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ABSTRACT

A vehicle must meet certain specific requirements to be classified as an ambulance if it is to satisfy the demands of the physician in terms of emergency care for which properly trained ambulance attendants can be held responsible. Developed by professional and lay experts for use by automotive designers and manufacturing, this publication would be useful resource material for a teacher in a technical institute or instructors of emergency squad personnel. Requirements are provided for: (1) The Ambulance, including requirements for general vehicular design and specific requirements for the driver and patient areas, (2) Security and Rescue Equipment, (3) Emergency Care Equipment and Supplies, which include litters, airway care, ventilation, oxygenation, external cardiac compression, immobilization of fractures, prevention and treatment of shock, wound dressings, emergency childbirth and transportation of newborn infants, poisoning, and special equipment, (4) Communication and Documentation, which includes a 2-way radio, telemetry equipment, and recording devices and (5) Transportation by Air. (SB)

Emergency Health Series C-3

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MEDICAL REQUIREMENTS FOR AMBULANCE DESIGN AND EQUIPMENT

prepared for the
U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Health Services and Mental Health Administration
Division of Emergency Health services

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**Committee on Emergency Medical Services
Division of Medical Sciences
National Academy of Sciences
National Research Council**

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FOREWORD

Previous reports by committees of the Division of Medical Sciences, National Academy of Sciences-National Research Council (1,2), concerned with emergency care of the sick and injured included statements that there are no acceptable standards for ambulance design and that most ambulances in this country are unsuitable, have incomplete fixed equipment, carry inadequate supplies, and are manned by untrained attendants. As in many other areas of emergency care, the obvious conclusion is that the broad gap between knowledge and its application must be closed.

Responsible professional organizations have standardized modern resuscitative procedures (3-9) and have recommended means for community-wide application of these methods toward improving the management of all types of life-threatening emergencies (1,9). Equipment that should be carried on ambulances (4,7-10) and the training necessary to its use (4,9,10) have been prescribed. Few ambulance operators have voluntarily adopted these recommendations. A recent analysis of state statutes (11) on regulation of ambulance services reveals that only 10 of the 50 states require that equipment be carried, and only six of these recommend the minimal list of the American College of Surgeons.

The NAS-NRC Committee on Emergency Medical Services has enlisted professional and lay experts to develop nationally acceptable standards for ambulance design and for equipment for many reasons. The mortician's vehicle, or modification of it, and the station wagon, do not provide sufficient space for the necessary equipment or the carrying out of modern resuscitative procedures either at the scene or during transportation. Unsuitable vehicles are being improvised to replace those being withdrawn from public service by morticians for economic and other reasons. Guidelines for safety and performance are lacking for those who are pilot-testing enlarged ambulances or special-purpose vehicles designed for emergency care of categorized disease entities, such as "mobile coronary care units" or "mobile operating rooms." Communities are demanding improved ambulance services, manufacturers are exploring the feasibility of assembly-line production of ambulances, and emergency medical services highway standards of the Department of Transportation require development at each state level of programs that include provision of adequate types and numbers of emergency vehicles, including supplies and equipment to be carried. Current federal motor-vehicle safety standards (12) prescribe requirements for passenger cars, multipassenger vehicles,

buses, and trucks. Although some standards applicable to these vehicles might apply to ambulances, comprehensive standards for ambulances have not been spelled out, and there may well be a need for additional requirements unique to ambulance design.

In response to requests by the Hospital and Ambulance Services Branch of the Public Health Service and the Bureau of Traffic Safety of the Department of Transportation, task forces and consultants, under the aegis of the NAS-NRC Committee on Emergency Medical Services, are engaged in three related projects with the goal of developing nationally acceptable standards for ambulance design and for the equipment to be used by ambulance personnel.

The first project has been completed and the report is published (10). It prescribes the special training necessary to the administration of optimal emergency care at the scene and during transportation. The responsibilities and functions of ambulance attendants are identified in terms of driving of the ambulance, safeguarding at the scene, communication, rescue, proper use of equipment and supplies in rendering optimal emergency care before and during transport, and safe and efficient delivery to a hospital.

The second project is the subject of this report. The purpose is to relate to professional automotive designers and manufacturers the requirements that must be incorporated in an ambulance if it is to satisfy the demands of the physician in terms of the emergency care for which properly trained ambulance attendants can be held responsible.

The third project is now underway. Automotive engineers, physicians, and experienced ambulance operators will translate and enlarge on the medical requirements detailed in this report in terms of engineering and performance design criteria for an ambulance vehicle in sufficient detail to provide for industrial design and production.

INTRODUCTION

To be termed an ambulance, a vehicle must provide space for a driver, two attendants, and two litter patients, so positioned that at least one patient can be given intensive life-support during transit; carry equipment and supplies for two-way radio communication, for safeguarding personnel and patients under hazardous conditions, for light rescue procedures, and for optimal emergency care outside the vehicle and during transport; and be designed and constructed to afford maximum safety and comfort and to avoid aggravation of the patient's condition, exposure to complications, and threat to survival.

Although ambulances may be used for elective transport of nonambulatory patients—e.g., hospital to home or nursing home—or for outpatient visits, a vehicle used for this purpose that is not designed and equipped to respond to emergency calls should not be termed an ambulance. Unless the vehicle is suitable to both purposes, it should not be permitted to use ambulance-identifying insignia, flashing lights, or warning signal devices.

These recommendations are for regular emergency ambulances, but developments beyond this level, such as vehicles for more than two litter patients or mobile intensive-care units for more definitive therapy outside the hospital, should continue. Designing vehicles and equipment around only one disease entity, however, should be discouraged unless they incorporate design and equipment for the management of *all* critically ill or injured patients. It is, therefore, preferred that the term "mobile intensive-care unit" be applied to such vehicles, rather than "mobile coronary-care unit" (specifically for heart-attack patients) or "mobile operating room" (specifically for patients with trauma).

The equipment and supplies and the design factors necessary to their use in direct patient care included in this report are a composite of the recommendations of members of the Task Force and its consultants, the Committee on Trauma of the American College of Surgeons (7), the Ad Hoc Committee on Cardiopulmonary Resuscitation of the NAS-NRC (5,6), the American Heart Association (3,4), the Committee on Acute Medicine of the American Society of Anesthesiologists (9), and the Committee on Emergency Medical Services of the NAS-NRC (10). Items of equipment should satisfy the indications for use, performance requirements, and safeguards and other recommendations contained in publications of those organizations and in nationally endorsed training courses of the caliber of the cardiopulmonary resuscitation program of the American Heart Association (13).

The Ambulance

GENERAL VEHICULAR DESIGN

General Safety Standards. The ambulance must comply with motor-vehicle safety standards as may be issued by the United States Department of Transportation.

Identification of ambulances should be distinct from that of other emergency vehicles, with nationally uniform emblem, color, intermittent audible warning signal, and flashing roof light for easy recognition and to ensure traffic priority.

Speed and Acceleration. Because rapid and safe arrival of an ambulance at the scene of an accident or in case of the onset of life-threatening illness may be essential to survival, the vehicle must be capable of acceleration comparable with that of other passenger-carrying vehicles; however, optimum preparation before transport and the requirements of comfort, safety, and avoidance of aggravation of the patient's condition preclude excess speed, rapid acceleration, or traffic violation, in delivery of the patient to a medical facility.

Riding characteristics must ensure smooth, gentle, and comfortable transportation. Ease and reliability of handling are essential. The ambulance should be equipped with a positive-traction differential. Provision for four-wheel drive may be necessary in areas where required by the terrain. The braking system should be adequate. There should be minimal pitch, roll, and side-wind effect. The center of gravity should be as low as possible for ease of loading and maximum stability. Puncture-proof tires are essential. Road clearance must be adequate for country roads or disrupted city streets. Underseal of the body is desirable to avoid flooding.

The floor should be at the lowest level consistent with adequate clearance and the space for litters and for attendants at the ends and sides should have a flat surface and be unencumbered by wheel wells, drive shaft tunnels, etc. It should have a nonskid surface that is easily cleaned.

Collision reinforcing bars should be incorporated in the sides and rear and roll bars or other reinforcement should be incorporated in the roof, to protect occupants in the event of an accident.

8/9

The electrical power supply provided by the motor should be capable of producing sufficient current at 12 volts to meet such vehicular requirements as lighting, radio, and temperature control, and the battery should be of sufficient capacity to function for at least 20 min with the motor not running. In addition, a 110-volt, at least 3000-watt, power supply must be provided for installed and portable equipment.

DRIVER AREA

Separation from the patient area is essential to afford privacy for radio communication and to protect the driver from an unruly patient. The bulkhead must be strong enough to support an attendant's seat in the patient area at the top of the patient's head and to withstand deceleration forces of the attendant in case of accident.

Access to the driver area is to be provided by two doors, one on each side. Access to the patient area must be both direct (by passing through an opening in the bulkhead) and indirect (by leaving the driver area and entering an external door to the patient area). There must be provision for both visual and voice communication between the two compartments.

Lighting must be available for both the driver and an attendant, if riding in the driving compartment, to read maps, records, etc. There must be shielding of the driver's area from the lights in the patient compartment.

Environmental control should allow for adequate ventilation, heating, and cooling. This equipment must be capable of reaching 75°F in a reasonable time and maintaining this temperature under various operating conditions. Rapid air exchange (ventilation) may prove necessary under certain circumstances—for instance, during the transport of gas-contaminated victims. Entry of exhaust gases must be avoided.

Safety requirements for the driver area include restraining devices, dash padding, collapsible steering wheel, and such other safeguards as prescribed by the Department of Transportation.

Communication equipment requiring space in the driver area consists of two-way radio (see "Communication and Documentation"), a tachograph, maps, manuals, and such records as the driver may need to maintain.

PATIENT AREA

Over-all dimensions of the patient area must provide for two litters (each 76 in. long and 23 in. wide), two attendants, space for administering life-supporting care, and all equipment and supplies not carried in the driver area or on the outside of the vehicle.

Minimum space between the head of the litter and the bulkhead must be 25 in., including a seat for an operator who sits at the patient's head for respiratory care and resuscitation.

Minimum space at the foot of the litters must be 15 in. to accommodate traction splints and/or an attendant. The handles of folding litters that extend beyond 76 in. are accommodated within this space.

Minimum space between litters must be 25 in. to provide room for the operator to kneel while performing external cardiac compression and other functions.

The minimal height throughout this area is 54 in. from floor to ceiling. A height of 60 in. is preferable. The minimal height affords only 39 in. from the surface of the litter to the ceiling when the litter is adjusted to a height of 15 in., to allow an operator to kneel beside the patient on a pillow and use maximal body weight in performing cardiac compression with his arms straight.

In summary, the minimal over-all internal dimensions of the patient area are: width, 71 in. (2 litters 23 in. wide plus 25-in. space between litters); length, 116 in. (25 in. at the head plus 15 in. at the foot of a 76-in. litter); and height, 54 in. from floor to ceiling.

Crash-stable fasteners must be provided to secure litters to the floor or side walls. Litters must not be suspended by wall brackets or from the ceiling. Where a single patient may be centered in the area on the wheeled litter, additional attachments should be provided. Floor and side-wall attachments should be flush with the surface when not in use.

Seats must be provided for attendants, one at the top of the patient's head, as described above. In addition, seating space with restraints should be provided for ambulatory patients, for example, in the form of a fixed bench, otherwise used to support a folding litter.

Equipment, installed or portable, and all supplies must be positioned for ready accessibility and not impinge on litter or access

areas. Storage cabinets and installed equipment should be designed or positioned to avoid projecting injurious objects, including recessed ceiling hooks for suspension of intravenous-fluid containers. (The basis for space and location of these items is covered under "Emergency Care Equipment and Supplies.")

Doors must be provided at the rear and curbside at the front of the patient area. The rear doors should be hinged to open flush with the sides and ceiling of the patient area and stabilized in the open position to permit litters to be placed into their ultimate riding positions with minimum movement of patients. Latches should permit easy opening by an attendant with one hand while he is carrying a litter. The curbside door must allow the attendant to position himself rapidly and easily at the head of the patient and to remove patients in an emergency if the rear door is jammed.

Steps, if present, should be built to prevent slipping and accumulation of snow, ice, or mud.

Communication with the driver area, both visual and by voice, must be provided. Access to the two-way radio equipment is required for communication with dispatchers, hospitals, physicians, etc. (See "Communication and Documentation").

Illumination must be adequate throughout the compartment, and provide an intensity of 40 ft.-candles at the level of the patient for adequate observation of vital signs, such as skin color and pupillary reflex, and for care in transit. Lights should be controllable from the entry doors, the head of the patient, and the driver's compartment. Windows, if present, should not encroach on necessary storage space, and, while providing daylight, should ensure patient privacy and safety.

Environmental control of the patient area must allow for adequate ventilation with doors and windows closed and for comfortable heating and cooling. The system should provide a temperature of 75°F within minutes and be able to maintain it under extremes of operating conditions. Entry of exhaust gases must be avoided.

Interior surfaces of the patient area must be insulated; resistant to water, heat, and chemicals; and easily cleaned. There should be no sharp projections that could be injurious.

Restraints for attendants must be provided and their seats must be strong enough to meet deceleration requirements of the Department of Transportation. A padded headrest should be installed

above the seat fixed to the bulkhead. Restraints must also be provided for patient protection during transit, including control of the unruly or mentally disturbed patient.

Power outlets for 110 volts should be provided inside near the patient for use of specialized equipment during transport and for recharging battery-powered equipment, and outside for floodlights and electrically powered rescue tools. Receptacles should be approved, grounded units.

Security and Rescue Equipment

SECURITY

Safeguarding of patients and ambulance personnel at the scene of an accident or disaster requires equipment to direct and control traffic and bystanders, isolate areas, and remove victims from hazardous situations. Such equipment should be readily accessible from the outside of the vehicle. Items of equipment include:

Illumination devices, i.e., flares, reflectors, and flashlights; and floodlights with extension cords at least 100 ft long for treating patients outside the vehicle.

Fire extinguisher, 5-lb, dry-powder BC.

Voice amplification devices, installed and portable.

***Gas masks**—self-contained breathing apparatus (not oxygen-generating).

Disposable gauntlets.

RESCUE

Rescue of victims with lightweight equipment may be mandatory when specially equipped rescue vehicles are not readily available, in areas where such vehicles may be nonexistent, or when valuable time might be lost in calling from the scene of the accident for equipment. Ambulance personnel must be provided with such simplified light rescue equipment as may be carried on the ambulance, and they must be trained in its proper use. Reliance must not be placed on the tools necessary for vehicle maintenance.

Release from entrapment and confinement requires lifting, prying, battering, and cutting tools.

Extrication and short-distance removal requires long and short backboards, straps and ropes, or a litter, if designed for the purpose.

*As determined by local hazards or ready availability from other sources.

Emergency Care Equipment and Supplies

SPACE REQUIREMENTS

For purposes of estimating space requirements for installed, portable, and stored equipment and supplies, and for location for optimal accessibility, designers must be familiar with the size, weight, shape, and power requirements for each item as applicable.

Design must not be limited to accommodation of contemporary equipment and supplies. Allowance should be made for additional space and power supply so as to adapt to inevitable scientific advances in resuscitation and immediate wound care, and to the new and refined equipment that will be used by increasingly proficient ambulance attendants to whom professional advice and direction will be available through voice and perhaps video transmission (10).

The location of equipment and supplies is dictated by the relative importance of ready accessibility to attendants, with priority given to items necessary to cope with life-threatening conditions at the scene and in transit. Thus, the equipment and supplies necessary for airway care, artificial ventilation, oxygenation, and suction should be within reach of the attendant at the head of the litter, and those for cardiac resuscitation, control of external hemorrhage, administration of intravenous agents, and the monitoring of blood pressure should be readily available to the attendant at the side of the litter.

To the maximum extent possible, equipment and supplies should be so standardized and durable as to make acceptable a regular practice of interchange between ambulances and between ambulances and hospitals.

Storage cabinets, drawers, and kits should be easily opened, but should not come open in transit. For rapid identification of contents, it may be desirable to use transparent material for the fronts of some cabinets and drawers. Otherwise, labeling of the contents of these and others for identification and inventory is recommended. Drawers should be removable.

PATIENT TRANSFER—LITTERS

Each ambulance should be provided with (1) a wheeled litter, (2) a folding litter, and (3) a collapsible device that enables attendants to carry a patient over stairways and other narrow spaces where a rigid litter cannot be used. Litters (2) and (3) may be combined as one folding litter. Litters must be easy to move, load, store, clean, and disinfect. The folding litter should keep the patient above floor level; the wheeled litter, adjustable in height, should be designed so that in the low riding position the top may be as low as 15 in. above the floor of the ambulance. Litters should be equipped with a nonremovable, collapsible, telescoping support for intravenous infusion bottles.

The head of the litter must be capable of being tilted upward to a 60-deg. semisitting position, and the entire litter capable of being tilted into the head-down position of at least 10 deg. (for airway care). To permit lying full length in the supine, prone, or lateral position, litters must be at least 69 in. long and 20 in. wide. Most standard litters are 75-86 in. long and 22-23 in. wide. The frame or handles should be designed to permit up to four persons to carry the litter and should provide for fasteners to secure it firmly to the floor or side of the vehicle during transport. Restraining devices must be provided to prevent longitudinal or transverse dislodgment of the patient during transport. It is preferable that litter tops be radio-translucent and interchangeable at the emergency department so that the patient can be carried from the scene, in the ambulance, and through the emergency room, X-ray department, and operating room, and removed from it only once to be placed on a bed.

AIRWAY CARE, ARTIFICIAL VENTILATION, AND OXYGENATION

Artificial-ventilation devices must be portable and independent of a supply of oxygen. Two units are desirable, one for use in the ambulance and the other for use outside the ambulance and serving as a spare unit.

The artificial-ventilation device should be a manually operated, self-refilling, portable bag-valve-mask unit that operates with either air or oxygen enrichment (5,9). When used in the ambulance, it should permit delivery of 100% oxygen, for instance, by attaching an oxygen reservoir tube. The unit should be easy

to clean and decontaminate. It should have one standard universal adapter (15-mm tracheal tube/22-mm mask). The non-rebreathing valve should permit inhalation of oxygen during artificial and spontaneous breathing from the bag. Masks, in sizes for adults, children, and infants, should be preinflated and transparent to permit rapid recognition of color change, vomiting, and breathing (clouding during exhalation), and should permit fastening to the patient's face.

Oxygen-powered, manually triggered inflation devices are acceptable if properly designed (5), but their dependence on compressed oxygen limits their use to inside the vehicle.

Airways. Oropharyngeal airways for adults, children, and infants should be provided. Airways for mouth-to-mouth ventilation should also be carried in all sizes.

Mouth gags or tongue blades taped together should be provided for use during convulsions to prevent injury to the patient's tongue.

For ventilation and oxygenation of tracheotomized patients, 15-mm tracheostomy tube male adapters of various sizes should be available.

Oxygen inhalation equipment. There should be two oxygen supplies, one portable, the other installed.

The portable unit of 300-liter capacity located near a door for ready use outside should be equipped with a yoke, pressure gauge, flowmeter (not gravity-dependent), delivery tube, and oxygen mask. The unit should be capable of delivering an oxygen flow of at least 10 liters/min. An extra 300-liter-capacity cylinder should be available.

The installed unit is supplied by at least 3000 liters of oxygen contained in two tanks and delivered by a two-stage regulator under 50 psi. There should be yokes, reducing valves, flowmeters (not gravity-dependent), humidifiers with sterile water and unbreakable bottles, delivery tubes, and oxygen masks for two patients. Oxygen pressure gauge and flowmeters, humidifiers, and delivery tubes should be visible and accessible to the attendant seated at the head of the litter. Delivery tubes should reach to the face of patients transported in the horizontal position and deliver a continuous flow of at least 10 liters/min. and should connect readily to oxygen masks and the bag-valve-mask ventilation unit.

Oxygen masks (with or without bags) should be semi-open, valveless, transparent, disposable (or easy to clean and decontaminate), and in sizes for adults, children, and infants.

Suction Equipment. Portable and installed suction equipment should be available. The portable unit should provide vacuum and flow adequate for pharyngeal suction. It should be fitted with large-bore, nonkinking suction tubing and a rigid pharyngeal suction tip. There should also be sterile suction catheters of various sizes for suctioning via tracheal tube or tracheostomy tube, a non-breakable collection bottle, and a supply of water for rinsing tubes. The installed suction unit should be powerful enough to provide an airflow of over 30 liters/min. at the end of the delivery tube and a vacuum of over 300 mm Hg when the tube is clamped (8,9). The suction force should be controllable for use on children and intubated patients. There should be an additional set of rigid pharyngeal suction tips (tonsil suction tips) and sterile tracheal suction catheters of various sizes. For tracheal suction, a Y- or T-piece or a lateral opening should be between the suction tube and suction source for on-off control. The suction yoke, collection bottle, water for rinsing, and suction tube should be readily accessible to the attendant at the head of the litter, and the tube should reach the airways of patients regardless of their position. Suction apparatus must be easily cleaned and decontaminated.

EXTERNAL CARDIAC COMPRESSION

A backboard should be readily available and, when placed under the patient in bed or on a litter, provide the necessary resistance for effective external cardiac compression and raise the patient's shoulders 3-4 in. above the level of the litter in order to keep his head in a position of maximal backward tilt, and in a straight position without manual support. This may help maintain an open airway during cardiopulmonary resuscitation by one operator during transportation. A special backboard may be used, or the long or short spinal-fracture board supplemented with a tightly rolled sheet under the patient's shoulders and a head stabilizer, such as a doughnut-shape rest or sandbags.

The superiority of mechanical over manual external cardiac compression has not yet been established. In anticipation of future development of satisfactory equipment, space should be provided for this equipment.

IMMOBILIZATION OF FRACTURES

The following supplies must be carried for immobilization of fractures or suspected fractures (7):

A hinged, half-ring lower-extremity splint with a minimum ring size of 9 in. and minimum over-all length of 43 in., and with padded ankle-hitch or skin-traction device, with either a built-in turnbuckle device or a supplemental "Spanish windlass" device.

Splints for the upper and lower extremities, such as padded boards, of material comparable with four-ply wood in widths of 3 in. and lengths of 15, 36, and 54 in.; cardboard, plastic, wire ladder, canvas-slotted lace-on and inflatable types; the number and types of splints to be determined by local experience in the area served.

Triangular bandages for fractures of the shoulder and upper arm.

Short and long spineboards and accessories (7,14) for safe extrication, as well as immobilization in case of actual or suspected injuries of the spine.

WOUND DRESSINGS

Supplies to be carried for dressing of open wounds and for padding and application of splints include:

Sterile gauze pads of conventional sizes for covering wounds.

Multiple-width 5-yard soft roller and elastic bandages (soft roller preferred) for application of large dressings, for securing of pressure dressings for control of hemorrhage,* and for securing traction or coaptation splints.

Sterile nonporous dressings for occlusion of sucking wounds of the chest.

Universal dressings, approximately 10 in. by 36 in., packaged folded to 10 in. by 9 in., for covering large wounds, including burns, and for compression, padding of splints, or application as a cervical collar.

*Application of pressure dressings is the procedure of choice for control of hemorrhage, except for inaccessible sites, where direct digital pressure may be life saving. Inflatable splints have proved effective for hemorrhage below the elbow or knee. If carrying of tourniquets is elected, strict limitations in their use must be imposed.

Adhesive tape—1-, 2-, and 3-in.
Safety pins, large.
Bandage shears.

PREVENTION AND TREATMENT OF SHOCK

Equipment should include sterile intravenous agents, preferably in plastic bags, such as isotonic saline solution, 5% dextrose in lactated Ringer's solution, 5% albumin, or dextran; and sterile, disposable intravenous administration sets and injection kits (needles, catheter needles, syringes, antiseptic sponges, venous tourniquet, tape).

EMERGENCY CHILDBIRTH

In addition to sterile dressings and towels, a sterile kit containing gloves, scissors, and umbilical clamps or umbilical tape should be carried.

TRANSPORTATION OF NEWBORN INFANTS

Each ambulance service should have available immediately from hospitals or other sources a portable incubator that can be secured on the litter for transporting newborn infants. The incubator should permit oxygen enrichment, humidification, control of body temperature, and accessibility of the baby's head for resuscitation. There should be artificial-ventilation and sterile tracheal-intubation equipment in appropriate sizes for this purpose.

ACUTE POISONING

Activated charcoal and syrup of ipecac should be provided, as well as potable water and equipment for oral administration and for irrigation of the conjunctiva and skin. Snakebite kits should be carried in areas where the hazard of snakebite exists.

MISCELLANEOUS EQUIPMENT

The following miscellaneous equipment should be carried on each ambulance: pillows, blankets, sheets, pillow cases, towels, tissues, emesis basin, urinal, bed pan, thermometer, aneroid blood-pressure manometer and cuff, stethoscope, drinking water, disposable cups, and sandbags.

SPECIAL EQUIPMENT FOR USE BY PHYSICIAN OR OTHERS TRAINED IN ITS USE

There should be space in the ambulance for additional special equipment to be used by physicians or others with special training. Wherever possible, special-purpose equipment should be in the form of kits and items disposable or easy to sterilize. This equipment includes: tracheal intubation kit (including cricothyrotome and nasopharyngeal tubes), pleural decompression set (including trocars, chest tubes of various sizes, and one-way valves), drug-injection kit, tracheostomy kit, portable cardioscope/external defibrillator, and cardiac compression machine.

Communication and Documentation

RADIO

Equipment for communication by two-way radio is mandatory for direct voice dispatching, routing, notification of emergency departments, and direction and assistance from physicians, and for cross-communication for liaison with fire, police, and civil-defense authorities and other ambulance units. Regardless of the location of the basic radio equipment, it must be adaptable for use by both the driver and the attendant in the patient area with volume control, in the interests of the patient. Portable radios should be provided for communication between attendants working at a distance from the vehicle.

TELEMETRY EQUIPMENT

Advances in the development of devices for telemetering physiologic data warrant provision of space in an ambulance for installation of this equipment.

DOCUMENTATION

Space should be provided for recording devices (tapes or records being interchangeable with hospitals) for detailed reports on patients, to include time intervals from the time of dispatch to delivery to the hospital, physical condition at the scene and during transport, and care rendered. In addition to verbal and written reports to emergency department personnel and such other reports as may be required by the ambulance operator, the recording tapes or records should be delivered with the patient for transcription and incorporation into the permanent hospital record. Photographic documentation is encouraged.

Transportation by Air

Helicopters or aircraft used for the transportation of critically ill and injured patients should be designed and equipped to permit the same resuscitative and life-supporting measures and other emergency-care procedures as are described above for land ambulances.

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