SUMMARY OF STATEMENT OF AMERICAN COLLEGE OF SURGEONS ON S. 504

March 9, 1973

I am Dr. J. E. Dunphy, Chairman of the Board of Regents of the American College of Surgeons (ACS) and Professor and Chairman of the Department of Surgery, University of California at San Francisco. Accompanying me is Dr. Oscar P. Hampton, Jr., Assistant Director and Director of the Trauma Division of the College. We welcome the invitation to present the views of the College on S. 504, a Bill which should lead to improvement in the deplorable state of emergency medical services (EMS) in too many areas of this country. This statement is a summary of the complete text. I respectfully request inclusion in the record of the complete testimony and the attachments.

ACS during the past 51 years has waged a strictly volunteer effort to upgrade the quality of EMS. This effort has been an activity of the ACS Committee on Trauma and its subordinate regional committees of which there are 57 with state committee status - one in each state except my own state of California has two, a Northern and a Southern California Committee. Also, there are six committees in large metropolitan areas about the country that have state committee status. Within the states there are over 300 local committees. Altogether, over 3,400 physicians serve on ACS trauma committees, all strictly as volunteers.

An EMS system is comprised essentially of emergency ambulance service and in-hospital emergency medical care. An essential part of in-hospital emergency care is emergency department (ED) or emergency room service.

The first standards for emergency ambulance services ever promulgated in this country came from the College. These include

guidelines for each component of an effective emergency ambulance service. These components are adequate vehicles, trained personnel, essential equipment and two-way radios. College documents on training personnel and essential equipment for ambulances are included in packets previously distributed to the members of the Committee.

Vehicles must afford adequate space in the patient compartment for storage of equipment and for an attendant to provide continuing emergency care during transit.

Personnel - driver and at least one attendant must be well-trained in emergency care. One method of training such personnel is described in this College publication, Curriculum of Training of Emergency Medical Technicians - Ambulance. Emergency medical technicians (EMTs) is a term generally used to denote well-trained and qualified ambulance attendants.

Essential equipment on the vehicle - This College document, Essential Equipment for Ambulances, is the accepted standard nation-wide; it is often referred to by both governmental and non-governmental agencies and organizations.

Two-way radio equipment for voice communications with a central ambulance dispatcher and hospital EDs is essential. The lack of two-way radio communications currently is probably the most glaring deficiency in EMS systems. Such communications are crucial if the ED is to be alerted to the impending arrival of a critically injured or ill patient and if physicians in the ED are to advise ambulance personnel at the scene and enroute on the care of such patients.

The College, during the past two decades, has had an active program designed to improve hospital ED services. The first published standards for hospital emergency departments in the United States came from the College. These were promptly embraced by the Joint Commission on Hospital Accreditation (JCAH) and distributed to accredited hospitals. Subsequently, JCAH has published its own set of standards for hospital emergency services, utilizing members of College trauma committees as consultants during their development. This College document, Guidelines for Design and Function of a Hospital Emergency Department has been widely distributed gratis to fulfill requests for it. It also is in the packets previously distributed to members of the Committee. The College has produced 12 motion pictures on facets of the emergency medical care of the seriously injured in the ED. Prints are available for loan or sale to physicians or hospitals. The crucial ingredient for excellent medical care in the ED is physician expertise, skill and availability. Currently, only 17 to 20 per cent of hospitals have a physician in-house 24 hours a day and a smaller percentage in the ED at all hours. If ambulance personnel in transit are to communicate with physicians in the EDs by radio, physicians must be physically available to receive the calls.

Deterrents to the development of effective EMS systems are first, apathy of citizens, governmental officials, the medical profession and hospital administrators, and second, and of great importance, the economics of emergency ambulance services and, in many hospitals, ED services. The cost of a first-class emergency ambulance service requires about

six emergency calls per day per vehicle to reach the break-even point, provided the service has a 90 per cent collection rate. Unfortunately, the collection rate is usually much lower.

Emergency ambulance service should be the third governmental assured emergency service; the first two are law enforcement and fire fighting services. Emergency ambulance services may be governmental (fire department, police, or tax-supported hospital based), for-profit commercial or funeral director services, or volunteer services. The latter are particularly appropriate for small communities. Governmental-provided services are particularly appropriate for large cities but, even in these, a for-profit commercial or funeral director service can be franchised and subsidized by the local government. A volunteer fire department provides a good base for the development of a volunteer ambulance service. Volunteers currently provide some of the best emergency ambulance services in this country. Such services could be promoted by governmental officals and all others concerned in many relatively rural areas which now lack good services.

The College would welcome federal legislation such as Senate Bill 504. Actually, federal legislation can make two major contributions. First, it can establish acceptable standards for EMS systems to be supported by grants. Second, for federal funding, an entire EMS system should be required, not merely single components. The absence of any component makes the system ineffective. The ACS Standards for Emergency Ambulance Services could be the guidelines, although the current

standards of both the Department of Transportation and of some agencies in the Department of Health, Education and Welfare are comparable to ACS standards.

ACS urges that any federal legislation provide for funding of proposals from a community or a group of communities, perhaps irrespective of state boundaries, as well as for state-wide proposals. Actually, in many states, a state-wide emergency ambulance service system is impracticable, although if there is a state plan, it is reasonable that intra-state regional systems should conform to the state plan. State governmental agencies, just as federal agencies, can provide stimulating leadership. However, decisions as to the preferable type of emergency ambulance service, how to obtain and maintain a first-rate service and how to fund it are best made community by community, utilizing the judgment of representatives of local government, the medical profession, hospitals, ambulance service providers and interested citizens.

Finally, as I interpret it, Section 638a of Senate Bill 504 would provide some funds for research in the medical care of traumatized patients, as previously funded by the National Institute of General Medical Sciences. Continuing research in trauma is crucial if the care of the injured is to be improved nationwide. Many people believe that surgeons now know everything about the treatment of traumatized patients. This is just not true even though medical care of the injured in this country is probably the best in the world at this time. Just as continuing research is crucial to improved management of cardiac and cancer patients, so

it is essential for improved care of the injured.

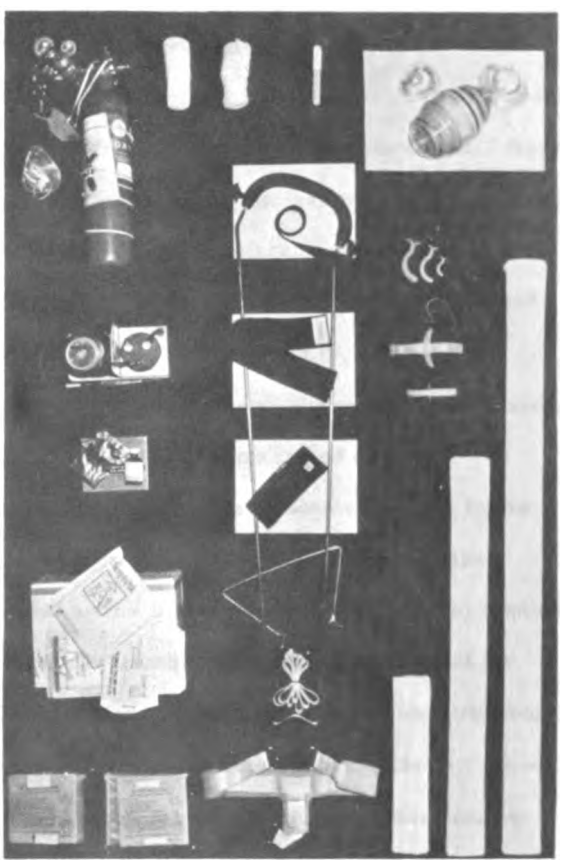
Thank you, Mr. Chairman, for the opportunity to present the views of the College on this important issue. We will be happy to try to answer any of your questions.

Essential equipment for ambulances

THE EQUIPMENT shown in the accompanying photographs is considered by the Committee on Trauma to be that which is essential if the emergency medical technician (ambulance attendant) is to provide adequate care for the critically ill and injured at the emergency scene and during transport to medical facilities.

These items are:

1. Portable suction apparatus with wide-bore tubing and rigid pharyngeal suction tip
2. Hand operated bag-mask ventilation unit with adult-, child-, and infant-size masks. Clear masks are preferable. Valves must operate in cold weather, and unit must be capable of use with oxygen supply
3. Oropharyngeal airways in adult, child, and infant sizes
4. Mouth-to-mouth artificial ventilation airways for adults and children
5. Portable oxygen equipment with adequate



Essential equipment for an ambulance shown here is (left from top down) oxygen, foot powered suction pump, poison kit, obstetrics kit, inflatable splints, (center from top down) soft roller bandages and mouth gag, traction splint with slings, ankle hitch and traction strap, (right from top down) bag-mask resuscitator, oropharyngeal airways, two-way airways, padded boards.

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tubing and semi-open, valveless, transparent masks in adult, child, and infant sizes

6. Mouth gags, either commercial or made of three tongue blades taped together and padded

7. Sterile intravenous agents, preferably in plastic bags, with administration kits

8. Universal dressings, approximately 10 inches by 36 inches, compactly folded and packaged in convenient size

9. Sterile gauze pads, 4 inches by 4 inches

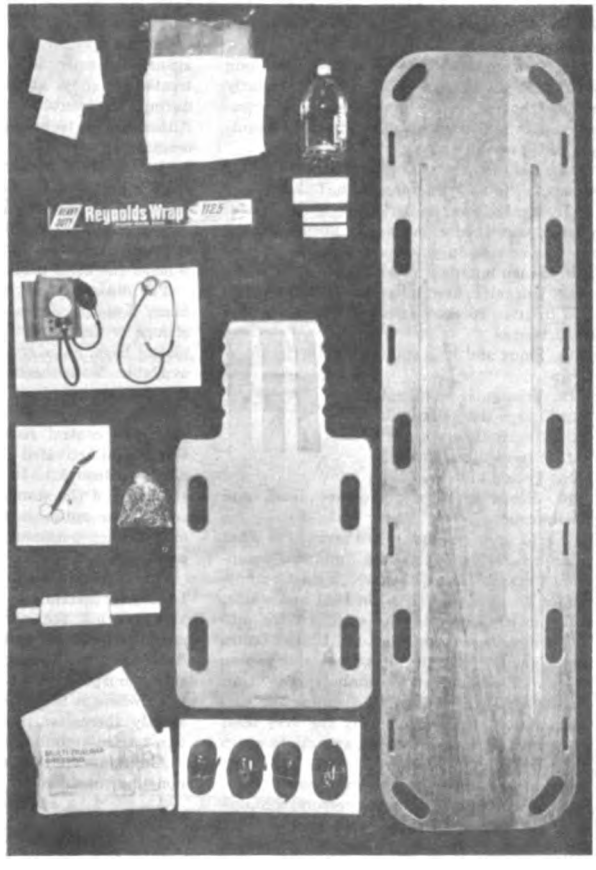
10. Soft roller self-adhering type bandages, 6 inches by 5 yards

11. Roll of aluminum foil, 18 inches by 25 feet, sterilized and wrapped

12. Two rolls of plain adhesive tape, 3 inches wide

13. Two sterile burn sheets

14. Hinged half-ring lower extremity traction



Shown here are (left from top down) gauze pads and burn sheets; aluminum foil; blood pressure manometer cuff and stethoscope; shears; safety pins; adhesive tape; universal dressing; (center from top down) infusion agents, tubing, needles, short and long spine boards; straps for boards.

splint (ring 9 inches in diameter, over-all length of splint 43 inches) with commercial limb-support slings, padded ankle hitch, and traction strap

15. Two or more padded boards, 4½ feet long by 3 inches wide, and two or more similarly padded boards, 3 feet long, of material comparable to four-ply wood for coaptation splinting of leg or thigh

16. Two or more 15-inch by 3-inch padded wooden splints for fractures of the forearm.

(By local option, similar splints of cardboard, plastic, wire ladder, or canvas slotted lace-on may be carried in place of the above 36-inch and 15-inch boards.)

17. Uncomplicated inflatable splints in addition to Item 16 above or as substitute for the short boards

18. Short and long spine boards with accessories

19. Triangular bandages

20. Large-size safety pins

21. Shears for bandages

22. Sterile obstetrical kit

23. Poison kit

24. Blood pressure manometer, cuff, and stethoscope

The foregoing is the second revision of what was formerly described as a "*minimal* equipment for ambulances" list which the Committee on Trauma established in 1961 and which, subsequently, became the standard for ambulance services throughout the United States and Canada. Its name has been changed to "*Essential* equipment for ambulances," thus giving it more meaning and avoiding the suggestion that it represents only the very least equipment with which an operator might equip his vehicle.

The present list contains seven new items—intravenous agents, blood pressure manometer, cuff and stethoscope, an obstetrical kit, a poison kit, inflatable splints, aluminum foil, and burn sheets.

The tourniquet and elastic bandages which were on the 1961 list are purposely omitted here. In thus forcing a technician to improvise a tourniquet, the Committee on Trauma hopes to make him think carefully before he uses one, thereby minimizing the indiscriminate use of same.

To eliminate the danger of deleterious pressure if improperly applied, elastic bandages have been replaced by soft roller-type bandages.

Of the seven new items, the intravenous agents are essential if the patient is to be treated for shock at the emergency scene and during transportation to medical facilities. Although the technique of infusion is a recommended part of the basic training program for technicians, the exact agents to be used and their use should be determined by the local physician and preferably via radio control.

The technique of blood pressure monitoring is readily acquired during the in-hospital sessions of the basic training program.

The obstetrical kit should contain a minimum of sterile gloves, scissors, umbilical cord clamps or tapes, sterile dressings, towels, and plastic bags. Satisfactory disposable units are available. Burn sheets may be used as drapes if necessary.

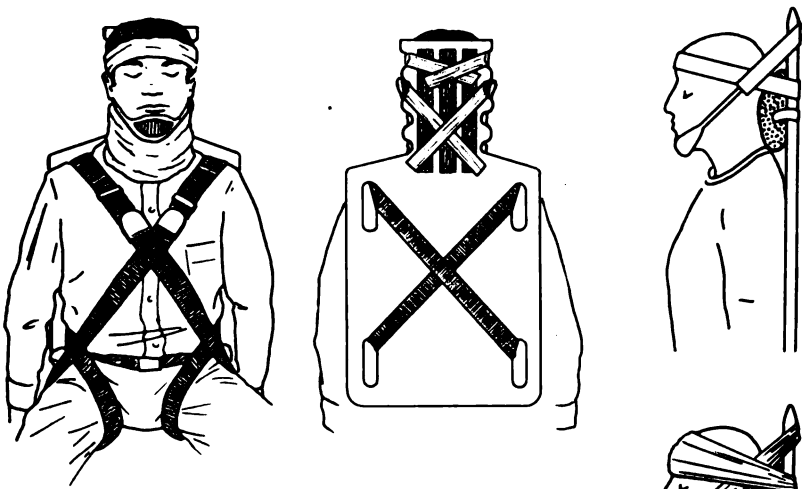
Consultants knowledgeable in the field of poisoning control recommend that syrup of Ipecac and activated charcoal be the contents of the poison kit. In the conscious patient, emptying of the stomach by vomiting is considered the optimum treatment in poisoning, except when poisoning is due to corrosives or petroleum products.

Uncomplicated inflatable splints are satisfactory for fractures at and below the knee and at and below the elbow. The hand and foot must be included, and the splint is to be inflated only by lung pressure. Pressure in the splint must be controlled, especially in situations where it is applied in cold weather and, shortly thereafter, the patient is transferred to a heated ambulance.

Aluminum foil is useful as an occlusive and nonadherent dressing.

An effective emergency incubator may be

The Subcommittee on Pre-hospital Emergency Services which on behalf of the Committee on Trauma developed the accompanying list of essential ambulance equipment consists of J. D. Farrington, Minocqua, Wisconsin, chairman; Robert H. Brown, Bethesda; Francis J. Cox, San Francisco; Walter A. Hoyt, Jr., Akron, Ohio; William R. MacAusland, Jr., Boston; Charles S. Neer II, New York; and Watts R. Webb, Syracuse.



Two 9-foot straps are passed through the upper handholds, crossed behind the board, passed through the lower handholds, passed around the thigh from outside to inside, and finally drawn under and over the thigh to the chest buckle. The straps remain as close as possible to the groin. In the rear view of the short board the position of the straps and fixation of the Velcro fastenings are shown. In the profile view the position of the headband, chin strap and neckroll is demonstrated. End of short board is blunt-tapered. At right is alternate method of fixation (E, page 11).

Equipment for the short board consists of headband, chin strap and neck roll.

Headband (Fig. 1), which measures 42 inches, has:

a. Padded section;
b. Thin webbing 2 inches wide;
c. Strip of looped or pile Velcro.

Fig. 1

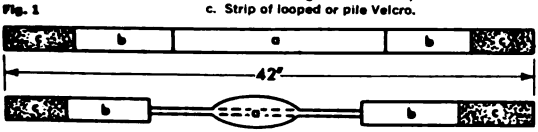


Fig. 2

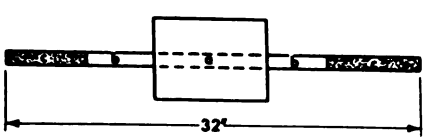


Fig. 3

Chin strap (Fig. 2), which measures 42 inches, has:

a. Regulation football chin strap;
b. Thin webbing 2 inches wide;
c. Strip of looped or pile Velcro.

Neck roll (Fig. 3), which measures 32 inches, has:

a. Foam rubber roll 8 inches wide and 6 inches in diameter, covered for protection first with plastic, then stockinette, both disposable and easily replaceable;
b. Thin webbing 1-inch wide;
c. Strip of looped or pile Velcro.

Ends (looped or pile Velcro) of straps grab strips of Velcro with hook surface affixed to back of head piece on the short board.

The neck roll is seldom used. It is necessary in rare fracture-dislocations of the neck in which the head is fixed in an awkward position. A heavy folded towel will serve well as a substitute.

Velcro is a fastener. It consists of two strips of nylon tape—one covered with minute hooks, the other with minute loops forming a pile surface—which lock securely when pressed together, open when peeled apart.

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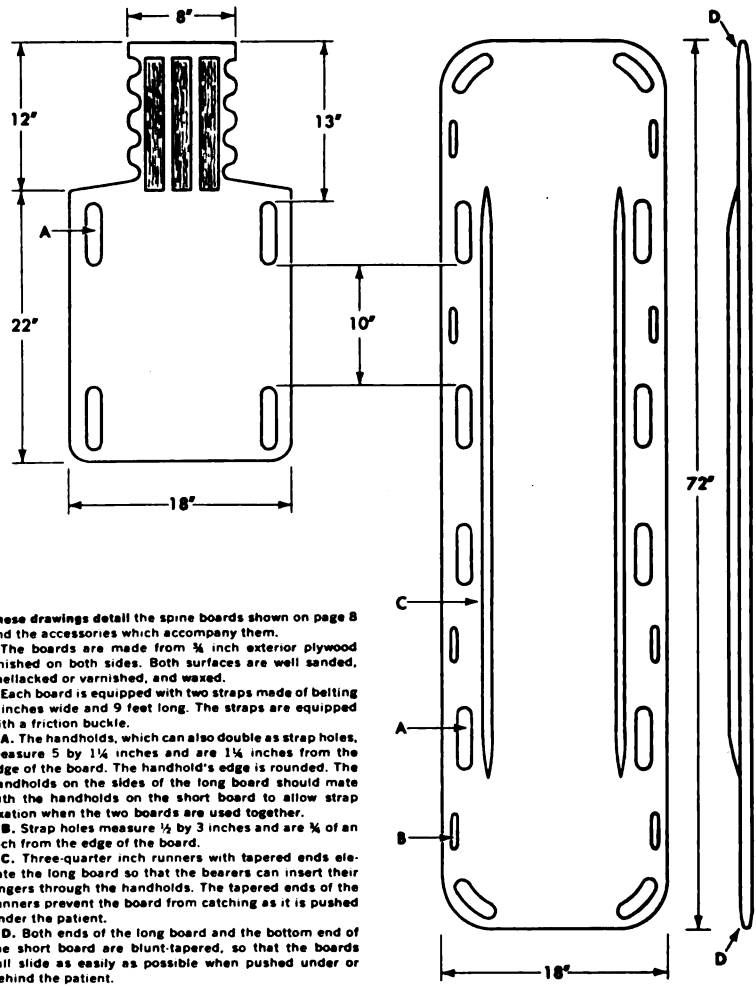


These drawings detail the spine boards shown on page 8 and the accessories which accompany them.

The boards are made from ¾ inch exterior plywood finished on both sides. Both surfaces are well sanded, shellacked or varnished, and waxed.

Each board is equipped with two straps made of belting 2 inches wide and 9 feet long. The straps are equipped with a friction buckle.

A. The handholds, which can also double as strap holes, measure 5 by 1¼ inches and are 1¼ inches from the edge of the board. The handhold's edge is rounded. The handholds on the sides of the long board should mate with the handholds on the short board to allow strap fixation when the two boards are used together.

B. Strap holes measure ½ by 3 inches and are ¾ of an inch from the edge of the board.

C. Three-quarter inch runners with tapered ends elevate the long board so that the bearers can insert their fingers through the handholds. The tapered ends of the runners prevent the board from catching as it is pushed under the patient.

D. Both ends of the long board and the bottom end of the short board are blunt-tapered, so that the boards will slide as easily as possible when pushed under or behind the patient.

E. The edges of the head portion of the short board are serrated to allow an alternate method of fixation of the head. One or more 6-inch soft roller bandages are wrapped about the board, forehead and chin. The serrations prevent the bandage from slipping.

constructed by wrapping a premature infant in foil, leaving its face free.

Ordinary bed sheets—wrapped sterilized, and packaged in plastic bags—provide excellent dressings for burns of any magnitude.

The short and long spine boards are essential for safe removal of various injured patients, especially those with actual or suspected damage to the spine. Either board is also useful in providing a firm surface on the wheeled stretcher for performance of cardiopulmonary resuscitation. The straps of 2-inch belting should be at least 9 feet long and equipped with slip-through friction catches. While various kinds of short boards are in use, the one shown here is similar to that described by Louis C. Kossuth in the September 1966 *Journal of Trauma*.

Both spine boards have been modified as a result of extensive use. Drawings on pages 10 and 11 give details.

The Universal dressing unfolds to 10 inches by 18 inches or to 10 inches by 36 inches and affords adequate coverage for any wound. It may be used also as padding for splints. When two dressings are folded together lengthwise,

Hand operated bag-mask ventilation units *for ambulance use**

*As evaluated by Emergency Care Research Institute, Philadelphia***

Name	One-year shelf life	Low-temperature operation 32° F. or below	Clear mask	Ease of cleaning	Comments
Resusci folding bag Mark II Laerdal Medical Corp.	good	good	yes	good	Oxygen reservoir supplied
PMR Puritan-Bennett Corp.	good	good	no	good	relatively heavy
AGA Revivator AGA Aktiebolag	good	good	no	poor	oxygen reservoir permanently attached; relatively fatiguing to operate
Hope Ohio Chemical & Surgical Equipment Company	good	valve freezes	no	good	with high oxygen flow, valve may lock in inspiratory position
Ambu Air-Shields, Inc.	fair	valve freezes	no	poor	valve may lock (see comments on Hope, above)
Air-Viva Bird Corp.	good	valve freezes, bag inoperable	yes	poor	10 to 20 per cent of expired air is rebreathed with each cycle
Pulmonator Corbin-Farnsworth, Inc.	good	bag inoperable	no	good	relatively fatiguing to operate; manufacturer states unit tested no longer produced
Porton Greiner Scientific Corp.	good	good	no	poor	mechanical defects cause large leaks to develop in folds of bellows
Clar Aire** Clar Aire Corp.					
Res-Q-Aire** Res-Q-Aire, Inc.					

*In "estimated order of preference," according to the Emergency Care Research Institute.

These two units, **Clar Aire and **Res-Q-Aire**, were listed by the Emergency Care Research Institute and described as "ineffective and dangerous, should be removed from service." In a letter to the editor of J.A.M.A (vol. 210, no. 7) Joel J. Nobel, M.D., Director of Research, E. C. R. I., drew attention to the widespread distribution of these two dangerous emergency respiration support units and urged all physicians, other health authorities, and health organizations to destroy all of the devices in their possession and to encourage others to follow suit. In the *EHS Memo* of December 30, 1969 is a report on the manually operated emergency ventilation devices tested by the Emergency Care Research Institute.

they form an effective cervical collar which may be held in place either by safety pins or by wrapping with a soft roller bandage.

The Universal dressing is available commercially but is easily made locally by cutting bolts of standard "A.B.D." material into 36-inch lengths, folding these from each end to the center three times, and packaging each in a paper bag, the end of which is sealed by stapling. After sterilization, each packaged dressing is placed individually in a plastic bag which also contains a 6-inch soft roller bandage.

The hand operated bag-mask ventilation unit is superior to the mechanical resuscitator or pulmotor. It is simply constructed, it performs adequately, and the operator may make immediate pressure adjustments simply by changing his hand pressure. The unit is also much less costly than the mechanical resuscitator or pulmotor.

The major advantage of the bag-mask unit is that it permits the technician to direct attention to the patient rather than to apparatus.

For effective pharyngeal suction a minimum vacuum of 12 inches of mercury (20 inches optimal) and free air flow of over 30 liters per minute at the delivery tube, with rapid drawdown time, is required.

Some types of bag-mask ventilation units and portable suction apparatus, with a description of their characteristics, are named on opposite page and this page, respectively.

Litters, and safety and housekeeping equipment, are not specified, since it is assumed that these basic items, as well as *installed* suction and oxygen, will be carried.

In anticipation of more advanced training in the use of specialized equipment for greater numbers of technicians, and the occasional presence of physicians at the scene of emergencies, additional equipment may be carried in a sealed container, depending on local conditions and decisions.

These items are:

Tracheal intubation kit
Pleural decompression set
Drug injection kit
Venous cut-down kit
Minor surgery kit
Tracheostomy or cricothyrotome set
Urinary catheters
Portable cardioscope and defibrillator

Suction units for ambulance use*

Name and manufacturer	Vacuum in inches of mercury	Rate of air flow per minute
Vaculette Corbin-Farnsworth Inc.	25	17 liters
Laerdal suction unit Laerdal Medical Corp.	25	50 liters
Ambu foot-powered unit Air-Shields, Inc.	12	12 liters**

* Performance data supplied by manufacturer
**Approximately

Unless a rescue vehicle accompanies an ambulance on every accident call, certain access and extrication equipment should be carried. The time element in life-threatening problems is so critical that, if the technicians must await the arrival of such equipment, lives that could be saved will be lost.

Specifically, these items are:

One wrench, 12 inches, with adjustable open end
One screw driver, 12 inches, with regular blade
One screw driver, 12 inches, Phillips type
One hacksaw with 12 wire (carbide) blades
One pliers, 10-inch vise-grip
One 5-pound hammer with 15-inch handle
One fire axe butt with 24-inch handle
One 24-inch wrecking bar (bar and two preceding items can either be separate or combined as a forcible entry tool)
One crowbar, 51 inches, with pinch point
One bolt cutter with $1\frac{1}{4}$-inch jaw opening
One portable power jack and spreader tool
One shovel, 49 inches, with pointed blade
One double-action tin snip, minimum, of 8 inches
Two manila ropes, each 50 feet long and $\frac{3}{4}$ of an inch in diameter

A power winch is optional. A front-mounted winch, with a minimum capacity of two tons, is recommended, particularly in areas where it would not otherwise be readily available. In addition to rated cable, ambulance should carry a 15-foot rated chain with one grab hook and one running hook.

Standards for *emergency ambulance services*

Organization and operation

IN EACH COMMUNITY the health department or other governmental agency should obtain the authority to regulate all public and private ambulance services. (If enabling legislation is required for such authority, the local government should request it from the state legislature.)

A state, county, or municipal agency, perhaps a community council, should determine the need for volunteer, tax supported or proprietary ambulance services, and procedures for licensing and enforcing standards for each service. Twenty-four hour, year-round coverage should be available.

The operator of an ambulance service should be legally and morally responsible for the conduct and operation of the organization. The employer should be accountable for the character and moral conduct of those whom he employs.

A manual of ambulance service policies and standards should be available for use by all personnel.

A privately owned ambulance company should be financially responsible, and should carry adequate public liability insurance. Reasonable charges, predicated on services provided and operating costs, should be posted with and approved by the licensing authority.

All ambulance personnel should respect local fire, building, health and traffic regulations and be familiar with community disaster plans.

Standby emergency ambulance service should be established and coordinated with other operators of other services in adjacent areas.

A record of all violations of the law by his personnel should be kept by the operator of the ambulance service. He should also keep a record of any accidents in which his vehicles are involved.

All communities should have an ordinance regulating ambulance service. The Committee on Trauma recommends that "*A Model Ordinance or Statute Regulating Ambulance Service*,"* as revised in 1970, be used as a guide by local authorities for any necessary legal action.

Personnel

At least two persons, equally trained as emergency medical technicians-ambulance (EMT), should man each emergency ambulance.

Each EMT's ability to drive and his competence in emergency care should be certified by the licensing authority. Before an applicant is certified, the licensing authority should determine that he is not addicted to alcohol or drugs and has not been convicted of a felony. He should read, speak, and write English.

Physical examination by a physician should confirm that the applicant has a sound body; has distant visual acuity of at least 20/40 (Snellen) in each eye without corrective lenses or visual acuity separately corrected to 20/40 (Snellen) or better with corrective lenses; distant binocular acuity of at least 20/40 (Snellen) in both eyes with or without corrective lenses; field of vision of at least 70° in the horizontal meridian in each eye; the ability to recognize the colors of traffic signals and devices showing standard red, green and amber, as recommended in April 1970 by the Federal Highway Administration for drivers engaged in interstate commerce, and has no physical defects which might impair his ability to serve as an EMT. Provisions for periodic re-examination should be made.

He should hold a current advanced first aid certificate of the American National Red Cross or its equivalent, and in addition should have received basic training and demonstrated proficiency in all phases of emergency care and protective extrication. Recommended training** and refresher programs of several days'

These standards, developed by the **Committee on Trauma** of the American College of Surgeons, were first approved by the Board of Regents in February, 1967. Since then, they have been revised and again approved by the Board of Regents in February, 1971.

These standards include requirements for emergency care at the site of injury or illness, and for safe and comfortable transportation to a hospital. The Committee on Trauma believes that lives can be saved if ambulance personnel are well trained as emergency medical technicians-ambulance; if ambulance vehicles are equipped adequately and operated safely, and if all communities and operators insist on meeting and maintaining high standards for the organization and operation of emergency ambulance services. The committee recommends that every community or groups of small communities, regardless of size, organize a council on emergency medical services to coordinate all lay and professional activities that encompass emergency care, transportation, and definitive treatment of patients with an acute illness or accidental injury in hospital emergency departments.

duration should be provided by physicians. EMT's should avail themselves of refresher courses and other meetings which could enhance career development.

Ambulances

The patient-carrying vehicle should provide easy loading, privacy, and comfortable riding. There should be adequate space for essential equipment and for an EMT to continue emergency care in transit. Driver's and patient's compartments should be separate. Good illumination and temperature control of the patient area are required.

The ambulance should start and stop slowly and smoothly and travel at a safe speed. Jostling and speed may be harmful and dangerous to the patient.

An ambulance should be kept clean and supplied with fresh linen for each call. After it has transported a patient with a contagious disease, the vehicle must be cleansed thoroughly before it is used for another call.

Equipment

The ambulance must be adequately equipped, according to the American College of Surgeons' "Essential Equipment of Ambulances",*** with which an EMT may provide adequate emergency care for the critically ill or injured at the scene and during transport to medical facilities.

Unless a rescue vehicle accompanies the ambulance on every emergency call, certain access and extrication equipment should be carried on the vehicle, as the time element in life-threatening situations is critical.

Communications

All vehicles should be equipped with a two-way radio capable of clear transmission and reception over not less than 20 miles. There should be two-way radio communication between the ambulance, hospital emergency department, and dispatcher.

A central dispatching office for all emergency ambulances should be established. It should be equipped with an adequate communications system, a time-recording device, and adequate space for records. On all shifts the dispatcher should have at least as much training as the EMT's on ambulances so that he can receive and transmit reliable information as to the illness or injury of the patient.

Ambulance-Hospital Emergency Service Liaison

There should be a close working relationship between ambulance services and the hospitals of the community. The hospital staff should provide training for ambulance personnel. There should be an agreement for exchange of appropriate items of equipment.

Verbal report should be made to the personnel of the emergency department at the time of delivery of the patient. A report, either written or dictated, to be part of the patient's permanent record, should be made by the EMT prior to leaving the medical facility.

The hospital staff should conduct critiques with EMT's on all patients at regular intervals depending on day-to-day experience.

Ambulance personnel should know the hospital to which patients should be taken, according to degree and nature of their injuries or illnesses.

Ambulance Esprit de Corps

Ambulance services should be conducted in such a manner as to espouse esprit de corps among all members of the staff of the ambulance service. All members should wear neat, clean uniforms.

Speed and Use of Sirens and Flashing Light

Ambulances on emergency calls should obey, under most circumstances, the regulations controlling speed, and the traffic signs and signals which apply to ordinary non-emergency traffic. On rare occasions, speeds above the established limit and certain other traffic violations may be justified. The use of flashing lights at the scene of the incident and low-key use of sirens for clearing traffic is recognized as a necessity.

* *"A Model Ordinance or Statute Regulating Ambulance Service." Developed by the American College of Surgeons, the American Association for the Surgery of Trauma, and the National Safety Council under their Joint Action Program. The model ordinance may be obtained from the National Safety Council, Traffic Department, 425 North Michigan Avenue, Chicago, Illinois 60611.*

** *Recommended basic training for EMT's may be found in:*

1. *"A Curriculum for Training Emergency Medical Technicians", Bulletin, American College of Surgeons, Sept.-Oct., 1969. ACS, 55 East Erie Street, Chicago, Illinois 60611.*
2. *"Basic Training Program for Emergency Medical Technicians Ambulance", Instructor's Lesson Plans, Feb. 1970. U.S. Dept. of Transportation, National Highway Safety Bureau, Nassif Building, Washington, D.C. 20591.*
3. *Ambulance Design Criteria, A Report to the National Highway Safety Bureau, FHWA, DOT, June 30, 1969, National Academy of Engineering, Washington, D.C.*

*** *Essential Equipment for Ambulances may be obtained, single copies free, from the American College of Surgeons, 55 East Erie St., Chicago, Ill. 60611.*

A curriculum for training emergency medical technicians

J. D. FARRINGTON, M.D., F.A.C.S., Minocqua, Wisconsin
and
OSCAR P. HAMPTON, JR., M.D., F.A.C.S., St. Louis

SEVERAL MONTHS AGO the American College of Surgeons entered into a contract with the Division of Emergency Health Services, Public Health Service, whereby representatives of the College would carry out several missions related to the training of ambulance attendants. The first was the development of a curriculum for a basic training course in consonance with "TRAINING of Ambulance Personnel and Others Responsible for Emergency Care of the Sick and Injured at the Scene and During Transport," a document developed within the Division of Medical Sciences, National Academy of Sciences-National Research Council.

The second mission called for a list of training aids to be used with the curriculum.

In consonance with current concepts for courses of training for emergency medical technicians, the curriculum for a long-term, continuing course of 24 sessions of three hours each, to be given at the rate of one or two per week, was developed. After these were completed, four additional in-hospital training sessions were provided. These supplemental sessions in the hospital are necessary. A prerequisite to the entire curriculum of training is the completion by each participant of both the Standard and Advanced First-aid Courses of the American Red Cross, or their equivalent.

The list of training aids which was developed includes printed material for instructors and for students, reference material for students, audio-visual aids for each of the sessions, and the equipment necessary for the instructional and practice sessions.

In the anticipation that they will be of value to those interested in instituting courses for training emergency medical technicians in their localities, the outline of the curriculum and the list of aids follow.

Reprints will be available on request from the College, 55 East Erie Street, Chicago, Illinois 60611.

Curriculum
24 three-hour sessions
72 hours plus four in-hospital training sessions

Session	Topic	Content and objectives
		These sessions are designed to—
1.	General information and orientation	describe ambulance and its equipment; objectives of training; responsibilities to patient, family, religion; police and
2.	General information and orientation	news media; public relations; control of scene; handling of the deceased; sorting multiple casualties; defensive and emergency driving*; communications; reports and records.
3.	Anatomy and physiology	describe, using visual aids, anatomical structures as they
4.	Anatomy and physiology	should be understood by emergency medical technicians; physiology of respiration, circulation, nervous, osseous and muscular systems; and how to evaluate diagnostic signs.
5.	Review, questions and evaluation session	make certain students have assimilated material presented in previous sessions and are prepared for those to follow.
6.	Life-threatening problem—pulmonary	emphasize necessity to establish and maintain airway, describe artificial ventilation such as mouth-to-mouth and other methods (bag-mask resuscitation units and manually triggered units). Demonstrate use of suction equipment and airways.

(*Continued*)

*In this course, defensive and emergency driving are discussed in general terms. It is highly desirable that emergency medical technicians avail themselves of the present courses given in each state in defensive and emergency driving.

Reprinted from BULLETIN OF THE AMERICAN COLLEGE OF SURGEONS September · October 1969

Session	Topic	Content and objectives
7.	Life-threatening problem—cardiac arrest	teach how to recognize arrest and perform external cardiac compression, using inflatable mannequins, and film *Pulse of Life.*
8.	Practice session—cardiopulmonary resuscitation	review techniques of providing and maintaining an open airway, using equipment; artificial ventilation; use of oxygen and external cardiac compression. (Students are separated into groups depending on number of inflatable mannequins available but never in a group of more than ten per instructor and mannequin.)
9.	Review, questions and evaluation session	make certain students have assimilated material in lessons 6, 7 and 8; re-instruct them in techniques covered in those sessions.
10.	Life-threatening problem—bleeding and shock	teach how to recognize and control bleeding, using pressure dressings; explain limited use of tourniquet; give measures to overcome shock, including intravenous fluids; conduct general discussion and demonstration using training arm (actual performance during training in hospital sessions).
11.	Acute medical problems	instruct on heart attack, stroke, diabetes, contagious disease, allergic reactions, convulsive disorders, unruly patient, nosebleed, poisonings, exposure to heat and cold; heart failure; pulmonary edema; emphysema and unconscious states.
12.	Acute medical problems	
13.	Review, questions and evaluation session	make certain students have assimilated material in lessons 10, 11 and 12; and re-instruct them in techniques covered in those sessions.
14. (a)	Emergency obstetrics and care of infants	instruct on physiology of childbirth; how to deliver infant, protecting it and mother; ligation of the cord; afterbirth; care of infant, including transportation of the premature infant. Film *Medical Self Help,* Lesson 11 (page 4) is excellent for teaching.
14. (b)	Eye, body cavity and genitalia injuries	instruct on care of eye injuries; protective dressings; care of thoracic cage injuries, including fractures, crushed chest, flail chest and sucking wounds; care for evisceration and blast injuries of the abdomen; protect genitalia and transport avulsed genital parts.
15.	Wounds, burns, and environmental injuries	instruct on soft tissue injuries, including thermal, electrical and radiation injuries.
16.	Fractures and dislocations of long bones and pelvis	instruct on anatomy and terminology of fractures; how to suspect fractures; reasons for splinting; splinting equipment and its use. Demonstration.
17.	Spinal fractures and head injuries	instruct on danger of spinal fractures; reasons for protecting spine against movements; extrication, including use of backboards; dressings and splinting prior to movement; significance of head injuries and handling the unconscious accident victim.
18.	Practice session	apply dressings, bandages, and splints.

Session	Topic	Content and objectives
19.	Movement of patients	describe lifts and carries; use of litters and stretchers, including movement of patients under difficult circumstances; presentation of slides and demonstration of lifts and carries by instructors.
20.	Extrication	describe surgical principles--presentation and demonstration by instructors.
21.	Practice session	practice use of lifts and carries, litters and stretchers, including movement of patients under difficult circumstances.
22.	Practice session	practice extrication, including care of patient, dressing, bandaging and splinting prior to movement.
23.	Practice session	
24.	Written and practical examination	determine proficiency of technicians.
		The four supplemental sessions are designed to— supply in-hospital training with exposure to cardiopulmonary resuscitation, obstetrical problems, general care of patient, intravenous fluids and blood pressure monitoring.

Printed material for instructors

Topics	Session
Curriculum for Training Emergency Medical Technicians, Division of Emergency Health Services, Public Health Service (First Report under American College of Surgeons—Public Health Service Contract No. 110-69-10).	1 - 23
Cardiopulmonary Resuscitation, A Manual for Instructors. Published by the American Heart Association, Catalogue #EM408. One for each course.	1 - 23

Reference material for instructors

Topic	Session
Emergency Medical Guide, Second Edition. John Henderson. (New York: Blakiston Division, McGraw-Hill Book Co., Inc., 1969)	1 - 23
First Aid, Diagnosis and Management. Edited by Warren H. Cole and Charles B. Puestow. (New York: Appleton-Century & Crofts, sixth edition, 1965) One for each course.	1 - 23
Emergency Victim Care and Rescue Textbook for Squadmen, 1965. Ohio Trade and Industrial Education Service, Division of Vocational Education, State Department of Education. (Published by Instructional Materials Laboratory, Ohio State University, Columbus)	1 - 23

Printed material for students

Topics	Session
Wonderful Human Machine, The. (Published by American Medical Association, Catalogue #OP9) One for each student.	3 - 5
Training of Ambulance Personnel in Cardiopulmonary Resuscitation (Discussion guide published by American Heart Association, Catalogue #EM386A) One for each student.	6 - 9
Emergency Measures in Cardiopulmonary Resuscitation. (Discussion guide published by American Heart Association, Catalogue #EM376A) One for each student.	6 - 9
Minimal Equipment for Ambulances. Committee on Trauma, American College of Surgeons (Bulletin, A.C.S. March-April 1967) One for each student.	10, 14(b), 15 - 17
First Aid for Laryngectomees. International Association of Laryngectomees-American Cancer Society, 219 East 42 Street, New York 10017. One for each student.	6 - 9

(*Continued*)

A curriculum *for training emergency medical technicians—continued*

Reference material for students

Topics	Session
Emergency Care of the Sick and Injured. Edited by Robert H. Kennedy, and sponsored by the Committee on Trauma, American College of Surgeons. (Philadelphia: W. B. Saunders Co., 1966)	1 - 23
First Aid for Emergency Crews: A Manual on Emergency First Aid Procedures for Ambulance Crews, Law Enforcement Officers, Fire Service Personnel, Wrecker Drivers, Hospital Staffs, Industry, Nurses. Carl B. Young, Jr. (Springfield, Illinois: Charles C Thomas, Publishers, 1966)	1 - 23
Pennsylvania Ambulance Attendant Training Manual. Edited by Dan D. Gowings, Pennsylvania Department of Health, Harrisburg.	1 - 23

Audio-visual aids

Topic	Session
A.C.S slides set: Series A (Sessions 1, 2); C (3, 4); F (6, 7); G (10); M (11, 12); N (14-a, 14-b); H (15); J and K (16); L (17); B (20). One set (560 slides) for each course.	
Training of Ambulance Personnel in Cardiopulmonary Resuscitation. American Heart Association. Slide set, Catalogue #EM386. One set for each course.	6 - 9
Emergency Measures in Cardiopulmonary Resuscitation. American Heart Association. Slide set, Catalogue #EM376. One set for each course.	6 - 9
Medical Self-Help. Lessons 1-11 (motion pictures). U.S. Public Health Service. Available through: Regional Program Director, P.H.S.	1 - 23
Breath of Life, motion picture. American Heart Association.	6 - 9
Pulse of Life, motion picture. American Heart Association.	6 - 9
Cry for Help, motion picture. U.S. Public Health Service Audio-Visual Facility, Atlanta, Georgia. Code MIS 682.	12

Equipment

	Session
Blackboard, chalk and eraser	1 - 23
Mannequins	
Resusci-Anne or equivalent	6 - 9
Thoracic cut-away or equivalent	6 - 9
Anatomic-Anne or equivalent	6 - 9
Clothes mannequin and moulages provided locally for simulated injuries	10, 13 - 17, 20 - 23
Simulated or outdated blood (simulated blood made with liquid starch and food coloring) to pour on rugs, carpet, car seats, clothes, etc., to simulate injuries and aid in instruction in estimating blood loss.	10, 13 - 15
Long and short spine boards (use of a scoop-type stretcher optional)	16 - 18, 20 - 23
Automobile front seat affixed to table to demonstrate proper application of short board to sitting injured and application of long board	20 - 23
Minimal Equipment for Ambulances. Committee on Trauma, American College of Surgeons (BULLETIN, A.C.S., March - April, 1967). One of each item listed, and, in addition, inflatable splint, blood pressure manometer, two-way teaching stethoscope.	10, 13 - 17, 20 - 23
Aluminum foil, roll 18 inches wide, for wrapping premature infant, except for face, when ambulance does not carry incubator, and also for covering eviscerations and sucking wounds of the chest.	14(a), 15
Doll, approximately 17 to 20 inches long, for practice of above.	14(a)

Special issue

Commemorating the 50th anniversary of the Committee on Trauma

A history of the
Committee on Trauma

Fifty years' progress in:

Burns

Abdominal injuries

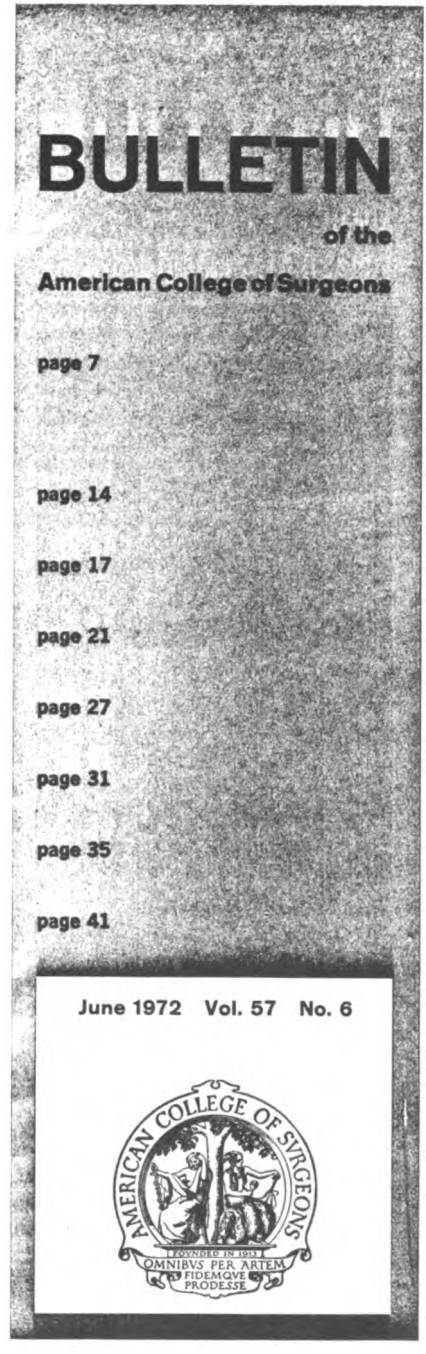
Chest injuries

Shock

Skeletal injuries

Vascular injuries

Neurological trauma



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HEINZ R. KUEHN, EDITOR-IN-CHIEF

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Introduction

The Committee on Trauma of the American College of Surgeons held its annual meeting in Charleston, South Carolina April 13–15, 1972. Because this was the Fiftieth Anniversary meeting, it was decided that this should be in the form of a special celebration. The Medical University of South Carolina served as the host institution. Current and previous members of the committee, officers of the College, section chiefs, and state/provincial chairmen attended.

The clinical program was held in the new Basic Sciences Auditorium of the Medical University of South Carolina. After appropriate introductory remarks by William M. McCord, MD, President of the Medical University of South Carolina, and Jonathan E. Rhoads, President of the American College of Surgeons, an outstanding scientific program followed. The Golden Anniversary Orations were given by distinguished lecturers who reviewed fifty years' progress in specific aspects of trauma.

Curtis P. Artz, MD, FACS
Chairman, ACS Committee on Trauma

Richard J. Field, Jr. (*center*) received one of the two Trauma Achievement Awards presented during the 50th anniversary celebration. Doctor Field, chairman of the Mississippi Committee on Trauma since 1963, was honored for his extensive and effective program to improve athletic standards for high school and grade school competitors, for his efforts as section chief of an eight-state area, and his development of active committees in three of the states. The award was presented by Robert W. Gillespie (*left*) chairman of the subcommittee on regional committees, and Curtis P. Artz (*right*) chairman of the Committee on Trauma.

C. Thomas Thompson (*center*) chairman of the Oklahoma Committee on Trauma, also received a Trauma Achievement Award for his activities toward the improvement of the status of the burn patient in northeast Oklahoma, actions to improve emergency medical care through the development of a statewide program of emergency transportation and medical services, and the preparation and publication of extensive audio-visual training programs for emergency medical technicians. Doctors Gillespie (*left*) and Artz (*right*) made the presentation.

William M. McCord, President of the Medical College of South Carolina, which was host to the meeting, Curtis P. Artz, chairman of the ACS Committee on Trauma, and Jonathan E. Rhoads, President of the American College of Surgeons (*left to right*) during opening ceremonies of the clinical program of the 50th annual meeting of the Committee on Trauma.

The Authors

HAMPTON

MONCRIEF

FITTS

SAMSON

GURD

WADE

RICH

MEACHAM

Foreword

One of my greatest privileges as President of the American College of Surgeons is to felicitate the Committee on Trauma on the completion of fifty years of service.

The Committee on Trauma, originally the Committee on Fractures, was, I believe, the first committee of the College to address itself to a categorical problem. It was followed much later by the group interested in cancer, another group interested in pre- and postoperative care, one on graduate education, and others. Possibly my first opportunity to go to a College meeting arose when I was working for Dr. Walter Estell Lee who asked me to help with some fracture demonstrations he had organized for one of the congresses in Atlantic City before world war II.

Not only have you had a great cause, but you have had a succession of great people as members of this committee. Beyond this, it is a committee which has brought together people from many disciplines, particularly after it broadened its charge from fractures to the whole field of trauma. Yours is one of the proudest traditions of the American College of Surgeons and your activities have reached out more broadly perhaps than any other program of the College, unless it be the program in hospital accreditation now carried on as a joint enterprise through JCAH.

As some of you know, this group recommended to the Regents of the College that the College endorse the formation of an American Trauma Society with a purpose of raising more money to improve surgical care in the field of trauma by research, education and increased recognition of the problem by the public. This group is now moving forward under strong leadership with William T. Fitts, Jr. as president and John M. Howard as secretary-treasurer, both members of this committee. Some money has been raised through founder memberships and more is anticipated.

An encouraging sign is that Congress is showing an increased interest in programs in emergency medical care. At a recent meeting of the ACS Committee on Pending Legislation, under the chairmanship of William A. Altemeier, we had the opportunity of asking one of the staff members of the House Committee on Interstate and Foreign Commerce how to go about giving testimony at hearings of Rep. Rogers' sub-committee on health. The method is simple: one writes to the clerk of the House Committee on Interstate and Foreign Commerce, identifying oneself and asking to be notified when hearings will be held on bills concerning emergency health care, indicating that one would wish to offer testimony.

I am very hopeful that one or more representatives of the American Trauma Society can be heard, and I should think it very important also that representatives of this committee be heard. Oscar P. Hampton, Jr. is taking steps to provide appropriate witnesses. I think there is some chance that some federal funding in the area of emergency care might be enacted in 1972, and if not in 1972, in 1973. I gather that the kind of things which some congressmen are concerned about relate to evacuation, improvement of practices in accident wards and better communications. There are several bills which have been introduced. It is believed that if Representative Rogers held hearings on them, the sub-committee would address itself to the whole area rather than to one specific bill. The sub-committee might then write its own bill embodying those features which seem to it most pertinent and practical.

It is high time that we moved to employ in civilian life some of the advanced techniques, including those dependent on helicopter evacuation, which have been so well worked out in Viet Nam.

There never has been adequate funding for research in trauma and shock, but the current interest of some of our health statesmen in the Congress may well bring forth significant government support if we can agree on meaningful programs and then point the way.

I congratulate the Committee on Trauma on its great record, its fine program and believe that the time is ripe for even more rapid advances in the years immediately ahead.

Jonathan E. Rhoads, MD, FACS
President
American College of Surgeons

"No argument is necessary to convince surgeons that results of fracture treatment in the U.S. and Canada are deplorably bad . . . there are good results, there are remarkable results but, generally, by and large, the results are poor—poor anatomically and poor functionally. We are surgeons desiring improvement in the results of fracture treatment."

ACS Yearbook, 1923

The Committee on Trauma
of the
American College of Surgeons
1922-1972

OSCAR P. HAMPTON, JR., MD, FACS, Chicago
Assistant Director, Trauma, ACS

THE COMMITTEE ON TRAUMA, a standing professional committee of the American College of Surgeons, was established 50 years ago this May and, while its name has changed several times during the span, has kept its original objective—improvement in the care of the injured. In 1922 the Regents appointed the first committee and named it the Committee on the Treatment of Fractures. In 1933, it was renamed the Committee on Fractures and kept this title until 1939, when it merged with the College's Board of Industrial Medicine and Traumatic Surgery, and came out as the Committee on Fractures and Other Trauma. In 1941, "Fractures and Other" was dropped, and the committee came into existence as we know it today.

Actually, its history antedates 1922. Ten years earlier, and one year prior to the founding of the College, the American Surgical Association passed a resolution calling for an ad hoc, five-man committee to prepare a statement on the relative value of operative and non-operative treatment of long bone fractures, and to offer an opinion on the value of radiography in the choice of a treatment method.

John B. Roberts chaired the ASA Committee of Five from 1912 through 1914 and William L. Estes, Sr., from 1915 until it was disbanded in 1921. In 1914, Charles L. Scudder and six others were made associate members to broaden its geographic representation. In 1921, the committee's final report to ASA concluded:

Continued

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COMMITTEE ON TRAUMA

"The first step in the betterment of fracture treatment is the study of results achieved by present day methods. An adequate study is impossible without complete records."

The report led the ASA to suggest that the eight year old American College of Surgeons continue the work of the Committee of Five, anticipating that adequate fracture records could be obtained by the College through its hospital inspection activities, then three years old. Indeed, as a part of its accreditation program, College inspectors investigated organization and records of fracture treatment in hospitals.

The following year, in May of 1922, the Board of Regents of the College appointed the first Committee on Treatment of Fractures, with Doctor Scudder of Boston, who had organized the first fracture service in the U.S., as chairman.

The first committee report to the Regents was published in the 1923 *Year Book* of the College. The report set a pattern for committee activities to the present. Many of the goals outlined remain current objectives. The report read, in part, as follows:

"Surgeons are today, as never before, interested in fractures of bone. A well-grounded, latent enthusiasm exists which may be advantageously utilized. There is no recognized authoritative standardization of principles governing their treatment . . . and the teaching of fractures in medical schools varies and is most unsatisfactory. No argument is necessary to convince surgeons that results of fracture treatment in the United States and Canada are deplorably bad . . . there are good results, there are remarkable results but, generally, by and large, the results are poor—poor anatomically and poor functionally. We are surgeons desiring improvement in the results of fracture treatment. This Committee on Fractures has recently been formed and, with the regional committees, over 200 men are serving. The committee has already asked three questions of the regional committees: (1) What principles underlie first-aid treatment, including transportation? (2) What are the means by which these principles may be carried out? and (3) What are your recommendations as to the equipment of ambulances, first-aid agencies, including hospital receiving wards, in the effort to establish standardization of this phase of treatment? In due time, a study of teaching methods in medical schools will be made by your committee. The committee is alive to the grave situation in fracture treatment. There are many suits for malpractice and 60 percent of malpractice suits brought in New York State alone are because of fractures. Cases of blackmail exist—"send me a bill and I will sue you"—and are rapidly increasing in number. There is ignorance regarding simple and efficient methods of treatment of fractures. There is need for improvement in both graduate and undergraduate medical school instruction. Your committee will spare no pains in its investigation and deliberations to help remedy these evils."

In 1926, the Regents of the College appointed the Board of Industrial Medicine and Traumatic Surgery, with the task of gaining improved medical service in industry in the elimination of industrial health hazards. Frederick C. Besley of Waukegan, Illinois, served as board chairman until its merger with the Committee on Fractures in 1939. Three Fellows were members of both the committee and the board. Seven other board members became committee members following the merger.

THE BOARD was joined by medical departments of insurance carriers and industrial corporations in their studies and attempts to institute improvements. Surveys by members of the board of large industrial plants at various locations revealed several deficiencies. Generally, industrial injuries had not been treated by the better qualified surgeons. Physicians serving industry appeared disinterested in administrative and preventive phases of industrial medicine, partly because appropriate authority had not been delegated to them by their employers. Smaller industrial establishments lacked adequate medical service. From its findings, the board formulated a set of minimum standards for medical service in industry which was applicable to plants of all sizes. Just as compliance with current standards and recommendations of the Committee on Trauma is voluntary, any improvements in industrial medical services are based on voluntary compliance with board recommendations.

In 1933, a list of approved industrial medical services was published. By 1937, 50 percent of 1,657 industrial establishments surveyed had been approved. Interestingly, the board granted a certificate of approval. Currently the Committee on Trauma avoids issuing certificates of approval because of medical legal implications. The committee and its regional committees issue certificates only to show that individuals have attended a specific educational or training program.

Doctor Scudder terminated his tenure as chairman in 1932, but he continued as honorary chairman. Fred Bancroft of New York became chairman in 1933. Robert Kennedy of New York, an appointee in 1931, was secretary from 1933 until he was made chairman in 1939.

Bob Kennedy served until 1952, the longest tenure of any chairman. He was succeeded by Arnold Griswold of Louisville, who established the practice of a five-year tenure for committee chairmen. Griswold was succeeded by Preston A. Wade of New York in 1957, who served only two years, resigning to become a Regent.

In 1959, Harrison L. McLaughlin of New York became chairman and, in line with the Griswold concept, served for five years. A bleak period in the Committee's history followed as your author was appointed chairman in 1964. The College terminated his tenure in 1968, by putting him on the payroll as an assistant director. Things improved promptly when Curtis P. Artz of Charleston was appointed chairman.

Since the first appointments five decades ago 161 Fellows of the College have been committee members. The first Committee on Fractures was composed almost entirely of general surgeons, the single exception being one orthopedic surgeon. Through the decades of the 20s and 30s, general surgeons predominated as authorities on fractures. As orthopedic surgeons moved into the field of trauma, particularly the treatment of fractures, an increasing number became committee members during the 30s, 40s and 50s and made splendid contributions to committee activities. Currently, about half of the committee are orthopedic surgeons, specialists who naturally accept and meet responsibilities.

THE COMMITTEE currently has 41 active members, representing practically every surgical specialty concerned with trauma, and in line with the goal established in the 1930s. Until 1959, active members, on request or on committee action without request, could be given emeritus status with indefinite tenure. In 1959, the Regents limited senior membership to six years. However, at that time, the Director of the College ruled, without being over-ruled by the Regents, that all current senior members would have indefinite tenure. He couldn't bear the thought of telling the likes of Paul Magnuson, Bob Kennedy, Isidore Cohn, Bill Estes, Pep Wade and Phil Wilson, that they were no longer senior members of the committee. Paul North had been an active committee member until he became Director. In 1968, the Regents made him a senior member with indefinite tenure. Currently, the committee has 49 senior members, many of whom continue to participate and render valuable service.

Regional committees, that is, state/provincial and local committees, are currently and apparently always have been action arms of the Committee on Trauma. Each member of the first Committee on Fractures was charged with the development of a regional committee in his home area. The first report to the Regents indicates regional committee membership of about 200. As of January 1, 1972, there were 66 state/provincial committees and 341 local committees. The number of state committees is 58 because committees in six metropolitan areas are given state status and California and Florida both have northern and southern committees. While the degree of activity among these committees varies, all but one have projects underway designed to improve prehospital or hospital care of the injured. On January of this year, 1,953 members, about 90 percent Fellows, constituted the state/provincial committees. Including the membership of local committees, the total network numbers about 3,400.

AS PART OF the regional committee organization, state/provincial committees are grouped into sections, each with a chief. Currently, there are 10 U.S. Sections, the boundaries of which conform to those of the U.S. governmental regions. Two sections cover Canada. The majority of section chiefs are not members of the Committee on Trauma.

From the beginning, regional committees have provided periodic courses in continuing education for physicians, first on the management of fractures and later on the management of various phases of care of the injured. The Chicago committee, one of the most productive regional committees, initiated the first of 15 annual courses in 1957 under the leadership of Doctors Sam Banks and John Fahey. Thereafter, other regional committees periodically have sponsored similar programs. In line with the efforts of the first fracture committee to achieve splinting of fractures by ambulance personnel, regional committees over the years have provided hundreds of training programs for ambulance attendants. For example, the

Continued

Chicago committee has provided one or two courses annually during the past 11 years. In fact, until about 1960, trauma committees constituted the only physician groups striving to improve emergency ambulance service. They were essentially voices in the wilderness and their volunteer efforts were often scorned by local governmental officials. Regardless, regional committees worked diligently and undoubtedly achieved improvement in their respective localities. They were organized and ready to participate when the National Highway Safety Bureau came into existence with funds to help support state activities to improve emergency ambulance service. In almost every state, ACS committees have been involved in governmental efforts to upgrade emergency care and transportation of the injured.

REGIONAL committees have had many other kinds of projects. A number, following the format established by Doctor George Anast for the Chicago committee, have provided highly successful courses for emergency department nurses. Many, following the example of the New Jersey committee, have made surveys on request of hospital emergency departments, offering constructive advice on organization, facility design, equipment and staffing. A great many have participated in local and regional disaster preparedness, often serving as the stimulus for efforts at improvement. The Nebraska committee waged a state-wide campaign for active immunization against tetanus. The Oklahoma committee participated in the establishment of a regional burn center and is the leader in efforts to improve the state's emergency services.

One of the most important assignments to a member of the Committee on Trauma is that of chairman of the subcommittee on regional committees, which is made up of section chiefs. This subcommittee has had great leaders as chairmen. To name some, Wade (1949–1954) who wrote the first guide for regional committees; George Curry, (1955–1959); Vernon C. Abbott, (1960–1966); and Robert W. Gillespie, (1967 to date). The Committee owes much of its success to these men.

In 1949, following the death of Doctor Scudder, the committee adopted a resolution which ends "The regional committee idea represents a fitting memorial to his zeal for widespread education in fracture problems".

Activities, more than personnel, are the *raison d'être* for the Committee on Trauma. Although several activities have extended through the 50 years, committee activities could be grouped into those of (*A*) the Scudder era, 1922–32 (*B*) Committee on Fractures, 1933–39, (*C*) Committee on Fractures and Other Trauma, 1939–49, and (*D*) Committee on Trauma, 1949–71. It seems preferable, however, to divide them into only two phases, the first 1922–1959, and second, the decade of the 60s.

The Committee on Fractures in 1922 recognized two needs, improved emergency ambulance service and improved definitive care of fractures. For the first, interestingly, only emergency splinting of fractures was sought. During succeeding years the committee urged, additionally, maintenance of open airways, dressing of wounds, control of hemorrhage and other items taught in the advanced course of the American National Red Cross, the training standard until the decade of the 60s, when protective extrication, cardiopulmonary resuscitation, poison control, emergency childbirth, care of the newborn and other items were added and published in the ACS *Curriculum of Training for Emergency Medical Technicians-Ambulance*.

During early committee days, several regional committees, such as those in New York-Brooklyn, Boston and Philadelphia, initiated fracture conferences and later joint conferences or Fracture Days.

AS EARLY AS 1922, efforts were initiated to improve fracture treatment. Deficiencies in medical school teaching of fracture treatment were emphasized. All subsequent committees have sought improved undergraduate teaching, first for fractures and later for all trauma. In this effort, the committee has been less than totally successful.

In the 1920s the committee recognized the need for "a safe and ready guide" to fracture treatment. In its March 1931 Issue the ACS BULLETIN carried what is now considered as the first edition of the *Outline of Treatment of Fractures*. Bob Kennedy has said that heated disputes over contents of the guide led to two threatened or actual resignations from the committee. With some revisions, the material was published in booklets in 1932 and 1939 as second and third editions. Each was reprinted several times, particularly the third because the armed forces requested a large quantity during World War II.

The Fourth Edition in 1949 was made to fit in the pocket of a house officer's short white

coat. This volume sold for fifty cents. Directors of training programs were urged to purchase a copy for each intern and resident.

In 1954, a fifth edition of the *Fracture Manual* and a first edition of "*Early Care of Soft Tissue Injuries*" were published in paper back pocket size, each to be sold for $1.00 by the College. The editions were reprinted several times. Over 24,000 *Fracture Manuals* and nearly 22,000 *Soft Tissue Manuals* were sold.

In 1960 and 1965, paperback pocket-size seventh and eighth editions of the *Fracture Manual* and second and third editions of the *Soft Tissue Manual* were published and marketed by W.B. Saunders Company, on whose recommendation the two manuals were combined within a hardback cover as "*The Management of Fractures and Soft Tissue Injuries*". Saunders has sold over 16,000 *Fracture Manuals*, over 100,000 *Soft Tissue Manuals* and over 36,000 *Combined Manuals*, and has paid royalties to the College in excess of $29,000.00. Currently in press is a combined, completely rewritten edition under a new title, "*Early Care of the Injured Patient*".

Each edition of each manual was the product of hard labor by expert members of trauma subcommittees.

Each committee tried by precept and example to improve the definitive management of fractures and later of all injuries. As program participants at medical meetings, committee members "preached the gospel" of how-to-do-it for specific fractures or other injuries. In an effort to obtain data on the results of fracture treatment, in the late 1920s, a fracture report form to be part of the hospital records was published in the BULLETIN. Reprints in quantities were furnished on request to hospitals or surgeons.

The committee chairman or his designee has been responsible for portions of Clinical Congress programs since the 1920s. During the period of "wet clinics", Committee members usually made certain that clinics on fracture treatment were included. Every year since post-graduate courses replaced wet clinics, the committee has provided a four-day course on fractures or other aspects of trauma. Annually, for two decades, a Symposium on Trauma has been a committee responsibility. A trauma field program panel, initiated by Doctor Kennedy, has been provided each year since 1961.

FRACTURE ORATIONS for the Clinical Congresses under committee sponsorship began in 1929. The first was given by Doctor Scudder. Annually thereafter, except for the World War II years, an oration on the definitive management of fractures was given until 1952 when it was replaced by an oration on trauma. This oration was provided annually until 1963 when it became the Scudder Oration on Trauma, honoring the first chairman.

At various times the committee has made incursions into socio-economic areas. In 1931, it developed guidelines which led to standards published by the Department of Commerce regarding metal for internal fixation of fractures. In the 1940s, a subcommittee, in cooperation with committees of orthopedic associations, developed other guidelines on quality and design of internal fixation equipment. In 1955, the committee prepared a resolution calling on automobile manufacturers to stress occupant safety in automobile design by providing doors that do not open, seats and cushions that do not displace on impact, energy absorbing interiors and adequate seat belts and other passenger stabilizing devices that resist impacts of 20 Gs. The resolution was recommended by the subcommittee on crash injury, and by committee chairman Griswold. The committee and the Regents, which approved the resolution, were more than a decade ahead of the almost identical proposed requirements of the Department of Transportation.

PERHAPS the most significant socio-economic effort resulted from the 1950 57 efforts of Alexander Aitken of Boston and his subcommittee on industrial relations. Doctor Aitken had become deeply concerned about inadequate medical care for injured workmen and deplorable efforts toward their rehabilitation. After speaking before the National Rehabilitation Association in 1950, he heard the medical profession castigated for lack of efforts in these areas. In subsequent discussions, he admitted medical profession deficiencies but took labor unions to task for depriving injured workers of the opportunity to work because of seniority rights. He was able to organize a committee comprised of members of his subcommittee, representatives of labor organizations such as Phillip Murray and William Green, the Department of Labor, Bureau of Labor, Bureau of Labor Statistics, Office of Vocational Rehabilitation, the U.S. Public Health Service, and the insurance industry. Efforts to involve the National Association of Manufacturers

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and the U.S. Chamber of Commerce were unsuccessful.

From information gained at several committee meetings, Doctor Aitken in 1952 proposed *"Principles for Rehabilitation of the Injured Worker"*, which received committee and Regental approval for publication in the July-August 1952 BULLETIN. Soon thereafter, Aitken was appointed to the President's Committee on Employment of the Handicapped. In testifying before a House subcommittee in 1953, Michael J. Quill of the CIO called for a coordinated effort between all federal and state services concerned with workmen's compensation and rehabilitation under the Department of Labor. He singled out the College as the one medical organization active and organized to participate.

THE FIRST principles were followed by *"Operating Principles for a Modern Workmen's Compensation System"* that was published, following Regental approval, in the January-February 1955 BULLETIN. Aitken subsequently reported improved workmen's compensation laws in several states and increased interest of the insurance industry in better regulations for rehabilitation of injured workmen, both in part because of the 1955 operating principles.

In 1957, through the committee, the College, the American Association for the Surgery of Trauma, and the National Safety Council formed the Joint Action Program for a joint effort to minimize the incidence and serious effects of accidents. Within this program, a nationwide survey of emergency ambulance services was made, a model ordinance regulating emergency ambulance service was developed and the NSC's Surgeons' Award for Meritorious Service to Safety was initiated. To date, all except one of the recipients of the award have been active or senior members of the committee.

The decade of the 60s, with a year or two added at each end, is outstanding in the history of the Committee on Trauma. For the first time in its history, sufficient funds were available for activities through three grants from the John A. Hartford Foundation. These funds permitted establishment of the Trauma Field Program with Doctor Kennedy as the Director, the first College staff member full time in trauma. Previously staff duties for trauma were really part-time added duties.

In 1959 two significant events occurred. First, a nationwide survey, using a routine questionnaire of the National Safety Council, was made on emergency ambulance equipment and service, a study that documented their grim state. Second, the committee developed a list: *Minimum Equipment for Ambulances*, an enthusiastically accepted document which received the largest distribution of any BULLETIN trauma reprint. The list was improved and updated in 1969, by J.D. (Deke) Farrington and his subcommittee, into *Essential Equipment for Ambulances*, which today is the nationally accepted standard. In 1970, largely through Deke's expertise, a *Curriculum for Training for Emergency Medical Technicians—Ambulance* was developed and published. This is equal, if not superior, to the training program of the National Highway Traffic Safety Administration.

USING FARRINGTON'S collection as a model, sets of 560 slides to be used in training ambulance personnel were developed. There were eight sets for loan to regional committees and others, and 125 sets for sale; these were exhausted long before requests to purchase ceased.

In 1969 70, using a small grant from the Insurance Institute for Highway Safety, which was matched by the Regents, a series of continuing educational programs on *"Life-Saving Measures for the Critically Injured"* was provided in four states for rural physicians. Finally, the committee supported the concept of community and regional categorization of hospital emergency capabilities. A set of guidelines, provided by Andy Ruoff and his ad hoc subcommittee, was used in the AMA Conference on Categorization in February 1970, a report of which has now been distributed.

In 1964 John Moncrief and his subcommittee on burns produced *The Initial Therapy of Burns*. In 1965, largely through the work of Wesley Furste and Paul Skudder, *Prophylaxis Against Tetanus in Wound Management* was published. Reprints and emergency department posters of each, and their subsequent revisions, are among the most widely distributed trauma literature.

Bob Kennedy, almost single-handedly, was responsible for the other achievements in this expanded decade as follows:

(1) Production of two motion pictures: *Emergency Ambulance Service: Organization and Operation*, and *Emergency Department: Organization and Operation*. Copies in the College motion picture library were among those

films backlogged with requests. Today, they remain well worth showing.

(2) Developed in 1963 a widely distributed brochure, *Model of a Hospital Emergency Department*, which went through three printings, totaling 25,000 copies. A heavy cardboard model of an emergency department was constructed and shown in an exhibit at several Clinical Congresses and other medical meetings. The model brochure was replaced in 1970 by *Guidelines for the Design and Function of a Hospital Emergency Department* as a project of a subcommittee chaired by Roger Sherman.

(3) Developed a set of *Standards for Emergency Ambulance Service* in 1967 which received committee and Regental approval. These standards were a pattern for those eventually established by the National Highway Safety Bureau.

(4) Made extensive studies of hospital emergency departments and compiled data on them submitted by others. In 1963 this activity culminated in a set of standards for emergency departments which was approved by the committee and the Regents. These standards remain sound today.

(5) Proposed a Conference on Emergency Medical Services which culminated in the Airlie House Conference of May 1969, cosponsored by the Committee on Trauma and the Committee on Injuries of the American Academy of Orthopaedic Surgeons. The proceedings of this conference is a unique document containing information on each facet of emergency ambulance service.

(6) Concurred in the production from 1969 to 1972 of 10 short motion pictures on various facets of the emergency treatment of the seriously injured in the emergency department. Four other films to complete the series were produced with Insurance Institute for Highway Safety funds. Prints are now available for purchase.

(7) Edited, with encouragement from the committee, a small pocketsize paperback manual entitled "*Emergency Care*" for rescue, ambulance, fire and police personnel, as a sorely needed pioneer text and reference book for such personnel. Published in 1966 by W.B. Saunders, over 57,000 copies have been sold. Dr. Kennedy demanded that the cost of the book be held to $2.00, the College foregoing royalties on the first 20,000 copies. The College has received nearly $7,000.00 as royalties on the remainder. The book is one of several deserved monuments to Bob Kennedy.

This account of Doctor Kennedy's activities is too brief for justice to them or to him. He never hesitated in his efforts to achieve improvement in pre-hospital, emergency department and in-hospital care of the injured. I doubt if anyone will ever carry the torch of the College's program on trauma higher than did Bob Kennedy.

Many items and personalities deserving of comment in this history have been omitted in the interest of brevity. The hope is that enough has been included to serve as a guide for future Committees on Trauma in their efforts to improve all phases of care of the injured.

"Doing away with the cumbersome dressings which had been used for many years was not taken to heart by many people in this country until the exposure method was brought back from England. It remains our primary method of treatment of major thermal injury."

Fifty years' progress
in burns

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IN CONSIDERING the progress in the treatment of burns over the past 50 years, time is going to limit me to those contributions which were made by American physicians, with a few exceptions.

Just one year after the beginning of the Committee on Trauma, in 1923, Frank Underhill of Yale demonstrated the striking hemoconcentration that occurs as the result of thermal injury. This formed the basis of the further development of fluid resuscitation therapy. Underhill was a physiologist and pharmacologist, not a practicing physician, but his clever observations of what occurs in thermal injury are certainly a landmark. It was not for several years after this, however, that we really made any great strides in applying Underhill's knowledge to the treatment of the burn patient.

In 1925 Edward Clark Davidson, working at the Henry Ford Hospital, introduced 2.5 percent tannic acid for the local treatment of the burn wound. Although it became quite popular, it was quite some time before we realized that tannic acid was really not the panacea it had claimed to be.

It came to our attention, again through Frank Underhill, that something else should be done to the burn. "Why stop drainage by application of substances like trinitrophenol or tannic acid? Why not treat a burn like any other wound?" Underhill published this idea in 1930, but the work was largely overlooked. It was not until many years later that the chemical escharotics were abandoned and we began to treat the burn as we would any other wound. However, Vilray Blair and James Barrett Brown took some of this advice to heart, and began to treat the burn wounds by applying wet saline soaks and compresses to the wound, and changing them frequently—as

often, actually, as the nurses could get around to it—thus preparing the wound more rapidly for ultimate graft coverage.

In 1933 Robert Aldrich, working with Firor at Johns Hopkins, published a classical article in the *New England Journal of Medicine*, in which he expressed the thought that "there is enough infection in the burn area to account for all the symptoms and physical signs" that physicians had been ascribing to the "toxemia" which occurred, supposedly, as a result of thermal injury. Today, unfortunately, history repeats itself and the subject of "toxemia" is coming back to the fore. Many are still trying to implicate nebulous toxins in the problems of the burn patient.

THE INTRODUCTION of gentian violet by Aldrich was another step forward in the attempt to control surface infection in the burn wound. However, this did nothing to the gram negative organisms, so he later introduced triple dyes in an effort to control them. As you know, this also was not effective.

In 1935 Bettman wrote an article for *Surgery, Gynecology and Obstetrics* in which he advocated the use of five percent tannic acid plus ten percent silver nitrate for the treatment of the burn wound. This was a combination of an active antibacterial, silver nitrate, with an escharotic, five percent tannic acid, and was used quite popularly for a number of years.

In 1937 an article appeared in the *British Journal of Surgery* implicating tannic acid in central lobular necrosis of the liver, but this connection was not proven until 1942, when tannic acid was demonstrated to cause liver necrosis.

Henry Harkins, in 1942, published a monumental treatise, *The Treatment of Burns*; a volume which even today is a good guidepost to burn treatment. Also in 1942, Harvey Allen, working in Chicago with Sumner Koch, demonstrated that cleaning the wound and wrapping in gauze pressure dressings would result in a mortality rate 25 percent of that of other types of therapy. This gauze pressure dressing technique was used extensively during world war II and the years that followed. Allen was unalterably opposed to the use of chemical escharotics and substances which were placed on the burn wound and, as Underhill did, felt that the burn wound should be treated as any other wound.

The disastrous Coconut Grove fire in Boston in 1942 gave Oliver Cope and others, including Francis Moore, a chance to study the problems associated with thermal injury on a large scale, as well as problems of the individual burn patient. As you no doubt recall, Doctor Cope studied the effect of pressure dressings on the fluid exchange from the vascular compartment to the extravascular space in the burn area, and demonstrated very clearly that the pressure dressing, contrary to popular belief, had no real effect on the rate of fluid loss from the vascular compartment.

In 1949 A. B. Wallace introduced the exposure method of treating burns, doing away with the cumbersome dressings which had been used for many years. This was not taken to heart by many people in this country until Edwin Pulaski, on a trip to England, heard about this and brought the method back to this country. It has remained the primary method of treatment of thermal injury to this day.

One of the prime movers in the treatment of the burn patient and the investigations of the changes dependent upon thermal injury was Everett I. Evans who, in 1950, set forth his fluid formula for the resuscitation of the burn patient. This was twenty-seven years after Underhill's paper. It was the first formula based upon the extent of burn and the size of the patient. Immediately this became popular, and has since been used widely as a primary means of determining the type of fluid and the amount and rate of fluid to be administered. Also about the same time, he began publishing articles advocating the use of sulfanilamide ointment for the treatment of burn wounds. Although this fell into limbo for many years, it was effective.

THE POSSIBILITY of thermonuclear warfare really became the impetus for the advancement of burn care in this country. Prior to this awakening, very little money had been made available for the study of the care of the thermally injured. Thanks to the hysteria surrounding the possible use of A, H, and XYZ bombs, considerable amounts of money were made available. Everett Evans, fortunately,

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was a recipient of some of this money. In the early 1950's Colonel William Stone of the Army Research and Development Board was authorized to provide money for the study of burns. He established, with Doctors Pulaski and Seeley, the Surgical Research Unit in San Antonio, recently renamed the Institute of Surgical Research. Many significant developments in the field have come from workers in that facility. In 1950 Edwin Pulaski introduced the exposure method of treatment to this country. Curtis Artz helped popularize it and along with Eric Reiss, Harry Soroff, and Charles Fox, developed the Brooke Burn Formula.

Truman Blocker and his lovely wife, Virginia, contributed much to the care of the burn patient: Dr. Virginia Blocker with her interest in nutrition and Dr. Truman Blocker with his plastic surgery training, and his primary emphasis on the care of the burned child. Both continue to work actively in the field, and their contributions are numerous.

In 1960, at the urging of Curtis Artz, the first International Congress on Research in Burns was held in Washington. Since then two subsequent Congresses have been held, one in Edinburgh and the second in Prague in 1970. Doctor Artz was also a moving force in the organization of the American Burn Association in 1967, and became its first president.

Then in 1964 the late Carl Moyer presented, at the New York Academy of Medicine, his results in 17 cases of extensive burns treated with 0.5 percent silver nitrate. His presentation, first viewed with skepticism, was accepted by others after experimentation. About this same time we were working in San Antonio on the control of burn wound infection in the burn patient. The work of Teplitz demonstrated that the burn wound itself is indeed the primary source of fatal sepsis in the burn patient. We tried something different, a sulpha derivative, which has been used rather extensively with success that equals that of the silver nitrate. A number of other types of topical therapy have been brought into use, such as gentamicin, silver sulphadiazine and silver lactate and other silver compounds that are presently being tried, both clinically and in the laboratory.

IN RECENT YEARS Charles Baxter has contributed much to our understanding of the immediate postburn period and has introduced treatment innovations of great merit. Most recently he has demonstrated the prominence of the sodium ion in effective resuscitations and developed a new type of burn formula.

In 1965 the second International Congress in Burns, held in Edinburgh, further stimulated the study of burn patients in the laboratory and clinical situations. The main thing these congresses have accomplished is the bringing together of people from various parts of the world, not only physicians, but paramedical personnel, biochemists, bacteriologists and others, allowing them to exchange ideas and better understand the problems which each of them faces. The annual meeting of the American Burn Association has been a forceful stimulus to this end in this country. Indeed, progress has been quite evident in many areas of the burn field previously left untouched such as immunology, vaccine therapy, pulmonary function, Curling's ulcer, and the practical aspects of burn prevention and delivery of burn care.

To sum up, progress in therapy for burn injuries has been slow. In the last ten to fifteen years, the pace has picked up. I am hopeful that in the near future, it will be even more so.

"A great deal remains to be done, not the least of which is to assure that what is now known and applicable is indeed available to the injured."

Fifty years' progress
In abdominal injuries

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I CONSIDER IT an honor to take part in this Golden Anniversary Program. The Committee on Trauma of the American College of Surgeons has greatly influenced my professional life, and my associations with its members have been as close as any I have ever had. Although I have had considerable experience in abdominal surgery, I am not nearly so well qualified as many others to discuss injuries to the abdomen. Many have made important contributions in this field, and to them I apologize. However, I can view the scene from firsthand, having participated at resident level in the management of abdominal injuries in world war II, and I have closely followed progress since that time. In the last few years, the editorship of *The Journal of Trauma* has allowed me to view current progress in treating abdominal injuries from the review of many manuscripts on such injuries, both from Vietnam and from trauma centers in this country.

It is interesting to consider the orations that have been sponsored by the Committee on Trauma, beginning in 1929 when Dr. Charles L. Scudder gave the first "Oration on Fractures". The first ten orations were restricted to injuries of bones and joints. In 1940, however, Dr. Frederic W. Bancroft spoke on "Treatment of Traumas of Skin and Subcutaneous Tissues". He was followed the next year by Dr. Walter Estell Lee who spoke on "The General Surgeon's Approach to the Problems Presented by Fractures and Other Traumas". The first Oration on Trauma, as opposed to the Orations on Fractures, was given in 1952 by Dr. Sumner L. Koch whose topic was "The Working Man's Hand". The next year, Dr. William L. Estes, Jr., of Bethlehem, Pennsylvania spoke on "Present-Day Problems in Non-Penetrating Abdominal Trauma". Since that time two other orations have featured abdominal injuries, that of Dr. R. Arnold Griswold in 1959 on "Wounds of the Abdomen and Pelvis", and Dr. Rudolf J. Noer in 1969 on "Liver Injuries".

PROGRESS in the management of abdominal injuries has been tremendous in the last 50 years, both in penetrating and non-penetrating types of trauma.

The study of abdominal injuries due to blunt trauma has been carried on for many centuries. Aristotle has been given credit as being the first to record visceral injury from blunt trauma.[1] He noted that the intestine of the deer was so delicate that a slight external blow might rupture it without injuring the skin. This could have been the first recorded observation of visceral injury from blunt abdominal trauma. Blunt abdominal trauma carries a higher mortality rate than penetrating trauma, the rate being at least 20 to 30 percent.

Twenty years ago Dr. Estes[2] summarized progress to that time in the management of non-penetrating abdominal injuries. He told

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of improvement in the mortality rate over the preceding thirty years, which showed a drop from 30 percent in 1900 to 14 percent in 1950, and attributed these improvements to several factors: better treatment of shock; operation while in shock; exploratory operation in selective cases; certain ancillary aids, such as antibiotics, better anesthesia, definitive means for the control of hemorrhage, and better therapy in trauma of the solid viscera.

It is not difficult to explain a great deal of the progress when one considers how non-penetrating abdominal injuries were viewed just a half century ago. A paper published in *The Annals of Surgery*, from an excellent trauma service at that time, is noteworthy.[3] This paper stated that in ruptures of the liver, conservative treatment is more desirable than an exploratory laparotomy, because surgery is of no avail. Caution was advised in giving blood in abdominal injuries, because of the fear of dislodging a clot. Ruptures of the spleen were treated expectantly. Progress in the supportive care and resuscitation of the patient have been great in the last fifty years and logically account for the greatly reduced mortality.

Progress just as striking appears to have been made in the management of penetrating abdominal injuries over the last fifty years. In world war I, the mortality was 50 percent, in world war II 25 percent, in the Korean Conflict 12 percent, and in Vietnam, 8.5 percent.[4,5] Many of the factors already mentioned are responsible for this improvement, plus the more rapid evacuation of casualties from Korea and Vietnam battle areas using helicopters.

THE VALUE of antibiotics in penetrating abdominal wounds is well illustrated by the work of Fullen, Hunt and Altemeier.[6] When antibiotics are given early in the course of penetrating wounds of the abdomen, the incidence of wound infection and intra-abdominal abscess is sharply reduced.

The use of x-rays in diagnosing intestinal injuries was first described slightly over 50 years ago. The development of better techniques, and especially the use of angiography, have allowed more precise diagnosis in certain instances of abdominal injury. Abdominal damage to large vessels can be diagnosed by arteriography. Angiographic techniques are especially helpful in instances of suspected injuries to the kidney and other viscera.

Although diagnostic abdominal tap was also first described more than 50 years ago, or before the period we are considering, it has been used much more frequently in the last few years.[7] Abdominal paracentesis is helpful only when positive, since significant intra-abdominal injuries can be present even with a negative tap. Peritoneal lavage is more sensitive, but false positives may be obtained.

THE DEVELOPMENT of newer methods of diagnosis should not let us overlook the contribution made by Shaftan[8] and his colleagues. Shaftan states: "When adequate facilities for the careful observation and investigation of these wounded patients are available, superior mortality and morbidity statistics can be expected by judiciously selecting those patients requiring exploratory laparotomy. The technique uses the same surgical judgment based on training and experience exercised in evaluating the need for abdominal exploratory for intra-peritoneal inflammation". Shaftan's experience was confirmed by Nance and Cohn,[9] who felt that they lessened their mortality from 27 percent to 12 percent by the use of this technique. Not all surgeons agree with this approach. In an editorial in *The Journal of Trauma* in December 1969, as a companion editorial to that of Dr. Shaftan,[10] Dr. Carleton Mathewson, Jr.[11] gives evidence to support the routine exploration of stab wounds of the abdomen.

Dr. Rudolf J. Noer[12] summarized progress in liver injuries in his Scudder Oration of 1969, when he stated: "Severe injuries of the liver can now be effectively managed by early diagnosis and prompt adequate treatment: *1)* aggressive resuscitative measures with blood replacement supplemented by lactated Ringer solution; *2)* thorough exploration with adequate exposure and effective vascular control to determine laceration type and extent of injury; *3)* individual ligation of bleeding vessels and of bile ducts as indicated; *4)* repair when or as indicated, always with drainage, dependently placed and brought out through separate incision; *5)* resection or resectional debridement in the presence of severe damage with devitalized or non-viable tissue present; *6)* common duct drainage in all injuries involving damage to biliary ductal system, and *7)* careful attention to the postoperative metabolic needs of the patient".

However, the mortality in severe blunt hepatic injuries remains high. Some believe that lobectomy has been carried too far, when

lesser and safer procedures would be just as effective.

Dr. E. Truman Mays[13] has reported on the control of exsanguinating liver injuries by the ligation of the lobar arteries to the liver. In 18 patients, when traditional methods of controlling hemorrhage either failed or were not applicable, the lobar artery was ligated: the right hepatic artery in nine; the left hepatic artery in three, and the medial segmental artery in one.

Drs. Lucas and Walt[14] have done a prospective randomized clinical evaluation of the use of T-tube choledochostomy in liver injuries. Their results failed to demonstrate any advantage of such drainage, and show a significant increase in morbidity when choledochostomy was employed. Complications that have increased significantly with T-tube choledochostomy were intra-abdominal abscess, "stress" gastric bleeding, "septic jaundice", and cholangitis. They warn against the use of T-tubes in very small common ducts.

INJURIES to the vena cava and the hepatic veins and retrohepatic vena cava continue to be associated with a high mortality, and present one of the most formidable therapeutic challenges in surgery. Difficulties of gaining control and performing an accurate repair of this thin walled vessel are well known. The number of such injuries is increasing, and a recent report from Baylor College of Medicine[15] notes that more patients with such injuries have been seen in the last six years than in the previous 20. This increase in frequency also has been paralleled by an increase in the magnitude of the problem occasioned by the use of more destructive weapons, with an attendant increase in the number of severe associated injuries. In spite of this, the mortality rate has been reduced from 50 percent in the earlier series to 40 percent in the latter. Utilization of an internal vena cava shunt, or a tamponading balloon catheter, may allow precise repair in a bloodless field, and has been reported to be life-saving in some cases. Schrock, Blaisdell, and Mathewson[16] reported such a technique in 1968.

Accidental Death and Disability: The Neglected Disease of Modern Society, published in 1966 by the Division of Medical Sciences, National Academy of Sciences, National Research Council, recommended the development of trauma registries. The publication pointed out that emergency case records are often inadequate, and stated that sufficient thought has not been given to extracting information concerning the nature of the accident, the clinical condition at the time of injury and during transportation to the emergency department, the resuscitative measures used, the response of the patient, the initial laboratory and x-ray records, and finally, the ultimate outcome with or without temporary or permanent disability. It recommended the establishment of trauma registries within hospitals similar to registries for cancer.

THE USE OF a computerized trauma registry has been reported in the study of abdominal injuries by Chilimindris, Boyd, Carlson, Folk, Baker and Freeark.[17] The data collection and retrieval are facilitated by new specialized computer methodology. Their trauma registry utilizes up to 13, 80 column computer cards for each trauma patient. These record mutually exclusive data, events of epidemiological, clinical, surgical and bacteriological nature.

Adequate nutrition is a difficult goal to achieve in the presence of the increased metabolic requirements of the injured patient. Anatomical or functional disruption of the gastrointestinal tract further increases the feeding problem by precluding adequate enteral alimentation. Following trauma and subsequent operation, fistula formation is not an uncommon complication, and contributes significantly to morbidity and mortality. This is particularly true of fistulas of the pancreas and upper gastrointestinal tract. The technique of intravenous hyperalimentation allows adequate nourishment, while physically bypassing the gastrointestinal tract, thus minimizing its secretory mechanical stimulation and promoting conditions conducive to spontaneous fistula closure.[18]

Recent reports have described postoperative acute cholecystitis, often associated with gangrenous changes, in young men initially wounded in Vietnam. Gangrenous cholecystitis develops without the presence of gallstones. The mortality rate has been significant and the cause of this entity remains unknown.[19] In most instances of this entity there was a preceding abdominal wound. Patients had suffered severe blood loss, multiple surgical procedures, wound infections, and frequently had had septicemia. An increased index of suspicion should lead to earlier surgical intervention, and a decrease in the high mortality rate.

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ALTHOUGH many problems remain in the management of abdominal injuries, which will be solved by research, it is distressing that many are now dying in this country because of lack of application of what is already known. A study that we did in Philadelphia, and reported in 1964, convinced us that this was especially true for abdominal injuries.[20] Out of the group of 950 deaths from accidental injury, we thought that fifty were salvageable. A number of these had abdominal injuries. Errors made included failure to diagnose a ruptured viscus, and death resulted from hemorrhage because of lack of readily available blood. A recent study from Baltimore tends to confirm our findings.[21] Hospital records and postmortem findings were reviewed for 33 highway deaths in which the main injuries were intra-abdominal. Only one patient out of the 33 died before reaching the hospital. It was estimated that half of these lives might possibly have been salvaged by prompt and proper diagnosis and treatment. The investigation suggests that there is much room for improvement, even in the application of the most basic principles of the management of the injured. In particular, over one third of the cases showed a need for more aggressive treatment of patients in shock. Nearly half involved either failure to operate or excessive delay in operation, despite symptoms of abdominal injury. The results suggest that greater attention should be given to transporting injured patients to facilities which are best equipped and staffed to handle major trauma.

I hope I have pointed out the great advances which have been documented during the last 50 years in the management of abdominal injuries. Many of these have been made by members of the Committee on Trauma of the American College of Surgeons. A great deal remains to be done, not the least of which is to assure that what is now known and applicable is indeed available to the injured. In this regard, no group has done more than this committee in the past, or will have a greater influence on the future.

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"Paracentesis of the pericardium approaches that kind of intervention which some surgeons would term a prostitution of the surgical art and other madness. The surgeon who would attempt to suture a wound of the heart would lose the respect of his colleagues . . . Perhaps another generation will think otherwise about it."

T. Billroth, 1882

Fifty years' progress

In chest injuries

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An overview of the treatment of thoracic/thoracoabdominal wounds and injuries shows that distinct advances were made during the wars of this century, particularly world war II. While many of the precepts proven practical in the second world war have remained valid, the amazing advances in medicine have added refinements to the management of thoracic wounds and have resulted in further improvements in technique.[1] Through the years there have been, of course, lessons in trauma which had to be relearned by following generations of civilian surgeons; even in world war II, reasonably established principles were sometimes ignored or forgotten during succeeding campaigns in different theaters. On balance, however, the pace of improvement has been steady and sometimes spectacular.

In 1922 I was an undergraduate, two years away from entering the University of Michigan Medical School. The armistice was only four years old. The American Association for Thoracic Surgery had been founded five years before. It had been only four decades since Billroth[2] and Paget[3] uttered their now famous prophecies followed closely by Rehn's[4] first successful closure of a heart wound. In 1882 Billroth said, "Paracentesis of the pericardium approaches that kind of intervention which some surgeons would term a prostitution of the surgical art and other madness. The surgeon who should attempt to suture a wound of the heart would lose the respect of his colleagues . . . Perhaps another generation will think otherwise about it". Paget, in 1886, added, "Surgery of the heart has probably reached the limits set by nature to all surgery. No new method and no new discovery can overcome the natural difficulties which attend a stab wound of the heart".

Since many of the attitudes on thoracic injuries during the twenties and thirties came from world war I experience, I will attempt briefly to sum up such thinking.

In the *Medical History of World War I* there was no discussion of thoracic surgery as such, but it was covered in approximately 100 pages under general surgery.[5] Empyema[6] had the big play of 360 pages, and resulted in the tradition that all thoracic surgery was dirty. Even in early 1941, in a named general hospital, I, as a thoracic surgeon, was assigned to the septic service under general surgery. In regard to empyema, it is a pity that no real distinction was made between post-traumatic and post-pneumonic empyema. As some of you may remember, post-pneumonic empyema was a tremendous problem during and immediately following world war I. Graham[6] showed the

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necessity for closed drainage with acute empyema, particularly that due to the streptococcus. In the cronic stage he advised adequate dependent drainage. He noted that both the Estlander and the Schede operations left considerable deformity, both anatomical and physiological, as well as increased mortality. "Extensive decortication is usually accompanied by a large amount of hemorrhage, is extremely difficult and, at times, impossible because there is generalized fibrosis both in the pleura and subpleural tissues", he stated.

Colonel Keller[6] made a name for himself in the treatment of refractory empyema. In 40 closely supervised cases, 173 operations were performed. The average patient was cured at 18 months, but over half were of four years duration at the time of cure. There were but three deaths. Thirty-six of the 40 cases had had multiple operations prior to admission to his service.

Lilienthal[7] had presented his work on "primary major intercostal thoracotomy with lung mobilization" in 1914, but this direct ancestor of modern decortication was literally buried in the surgical literature for the next 30 years.

At the end of world war I, both boldness and reticence characterized the treatment of thoracic wounds. Unfortunately, neither precept has stood the test of time. It was believed that the parietal pleura as the main organ of defense must be preserved and closed airtight. "*This layer is no more amenable to plastic surgery than a wet drum head*". Operations on the lung were done primarily to protect the pleura. Portions of the injured lung were removed "*to insure pleural integrity*". "*Any lung tissue which cannot be inflated or is 'splenized' (i.e., contused) is without function or blood supply and should be removed*". Of course there was a fearful mortality with these operations.

On the other hand, there was great reluctance about draining the pleural space ("*increased risk of empyema*"). Where possible, thoracotomies were closed without drainage. Hemothorax was seldom aspirated unless it was massive and the patient dyspneic. Only then was thoracentesis undertaken; air replacement was almost always practiced "*to prevent bleeding from the lung*".

A careful follow-up of a series of patients stressed the need for continuing rehabilitation and demonstrated the limitations of operative procedures alone as a means of restoration of function.

In the years between the wars, the switch blade and ice pick wounds of the twenties and thirties gave Beck,[8] Elkin[9] and others, particularly in the south, ample opportunity to demonstrate the value of early operation in wounds of the heart. There were no great advances that I can recall in the general treatment of thoracic wounds. During my residency years, John Alexander gave the bulk of his attention to surgery of the thoracic wall and of tuberculosis, and helped with the gradual development of intrathoracic expertise. Looking back on those days, I wonder sometimes what I ever saw in thoracic surgery.

While in Ann Arbor, I can remember a "decortication" for empyema following traumatic infected hemothorax. It was a fairly prodigious undertaking—multistaged of course, including two drainage procedures, several rib resections and a temporary phrenic paralysis: a prolonged clinical exercise but eventually successful. I can remember a student nurse who was admitted following an auto accident. She was in grave shock, and a ruptured diaphragm was diagnosed. But we never operated because we "never could get her in shape for an operation". Of course, she died. It was still years before the universal acceptance of the dictum that early thoracotomy may at times become a necessary extension of the resuscitation process.

And so to the dawn of world war II. Our main guide was the *Manual on Neurosurgery and Thoracic Surgery*.[10] The thoracic portion of some 80 pages was written by our foremost thoracic surgeons of the day: Graham, Bigger, Churchill and Eloesser. A few excerpts show the state of the art in 1940.

Table 1: Treatment pearls from military surgical manual

Non-penetrating chest wounds with hemoptysis:	*If bleeding severe, induce artificial pneumothorax.*
Penetrating injury to internal mammary or intercostal vessels:	*Expose and ligate artery. Close thoracic wall without drainage. "Observe for empyema".*
Penetrating injuries from HEF:	*X-ray. Immediate thoracotomy and removal.*
Penetrating injuries with bleeding and lung contusion:	*Thoracentesis and air replacement. May do thoracotomy and resect lacerated lung. Air-tight closure of chest.*
Rupture of diaphragm:	*If repair is transpleural, crush phrenic nerve.*

There was also an historic issue of the *Hawaii Medical Journal*, now all but forgotten in the dusty archives of medical history. I am sure some of you will remember that John J. Moorhead[11] was giving lectures on traumatic surgery in Honolulu at the time of the attack on Pearl Harbor. The January 1942 issue recorded some of the agonizing trials and tribulations of the army, navy and civilian medical services. At Tripler General Hospital, for instance, 400 major casualties were admitted on December 7, 1941 between 8 am and 2 pm.

For the first time, thoracic surgeons came to be recognized as specialists. Indeed, advances in the management of chest injury were legion, and were made by general as well as thoracic surgeons, chest internists and anesthesiologists. I can list but a few which I believe were outstanding. For the most part, these are still valid today. They have been cited in considerable detail in the two volume, 900-page *History of Thoracic Surgery in World War II*, authored by Berry, Blades, Brewer, Burford, Carter, DeBakey and Harken.[12] In particular, I am proud of the contributions by thoracic surgeons of the Second Auxiliary Surgical Group.[13]

Following is a brief tabulation of some of the contributions from world war II.

1. In the initial management of thoracic trauma, the primary emphasis was on resuscitation: establishment of a patent airway; cessation or control of hemorrhage; relief of thoracic wall pain usually by regional intercostal nerve block and continuing correction of the impaired cardiovascular physiology.

a. Prompt and repeated aspiration of hemopneumothorax until the pleural cavity was dry, without air replacement.

b. Recognition of the traumatic wet lung syndrome. Development of the attendant philosophy that excessive bronchopulmonary secretions needed constant attention, including catheter suction and bronchoscopy. In the field hospitals of Italy, France and Germany, our nurses and corpsmen all became particularly adept at catheter suction.

c. Correction of impairments in the thoracic wall, whether due to a sucking wound, flailing or crushing.

d. Recognition and correction of pericardial tamponade.

e. Recognition that contused hearts and blast lungs withstood anesthesia poorly, and that all but the most necessary life saving surgery should be postponed.

2. It was soon recognized that at times early thoracotomy might become necessary as an integral and continuing part of resuscitation. Implicit were the dicta that thoracotomy was not indicated just for a "look-see", nor was the mere presence of an intrathoracic foreign body or even a large hemothorax per se, indication for immediate surgery. Specific indications for emergency or early thoracotomy included the following: continuing hemorrhage; massive uncontrollable pneumothorax (probable rupture of main bronchus or trachea); recurrent pericardial tamponade; mediastinal traverse (esophageal or great vessel injury); massive sucking wound (traumatic thoracotomy), and thoracoabdominal wounding.

3. A completely conservative attitude on pulmonary resection if prompt thoracotomy was necessary. It was learned that contused, lacerated lung possessed great recuperative powers. Therefore, an early operative repair rather than resection became the motto.

4. Aggressive approach to wounds of the heart. This writer personally supervised treatment of nine of the 75 wounds and injuries of heart and pericardium cared for by surgeons of the Second Auxiliary Surgical Group.[14] Under field hospital conditions, I had the opportunity to close successfully a through-and-through wound of the left ventricle, and on another occasion, remove an embolic 45 caliber bullet from the right ventricle. In a more formal setting, Harken[15] reported on the removal of 134 foreign bodies from in and around the heart without fatality.

5. The finding that blood in the pleural cavity would clot and organize, with the attendant rediscovery and reapplication of the old principle of decortication for organizing hemothorax and hemothoracic empyema, but at a much earlier stage than before.[16, 17]

As described above, much of what was learned in world war II has become doctrine. Brewer[1] has nicely delineated many of the more recent discoveries in new techniques and in advanced technology, and I am borrowing freely from his excellent presidential address before the Society of Thoracic Surgeons in 1968. Our more recent conflicts, including the present and continuing unpleasantness in Vietnam, have each added its ration of expertise to the general care of the patient with thoracic wounds.

One of the outstanding technical advances

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has been the early and rapid removal of the injured from the field of battle to a unit equipped for expert surgical care. Originally heralded by the limited use of C-47 "ambulances" in Sicily and Anzio, and individual patient evacuation by L-5 planes in the mountains of northern Italy, such transport has been brought to a high state of art in Vietnam by helicopter evacuation. This almost certainly explains the increased mortality in forward hospitals in Vietnam as compared to the best figures in world war II (*see table 4*). Heaton[18] has rightly emphasized that seven of the 15 deaths in his group of 159 soldiers occurred in patients who were in fact mortally wounded but who survived to reach the hospital because of rapid helicopter evacuation. Three died shortly after hospital admission, and four died in the operating room. Even in world war II, there was noted an increased mortality when the evacuation time was shortened. Already there have been a number of experiments in civilian helicopter evacuation in an effort to speed the victims of auto accidents or medical emergencies to a hospital center.[19]

During the past 25 years there have been changes in the approach to thoracoabdominal and esophageal wounds. Many more primary laparotomies have been done with closed chest drainage, and repair of the diaphragm from below. In general, thoracotomies are not performed unless a specific indication exists. Advances in the treatment of abdominal viscera have included improvement in diagnostic procedures including angiography and other radiologic techniques; peritoneal aspirations; Hypaque injection of the wound; improved electrolyte balance; emphasis on thorough abdominal exploration in thoracoabdominal wounds, and improved surgical techniques both for the alimentary tract as well as for abdominal vascular catastrophes. In particular, esophageal wounds and ruptures have received increasing attention. We now know that the only hope of salvage lies in prompt recognition of a rent, whether in the neck or chest; the earliest surgery possible consistent with preliminary efforts to stabilize vital signs, wide debridement of the mediastinum and primary closure of the perforation. This is an outstanding example of corrective surgery as an extension of resuscitation.

Table 2: Advances in respiratory care—diagnosis and surgery[20]

1. Better understanding of pulmonary function, pulmonary dead space, shunts, etc.
2. Lung scanning and angiography.
3. Blood alveolar gas studies (ph, pCO_2, PO_2).
4. Improved use of endotracheal tubes.
5. Greatly widened use of tracheostomy techniques.
6. General use of IPPB and CPPB, both volume and pressure machines.
7. Better surgical techniques:
   a. tracheobronchial repair
   b. pulmonary salvage
   c. use of extrapleural techniques.

Table 2 outlines the general advances made in respiratory care during the past 25 years. Shortly after the war there were early publications by Baronofsky[21] and by B. N. Carter[22] on the value of tracheostomy in caring for the lower airway in trauma. We rapidly came to realize that tracheostomy had been performed very rarely during world war II. My recollection is that I performed only two tracheostomies and in both the indications were laryngeal injury. Two classic papers then set the stage for combining tracheostomy and mechanical respiration in cases of crushed chest with flailing. In 1956 Avery[23] described his combination of an uncuffed tracheostomy tube and Mörch respirator to produce "alkalotic apnea" and "internal pneumatic stabilization". In 1957 Björk[24] introduced cuffed tubes with the Engström volume ventilator.

Shortly after world war II it became routine to drain extensive hemothorax with large intercostal tubes in a closed system; this has continued in wide usage today.

Tracheobronchial repair including local excision and end-to-end anastomosis has gained increasing popularity. Pulmonary surgery including resection has become commonplace and the techniques have greatly improved. Over the years there has been increasing appreciation of the surgical significance of the extraparietal pleural plane. It has been learned that this plane may give rapid access to the mediastinum when there is obliteration of the interpleural space. This has resulted in the techniques of extrapleural pneumonectomy, and closed ex-

enteration without spillage of a pocket of organizing hemothorax or of empyema.

Nevertheless, conservation continues in the performance of prompt thoracotomy. Thus from 75 to 80 percent of chest wounds in Vietnam[18] did not require early thoracotomy. Figures from our own civilian experience[30] have shown the need for immediate or early thoracotomy to be slightly more than five percent.

Table 3: Advances in cardiovascular diagnosis and surgery

1. Improved diagnosis
   a. cardiac catheterization
   b. cardiograms
   c. angiography
   d. isotopes
   e. monitoring
2. Cardiac resuscitation—rhythmic closed chest compression and defibrillation
3. Cardiac pacemaker
4. Better vascular techniques
5. Superior prostheses
6. Better management of stab wounds
7. Better closed heart surgery
8. Open heart surgery for trauma
   a. hypothermia
   b. cardiopulmonary bypass

As indicated in Table 3, some of our more striking technological advances have come in the cardiovascular field. The pre- and postoperative care of cardiac surgical patients has improved immeasurably. Steady progress in closed heart surgery has continued, including better handling of wounds of the heart. The brilliant achievements of open heart surgery during the past 20 years are too familiar to recount in detail. Both hypothermic techniques and cardiopulmonary bypass have their advocates and their indications. As applied to thoracic cardiovascular wounds and injuries, there is now the opportunity to correct all sorts of previously nonrepairable types of cardiac and great vessel trauma, such as interventricular septal defects and other internal shunts, torn valves and aortic disruptions or aneurysms.

Finally, comparative statistics of our major wars and of civilian practice (*Table 4*) show progressively faster evacuation, superior resuscitation, more expert surgery, lower case fatality, and better rehabilitation, to the end that not only have we continued to add years to life but we are also adding life to years.

Table 4: A comparison of case fatality rates through the years

Period	*Case*	*Fatality rate*
World war 1	Intrathoracic wounds	50 percent
World war 2 Second Aux[18]	1-intrathoracic wounds (1942-44)	10 percent
	in 1945	7 percent
	2-thoracoabdominal wounds (1942-44)	27 percent
	in 1945	20 percent
Korea MASH-1951[36]	1-intrathoracic wounds	3 percent
	2-thoracoabdominal wounds	21 percent
MASH-1952-53[36]	Thoracoabdominal wounds	4.7 percent
Korea-Tokyo G/H[37]	Intrathoracic wounds	0.4 percent
Vietnam-Fwd Surg[18] (Rapid Evac)	Intrathoracic wounds	9.4 percent
Vietnam-Fixed AFH[38]	Intrathoracic wounds	0.2 percent
Beall[39] (County hospitals—1955-1965)	Major hemothorax-intraabdominal trauma	7.9 percent
Jones-Samson[30] (County hospitals—1955-1965)	Major chest injury	1.8 percent
Brewer[1] (County hospitals—1948-1968)	1-thoracoabdominal wounds	7.2 percent
	2-Major chest injury excluding heart	0.7 percent

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"A turning point came for many of us in 1960 at a conference in Washington . . . He referred to his personal experience . . . and made a comment: 'It seems to me that what we need now is not so much more and better animal experiment but rather more and better observation of the injured man.'"

Fifty years' progress in shock

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IT IS A PRIVILEGE to have been asked to speak to this imposing title. Upon reflection it has seemed more suitable to concentrate on how advances have been turned to useful treatment, than to spend so short a time in following the ebb and flow of theories about shock. The Committee on Trauma has a lineage of fifty years of surgeons of the practical variety, prepared to move ahead in practice despite confusion in the field of theory, never unmindful of good scholarship and good research, but interested morning, noon and night in what can be applied to injured patients. In line with this tradition I shall deal with progress in the management of shock, risking the accusation of neglecting work of scientific merit in the process.

How did our founders view the field of shock in 1922? Rest, saline, blood and morphia were established as prime elements in treatment. In world war I splinting of major fractures had been introduced. My father, Dr. Fraser B. Gurd, who was active as a front line surgeon, described the Thomas splint as the single most important contribution of the first world war in the control of shock.

Saline was used with caution on the basis that it would dilute the toxins of infection and disintegrating proteins. The concept of a deficit of fluid was not entirely new. Its role in the mortality of bowel obstruction had been noted in the dog, but the need for salt solution in substantial quantities was slow to be appreciated. Obsession with the toxic theory of the cause of shock diverted the direction of research and delayed the rational evaluation of results of treatment. The strongest advocacy of intravenous saline in shocked patients in the early 1920's came from Dr. Rudolph Matas.[1] The story has been told by Louis Mengoli in a most charming paper published just a year ago.[2]

Blood transfusion was gaining in respectability. However, as with fluids and electrolytes, its application was not soundly based, for the techniques were not available whereby a protocol to monitor its quantitative use could guide the therapy. In 1922 a normal transfusion was a pint of blood.

The years from 1922 to 1940 reveal a curious lack of effectiveness on the part of basic scientists to help in the elucidation of the process known as shock. Changes in the contractility and in particular the permeability of capillaries were considered all-important. The new endocrinology blamed adrenal insufficiency. On balance, the scientists were more often wrong than right, their teachings actually impeding the work of a new breed which was emerging, the surgical investigator. The critical corrections in the course of shock research were made by a small group of able surgeons. Dr. Blalock

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in 1927 showed that shock after muscle trauma could be explained by hemorrhage and local fluid loss.[3] Drs. Phemister, Freeman and, before long, Wangensteen were likewise active in the laboratory, studying the nervous system, venous return, cardiac output, and adding to our knowledge of blood volume. Most important of all, these men were taking what was learned in the laboratory and putting it to practice on the wards.

By the outbreak of world war II it was agreed in general that shock was largely a form of circulatory failure in which low venous return and venous pressure were commonly associated with low volume states. This much was good and led to more attention being directed to volume replacement. However, there were negative considerations to contend with, such as the exaggerated importance which was attached to generalized capillary damage. Toxemia in shock was felt by some to be inevitable, or at least predestined, in severe injuries. The presence of hypoxia went undetected and inadequately treated. Not least, precise diagnosis was neglected, and the blanket use of the term shock covered a multitude of sins.

IT WAS FORTUNATE for thousands of the wounded that world war II was preceded by the introduction of blood banks. The psychological acceptance of voluntary blood donation and the technology of banking were happily established just in time to meet the need. Plasma was also made available, replacing other substitutes inherited from prewar years. Those of us then engaged in early treatment of the wounded were now adequately equipped, for the first time in history, to replace the losses seen in battle casualties. The new and wonderful world of penicillin promised to displace sepsis as a major cause of death. Blood, penicillin and aggressive fluid therapy improved the tolerance of healthy men for shock and cleared the way for better early surgery, with both survival and return of function being assured as never had been possible before.

During this period the first good information on the dynamics of the circulation in the human during shock was being obtained by Cournand[4] and others. In many minds the management of shock was blood, and if enough was given by transfusion all problems would resolve.

However, it has been an axiom of progress in the management of shock that each advance has introduced what we might call the complications of survival. The first organ to display a lesion attributable to shock survived was probably the kidney, followed in certain cases by the liver and in short order by the lung.

The limitation which became apparent with the greater use of blood and plasma was the effect of overtransfusion upon the cardiopulmonary apparatus. It took close observation to identify the line between too little and too much, and sometimes it was not within the limits of clinical judgement to be sure which way to turn. My own military service gave me a large experience with freshly wounded men in Italy and Holland, and like many among you I knew the anguish of repeated failure. I hoped that the return of peace would bring a chance to study shock in greater detail, to learn how to resuscitate and hold our gains.

In 1947 Eaton described the pulmonary fluid load and increase in lymph flow in shock and in resuscitation,[5] and Moyer was working on congestive atelectasis, expanding the attempt to understand, prevent and treat the pulmonary changes which remain a major problem to this day.[6] From that year of 1947 to the present time the history of progress in the fields of shock and the related care of threatened systems is written in the volumes of the Surgical Forum of the American College of Surgeons.

The 1950's were a time of detailed study of the circulation, some marvellous applied technology and a succession of false hopes. The application of the flame photometer to measurement of sodium and potassium in fluids, together with dilutional studies of the composition of the body, led to a quantitative view of fluid and electrolyte requirements. The advent of the gas electrodes enabled us to recognize hypoxia and acid-base disturbances. Plasma expanders were improved. Owens and Wilson were working to define the indications for the use of central venous pressure.[7]

AT THIS JUNCTURE I would like to comment on a unique and particular privilege of my own, namely to have served the full nine active years on each of two great sister committees of ACS, Trauma and Pre- and Postoperative Care. I would like to pay a tribute to the Pre- and Postoperative Care Committee, a child of Dr. I.S. Ravdin, my old chief. In my opinion this one group deserves the major credit for our progress in supportive care in the last 20 years.

Despite the gains which have been noted, actual improvement in the care of the severely

injured was disappointing in the 1950's. Knowledge gained was slow to be applied on a broad scale. Progress bogged down repeatedly in endless arguments about the merit of details of treatment. Great effort was expended studying vasopressor drugs and autonomic blocking agents, research which helped our understanding but did little for our patients. Techniques like artificial hypotension, artificial hibernation and intra-arterial transfusion had their day. Corticosteroids seemed a two-edged sword, while protease inhibitors failed to control presumed destructive enzymes.

The war in Korea showed that fast evacuation of the wounded was rewarded by success in many types of wounds thought to be lethal. Major contributions to the management of shock were being developed by Curtis Artz and several other members of the Committee on Trauma.[8] Their work supported views congenial to this committee, namely, that one should not give up the struggle to resuscitate a patient despite the consolation of irreversibility as an excuse for failure.

The discovery that the tolerance to shock was linked to the degree of damage to the bowel was an important event. In 1957 Lillehei established that perfusion of the bowel could give survival in the shocked dog.[9] A little later our own studies showed that dogs protected against damage to the bowel by any means no longer showed the usual irreversibility but resisted shock, thereby persuading the authors at least that canine irreversibility was an accident of species, and that the term should not be used in human shock.[10, 11]

A TURNING POINT for many of us came in 1960 at a conference in Washington on shock, called largely through the initiative of Drs. Jonathan E. Rhoads, John M. Howard and Sam Seeley. To me, the key which opened a new door was the presence of Drs. R.T. Grant and E.B. Reeve. Some twenty years before, these men were driven from their laboratory in London by a German bomb. No longer able to continue their research, they went to work on the wards. There they found that the shocked patients were being undertreated in terms of blood replacement. They said so in clear terms, and their ideas became enshrined in War Office directives and saved untold lives during the war.

Therefore, on this day in 1960, we listened carefully when Dr. Grant presented his discussion on shock models. He gave examples of how animal experiment had actually misled us in the past. He referred to his personal experience in studying patients and then made a comment which I quote: "It seems to me that what we need now is not so much more and better animal experiment but rather more and better observation of the injured man".[12]

No one took this to mean the end of work with animals, for we all knew that we must have the controls which animals make possible. However, I know that I went home determined to set up a clinical shock study unit. During the middle 1960's several studies parallelled our own,[13, 14] and from the demonstration of the value of a formal protocol in managing refractory shock, emerged a concept of intensive care. It became clear that the objectives of the treament of shocked patients must go beyond the simple restoration of effective circulation and must provide for and maintain effective tissue gas exchange. The new art of ventilatory care was found to be as important for survival as the support of the blood volume in many types of patient. In addition, the general term "shock" came to be recognized as an inadequate diagnostic label. The influence of Francis Moore and others was seen in a more versatile clinical terminology, better defining the mechanisms actually involved in severe injuries.[15]

The consequences of this shift of emphasis brought a special thrill to me. It was about five years ago that I recall discovering that our staff could carry patients with critical multiple injuries through their resuscitation to immediate definitive surgery at the hands of multiple teams, with acceptable safety, under monitored control before, during and after the operation. The expectation not only of survival, but also of good function in an unbelievably short time, became the goal which spurred our men to greater efforts. A potent factor in this breakthrough, a vital complement to our new mastery of controlled therapy of shock, was the new and more integral role played by our specialist teams in the total care of the patients, and perhaps most important of all, their increased interest in basic physiology as well as specialized techniques.

THE CURRENT SCENE presents its share of challenges. Three major problems dominate the clinical care of ill and injured patients who have accumulated complications subsequent upon a period of shock. The first of these concerns the cardiopulmonary circuit and the

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transport of oxygen. The second concerns sepsis, the third the matter of nutrition. At present we appear to be held up in gaining understanding of the lung in shock, but despite these frustrations the quality of pulmonary care is constantly improving. Erythrocyte dysfunction as a detrimental factor in overall oxygen transport is becoming better understood. Measurements can now be made in man from both sides of the pulmonary circuit. The role of insulin in shock is under active study. Models in animals are used to mimic stressful situations and to dissect details of morphology by means of the electron microscope. This new approach to pathological histology, coupled with molecular biology, offers new insights into pathogenesis of organ change in shock and stress.

Alimentation in the grosser sense is at long last available to patients limited in their ability to handle normal food. The long-term work of Rhoads, Vars and Dudrick have put central venous feeding on a solid footing. This method can be teamed with oral elemental diets to provide support to a wide range of patients otherwise condemned to gradual starvation.

The protective effect of an elemental diet upon the gastrointestinal mucosae, described in shock, burns and stress ulcer by the group in Montreal,[16] undoubtedly is but one clue to possibilities in further study of the micronutrients. Precise demands of body cells for metabolic substrates have never been defined in relation to resistance and repair. Chiu has already shown that glucose in the lumen of the bowel protects it in an instant therapeutic sense.[17] A major study is now underway on the repair of tissues after insult, with special reference to patterns of nutrient metabolites which will enhance recovery.

In closing, I believe that both our Colleges, American and Canadian, are now embarked on steady courses towards their main objectives. The application of our present knowledge calls for educated team work, crosslinks with other specialties, sound standards and the finest training for all members of the team. A more inspired administrative stance is also needed if our profession is to play its part in organizing channels guaranteed to funnel injured patients to the best of treatment.

Both these progressive streams meet in this College, and perhaps they meet to best effect in this committee, combining as it does imagination in administrative matters with a solid academic base.[18]

There is surely much for this Committee still to do, enough to keep it busy for another fifty years.

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". . . many methods of treatment, techniques and new instruments were introduced, to become popular for a time, only to fall into disrepute and then be discarded. A few have stood the test of time."

Fifty years' progress in **skeletal injuries**

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Fifty years ago the treatment of fractures was, in the light of today's standards, primitive and slip-shod. The field was mostly presided over by general surgeons and a few orthopedic surgeons and, as in recent years, dominated by strong and sometimes controversial personalities. As a matter of fact, all of the significant steps in the progress of the specialty over the years have been marked by one man's or another's personality. In many instances the struggle for recognition and prestige sometimes outweighed and overshadowed the value of the issue in question. In certain instances the strength of will and the ability to convince his peers sometimes allowed a proponent of an outmoded idea to perpetuate his thinking years and generations beyond its possible value.

Witness the fact that Royal Whitman, even while in retirement in the later years of his life, continued, with the help of his son Armitage, to impress the profession with the value of the Whitman method of the treatment of fractured hips. His influence, even ten or fifteen years after Smith-Petersen had brought forth the three flanged nail, was responsible for slowing progress in this field for many years.

A similar story is that of the development of the hanging cast by John Caldwell. This clumsy, useless and harmful cast caught the imagination of the fracture surgeon and is used to this day by surgeons whose only excuse for using it is "I get such good results with it". Of course they would get as good results with less trouble if they applied the cast to the sound arm. McLaughlin called this "the elbow stiffening device". The drama of the story of fracture treatment over half a century is primarily the story of strong surgical personalities and the mere recital of the events in the careers of a dozen or more surgeons would cover most of the progress in the field.

When I was in medical school in 1922, the treatment of fractures at The New York Hospital was undertaken by general surgeons only. Lewis Atterbury Stimson, the first professor of

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surgery at Cornell and chief surgeon at The New York Hospital until 1913, and a commanding figure in surgery, had written a text book on fractures and dislocations which had gone through many editions. His work, carried on by his assistant James Morley Hitzrot in the 20's, was confined for the most part to closed reductions, applications of plaster, Whitman treatment for fractured hips and occasional open reductions for femurs and tibias.

INTERNAL FIXATION was used sparingly, employing Lane plates and screws, later to be supplanted by Sherman plates of vanadium steel, a development of William O'Neil Sherman, one of the original members of the fracture committee. Sherman's work as chief surgeon of the U.S. Steel Company in Pittsburgh gave him the opportunity to treat many serious fractures in steel workers, as well as to obtain the help of metallurgists and engineers in improving the strength and composition of the early vanadium steel plates.

We were still under the influence of world war I experience, and the Balkan frame and Thomas splint were the standbys for fracture traction and suspension. The frames were all home made of simple boards held together by bandages and adhesive. The plaster bandages were rolled with loose plaster and crinoline in each hospital, a tedious task. Plaster spicas were reinforced with wooden slabs and these clumsy thick objects were removed by interns by means of a hand knife only. There were no motor saws.

AS A COROLLARY to operative treatment, the Carrell-Dakin solution was popular and was used extensively, a very difficult and time consuming method, painful to the patient and irksome to the younger surgeon. The solution was quite unstable, and there was no way to check the rate of oxidation of the chlorine and thus the efficiency of the solution. After Sir Arbuthnot Lane brought open reduction and plating of fractures to America, Sherman improved the method and advocated it so earnestly that it became widely used, often with disastrous results. Darrach and Clay Ray Murray also were strong advocates of open reduction and plating of femurs and tibiae. They advocated certain technical details that made the "Presbyterian method" popular, but other surgeons were not able to achieve the results reported by Murray.

Lorenz Böhler, an advocate of conservatism in fracture treatment, warned of the dangers of indiscriminate operations and showed that closed reduction and plaster immobilization was the best treatment for most fractures. As late as 1950 he made the statement that he had never had an infection of a plating operation on a tibia, because, he added, he had never plated a tibia. His unpadded plaster and walking plaster became very popular, but the misuse of the unpadded plaster caused serious complications too.

During the 20's Baer at Baltimore advocated the maggot treatment for infected fractures. This rather distasteful technique did indeed clean up the wounds and kept them debrided constantly, but the preparation and application of the maggots was most annoying to the patients and all concerned. It was with relief that most surgeons discarded this means of wound care. Shortly thereafter another unsavory type of treatment was advocated by Orr for the treatment of osteomyelitis. This was applied to infected fractures where the wound was filled with vaseline gauze and a circular cast applied and left in place "until the odor became too foul to bear". Only then was it removed and replaced. This method was continued and used widely by Trueta in the Spanish revolution and great claims were made of excellent results. These methods preceded the discovery of antibiotics and were fortunately supplanted by other methods in later years.

AS A MATTER OF FACT the combination of antibiotics, improved anesthesia and the discovery of non-electrolytic metals, all appearing at about the same time, did much to change the operative treatment of fractures and place it on a safer plane. It then became possible to treat many fractures in a way that was not considered safe in early days.

Venable first used vitallium, a chrome cobalt and molybdenum alloy, in the manufacture of implantation devices in 1937. Later SMO-18-8 stainless steel was found to be almost as inert and in some ways more serviceable since it was a rolled alloy and not a cast alloy as vitallium was. Venable fought for his alloy (it was patented) and kept it going for many years. Finally it was supplanted by other metals, similar but with some advantages. Venable became bitter over the criticism of vitallium and he and Clay Ray Murray, once the closest of friends, became bitter enemies because Clay

Murray was advocating stainless steel instead of vitallium.

During the 30's and before world war II, the instrument makers got into the field and a number of apparatuses for fracture treatment were developed. One, the Ambulatory Splint (the name was retained by a brace maker for years) for fractured hips was supposed to hold the fractured fragments in place while the patient walked in the supporting long leg splint. Many wild claims were made of excellent results by this method, but the advent of nailing finally and kindly consigned this splint to oblivion.

THEN JUST BEFORE world war II came a rash of external fixation splints championed by Roger Anderson of Seattle and the veterinarian Stader in Philadelphia. These expensive and clumsy machines were sold by the manufacturers to both army (Roger Anderson) and navy (Stader) and put in almost every military hospital in the service. It has taken years to undo the damage that enthusiasts perpetrated on the unsuspecting public, all with the help of the army and navy departments. The method was so actively pushed that a Society for External Fixation of Fractures was formed and for a few years membership was solicited, but when the method fell into disrepute the name was changed to the American Fracture Society. *Sic transit gloria!*

A much more dangerous and vicious method of treatment was the plastic glue (Ostamer) treatment advocated and fiercely fought over by a few surgeons and a manufacturer. Only by strong measures was this harmful material taken off the market.

During the war the American army discovered, in prisoner of war camps, German pilots with intramedullary rods in femurs. Designed by Küntscher, this surprising method was found to be useful and became popular in this country after the war. It became one of the major developments of fracture treatment after world war II.

After the war Böhler continued to advocate conservatism in the treatment of fractures as did Watson-Jones. Watson-Jones became the hero of fracture care after the war and his excellent courses on fracture treatment did much to improve fracture care in America and maintain a perspective which had respect for open reduction but a preference for conservative care. His influence has probably done more to temper the popularity of open reduction than any other factor.

The improvement in metallic implants, as well as in the manufacture of fracture instruments, together with antibiotics, better anesthesia and more meticulous surgery, has allowed the operative treatment of fractures to become popular, useful and comparatively safe. In the past few years the Swiss Group, (AO or ASIF group) headed by Müller, has proposed its new principle of open reduction and internal fixation, the compression method, and has given courses in various centers in the world, more especially in Switzerland, to thousands of young men, advocating internal fixation by its method. It has sold thousands of very expensive sets of instruments and metallic devices to young surgeons the world over, who are encouraged to use the method in many fractures. The method is good in expert and experienced hands for a limited number of fractures, but, as in the past with other popular and dangerous methods, the indiscriminate use of the method and its misuse have caused many serious complications and given a bad name to the whole method.

AN EXCELLENT example of the course of progress in the treatment of fractures is that of the fractured hip, which has gone through the throes of development with improvement at each step. In the days before Whitman, the fractured hip was treated with little effort at permanent cure. Whitman is said to have been the one individual to lift the fractured hip into the realm of good treatment. He did indeed change the treatment, but did little to heal the fracture and held back the nailing method by his persistent criticism and unwarranted claims of good results by his method. Fred Cotton's impaction hammer was a vicious looking instrument which was impressive in its force, but surely did nothing to improve the condition of the fractured hip. It is now useful only as a museum piece in the Association for the Surgery of Trauma.

Smith-Petersen's development of the three flanged nail was one of the greatest steps in progress in the past fifty years of fracture care. He made operative treatment of the hip possible and although there have been many improvements since, in the type of metal alloy, in the design of the nail and in the addition of other types of nails, the contribution he made still stands as one of the greatest of the half century. The recent corollaries to hip surgery

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in the prostheses of Austin Moore and others, and the development of the total hip replacement by Charnley, are further chapters in the fascinating story of skeletal surgery.

THE DESCRIPTION of the treatment of fractures of both bones of the leg over the past fifty years will chronicle a story of a variety of treatments that have gone full circle from Böhler who, after world war I, advocated conservative treatment of leg fractures and advised closed reduction and walking plaster, through the era of operative treatment suggested by Lane, advocated by Sherman and made popular and fashionable by Clay Ray Murray and Darrach. The advent of external fixation became a semi-conservative method which competed with plates, Parham bands and circumferential wires of the French, until Lottes advocated his intramedullary nail for "most" tibial fractures. This method became popular, especially in St. Louis, and was reasonably countered by the surprising advocacy of conservatism by Col. Dehne who again has suggested that no tibiae be operated upon. His results have by and large been accepted and considered favorably by most American fracture surgeons to date.

However, in the very period of proof by Dehne of the advantage of conservative treatment, we have the recent compression plate treatment of the Swiss again capturing the imagination of the young venturesome surgeon. It is to be hoped that the young will learn from history and perhaps take up the new methods with at least an open mind.

The history of skeletal injury care over the past fifty years reveals that many methods of treatment, techniques and new instruments were introduced to become popular for a time, only to fall into disrepute and be discarded. A few have stood the test of time and there has been significant progress in the field. Improvements in surgery in general in the fields of resuscitation, blood replacement, antibiotics and anesthesia have given fracture treatment new horizons in which to develop the newer operative methods. New instruments and improved implant materials are adding to the surgeon's ability to use operative methods more safely. However, conservative methods are even now the safest and best treatment for many, probably most, fractures. The general principles of fracture care do not change, as do techniques and methods, and these principles must be adhered to as we continue the quest for progress in the field of skeletal injury.

"Opportunities for carrying out the more modern procedures for the repair or reconstruction of damaged blood vessels were conspicuous by their absence during the recent military activities. . . . Not that blood vessels were immune from injury; not that gaping arteries and veins and vicariously united vessels did not cry out for relief by fine suture or anastomosis. They did, most eloquently, and in great numbers, but he would have been a foolhardy man who would have essayed sutures of arterial or venous trunks in the presence of such infections as were the rule in practically all of the battle wounded."

. . . Bertram M. Bernheim, 1920.

Fifty years' progress in **vascular injuries**

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THE QUOTE ABOVE emphasizes the status of vascular surgery approximately fifty years ago. Despite the fact that the principles and techniques of vascular surgery have been practiced both experimentally and clinically, the potential complications of infection and exsanguinating hemorrhage loomed as formidable threats to any attempted vascular repair. Without the availability of antibiotics and blood transfusions, the general consensus following the experience in world war I was that it was safer to ligate a major vascular injury than to repair it. An extremity might be lost; but there would not be the danger of a disrupted suture line with ensuing hemorrhage, which was frequently fatal.

The experimental and clinical contributions of pioneers in vascular surgery around the turn of the century provided a firm foundation for the development of successful repair of arterial and venous injuries. Despite the disastrous results associated with some attempted vascular repairs during world war I, there were individual surgeons who continued to encourage vascular repair in selected situations. In reviewing his experience at the No. 1 (Presbyterian U.S.A.) General Hospital, B.E.F. France, in 1918, Goodman suggested the suture of blood vessel injuries from war projectiles:

"The ligature of the main vessels of an extremity for the control of hemorrhage seriously jeopardizes the life of that extremity, but this danger may be averted in many instances by suture, provided a certain degree of care be exercised in this attempt by the operator."

During more than the first half of the past fifty year period, the attention of those interested in vascular surgery was focused on the management of arteriovenous fistulas and false aneurysms. Even during world war II there were very few attempts made to repair acute vascular injuries.

One of the greatest contributions that resulted from the Korean conflict approximately 20 years ago was the demonstration that repair of acute vascular injuries could be successfully carried out, even under combat conditions. This has again repeatedly been demonstrated in the more recent experience in the combat situation in Vietnam. There has also been an equal interest, and frequently somewhat more favorable results, obtained during the past 20 years in civilian communities.

Hallowell is generally given credit for performing the first crude arteriorrhaphy more than 200 years ago. The account of this outstanding contribution is documented in a letter

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dated June 15, 1761, from Lambert, surgeon at Newcastle-upon-Tyne, to Hunter giving an account of a new method of treating an aneurysm. Lambert wrote:

"I consider the coats and motions of arteries, and compare their wounds with the wounds of veins and other parts. I reflected upon the process of nature in the cure of wounds in general, and considered in particular, how the union of divided parts was brought about in the harelip, and in horses' necks that are bled by farriers. Upon the whole, I was in hopes that a suture of the wound in the artery might be successful; and if so, it would certainly be preferable to tying up the trunk of the vessel. I communicated my thoughts to Mr. Hallowell. . . . He put it into execution on June 15, 1759. Everything was done in the usual method, til the artery was laid bare, and its wound discovered; and the tourniquet now being slackened, the gush of blood . . . . showed there was no deception. Next, two ligatures, one above the orifice, and one below, were passed under the artery, that they might be ready to be tied at any time, in case the method proposed should fail. Then a small steel pin, rather more than a quarter of an inch long, was passed through the two lips of the wound of the artery, and secured by twisting a thread around it, as in the harelip. This was found to stop the bleeding; upon which the arm was bound up, the patient put to bed, and ordered to be kept quiet, etc. as usual in such cases . . . . and July 19, the patient was discharged from the hospital perfectly well, and with a pulse in that arm nearly as strong as in the other. . . . If it should be found by experience, that a large artery, when wounded, may be healed up by this kind of suture, without becoming impervious, it would be an important discovery in surgery. It would make the operation for the aneurysm still more successful in the arm, when the main trunk is wounded; and by this method, perhaps we might be able to cure the wounds of some arteries that might otherwise require amputation, or be altogether incurable."

The above description emphasizes the fact that 213 years ago it was recognized that amputation of an extremity might be avoided if a major extremity artery could be repaired rather than ligated.

Following the Lambert-Hallowell success, it was more than a hundred years before significant additional contributions were made. There were some individual contributions during this interim, but they created little influence. G. J. Guthrie in 1880 reported closing the internal jugular vein by placing a tenaculum through the cut edges of the vein followed by tying a suture around the tenaculum which created a lateral type of ligature. Eck was the first surgeon to permanently provide a union between two blood vessels when he created his portocaval anastomosis in 1879, which became so important to physiologists (*Table I*).

In 1882, in Germany, Schede advocated the successful closure of the femoral vein in man by lateral suture. According to many, this accomplishment, together with reports by Glück and Braun, has marked 1882 as the birth of modern vascular surgery.

CONSIDERABLE experimental work was carried out during the 20 year period prior to 1900 by many individuals including Von Horach and Abbe. However, Jassinowski of Odessa is frequently recognized as being one of the most accomplished vascular surgeons of his era. In 1889 he published experimental work on the successful suture of carotid arteries in horses. He also emphasized the use of fine needles and silk in performing arterial repairs (*Table II*). In 1890 Burci advocated the use of continuous fine silk sutures in arterial anastomoses.

Table I: major contributions to the development of vascular surgery

Surgeon	Procedure	Year
Hallowell	Lateral repair of a brachial artery in man	1759
Eck	First permanent union of two blood vessels	1879
Schede	First lateral vein repair in man	1882
Murphy	First end-to-end suture of an artery in man	1896
Goyanes	First vein graft repair of an artery in man	1906
Lexer	First saphenous vein graft of an artery	1907
Carrel and Guthrie	Established many basic principles	1902 thru 1912

Table II: early contributions to vascular repair technique

Year	Surgeon	Method
1759	Hallowell	Pin and thread
1881	Glück	Small ivory clamps
1889	Jassinowski	Fine needles and silk
1890	Burci	Continuous suture
1896	Murphy	Invagination technique
1899	Dorfler	Suture all layers
1902	Carrel	Triangulation technique

In 1897 J. B. Murphy of Chicago reported the first successful end-to-end anastomosis of an artery in man which he had performed October 7, 1896. He utilized the invagination technique after resection of a femoral arteriovenous fistula. Kummel is given credit in 1899 for performing the first clinical end-to-end anastomosis of a femoral vein. In the same year Dörfler advocated including all three layers of the artery in the suture line rather than avoiding penetration of the intima, as had previously been advocated.

In the first ten years of this century significant contributions were made both experimentally and clinically. In his work of 1902-1903, Carrel advocated end-to-end arterial anastomosis by the triangulation technique. Carrel combined his efforts with those of Guthrie and their contributions were summarized in *Blood Vessel Surgery* in 1912. They gave impetus to vascular transplants using both autografts and homografts. The first clinical application of a vein graft to repair a missing arterial segment was performed in Madrid by Goyanes in 1906. The following year in Germany Lexer performed the first saphenous vein graft of an artery.

AS EARLY AS 1910 Stitch had collected over 100 reports of arterial repair by lateral suture and 46 by end-to-end anastomosis or vein graft substitution in man. Nevertheless, because of the high failure rate, usually from thrombosis, few surgeons at that time considered arterial repair as worthwhile. In the early part of world war I, when low velocity small arms bullets caused most of the limited arterial trauma, German surgeons had an interest in repairing these wounded arteries. But by 1915, with the widespread use of high explosives and high velocity bullets, there were wounds with more massive tissue destruction, which, together with mass casualty situations and slow evacuation of the wounded, made arterial repair less practical. As previously mentioned, the lack of antibiotics and blood transfusions, combined with the frequently fatal exsanguinating hemorrhage associated with infected vascular repairs, contributed to the continued acceptance of ligation as the preferred method of managing vascular injuries. This persisted into the early part of the Korean conflict.

Major interest in vascular surgery between 1920 and 1950 centered on the management of arteriovenous fistulas and false aneurysms. Outstanding leaders included Holman, Matas and Reid. The practical application of managing large numbers of arteriovenous fistulas and false aneurysms was accomplished during world war II. With the establishment of the first vascular center at the Greenbriar General Hospital at White Sulphur Springs in 1943 by Seeley, several hundred arteriovenous fistulas and false aneurysms were operated upon by Elkin. Other vascular centers were established, and Shumacker also had extensive experience in managing arteriovenous fistulas.

Discouraged by the world war I results, surgeons began to use various types of prostheses and tubes in an attempt to repair arteries. In 1942 Blakemore, Lord and Stefko advocated the use of a vitalium tube combined with a vein to bridge the gap between two arterial ends. Although their method was utilized in world war II, complications eliminated its acceptance.

While ligation was accepted during this 30 year period for arterial injuries, considerable controversy existed concerning concomitant ligation of the uninjured accompanying vein. This procedure had previously been advocated, and it was not until 1950 that it was finally generally accepted by everyone that ligating the accompanying vein was not only unnecessary but also harmful.

WITH THE ONSET of world war II, a National Research Council committee outlined recommendations for the care of combat-incurred vascular injuries. Published in a military surgical manual in 1943, the information was based to a great extent on the world war I experience, and proved greatly misleading when put into actual practice. An example from the published table suggested that ligation of the popliteal artery along with its accompanying vein would not result in gangrene!

During world war II numerous surgeons such as Rose, Hess, Wells, Smith, Stewart, Bradford, Moore and others attempted acute arterial repairs; but the results were little better than those following ligation. The classic review of the world war II experience by DeBakey and Simeone in 1946 evaluated 2471 acute arterial injuries from the American experience. The overall amputation rate was approximately 49 percent following arterial ligation. There were only 81 repairs with only three of these performed by end-to-end anas-

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tomosis. Nevertheless, the amputation rate following repair was lowered to 36 percent.

As a result of the world war II experience, there was a great interest created in vascular injuries and vascular surgery in general. The continued interest and research by many individuals including Blakemore, De Bakey, Elkins, Freeman, Gross, Holman, Lord, Shumacker, Simeone, Swan and others helped set the stage for the great progress in vascular surgery of the last 20 years. Also, during the world war II period, Murray inserted one of the earliest successful vein graft repairs when he repaired the popliteal artery by this method. He also entered his first successful use of heparin.

With the above mentioned contributions, plus the development of new drugs and instruments, the stage was set during the time of the Korean conflict when large numbers of patients provided the opportunity to test the practicability of repair of acute arterial injuries. Early in the Korean conflict, however, vascular ligation was practiced with conservative care of arteriovenous fistulas and false aneurysms. Again, under the direction and encouragement of Seeley, the major vascular center was established in 1950 at Walter Reed General Hospital. Several hundred arteriovenous fistulas and false aneurysms were treated by Hughes and Jahnke with an attempt made in their later experience to restore the continuity of the blood supply (*Fig. 1*).

With rapid evacuation in Korea, new vascular instruments, antibiotics, blood replacement, and stabilization of the fighting, acute vascular repair was begun in the MASH hospitals. Early members of the Army Surgical Research Team, which included Artz, Howard, Hughes and Jahnke, reported their first 130 cases with an average 11 percent amputation rate. Spencer worked in a Navy hospital under similar circumstances, but utilized more homografts than did the Army team. The majority of the repairs were by direct anastomosis with a liberal use of autogenous vein grafts and lateral suture. An overall study of the vascular injuries in Korea reported in 1958 by Hughes showed 304 major arterial repairs with an amputation rate of 13 percent (*Table III*).

Following the Korean conflict, both civilian and military interest in the field of vascular surgery was stimulated and expanded. A large number of civilian hospitals reported sizable numbers of vascular repairs (*Table IV*). For these large groups the overall amputation rates ranged from three to 16 percent. Because a number of the reports contained a significant number of minor arteries, arteriovenous fistulas and false aneurysms, it is difficult to compare statistical results. While some considered retention of a viable limb a success, others used the criteria of adequate pulses distal to the repair. A compilation of the available data suggests that the amputation rates in larger civilian hospitals ranged from approximately five to seven percent. While this percentage is markedly better than that achieved in Korea or Vietnam, it is not expected that the results in battlefield wounds created by high velocity missiles and repaired under mass casualty conditions in a battlefield hospital, will ever equal the results achieved in large fixed civilian or military hospitals. (*Fig. 2*).

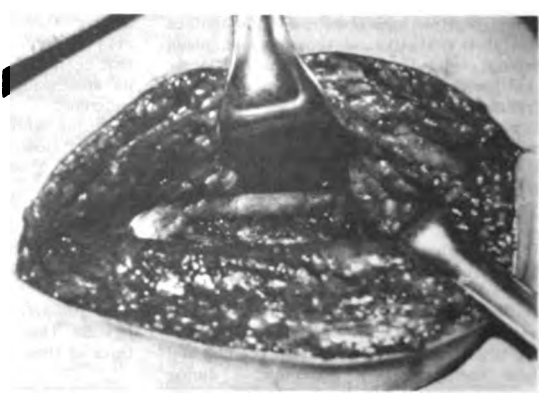

Figure 1: A contralateral autogenous greater saphenous vein graft was used by Hughes in 1952 to replace a missing segment of the popliteal artery shown above. (*U.S. Army photo, Walter Reed General Hospital*)

When various plastic prostheses for blood vessel replacement were developed, they were used in the repair of acute vascular injuries. However, there has been, in general, a higher percentage of complications from infection following placement of a foreign body in a contaminated wound. Although the use of arterial and venous homografts has continued, there has been a trend toward the use of replacement grafts by utilizing autogenous vein grafts, usually the greater saphenous vein.

Table III: the results of managing arterial trauma

	Method	Amputation rate
WORLD WAR II	Ligation	49%
KOREA	Repair	13%
VIETNAM	Repair	13%

Table IV: documentation of arterial trauma

War series	Author	Arteries
WW I	Makins (1919)	1,202
WW II	De Bakey & Simeone (1946)	2,471
Korean	Hughes (1958)	304
Vietnam	Rich, et al (1970)	1,000
Civilian series		
Houston	Morris, et al (1960)	220
Atlanta	Ferguson, et al (1961)	200
Denver	Owens (1963)	70
Detroit	Smith, et al (1963)	61
Dallas	Patman, et al (1964)	271
Los Angeles	Treiman, et al (1966)	159
St. Louis	Dillard, et al (1968)	85
New Orleans	Drapanas, et al (1970)	226
Dallas	Perry, et al (1971)	508
Galveston	Moore, et al (1971)	250

At the time of the onset of the Vietnam fighting, the Army had developed what was considered to be proper guidelines for the repair of acute vascular injuries in the combat zone. For the first time in any war, a surgeon capable of performing vascular repair was assigned to every military hospital in Vietnam. Coming from all areas of training over the United States, hundreds of surgeons brought their own ideas with them which often raised old controversies to be studied once again.

The Vietnam Vascular Registry was established at Walter Reed General Hospital in 1966 to document and follow all who sustained vascular trauma in Vietnam. To date, there have been approximately 7500 individuals' names and copies of military records included in the Registry. In addition to the preliminary and interim reports to evaluate the success of the various methods of vascular repair, other areas of study have been pursued by the registry where there has been controversy. These included the extent of arterial resection during debridement; the repair of venous injuries; the use of external fixation rather than internal fixation for concomitant fractures accompanying arterial wounds; the use of vascular prostheses in contaminated wounds; the repair of carotid injuries; the use of fasciotomy, and the management of wounds of the heart and great vessels. Approximately 1500 of these patients in the registry have been evaluated at

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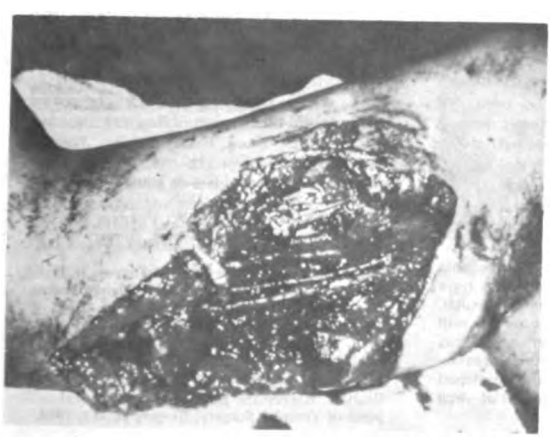

Figure 2: The recent increased use of high velocity missiles has compounded the already complex problem in managing vascular injuries. There may not only be arterial damage such as the above thrombosis of the brachial artery, but there can also be massive soft tissue destruction, osseous damage, interruption of venous return and trauma to adjacent nerves. (*Rich, et al, J Trauma 10:359, 1970, the Williams & Wilkins Company*)

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the Peripheral Vascular Surgery Service Clinic and Registry at Walter Reed General Hospital (*Fig. 3*). The fact that the overall amputation rate has remained approximately 13 percent is due to many factors. There have been more high velocity missile injuries as the etiology factor for the arterial trauma in Vietnam. On occasion, the over-enthusiasm of young surgeons has created a situation where an attempt to salvage a limb has been made when primary amputation should have actually been carried out. Because of rapid helicopter evacuation, many patients are seen in the hospitals in Vietnam that would not have survived in previous wars. Of all the extremity vessels (approximately 90 percent of arterial injuries in both civilian and military practice have been in the extremities) the popliteal artery remains the real enigma with approximately 30 percent amputation rate (*Table V*).

Table V: Vietnam amputation rate in 950 major arterial injuries* **

	Artery	Injuries	Amputation	Percent	Total percent
UPPER EXTREMITY	AXILLARY	59	3	5.1	2.0
	BRACHIAL	283	16	5.7	
ABDOMEN	COMMON ILIAC	9	1	11.1	0.1
	COMMON FEMORAL	46	7	15.2	
LOWER EXTREMITY	SUPERFICIAL FEMORAL	305	37	12.1	11.4
	POPLITEAL	217	64	29.5	
	TOTAL		**128**		**13.5**

**Excluding 50 carotid arteries. Arteries repaired without subsequent amputation—innominate, subclavian, aorta and external iliac—are not listed in this table.*

***Rich, et al, J Trauma 10:359, 1970.*

Figure 3: Approximately 1500 of the 7500 patients included in the Vietnam Vascular Registry have been evaluated at Walter Reed General Hospital. Marked stenosis of the proximal suture line with interpositioned autogenous greater saphenous vein graft in the right distal axillary artery is demonstrated angiographically in a man who developed pain in his extremity with use. (*Rich, et al, Arch Surg 100:646, 1970*)

Summary

Although some of the basic thoughts in the repair of vascular trauma occurred more than 200 years ago, it has only been in the past 20 years that large numbers of vascular injuries have successfully been managed by various methods of repair. With increasing numbers of reports of successful vascular repair, certain technical aspects have become readily accepted. Nevertheless, there do remain differences of opinion which warrant additional investigation.

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"We can point with some pride to the current concern regarding the maintenance and restoration of physiological priorities in the management of the acutely traumatized patient."

Fifty years' progress in neurosurgery for trauma

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I SALUTE the Committee on Trauma on this occasion, which attests to its dedication and motivation toward a problem that long has beset mankind. The advances in the knowledge of the general subject of trauma have obviously been the result of cumulative experiences shared by all who profess concern about this tremendous clinical problem.

As exemplified by this program, we have witnessed a fragmentation of the topographic areas of the human body, dictated by our own special interests and talents. Yet we all recognize that the injured human cannot be left to a strict and arbitrary parcellation for fear of ignoring the basic fact that a biological system such as ours must be considered as a whole. It is not neurosurgical heresy to admit that I am very concerned and vitally interested in the fractured femur, the ruptured spleen, and the tension pneumothorax in a brain injured patient.

Certain modern concepts and principles in the management of craniocerebral injuries can be dated from the experiences of Harvey Cushing and others in world war I. The realization that every penetrating wound of the brain was not necessarily fatal was the result of the meticulous surgical care imposed upon those victims, which consisted of the arrest of hemorrhage, the removal of foreign bodies and indriven bone fragments, and the general supportive care of the total patient. In the preantibiotic era, infection was, of course, a major complication (as it sometimes is today) and with no specific method to combat it. Yet, the lessons learned from those experiences have become axioms of therapy today.

THE PASSAGE of these past five decades coincides almost identically with the age of neurosurgery as a specialty, since it was at a meeting of the American College of Surgeons in New York in 1919 that Dr. William Mayo announced that the specialty of neurosurgery had been born. We have witnessed, through several generations of neurosurgeons, many innovative methods in the management of the injured brain and spinal cord—many of which proved valueless and were abandoned—but the stimulus resulting from the constant flow of the injured has kept our motivation high and

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has militated in favor of many principles which are essentials in contemporary management. We have seen the magnet for the removal of metal foreign bodies come and go; we have witnessed the birth and demise of profound hypothermia in the treatment of the contused brain; we have used and discarded the methods of stringent dehydration, multiple lumbar punctures, massive atropine administration, subtemporal decompression, magnesium sulphate by rectum, and the "woodpecker" procedure of multiple inspection burr openings for suspected intracranial hematoma. The conversion of the human calvarium into a saltshaker has always been reprehensible to most of us!

In lieu of these discarded concepts, we can point with some pride to the current concern regarding the maintenance and restoration of physiological priorities in the management of the acutely traumatized patient. As neurosurgeons, we have learned the proper order of priorities in the care of the multisystem injured patient. We are concerned with and agree that there should be, in such instances, a "captain of the team". The devastating effects of hypovolemic shock, metabolic acidosis, inappropriate ADH secretion, and failure of capillary perfusion are the concern of every neurosurgeon. The requirements of the "milieu interior" are known to be essential if recovery is to occur. The degree of therapeutic sophistication in the care of the long-term coma patient is a monument to these principles.

THE LAST DECADE has brought into routine employment the use of high potency glucocorticoids and mannitol for cerebral and spinal cord edema, the routine use of echo-encephalography, angiography, and brain scanning for the diagnosis of traumatic mass lesions (subdural, epidural, and intracerebral hematoma), thus obviating the "exploratory" burr opening. In the area of acute trauma to the spinal cord, there is experimental and clinical evidence to support the premise that the liberation by norepinephrine promotes the ischemic necrosis of the cord which may produce a permanent sensory motor loss. Local cooling of the cord combined with decompressive laminectomy, it is hoped, will prove beneficial in minimizing the devastating neurologic deficits so common to such injuries. Current investigations into the pharmacologic changes in traumatized central nervous system tissue and the peculiarities of the involved enzyme systems may yield further practical information that will lead to progressive improvements in our therapeutic approach. In concert with our orthopedic confreres, we have more efficient and practical methods of vertebral realignment and fixation after spinal trauma.

We recognize that the injury produced by severe acceleration-deceleration impact injuries, as well as penetrating injuries, will damage sensitive nervous tissues to a degree that may prohibit functional recovery—a *fait accompli* in the mechanistic sense—but there is every reason to continue our attempts to minimize the total effects of such trauma upon human performance. Hence, a new era of rehabilitation and functional restoration has evolved utilizing early physical therapy, speech and occupational therapy, and replacing the ghastly scenario of the once daily visit to the neurosurgical "vegetable garden".

Neurological surgery, like other surgical specialties, has not been remiss in the modification and development of advances in the area of technical skills. The use of power tools, visual enhancement through magnification and improved illumination, hemostasis by bipolar coagulation and gelatin foam and oxidized cellulose, and the corrective replacement of skull fragments by bone grafts and the acrylic resins, testify to the continuation of improvements in the technological area. The use of siliconed latex tubes for shunting, the use of inert metals (tantalum) for metallic inserts and hemostatic clips, and vastly improved radiographic technics with less toxic contrast materials for diagnostic angiography and myelography should be mentioned.

IN THE AREA of prophylaxis, we have worked with the auto manufacturers in the development of certain safety features in the modern cars, as well as to support the generally adopted crash helmet statutes for motor bike riders which now exist in most communities. Neurosurgeons, concerned with injuries occurring in sports, have been in the forefront in influencing the design and construction of protective headgear and other equipment and have also influenced certain rules changes that

prohibit such potentially dangerous technics as "spear tackling". Published indictments of the hazards of professional and amateur boxing indicate our concern for the risk factor inherent in such activity.

Agonizing over the plight of the paraplegic and quadriplegic has resulted in a concerted effort to improve the rehabilitation of these unfortunates and to promote legislation to support their care, since the medical expense attending such injuries is virtually prohibitive for the average family. A cooperative study on a national basis is being conducted regarding the spine injured and his care and long-term management. Furthermore, the establishment of centers for the acute and chronic care of the head and spine injured victim is proving practical and will certainly militate in favor of more intensive research into the problems relating to central nervous system trauma.

BENEFITTING from the experiences in world war II and the Korean and Vietnam conflicts, we have learned much concerning the care and management of peripheral nerve injuries, the value of rapid transportation of the injured to a definitive treatment center, and the value of triage systems in mass casualty situations.

Furthermore, central nervous system trauma is being given a more prominent role in the academic aspects of medical training, and in many institutions has once again assumed an important niche in the medical school and residency teaching curricula.

A quantitative concept of the problem of post-traumatic convulsive seizures is still receiving extensive study and evaluation so that this important aspect of trauma may be predicted with greater accuracy and the efficacy of treatment substantiated.

The names of the hundreds of persons who have made significant contributions in the field of nervous system trauma cannot be listed here, but suffice it to say that we are all standing on the shoulders of those who have gone before.

IN SUMMING UP, I would propose that four essentials in the management of the trauma problem have occurred in the past fifty years of neurological surgery:

1) The recognition of the need for prevention of central nervous system trauma wherever possible, and research into its causes;

2) The management of the traumatized patient on a basis of physiological principles with concern for all of the biological systems involved;

3) The ability and willingness of the neurosurgeon to perform as a member of a treatment "team" and to participate in the treatment arena on the basis of priorities where indicated, and concerted, simultaneous action when necessary, and

4) The refusal to delineate the subject of trauma to sidelines in our teaching and training curricula, but to make it a major item and *tour de force* in our academic settings.

Meetings of the American College of Surgeons

Clinical Congresses

1972	San Francisco	October 2–6	1976	Chicago	October 11–15
1973	Chicago	October 15–19	1977	Dallas	October 17–21
1974	Miami Beach	October 21–25	1978	San Francisco	October 16–20
1975	San Francisco	October 13–17	1979	Chicago	October 8–12

Spring Meetings

1973	New York	April 1–4	1976	Boston	April 5–7
1974	Houston	March 25–27	1977	Los Angeles	March 28–30
1975	Atlanta	April 21–23			

AMERICAN COLLEGE OF SURGEONS

STANDARDS FOR EMERGENCY DEPARTMENTS IN HOSPITALS

The accompanying standards for Emergency Departments in Hospitals were formulated by the Committee on Trauma and approved by the Board of Regents at its meeting on February 23 and 24, 1963.

The function of an emergency department is to give adequate appraisal and initial treatment or advice to any person who considers himself acutely ill or injured and presents himself at the emergency department door. This should assume the probability of obtaining care of the highest order.

The fact of constantly increasing emergency department use must be recognized. This use is not limited to real emergencies, since to the individual any complaint may become an emergency if he cannot locate his physician at the moment. This makes the hospital and its medical staff responsible for the organization and operation of the emergency department in a manner that will insure the same high standard of care as prevails in other areas of the hospital.

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The following standards are desirable. In certain institutions many of them may be impractical. Under the latter circumstances, they should remain as ideals to be approached as nearly as possible.

AUTHORITY. Policy should be formulated and the emergency department should be operated under the auspices of an emergency department committee, representing the major medical services and the hospital administration, including the nursing service.

STATUS. The emergency department is important in public relations. It should have departmental status.

DIRECTION. There should be a single director.

. He should be responsible only to the emergency department committee or its equivalent for the implementation of policy and the supervision of professional services.

. His tenure should be sufficient to provide directional continuity.

PERSONNEL. Medical staff coverage should be adequate to insure that an applicant for treatment will be seen by a physician within a reasonable period of time after arrival.

. A physician on second call should be available against unexpected or unusual contingencies.

. There should be a mechanism whereby specialized medical services can be obtained as promptly as possible when needed.

. A roster of available specialists should be posted in the emergency department.

. The nursing staff should be adequate to handle the average load with provision for additional nursing help during peak hours or unusual circumstances. Permanent tenure of the senior nursing staff or supervisor is essential to good patient care.

. Whenever practicable the nursing staff should not be required to carry out administrative duties normally performed by the business office.

RECORDS. Every patient should have a permanent record containing the history, findings and treatment or disposition.

. The physician involved is responsible for the record

. Periodic spot reviews of records should be made.

GENERAL POLICIES. The emergency department should be open 24 hours a day.
. Every applicant for treatment should be seen by a physician.
. Privileges of the attending staff relative to fee for service in the emergency department should be specified by the emergency department committee.
. The scope of treatment allowed in the emergency department should be specified by the emergency department committee and enforced by the director.

As a rule, patients requiring general anesthesia should be admitted and treated in the hospital operating suite, and surgical procedures in the emergency department should be limited to the suture of lacerations and the reduction of fractures amenable to local or regional block anesthesia. Serious conditions of acute nature may have resuscitative or supportive treatment started in the emergency department when necessary.

Revisits should not be permitted except by reason of special medical indications or in institutions where the emergency department also serves as an outpatient department during the day hours.

FACILITIES. The emergency department should be located on the ground floor, easily accessible from the main hospital but separated from the main entrance.
. The emergency department entrance should be well marked and illuminated, easily accessible from the street, without curbs or platforms, and sufficiently covered and enclosed to protect ambulance patients from the elements during unloading.
. Space for stretchers and wheel chairs should be reserved immediately adjacent to the entrance. Stretchers should be sturdy enough to serve as examining tables and ideally should be x-ray permeable.
. There should be waiting room space, separated from the working area of the emergency department, and containing telephone, toilet and drinking fountain. An explanatory brochure for patients and relatives is valuable.
. X-ray and laboratory services in or easily accessible to the emergency department should be available at all times.
. Laboratory facilities sufficient for urinalyses and blood counts should be present in the emergency department.
. A poison control chart and the telephone number of the nearest poison control center should be displayed in a prominent place.
. A manual of standard emergency department rules and routine procedures, both administrative and professional, as formulated or approved by the emergency department committee, up-to-date textbooks and a poison manual should be available for the guidance of the staff.
. All instruments in the emergency department should be of the same quality as prevails throughout the hospital.
. Air conditioning in many parts of the country and good communications are essential.
. The necessity for observation beds, doctors' call room, security room for disturbed patients, police, ambulance attendants' and reporters' room, and pantry should be considered, according to the community.

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(Minimally revised from that published in the Bulletin, American College of Surgeons. May-June 1963)

guidelines for design and function of a hospital emergency department

THE COMMITTEE
ON TRAUMA / 70
AMERICAN COLLEGE OF SURGEONS
55 EAST ERIE STREET
CHICAGO, ILLINOIS 60611

guidelines for design and function of a hospital emergency department

The American College of Surgeons is grateful to The John A. Hartford Foundation, Inc., New York City, for making possible the publication of this revised edition.

THE COMMITTEE ON TRAUMA / 70
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PREFACE

The first edition of this brochure was printed in 1961, following a study of conditions in the emergency departments of many American hospitals by the Field Program of the Committee on Trauma of the American College of Surgeons. Using its findings, the Committee put together a concise outline of facilities and professional services necessary to the efficient functioning of a modern emergency department. This outline reflected those trends which had altered substantially many of the traditional concepts relating to emergency department functions. Titled "A Model of a Hospital Emergency Department," the first edition went through four printings.

The trends in emergency department utilization by the public have continued, as has the need for expanded, renovated, and new facilities, and the demands for staffing predicted in 1961. The hospital and its medical staff are responsible for the organization and operation of the emergency department in a manner that will insure the same high standard of care as prevails in other areas of the hospital.

It is hoped that this revised edition will prove as helpful to those assigned the task of emergency department management as was the first.

Committee on Trauma
American College of Surgeons

Standards for Emergency Services in Hospitals*

PRINCIPLE

Adequate appraisal and advice or initial treatment shall be rendered to any ill or injured person who presents himself at the hospital.

Standard I: A well-defined plan for providing emergency care, based upon community need and the capability of the hospital, shall exist within every hospital.

Interpretation: The hospital must have some procedure whereby the ill or injured person can be assessed and either treated or referred to an appropriate facility, as indicated. Most hospitals that offer a broad range of services can provide effective care for any type of patient requiring emergency service. Hospitals that offer a partial range of services may be capable only of operating a limited emergency service and, therefore, must arrange for the transfer of certain patients to other facilities. Other hospitals may elect to transfer all emergency patients.

The degree to which a hospital provides emergency care should be guided by a community-based plan.[1, 2] If such a plan exists, the hospital and its medical staff should demonstrate evidence of participation in its development and implementation.

Standard II: The emergency service, when maintained, shall be well organized, properly directed and integrated with other departments of the hospital. Staffing shall be related to the scope and nature of the needs anticipated and the services offered.

Interpretation: The emergency service must be organized and competently directed. When warranted by its activities and the degree of complexity, the emergency service should be organized as a department.[3] An organizational plan must be developed that identifies the emergency service, its place in the overall hospital organization plan and its relationship to other community emergency services. There should be a chief of emergency service who is a member of the active medical staff and who implements the policies and supervises the professional medical services. In the absence of such an individual, the direction of the medical services may be provided through a multidisciplinary medical staff committee, the chairman of which serves in the capacity of chief of emergency service.

The hospital and the medical staff are responsible for ensuring that emergency patient care meets the same standards of care that prevail in other areas of the hospital. Service must be available 24 hours a day and medical staff coverage must be adequate to ensure that an applicant for treatment will be seen within a reasonable length of time relative to the illness or injury that exists.

Additional members of the medical staff should be on call for consultation and for unusual contingencies. The services of specialists should be made available by prearrangement. Acceptable methods of providing medical coverage include the use of house staff under adequate medical staff supervision, rotating panels of staff physicians and contracting groups whose members are members of the medical staff.

There must be an adequate number of nurses for the amount and type of care to be provided. These nurses must have had special training and must possess the necessary professional skills for the adequate performance of their duties. In hospitals providing complete emergency service, every effort should be made to assign a permanent nursing staff to the area. Hospitals providing limited emergency service should assign an adequate nursing staff that is continuously available for providing this care.

Participation in emergency care conferences for ambulance personnel,[4] emergency service personnel and medical staff should be considered one of the educational responsibilities of the hospital.

Standard III: Facilities for the emergency service shall be such as to ensure effective care of the patient.

Interpretation: The emergency service area should be in proximity to the emergency entrance and also should be easily accessible from within the hospital. The emergency receiving area should be kept free of obstruction at all times. The emergency ser-

*From the October, 1969, edition of *Standards for Accreditation of Hospitals*, Joint Commission on Accreditation of Hospitals, Chicago, which is annotated as containing Principles and Standards approved; interpretations only accepted for field testing.

[1] *Emergency Services in the Hospital*, 1966, American Hospital Association, may be referred to for further guidance.

[2] *Accidental Death and Disability: The Neglected Disease of Modern Society*, 1966, National Academy of Sciences, National Research Council, may be referred to for further guidance.

[3] *Emergency Department, A Handbook for the Medical Staff*, 1966, American Medical Association, may be referred to for further guidance.

vice area should have adequate space and should be separate from the surgical suite of the hospital. Reception, examination, treatment and observation rooms should be provided in such numbers, sizes and arrangements as to ensure effective care of emergency patients.[5]

In hospitals providing extensive emergency care, work areas must be large enough to accommodate the efforts of a multidisciplinary team whenever needed. It is preferable that all severely traumatized patients be treated in an area apart from other patients. It is desirable that there be separate rooms for urgent but limited surgery and for the treatment of fractures. Because many people with a diversity of diseases pass through this area, special emphasis must be placed on procedures designed to avoid contamination and cross-infection.

All instruments and supplies used in the emergency service should be of the same high quality as those that prevail throughout the hospital. Suction and oxygen equipment and cardiopulmonary resuscitation units must be available and ready for use.

Standard drugs, parenteral fluids, plasma substitutes and surgical supplies must be on hand for immediate use in the case of life threatening problems such as shock, hemorrhage, impaired airway, convulsive disorders, lacerations, burns, snakebites and fractures. All resuscitation equipment and supplies, including those used for tracheal intubation, tracheotomy, ventilating bronchoscopy, intrapleural decompression and intravenous fluid administration, must be suitable for adults, children and infants.

Radiologic and clinical laboratory facilities should be readily available for use at all times. Whenever necessary, patients should be escorted by hospital personnel to the areas for laboratory tests and radiological services.

When possible, emergency service personnel should prepare in advance for the arrival of a critically ill or injured patient. The planned reception of patients may be enhanced by a communications system that provides information from persons at the site of an accident or disaster, or in a moving ambulance.

Rapid communication with other departments of the hospital shall be ensured. This may necessitate a separate communications system connecting the emergency service and all functionally related areas, such as the blood storage area, surgical suite, clinical laboratories and diagnostic radiology.

Standard IV: Emergency patient care shall be guided by written policies and shall be supported by appropriate procedure manuals and reference material.

Interpretation: There shall be written policies concerning the extent of treatment to be carried out in the emergency service. Such policies must be approved by the medical staff and by hospital management and should be reviewed periodically; revised as necessary; and dated, to indicate the time of the last review. Written procedures should be developed that are based upon these policies. The policies and procedures should include at least the following:

- Explicit directions as to the location and storage of medications, supplies and special equipment;
- Methods for around-the-clock procurement of equipment and drugs;
- Specification of medical staff coverage, lists of medical staff members who are on call, and lists of available special consultants;
- Instructions relative to the notification of the patient's personal physician and the transmission of relevant reports;
- Plans for communication with the nearest poison control center and with police and local health authorities relative to accident victims and to patients who are in other reportable situations such as having contagious diseases or being victims of suspected criminal acts;
- Instructions relative to the handling of persons who are emotionally ill, under the influence of drugs or alcohol, victims of suspected criminal acts, contaminated by radioactive material,[6] diagnosed as dead on arrival and in other such situations requiring special instructions; and
- Explanation of the disaster plan, and how the emergency service is integrated into it.

Policies and procedures specifically for the medical staff shall include at least the following:[7]

- Clarification of the levels of professional responsibility;
- Listing of permissible procedures that may be performed in the emergency area; for example, good patient care dictates that procedures requiring general or major regional anesthesia should be performed only in the surgical suite;

[4] *Standards for Emergency Ambulance Services*, 1967, American College of Surgeons, may be referred to for further guidance.

[5] *A Model of a Hospital Emergency Department*, 1963, American College of Surgeons, may be referred to for further guidance.

- Circumstances under which definitive care should not be provided and procedures that should be followed in referring the patient to a more appropriate facility;
- The utilization of primary or secondary wound closure at the time of a major disaster;
- Appropriate utilization of observation beds;
- Circumstances that require the patient to return to the hospital for treatment, for example, when treatment is impossible to arrange otherwise; and
- Procedures for early transfer of severely ill or injured patients to special treatment areas within the hospital such as the surgical suite, the intensive care unit or the cardiac care unit.

Cardiopulmonary resuscitative training[8] should be required for the physicians, nurses and all allied health personnel who work in the emergency service.

Authoritative, current toxicology reference material and antidote information shall be readily available, along with the telephone number of the regional poison control center. Charts relating to poison control, the initial treatment of burns, cardiopulmonary resuscitation and tetanus immunization shall be prominently displayed.

Standard V: A medical record shall be kept on every patient receiving emergency service and shall become an official hospital record.

Interpretation: The medical record shall contain adequate patient identification; the time of arrival, by what means and by whom transported; the pertinent history of the injury or illness including details relative to first aid or emergency care[9] given prior to arrival at the hospital; a description of significant clinical, laboratory and roentgenologic findings; the diagnosis; the treatment given; the condition of the patient on discharge or transfer; and the final disposition including instructions given to the patient relative to necessary follow-up care. The patient and/or the patient's family shall be instructed regarding needed follow-up care. The record shall be signed by the physician in attendance, who is responsible for its clinical accuracy.

It is desirable that the patient's emergency record be incorporated in his previous hospital record, if he has one, and that a copy be sent to his physician. A review of these medical records should be conducted regularly to evaluate the quality of emergency medical care. Medical records of patients whose death occurred within 24 hours of admission to the emergency service should receive particular attention.

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[6] *Emergency Handling of Radiation Accident Cases*, 1969, United States Atomic Energy Commission, may be referred to for further guidance.

[7] *Management of Fractures and Soft Tissue Injuries*, 1965, American College of Surgeons, may be referred to for further guidance.

[8] *Emergency Resuscitation Team Manual: A Hospital Plan*, 1968, American Heart Association, may be referred to for further guidance.

[9] *Emergency Care of the Sick and Injured*, 1966, American College of Surgeons, may be referred to for further guidance.

Trends Affecting Emergency Services Function

1. Very few hospitals have met the needs imposed since World War II for the vast expansion in facilities, equipment, and personnel demanded by society for routine off-hour treatment of non-emergency conditions and for treatment of accidental injuries, which continue to steadily increase in number. Society, in fact, now looks to the hospital emergency department as a community center for outpatient care. Of the 40 million "emergency room" visits in 1966, more than two-thirds cannot be classified as emergencies. Past and projected estimates of this increasing load are as follows:

	Estimated Total Number of Hospital Outpatient Visits (in millions)	Estimated Emergency Room Visits (in millions)
1958	84.5	18.0
1960	91.9	23.0
1962	99.4	28.5
1968	121.6	44.1
1970	129.0	49.3

This social change has been paralleled by a decrease in the number of house calls and by a closer adherence to regular office hours by physicians. In utilization, these figures dramatically point out that emergency department facilities can be potent public relations instruments available both to the hospital and to the medical profession. The emergency department must be planned with this in mind.

2. Surgeons still man the emergency department even though less than 40 per cent of all cases are surgical or traumatic in nature. The emergency department must become the combined responsibility of all branches of the hospital staff.

3. Emergency department patients now come from all walks of life. Charges must be reappraised accordingly.

4. Every patient must be examined prior to treatment. Triage (sorting) can no longer be relegated to an inexperienced house officer. It must be carried out promptly by competent and experienced members of the medical profession within adequate facilities.

5. The public has come to look upon the emergency department as the community medical center where anyone with any complaint may apply, at any hour of the day or night, and expect prompt and courteous attention. This concept must be accepted as a community obligation by governing boards, hospital administrators, and the medical profession.

Emergency Department Renovation or Replacement

General Considerations

That existing emergency department services usually constitute the weakest, most neglected link in the chain of hospital care is a well established fact. Equally clear is the fact that emergency departments of many general hospitals are in need of renovation or replacement. Few persons responsible for these changes have any valid notion of how and what to plan for, and adequate plans cannot be designed without this knowledge. Therefore, the primary objective of this outline of requisites for a modern emergency department is to provide the assistance and guidance needed in this area.

The planning of new or remodeled emergency facilities should not be made on the basis of subjective impressions, but on the basis of an orderly survey of existing and foreseeable future needs.

General factors to be considered in planning for new or remodeled emergency facilities should include:

- Patient load for the past several years and the projected yearly load.
- Hours of maximum patient load.
- Type of patient presenting for care (out-patient, true emergency, etc.).
- Community plan delineating responsibility for the various aspects of emergency care.
- Other emergency facilities serving the same area.
- Geographic location of the institution, and whether urban, suburban, or rural.
- Industries located or proposed in the area and industrial growth potential.
- Population of the area served, population growth in the past 15 years, and population trends.
- Type of neighborhood served and such neighborhood trends as increasing slum areas, urbanization, suburbanization, industrialization, etc.

Architects' plans should be designed to satisfy predetermined medical and administrative needs, and must be subject to the combined approval of all concerned. The hospital administration will be concerned primarily with size, cost, and mechanics of the contemplated emergency department. Size should be predicated upon a comparison of past and present patient loads, the types of patients seen, and a projection of anticipated increases based upon pertinent statistical data pertaining to local conditions. Development and analysis of this information will provide the cornerstone for plans that may satisfy future requirements.

The breadth and limitations of function of the proposed emergency department are a primary responsibility of the medical staff. The answers to many questions must be integrated with early planning:

Is the emergency department to double as the main admitting office?

Is it to be used as an out-patient department during the day?

Are the surgery and fracture rooms to be used for elective procedures?

Are patients to be held in the emergency department overnight or admitted to the hospital?

Is the emergency department to be manned by attending staff or house officers?

Are lacerations to be sutured in the examining cubicles or only in the surgery room?

Are patients with major injuries to receive definitive treatment or resuscitation only and then be transferred?

Is there a central record system, or will emergency patients have separate charts?

These and many other questions must be answered before the architect can be provided with valid instructions.

If the contemplated emergency department is to be used for purposes beyond the reception, examination, and treatment of emergency patients, such functions and their extent must be predetermined in detail if the final product is to satisfy the estimated demand.

All of the features to be described are not necessarily suitable for any one specific institution. They are outlined merely as facilities necessary, or useful, to the efficient functioning of an emergency department in any general hospital. The facilities however, are essential to the reception, examination, and treatment of emergency admissions. Each unit must be available in or accessible to the emergency department. For each individual institution, specific requirements will dictate the elements of its program.

Physical Requirements

Location

The emergency department should be conveniently accessible to the "hospital core" and permit easy admission to the hospital of patients treated in the emergency department. It should also be readily accessible to pedestrian and vehicular traffic. It must be situated at grade level. It is desirable that the entrance to the emergency department be somewhat removed from other entrances to the hospital, and provide ample and separate space for vehicle movements and parking.

Ventilation

Adequate ventilation with filtered fresh air is essential. Air conditioning for cooling and heating is desirable.

Communications

The electric system should include a nurses' call system connecting all patient areas with the nurses' station. Telephone outlets provide adequate communication with the hospital switchboard. In larger installations, a complete intercommunication system may be desirable.

Two-way radio communications with ambulances serving the hospital can provide valuable information on incoming patients. Facilities providing radio communication with other community hospitals, and with existing central disaster headquarters, will be quite useful in the event of a major catastrophe.

If the hospital building is equipped with a pneumatic-tube system, a station should be available to both the registration area and the nurses' station of the emergency department.

Lighting

All work areas should be equipped with recessed fluorescent light fixtures providing a lighting intensity of between 40- and 50-foot candles. For corridors, storage rooms, etc., an intensity of between 15- and 20-foot candles is sufficient. Special lights are required for the surgery, fracture, and examining rooms.

Component Units of an Emergency Department

Entrance

The entrance must be clearly marked, well illuminated, and easily accessible from neighboring thoroughfares. The ambulance port should be sufficiently covered and enclosed to protect patients from the weather as they are transferred from the casualty-carrying vehicle to the emergency department. In approaching the entrance, the vehicle should not be forced to back into the doorway. The entrance should be on the ground level and free from saddles and other hazards to unhampered movements. Attendants should stand on the same level with the entrance when removing a stretcher from the ambulance. If a separate approach is provided for ambulatory patients, any difference in levels should be bridged by a ramp rather than by steps. The doors should be wide and, preferably, auto-

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matic. Stretchers and wheel chairs should be stored immediately adjacent to the emergency department entrance. The area immediately inside the entrances should be sufficiently large to provide space for triage in the event of mass casualties.

Waiting Room

Relatives and friends of patients should not be allowed access to the work areas of the emergency department. A comfortable, well appointed waiting room should be provided for them outside the main flow of traffic. Lavatory facilities should be included in this area if public rest rooms are not nearby. The decor and comfort of the waiting room reflect a hospital's attitude toward patients and visitors, and therefore have considerable public relations value. The waiting room may offer literature describing the purpose, functions, and rules of the emergency department.

Police, Press, and Ambulance Attendants' Room

Police, press, and untrained ambulance personnel should also be kept out of the work areas of the emergency department. A small room equipped with desk, telephone, and chairs will serve their needs and promote good public relations. Qualified, well trained ambulance attendants, however, should be permitted to enter work areas where they can assist the professional staff in treating the acutely ill or injured.

Registration Area

Administrative functions of the emergency department should be centered on and carried out in the registration area. The unit should be immediately adjacent to the nurses' station and quite near the emergency department entrance. The functions of the registration area include record keeping, admissions, discharges, making appointments with physicians in private practice, billing, and taking care of patients' valuables. In some situations it may double as the admitting office for the institution; in others the nursing staff may be required to perform administrative functions at night.

Doctors' and Nurses' Station

This unit should be next to the registration area. It should be glass enclosed above the counter level for maximum visibility of the remainder of the emergency department. It should have ample counter space and should contain a bulletin board upon which are posted rosters of doctors on call and recent directives pertaining to the emergency department. Policy and procedure manuals, reference books, and records of requisitions for supply and diagnostic procedures should be kept here. Doors should be omitted in this area because of the heavy traffic.

Work Room

For functional reasons this room should adjoin the doctors' and nurses' station. It should contain an icebox for storage of biologicals and specimens requiring refrigeration. There should be counter space with cabinets below and above for storage of drugs, intravenous fluids, and materials used in the emergency department. The poison control center should be located in this room. A small boil sterilizer is a desirable part of its equipment, even in institutions where all sterile sets are furnished by the central supply department. All cabinets and shelves must be clearly marked to show their contents, and a key storage plan must be kept at a central point in the work room.

Examining Rooms

The number, character, and furnishing of these units must be predicated on the anticipated patient load and a clear concept of their use. Are they to double as out-patient areas during the day? Are they to be used for treatment as well as examination? Are they to be used for patients requiring observation? These and other questions relative to the use of these units must be answered before their number can be determined.

It is advantageous for hospitals whose emergency department volume is considerable to provide for large examining areas divided by curtains and containing at least four tables, as well as for some smaller rooms with a one- or two-patient capacity.

In any event, the existing units require certain facilities for the management of emergency admissions. One unit should contain a chair suitable for eye, ear, nose, throat, and dental examination and treatment. This unit should be equipped with a slit lamp and permit complete darkening. Another unit should be adequately equipped for gynecological examination. Each of the remaining units should contain an examination table. These tables should be stable and should lock. They should be adjustable to provide a back rest when it is necessary to raise the patient's trunk; it should also be possible to tilt the entire table for procedures requiring positions such as the Trendelenburg and Reverse Trendelenburg positions, and to elevate or lower the table, with the patient in any position. Other desirable features are side rails, attachments for infusions and administration of oxygen (including a tank), easy mobility, and light weight so that the table can be used as a transporting stretcher. Tables which can be penetrated by x-rays are a great asset.

They eliminate the necessity of stretchers and moving a patient from the stretcher to the x-ray table and back to the stretcher. A variety of mobile examination tables and stretchers which possess all of these features are available commercially.

Slide tables, stools, kick buckets, etc., should also be mobile to permit rapid rearrangement of examination areas.

Utility Room

A utility room is necessary not only for storing instruments and containers which belong there, but also for rinsing those which are soiled.

Patients' Clothes Room

The emergency department should provide a patients' clothes room for the clothes of patients who are admitted as in-patients through the emergency department at hours when the hospital's central clothes storage room—usually open only in the daytime—is closed. In this room the clothes of the patient admitted after hours can be stored in a locker until the attendant of the central clothes storage room takes charge of them the following morning.

Storage

Several spaces are recommended for storage and linen. A central supply section may furnish the emergency department with most of its daily needs so that the supply of instruments, syringes, and quantities of dressings may be kept to a minimum. Bulk dressings for burns should be kept in the storage area. Separate spaces for clean and soiled linen are required. New emergency departments are usually short of storage space. Therefore, in planning an emergency department as much space as possible should be assigned to storage purposes.

Doctors' On-Call and Conference Room

Probably the majority of emergency departments are currently staffed by practicing physicians on rotation. There must be a place for them to rest when they are called for duty at night. Moreover, in hospitals with interns and residents, many are married and live outside the hospital. A bedroom, therefore, may be required for the house officer on night duty. This space may also be used for confidential conferences with relatives or friends of patients.

Observation Room

In some institutions, it may be advisable to have a room with hospital beds where patients who are not ready for immediate discharge from the emergency department—and who do not require hospital admittance—can be retained for observation for a limited time. Also, persons suffering from a mild degree of alcoholism may be kept here prior to release. Formal admission to the hospital, with all attendant details, should not be required. The number of beds in this area will depend on the patient type and load for a particular hospital. The holding period in this area for any patient should not exceed 24 hours. Patients in the observation room must have constant surveillance by someone designated for this duty by the nursing department. Local nursing conditions will determine whether these beds should be occupied through the night.

Resuscitation Room

It is important that there be a specific area of the emergency department for resuscitation of patients in severe shock or cardiac arrest, whether from medical or surgical causes. All patients with life-threatening conditions should be managed in the resuscitation room. The room should be large enough to allow sufficient working space for the personnel necessary to manage these cases. Resuscitation, ECG, pacemaker, defibrillation, and respiratory support equipment, emergency drugs, etc., should be available in this area.

Surgery Room

A room properly equipped for minor surgery, including the adequate management of lacerations, etc., should be provided. Other surgical procedures should be performed in the major operating suite, not in the emergency department. Since most of the work to be done here can be done in adequately equipped examining areas, the question of whether there should be a surgery room at all—and, if so, how complete—must be determined by the range of functions for which it is intended.

If used for general anesthesia, the surgery room should be equipped with conductive flooring and explosion-proof switches. Anesthesia should be administered only by those assigned regularly to this duty, and only if the patient can be transferred to a post-anesthesia recovery room where adequate supervision is available. It is advisable, of course, that general anesthesia be given only when proper facilities, equipment, and personnel are available—requirements that are best met in the operating suite of the hospital.

Instruments should be new and not hand-downs from the operating room. Hemostats, forceps, needles, needle holders, retractors, and other surgical instruments should include small types, since many of the wounds will be of face and fingers.

A complete sterile tracheostomy set should be kept in this room, and tubes in sizes suitable for use with children should be available. Special instruments and extra procedure trays should be kept available in sterile packages.

Fracture Room

This room should be used primarily for treatment of fresh closed fractures, but by prearrangement may be employed for changing the plaster casts of out-patients. For emergency work, only a stable stretcher is needed. If extensive fractures are to be treated, however, a fracture table may be required, with overhead and wall hooks, as well. Reduction of a fracture should be started here only if the procedure can be carried out completely under local or properly managed general anesthesia. The fracture room may serve as a second surgery room. In institutions with a small patient load, the surgery and fracture rooms may be one and the same; in others, one examining room may be supplied with plaster sink, etc. It is convenient if the fracture room is located near the x-ray facility.

X-ray Facility

The processing of patients through required x-ray examinations is the most frequent, time-consuming cause of delay in the emergency department. Therefore, adequate x-ray facilities must be available in or close to the emergency department. Transportation by elevator to another floor should not be necessary, inasmuch as this can delay treatment of a patient by an hour or more. If the hospital x-ray department is easily accessible on the same level, this arrangement is adequate. Available portable apparatus may be useful in critical cases where movement of the patient is inadvisable, but it is seldom satisfactory.

If the x-ray department is not nearby on the same floor, a complete x-ray unit with an assigned technician is required for the emergency department. Such a unit might be a necessity if the emergency load amounts to a thousand cases a month or if fractures are frequently encountered. The x-ray requirements for emergency work are continuous and extremely pressing.

The doors to the x-ray unit must be wide enough to admit a bed with traction apparatus in place. If a backlog of stretcher patients waiting for x-ray service is anticipated, provision for adequate space in the corridor leading to the x-ray room, and nursing personnel to observe them, should be provided.

Security Room

In many institutions a security room is a most valuable facility. Past experience will determine whether or not it is needed. Only a small room is required. It should be soundproof so that other patients are not likely to be upset or disturbed.

The prime purpose of a security room is the safe keeping of the acutely manic patient until arrangements can be made for transfer to the proper institution. Of course, if the hospital is set up to accommodate these patients, a separate security room may not be necessary.

A secondary purpose of the security room is to accommodate the patient suffering from alcoholism to an objectionable degree. If it is obvious that three or four hours of rest without another drink of alcohol will enable the patient to proceed on his way, this may be preferable to submitting him to arrest or hospitalization.

Clinical Laboratory

The necessity of having laboratory services available promptly for emergency patients cannot be overemphasized. If technicians are not on duty at night or on weekends, tests must be made by interns, residents, or practicing physicians.

An emergency department laboratory should be equipped to perform at least the following tests: hemoglobin, hematocrit, white blood count, blood smear, Gram stain, and routine urine examination, including microscopic examination.

Basic Staffing Patterns*

Five basic staffing patterns, generally, are used in hospital emergency departments. One fully satisfactory basic pattern has not yet been established. The five are:

1. Rotation of all or part of the attending staff.
2. Interns and or residents.
3. Salaried physicians (full- or part-time).
4. Medical group or partnership.
5. Various combinations of these patterns.

Rotation

Rotation of emergency room duty among members of the medical staff is a standard method of providing physician coverage for this facility. Many variations of this pattern exist, most of which are not too popular with the medical staff. Some hospitals require compulsory service by all staff mem-

bers, under the concept that all physicians, whatever their specialty, should be qualified to provide emergency medical services. Other plans utilize junior staff members only, or base emergency department duty on age, distance from home to the hospital, specialty, etc. Many combinations of duty hours are possible, with physicians actually on the premises, or on call, depending upon the particular needs of the institution.

Interns and Residents

Only 20 percent of U.S. hospitals have internship and/or residency training programs. Of these, many do not have a full complement of such house officers. This pattern of staffing, therefore, is limited by size and competence of the in-house personnel. Sufficient medical attending staff for proper supervision of emergency departments utilizing house officers is mandatory.

Salaried Physicians

The number of full- or part-time salaried physicians employed for emergency department staffing is steadily increasing. Full-time physicians are employed to supervise interns in some teaching hospitals, and to cover the night and/or weekend shifts in community hospitals. Part-time physicians are employed for various shifts during the week.

Recruiting for these positions is usually among physicians starting to practice, those who are retired, and those who are unwilling or unable to carry the load of full-time private practice.

Hospitals planning to utilizie salaried physicians for emergency department duty should be familiar with the official policy of the Judicial Council of the American Medical Association regarding employment of physicians on a salaried basis. In addition, the responsibilities of salaried physicians for supervision and direction should be carefully outlined.

Partnership of Physicians

A hospital's entire medical staff, or a portion thereof, may form a partnership or association of physicians for staffing the emergency department. The staff can use its own members, or engage other physicians to supply professional coverage on a 24-hour basis. Depending on the decision of the medical staff, participating physicians may or may not carry on separate private practices or have hospital privileges.

This system solves many of the problems generated by the rotating system and appears to be working successfully in many areas.

Combinations

Combinations of two or more of the above-mentioned staffing patterns are frequently used.

*Condensed from *Emergency Department, A Handbook for the Medical Staff*, American Medical Association, 1966.

Auditing for Quality Care

Special techniques for review of professional service in emergency departments have proven valuable. For example, ad hoc committees either from the medical staff, or by request from the committee of the American College of Surgeons, may be used to check facilities, equipment, procedures, and personnel. To assist them, check list outlines are available on request from the Headquarters of the American College of Surgeons.

Further, audit control and review methods for emergency department charts afford an analytical evaluation of specific cases and are recommended by the Joint Commission on Accreditation of Hospitals:

A. Daily chart check. While daily review of all emergency department charts by the clerk and supervisor should be routine, more is needed. Spot checks of a day's total charts by the director of the emergency department, or by members of the Records Committee, are needed to evaluate their adequacy, both as to services rendered and medical legal responsibility.

B. An analytical chart audit on trauma patients who have died within 24 hours of admission affords an excellent survey of the strength and weakness in patient care. Provision for treatment of the critical trauma patient, usually the one with multiple injuries, sets the standard for the whole unit. By reviewing the cases of those who die within 24 hours, attention is focused on the quality of emergency department care.

These audit forms are also available through the Headquarters of the American College of Surgeons. The breakdown of categories is as follows:

1. General information.

2. Condition on arrival—diagnostic information.
3. Laboratory—special tests.
4. X-ray.
5. Staff present.
6. Diagnosis.
7. Airway—resuscitation.
8. Blood—fluid replacement.
9. Operations.
10. Review.
    Autopsy.
    Staff Conference.

C. Interdepartmental trauma conferences are strongly recommended to review any gaps in cooperative team effort, and to coordinate the efforts of the multiple specialties.

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