Chapter 53

Ground and Air
Ambulance Operations

Learning Objectives

• List standards that govern ambulance performance and specifications.
• Discuss the tracking of equipment, supplies, and maintenance on an ambulance.
• Outline the considerations for appropriate stationing of ambulances.
Learning Objectives

• Describe measures that can influence safe operation of an ambulance.
• Identify aeromedical crew members and training.
• Describe the appropriate use of aeromedical services in the prehospital setting.

Ambulance Standards

• In 1968, National Academy of Sciences–National Research Council (NAS-NRC) recommended ambulance design standards
  – Included the size, shape, color, electrical systems, and emergency equipment
  – Led to development of federal specifications that many states now use as ambulance standards

Ambulance Standards

• Standards and their revisions provide basis for uniformity in design of ambulance vehicles
  – Cover three basic ambulance designs: type I, type II, and type III
  – Standards include additional duty type I-AD and type III-AD (ambulances mounted on large chasses)
  – Fire service vehicles also carry EMS equipment
Ambulance Standards

• Federal standards of design and performance for ambulance vehicles are augmented by
  – Other federal standards
  – State statutes
  – Administrative rules
  – City, county, and district ordinances
    • These influence ambulance design, equipment, staffing

Ambulance Standards

• Additional requirements
  – Air ambulance standards
  – Operational staffing standards
  – Operational driver standards
  – Operational driving standards
  – Operational equipment standards

Consider your state or regional standards. What do they require for ambulance design, performance, and equipment?
Checking Ambulances

• Completing equipment and supply checklist at beginning of every work shift is important
  – Essential for safety, patient care, risk management
  – Helps ensure proper handling and safekeeping of scheduled medications
    • Either paper checklists or special computer software can be used for this purpose

Checking Ambulances

• Some equipment requires routine maintenance, testing, cleaning
  – Ensures safe and effective operation
• Some disposable items checked monthly to ensure they are still within their appropriate shelf life
  – Medications
  – ECG patches
  – Defibrillation pads
  – Glucose check strips
Checking Ambulances

- Procedures for vehicle maintenance vary by EMS agency
  - Improve vehicles’ reliability and extended use of life
- Follow all agency guidelines and procedures for checking vehicles, equipment, and supplies

Ambulance Stationing

- In 1970s, methods for estimating need for ambulance service and where they should be stationed in a community were based on availability of ambulances
  - Also were based on average response time to emergency scene
- Methods for estimating needs have changed
  - Have shifted toward determining percentage of compliance (standard of reliability) in providing EMS services within timeframes that meet national guidelines

Ambulance Stationing

- Factors that may affect EMS system’s standard of reliability
  - Geographical area
  - Population and patient demand
  - Traffic conditions
  - Time of day
  - Appropriate placement of emergency vehicles
Ambulance Stationing

• Strategies for ambulance stationing
  – Often are based on areas with highest volume of calls (peak load)
  – Take into consideration day of week and time of day
  – Computers, global positioning systems, and other technology may be used to formalize strategic unit deployment and reduce response times

Ambulance Stationing

• Deployment strategies vary by EMS agency
  – Simple deployment of one vehicle stationed in middle of response area
  – Comprehensive automated deployment plans for each hour of day, each day of week
    • Include "mini-deployment" plans within each hour, depending on number of ambulances left in system (system status management)
  – Optimal deployment system usually is compromise between two extremes

Safe Ambulance Operation

• Between 1991 and 2000, 300 fatal crashes involving occupied ambulances
  – Resulted in deaths of 82 ambulance occupants and 275 occupants of other vehicles and pedestrians
  – Death for EMS employees due to transported-related fatalities is more than double that of other U.S. workers
Safe Ambulance Operation

• Safe operation of ambulances is crucial
  – Essential for safety of patients, EMS crew, others in vicinity of response
  – Most EMS agencies require their personnel to take emergency driving course
  – Many also required to undergo periodic evaluations of their emergency driving skills and knowledge

Safe Ambulance Operation

• Factors that influence safe operation of ambulance
  – Appropriate use of personal restraints
  – Appropriate use of escorts
  – Environmental conditions
  – Appropriate use of warning devices
  – Proceeding safely through intersections
  – Parking at the emergency scene
  – Operating with due regard for safety of others
  – Safely moving a patient into and out of the ambulance

How do you think you will feel if you strike another vehicle while driving an ambulance?
Appropriate Use of Personal Restraints

• According to National Safety Council, in 2008:
  – More than 1,800 ambulance crashes
  – More than 2,700 injuries related to those crashes
  – Many of these injuries might have been prevented with appropriate use of personal restraints
  – Many EMS agencies incorporate into their standard procedures guidelines to protect patients, passengers, and EMS personnel

Appropriate Use of Personal Restraints

• Guidelines
  – All operators and front-seat passengers of ambulance service vehicles must use seat belts when vehicle is in motion
  – Any patient on stretcher must be secured at all times when vehicle is in motion or stretcher is being moved
  – All equipment in ambulance must be secured to prevent it from becoming “missile” during crash
  – All EMS personnel in patient compartment must use seat belts when not attending to patient and when vehicle is in motion

Appropriate Use of Personal Restraints

• Guidelines
  – All non-EMS personnel in patient compartment must also use seat belts when not attending to patient and when vehicle is in motion
  – Whenever possible, if child is being transported and child’s own restraining device (child safety seat) is available, should be placed in device and belted into ambulance seat
  – If child is patient, he or she should be appropriately secured onto stretcher with straps or child seat
Appropriate Use of Personal Restraints

- Emergency vehicle should not be put in motion until driver, EMS personnel, all passengers are seated safely and wearing seatbelts
  - Every occupant of emergency vehicle needs to be belted
- Emergency vehicle should be completely stopped before anyone unbuckles their seat belts and exits ambulance

Appropriate Use of Escorts

- Police escorts during emergency response can be dangerous and should be used sparingly
  - Collisions can occur as result of confusion when motorists in area may wrongly assume that only one emergency vehicle is on road
  - Use escorts only when EMS crew is responding to scene in unfamiliar area

Appropriate Use of Escorts

- EMS driver should keep safe distance between ambulance and escort
  - Use of audible and visual warning devices during escorts should be guided by local protocol
  - If paramedic uses audible and visual warning devices, ambulance and police escort should use different siren tones (per protocol)
    - Alerts other motorists to fact that second emergency vehicle is in area
Appropriate Use of Escorts

- Some communities use tiered response system
  - Several units and sometimes several agencies respond to emergency calls
  - Allows for safer emergency response
  - Helps ensure proper resources and personnel are available during emergency

Environmental Conditions

- Poor weather conditions can create significant dangers when paramedics respond to call
  - Factors that can affect safe ambulance operation
    - Road and weather conditions, such as fog and heavy rain that reduce visibility
    - Slippery pavement caused by ice, snow, mud, oil, or water that can cause ambulance to hydroplane

Environmental Conditions

- When poor environmental conditions are present, driver of emergency vehicle should proceed at safe speeds
  - Speeds should be appropriate for road and weather conditions
  - Driver should use low-beam headlights during all responses
    - Increases visibility for EMS crew and makes it easier for other motorists to recognize ambulance
Environmental Conditions

• When poor environmental conditions are present, driver of emergency vehicle should proceed at safe speeds
  – Dry roads and clear weather do not guarantee safe response
    • About 69 percent of all emergency vehicle crashes occur on dry roads
    • About 77 percent occur during clear weather

Appropriate Use of Warning Devices

• During emergency response and patient transport, lights and sirens should be used according to protocol and state motor vehicle laws
  – Most EMS agencies authorize use of devices during all responses when cause or severity of emergency is unknown
    • Audible and visual warning devices should be used simultaneously
    • If one is indicated, so is other
    • Use of warning devices during patient transport usually is reserved for patients with limb- or life-threatening illness or injury

Appropriate Use of Warning Devices

• When using lights and sirens, keep in mind that motorists may not be able to hear sirens or horn due to:
  – Car windows rolled up
  – Audio device (i.e., radio)
  – Air conditioning or heating system
Appropriate Use of Warning Devices

• Always proceed with caution
  – Never assume vehicle’s lights, sirens, air horns provide absolute right-of-way or privileged immunity to proceed
  – Some state and motor vehicle laws grant privileged immunity only to drivers of emergency vehicles that respond using all available lights and sirens
  – Be familiar with motor vehicle laws in state that cover emergency response

In what situations do you think that the crew member driving an ambulance may be tempted to drive too fast?

Proceeding Safely Through Intersections

• Approximately 53 percent of ambulance crashes in U.S. occur in intersections where ambulance proceeds against red light
• Must stop at all controlled intersections
• Driver should try to make eye contact with all motorists before going through intersection
Proceeding Safely Through Intersections

• Make secondary stop to assess intersection before crossing
• Use siren’s “yelp” mode or air horn to alert nearby traffic
• Some emergency vehicles now have traffic signal preemption devices
  – Can change traffic light at intersection to green (in ambulance’s direction of travel)

Parking at the Emergency Scene

• When parking ambulance at scene, make sure vehicle’s location allows for traffic flow around area
  – If law enforcement and fire service personnel have secured scene, position ambulance about 100 feet past scene
    • Should be on same side of road
  – Ambulance should be positioned uphill (about 200 feet)
  – Should be positioned upwind if presence of hazardous materials is suspected

Parking at the Emergency Scene

• If law enforcement and fire service personnel have not secured scene, position ambulance about 50 feet in front of scene
  – This is fend-off position
    • In this position, emergency vehicle deflects and averts from scene other vehicles that may strike ambulance or providers
Parking at the Emergency Scene

- Other safety precautions when parking ambulance at emergency scene
  - Emergency lighting should be used when vehicle blocks traffic
  - Parking brake should be set
    - Setting parking brake before putting transmission in “Park” allows entire weight of vehicle to be shared between emergency brake and transmission

- Another person should be asked to help guide vehicle when it is backing up
  - Person should be visible in vehicle mirrors at all times while ambulance is slowly backing up

- Reflective gear should be worn when paramedics work near roadway

- When choosing parking area for ambulance, consider possibility of collapsing structures, fires, explosive hazards, downed electrical wires
### Operating with Due Regard for the Safety of All Others

- Most states allow privileges for drivers of emergency vehicles
  - Allowed to drive slightly above speed limit
  - Allowed to proceed through controlled intersection (after stop) during an emergency response
  - Must take into consideration safety of all people using roads

### Operating with Due Regard for the Safety of All Others

- Most states allow privileges for drivers of emergency vehicles
  - “Due regard for safety of all others” carries legal responsibility
    - Paramedic and EMS agency can incur liability if damage, injury, or death results from failure to observe principle
    - Be aware of local and state laws and regulations that cover operation of emergency vehicle

### Safely Moving a Patient Into and Out of an Ambulance

- After initial stabilization at scene, patient must be packaged and safely placed in emergency vehicle for transport
  - Use safe lifting practices
    - Help to prevent personal injury
    - Ensure patient is positioned securely on ambulance stretcher
    - Patient compartment of ambulance is equipped with locking devices
    - Prevent stretcher from moving while ambulance is in motion
Safely Moving a Patient Into and Out of an Ambulance

• Unnecessary equipment should be stowed before transport
  – Objects such as monitors should be secured in locking device to minimize risk of injuries in collision
  – All those traveling in ambulance (except for paramedic providing patient care) should have their personal restraints securely fastened
  – Before vehicle leaves scene, driver of ambulance should be signaled it is safe to put vehicle in motion

• During transport, patient should be closely monitored for any changes in status
  – If emergency care is required while ambulance is in motion (e.g., intubation, defibrillation), driver of vehicle should be advised to slow vehicle
  – When possible, driver should safely park vehicle and stay parked until procedure has been successfully performed

• Upon arrival at hospital, ambulance should come to a full stop
  – Personal restraints can be removed and vehicle can be exited
  – All patient care equipment must be secured before stretcher is released from locking device
  – Using safe lifting techniques, patient’s stretcher should be removed from ambulance
  – Patient should be appropriately transferred to health care personnel at facility
Aeromedical Transportation

• Air evacuation is rooted in military history
  – During Prussian siege of Paris in 1870, soldiers and civilians were evacuated by hot-air balloon
  – In 1928, Marine pilot used engine-powered aircraft to evacuate wounded in Nicaragua
  – First full-scale use of aircraft for medical evacuation did not occur until 1950, during Korean conflict
  – Experience gained in Korea formed basis for helicopter rescue in Vietnam
  – In Vietnam, nearly 1 million casualties were transported by air

Aeromedical Transportation

• In more recent military confrontations involving United States in Panama, Grenada, Middle East, massive advanced aeromedical support capabilities and plans were on site before conflicts began
  – Response times of 25 minutes were achieved for air evacuation of wounded soldiers in Persian Gulf
  – Field surgical units were set up to handle 1500 to 3000 casualties estimated to occur within first 24 hours of war
  • Most injured soldiers arrived by air transportation

Aeromedical Transportation

• Currently, more than 390 air medical service programs using fixed wing aircraft and/or rotary wing (helicopter) aircraft have been established throughout U.S.
  – Fixed wing aircraft services are not usually as high profile as helicopters
  • Often used for interhospital transfer of patients and to deliver organs for transplantation when distance is over 100 miles
Aeromedical Crew Members and Training

- Staffing of air ambulances includes pilot and various health care professionals
  - EMTs
  - Paramedics
  - Respiratory therapists
  - Nurses
  - Physicians
Aeromedical Crew Members and Training

- Air ambulance crews undergo specialized training in flight physiology and advanced medical equipment and procedures
- American College of Surgeons (ACS) Committee on Trauma and the Association of Air Medical Services have established guidelines for personnel qualifications

Aeromedical Crew Members and Training

- Department of Transportation (DOT) and the NHTSA funded development of Air Medical Crew National Standard Curriculum in 1988
  - Many flight programs have used this curriculum to teach
    - Flight physiology
    - Aircraft components and construction
    - Safety regulations
    - Aviation and navigation terminology
    - Operational safety

Use of Aeromedical Services

- Local EMS system develops criteria for requesting aeromedical services to scene of emergency
  - Consider air transport when emergency personnel determine one or more factors exist
    - Time needed to transport patient by ground to appropriate facility would pose threat to patient’s survival and recovery
    - Weather, road, or traffic conditions would seriously delay patient’s access to advanced life support
    - Critical care personnel and specialized equipment are needed to care for patient adequately during transport
Notification of Aeromedical Services

• Most aeromedical transportation providers accept requests for medical services from
  – Physicians
  – EMS and fire service personnel
  – Other on-scene public service agency personnel

• Local and state guidelines cover aeromedical activation
  – Consult with medical direction
  – Follow all state laws, administrative rules, and city, county, and district ordinances and standards when using aeromedical services

• When notified that an aeromedical response may be needed, flight crews of some services move to aircraft so they are ready for flight
  – If paramedics determine situation does not require aeromedical response, appropriate agency should be notified as soon as possible
  • Makes crew available for other flights
Notification of Aeromedical Services
• If paramedics request air service for medical, trauma, or search and rescue events, advise flight crew of
  – Type of emergency response
  – Number of patients
  – Location of landing zone (LZ)
  – Any prominent landmarks and hazards (e.g., vertical structures or power lines)

Notification of Aeromedical Services
• Direct ground to air communication must be available between designated LZ officer and aeromedical staff on responding aircraft
  – If possible, fire department should be dispatched to LZ to provide fire-suppression support
  – Law enforcement personnel also should be available for securing scene

Landing Site Preparation
• Space requirement for helicopter LZ generally is 100 x 100 feet
  – Should have no vertical structures that can hamper takeoff or landing
  – Should be relatively flat and free of high grass, crops, or other factors that can conceal uneven terrain or hinder access
  – Should be free of debris that can injure people or damage structures or helicopter
  – If patients are close to LZ, provide protection by covering wounds and eyes
Landing Site Preparation

• Rescue personnel close to landing site should wear protective equipment
  – Reflective clothing
  – Helmets with lowered face shields
  – Safety glasses

Landing Site Preparation

• If nighttime LZ is used, emergency vehicles with lighted bar lights should be situated at perimeters of LZ
  – If white lights are used, should be directed down to center of LZ as spotlights
    • White lights (spotlights or headlights) directed toward aircraft can temporarily blind pilot
  – Traffic cones with reflectors can help identify LZ

Landing Site Preparation

• If nighttime LZ is used, emergency vehicles with lighted bar lights should be situated at perimeters of LZ.
  – Flares should not be used because helicopter rotor wash can blow flares from site and create fire hazard
  – Fire crew should wet down dusty LZs, especially if vehicle traffic is moving in area
    • Prevents pilot and vehicle drivers from being temporarily blinded by dust
Landing Site Preparation

• Helpful radio communications with pilot include notification of wind direction and any possible obstructions or hazards
  – Wind direction can be determined by
    • Throwing grass or dirt
    • Wetting finger
    • Smoke patterns from smoke canisters
  – If hazardous materials are present
    • Advise flight crew of substance, location of hazardous materials site, possibility of patient contamination

Landing Site Preparation

• Pilot generally does not land aircraft until all danger of fire or explosion has been eliminated
  – Pilot has final decision to use or change an LZ to another location
  – When aircraft is coming in to land, one emergency responder should stand facing LZ so pilot will see landing area
  – Use LZ hand signals
Safety Precautions

- Everyone should be clear of landing area during takeoffs and landings
  - Distance of 100 to 200 feet is best

Safety Precautions

- Never allow ground personnel to approach helicopter unless pilot or flight crew asks them to do so
- Allow only necessary personnel to help load or unload patients
- Secure any loose objects or clothing that could be blown by rotor downwash (e.g., stretcher, sheets, or blankets)
- Do not allow smoking
- After aircraft is parked, make eye contact with pilot, move to front beyond perimeter of rotor blades, and wait for signal from pilot to approach
Safety Precautions

• Additional precautions
  – Approach helicopter in crouched position, staying in view of pilot or other crew members
  – Never approach rear of aircraft from any direction
    • Tail rotors on most aircraft are near ground and spin at 3400 revolutions per minute
    • Makes them virtually invisible
    • Tail rotor injuries are often fatal
  – Carry long objects horizontally and no higher than waist high
  – Depart helicopter from front and within view of pilot

Patient Preparation

• Preparing patient for air transport requires special measures
  – Some medical procedures must be done before patient is loaded into aircraft
    • Airway established and secured
    • Traction splint
  – Special equipment (e.g., automated chest compression devices) must be positioned according to aircraft’s configuration

Patient Preparation

• Preparing patient for air transport requires special measures
  – Most aeromedical crews perform brief patient assessment before liftoff
    • To verify patient’s condition
  – Patients who are combative may require physical or chemical restraint during flight
How do you think an alert patient will feel when waiting for helicopter transportation?

Summary

• Federal KKK A-1822 standards provide foundation of uniformity for design of ambulance vehicles
• Completing an equipment and supply checklist at start of every work shift is important
  – Essential for safety, patient care, and risk management
  – Also helps ensure proper handling and safekeeping of scheduled medications

Summary

• Methods for estimating ambulance service needs and placement in a community have changed
  – Compliance in providing EMS services within time frames that meet national standards is method now commonly used
Summary

• Factors that influence safe ambulance operation include proper use of escorts, environmental conditions, proper use of warning devices, proceeding safely through intersections, parking at emergency scene, and operating with due regard for the safety of all others
  – Moving patients safely in and out of ambulance is also essential

Summary

• Staffing of air ambulances includes a pilot and various health care professionals
  – These individuals undergo specialized training in flight physiology and the use of special medical equipment and procedures

Summary

• When paramedics request aeromedical service, flight crew should be advised of the type of emergency response, the number of patients, and the location of the landing zone and any prominent landmarks and hazards
  – Always follow strict safety measures during helicopter landings
    • Helps to prevent injury to air medical crews, ground crews, patient, and bystanders