcor EasyCap. The EasyCap will change color from purple to yellow in the presence of exhaled carbon dioxide. Both monitors have been shown to be helpful in assessing proper airway placement. Intubating a patient in-flight or in a moving ground ambulance can be difficult to near impossible due to limited working area and vehicle movement. Therefore, it is best to ensure that the airway is secure and properly monitored prior to transport.

Transport cardiac monitors generally come in two different types: those with a built-in defibrillator and those without defibrillators. In choosing the proper cardiac monitor, one must keep in mind the age and type of patient. Many new cardiac monitors with built-in defibrillators can attain low enough wattage needed to safely perform cardioversion on infants and toddlers. Other nondefibrillator cardiac monitors come with additional built-in capabilities and features, such as noninvasive and invasive blood pressure monitoring, pulse oximetry, end tidal CO_2 monitors, and hard-copy paper recorders. In choosing a monitor, one must also ensure that the display can be read easily from several viewing angles and in different lighting conditions.

Whether the clinician is transporting a patient from the ICU to the CT scan or on a cross-country interhospital flight, proper transport monitoring can make the task safer. The members of the transport team must adapt themselves and their equipment to the transport environment to provide the best possible patient care.

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