

# Abstracts of Selected Papers Presented at the Emergency and Disaster Medicine Collaborating Symposium of the 6th World Congress on Emergency and Disaster Medicine (6WCEDM)

17 and 18 September 1989, Beijing, People's Republic of China

## Preface

A collaborative symposium of the Sixth World Congress on Emergency and Disaster Medicine (6WCEDM) was convened in Beijing, China, on 17 and 18 September 1989 to consider problems related to implementation of the emergency medical service system, introducing up-to-date knowledge of resuscitation, other critical care medical techniques, and disaster preparedness medicine in the People's Republic of China.

These proceedings included lectures by notable experts in emergency care and disaster medicine from across the world. The personnel participating and in attendance included Peter Safar and Nicholas Bircher of the United States, Thomas Hamilton of Australia, Takashi Ukai and Hirofumi Shikai of Japan, John Schou and Markus Lipp of the Federal Republic of Germany, Claude Perret of Switzerland, Lambert Farand of Canada, and many others.

The following abstracts, though not inclusive of the total number of papers presented in Beijing, appear in the order of their presentation during the six special sessions devoted to resuscitation, critical care medicine, trauma, emergency medicine and EMS systems, disaster medicine, and research work in emergency medicine.

Emergency medicine is a young entity in the medical field. In China, it is even a much younger discipline. This international symposium, held recently in Beijing, has undoubtedly benefitted the development of emergency medicine in this country. We hope the interchange of knowledge and experience of emergency medicine among colleagues from around the world has been helpful in advancing this young, specialized field of medicine.

*Shao Xiaohong, MD*

*Department of Emergency Services, PUMC Hospital  
Chinese Academy of Medical Sciences, Beijing, PRC*

## Part I Resuscitation, Life Support

### **Cerebral Resuscitation for Cardiac Arrest**

*Safar P, Abramson NS, Leonov Y, Sterz F, Tisherman S  
International Resuscitation Research Center (IRRC) and Department of Anesthesiology, University of Pittsburgh, Pittsburgh, Pa., USA*

This will be a summary of recent results of research obtained at the IRRC concerning cerebral resuscitation. We have been pursuing a triple objective: 1) to determine the biologic limits to the reversibility of cardiac arrest; 2) to enhance therapeutic potentials; and 3) to develop reliable outcome predictors.

We have developed and used short-term mechanisms-oriented and long-term outcome-oriented animal models with prolonged cardiac arrest and reperfusion by external cardiopulmonary resuscitation (CPR), open-chest CPR, or emergency cardiopulmonary bypass (CPB). This has enabled us to obtain the most reproducible models. The insults have included ventricular fibrillation (VF), asphyxiation, exsanguination, hyperthermia, and hypothermia. Pre-arrest, arrest, and post-arrest variables were rigidly controlled and post-arrest life support was provided for 4–7 days. Outcome has been evaluated in terms of performance, neurologic deficit, and histopathologic damage scores for the brain and heart.

Treatment trials post-arrest in animal outcome models revealed: 1) hypertensive hemodilution mitigated cerebral hypoperfusion and improved outcome; 2) CPB for reperfusion and prolonged assisted circulation enhanced cardiovascular resuscitability and thereby conscious survival; 3) barbiturate loading (Bleyaert, Gisvold), calcium entry blocker therapy (Vaagenes), certain free radical scavengers (Vaagenes) or anti-reoxygenation injury cocktails (Reich, Cerchiari) showed inconsistent benefit; and 4) intra- plus post-arrest mild hypothermia (34–38°C) of the brain (by head cooling) mitigated neurologic deficit.

Treatments that have appeared promising in animal outcome models have been considered for clinical trials in a multi-institutional, international study mechanism—the Brain Resuscitation Clinical Trial (BRCT) 1979–1989—which is being used to study cardiac arrest and CPCPR at 20 hospitals in 8 countries. So far, up to 200 pages of data per patient have been collected on about 800 patients. Neither thiopental loading nor calcium entry blocker therapy (lidoflazine) post-arrest has changed the proportion of patients with good cerebral outcome. Old age per se was not a determining factor in poor cerebral outcome. Steroid administration did not enhance cerebral outcome. Standard treatment by our protocol achieved conscious survival after estimated arrest times of 6–20 min. Clinical signs of cerebral function on day 3 correlated reliably with a permanent vegetative state.

**Pathophysiology of the Post-Resuscitation Syndrome After Cardiac Arrest**  
Safar P, Johnson D, Latchaw R, Leonov Y, Oku K, Radovsky A, Sterz S, Tisherman S; International Resuscitation Research Center (IRRC) and Department of Anesthesiology, University of Pittsburgh, Pittsburgh, Pa., USA

This will be a summary of recent results obtained at the IRRC concerning the pathophysiology of the post-resuscitation syndrome. The post-resuscitation syndrome or disease after prolonged cardiac arrest consists of the following four components: 1) cerebral and extracerebral prolonged perfusion failure; 2) reoxygenation injury caused by necrotizing cascades triggered by free radical reactions; 3) self-intoxication from anoxic viscera; and 4) blood elements deranged by stasis interacting with 1, 2, and 3.

Novel, noninvasive, multifocal (local) cerebral blood flow (ICBF) monitoring using xenon-enhanced computerized tomography of dogs in a prolonged cardiac arrest model with CPR or cardiopulmonary bypass (CPB) revealed extreme heterogeneity of ICBF without fixed obstructions, with areas of trickle flow and low flow for many hours post-arrest. We found post-arrest global CBF reduction to be paralleled by a reduction in cardiac output, despite controlled normotension *in vivo*. Hemoperfusion and gastrointestinal washout may or may not enhance survival and cerebral recovery. Clotting problems, renal failure, and pulmonary failure reported after cardiac arrest by others was absent or transient in dogs after cardiac arrest (no flow) of up to 20 minutes when modern prolonged life support was provided.

Asphyxiation cardiac arrest is more injurious to the brain and less injurious to the heart than square-wave type ventricular fibrillation (VF) cardiac arrest of the same duration. Normothermic exsanguination cardiac arrest may or may not be better tolerated than VF cardiac arrest.

The multi-factorial pathogenesis of the post-resuscitation syndrome requires the design of optimized, etiology-specific, tailored, multi-faceted, combination treatments.

**Accidental Injury and Prehospital Life Support**

Yin ZF, Zhong LL, Jiang J (Direction), Yang HM (Direction), Guo WX (Translation), Zhang JS (Video), Ye H (Video)

Huang Pu District Central Hospital, Shanghai, PRC

Significant progress has been made in the theoretical research and clinical practice of CPR. Clinically, BLS and ACLS are applied widely for cardiopulmonary arrest. However, serious problems still exist in successful resuscitation and attempts to recover body functions completely. One of the reasons is that mass casualties following accidents may occur at sites far away from emergency centers. Therefore, the appropriate time for emergency treatment of many injured victims may have been lost.

Initiation of BLS in the prehospital setting not only relates closely to the survival rate from resuscitation but also defines many prognostic factors of cardio-pulmonary arrest. Therefore, it is very important to popularize the primary knowledge of lifesaving and to train vast numbers of non-medical workers to master the skills of BLS and how to carry out effectively prompt first aid.

In an accident involving a cross-river steamship on 10 October 1987, many of the injured victims suffered from crush and asphyxia that led to cardio-pulmonary arrest. Of the nine injured victims who received BLS, some survived, although a few died later from injuries sustained in the accident. It is concluded that the better the prehospital BLS training, the more lives will be saved.

The above mentioned accident was recorded by videotape and was shown at the Symposium.

**New Techniques for Emergency Artificial Circulation**

Bircher N, Safar P

International Resuscitation Research Center (IRRC) and Department of Anesthesiology, University of Pittsburgh, Pittsburgh, Pa., USA

Standard external CPR may be unpredictably incapable of generating required arterio-venous perfusion pressures through heart and brain in some victims of cardiopulmonary arrest. Sternal compressions produce intrathoracic venous pressure peaks almost as high as arterial pressure. Chest compressions move blood by variable combinations of heart pump and chest pump mechanisms. Chest compressions cause functional valving at the superior and inferior vena cavae.

Twenty years after Kouwenhoven rediscovered external chest compressions for artificial circulation and Safar combined steps A-B-C into basic life support (BLS) and combined it with D-E-F advanced life support (ALS) and

G-H-I prolonged life support (PLS) into a CPR system, we examined 3 "new" models of emergency artificial circulation.

1) *External CPR*. Generated blood flows are low without epinephrine. Pneumatic modifications are ALS. Simultaneous ventilation/compression CPR (SVC-CPR) sometimes can enhance flows and sometimes enhance pressures, but do not increase the proportion of patients with good outcome. Vest CPR is superior physiologically. Abdominal compression CPR and MAST CPR can generate side effects. Intermittent abdominal compression CPR is BLS but not physiologically superior. Details of experimental design and technique influence results. The longer the arrest time (stasis) preceding CPR, the lower are the perfusion pressures and cerebral blood flow (CBF). For primary, sudden ventricular fibrillation (VF), the C-A-B sequence makes physiologic sense but is not recommended for logistic and educational reasons.

2) *Open-chest CPR*. This ALS method is superior physiologically to external CPR. It is capable of producing near normal CBF. Two-hand heart compressions and occlusion the thoracic aorta enhance flow. Physicians hesitate to perform open-chest CPR, except for cases of trauma-induced arrest.

3) *Emergency cardiopulmonary bypass (CPB)*. Closed-chest CPB by venoarterial pumping via oxygenator has been explored since 1982 in 10 dog studies, including outcome experiments. CPB was found superior to external CPR-ALS in achieving restoration of stable spontaneous circulation and thereby conscious survival. CPB permits full-control overflow, pressure, temperature and composition of blood for reperfusion, and prolonged, assisted circulation. CPB enables reproducible outcome in dog models of prolonged cardiac arrest. CPB is ready for clinical trials in CPR-ALS resistant cases of cardiac arrest

## Part II

### Emergency Medicine, EMSS, New Drugs

**The Organization and Model of the Emergency Department in the General Hospitals in the Municipalities in China**

Wang PY

Beijing Red Cross Hospital, Beijing, PRC

Since 1985, emergency departments have been established in many general hospitals in China. However, most of these hospitals changed the name "Emergency Clinic" to "Emergency Department" without any alteration either in organization or function. In general, the Emergency Departments in China can be grouped into three categories:

1) The emergency department has specialized nurses but no doctors; the doctors on duty are assigned to the Emergency Department from other disciplines using a rotation system.

2) The emergency department is staffed by both specialized doctors and nurses.

3) The emergency department is staffed by specialized doctors and nurses who also take responsibility for the ICU and/or post-ICU wards—the "second line of emergency care." They do not directly receive and resuscitate the patients in the emergency clinic.

Patients coming to the emergency clinic are cared for first by doctors from other departments. The director of this type of emergency service either is an administrator or a doctor of medicine or surgery. The causes of this situation are:

1) The conservative ideas of the health planners.

2) The authoritative medical specialists neglect and give little attention to emergency medicine.

3) Up to now, there has been no legislation regarding the staffing in emergency departments or for the emergency medical service system in China.

The legal rights and interests of the staffs in emergency medical service are not protected. As a result, there are only a few doctors and nurses who are willing to devote themselves to emergency medical services.

**Establishment and Management of First Aid Network**

Li SF, \* Chen SH, \* Xu QS, \* Zhang YH, \* Chen ShuH, \*\* Li XD\*\*

Department of Emergency Medicine Changchun, Jilin, PRC

First aid is greatly needed by the public because of changes that have taken place in the medical care model. The situation in China and problems being

encountered have been discussed in detail. The discussions focused particularly on methods that could strengthen the educational campaign in communities, solve the shortage of qualified medical professionals, and replace out-of-date equipment. Three levels of a first-aid network both in city and countryside, and the relationships among them, have been explored. Suggestions were made for a bill that would make first-aid training law, strengthen the post-education training program, speed up the replacement of obsolete equipment, and assist in the further development of first aid in China.

\*CCPH, \*\*CCDH

### Artificial Intelligence and Emergency Medical Services Systems

Kalina M, Preker A, Farand L

*Urgences-santé, Montreal, Quebec, Canada*

Quebec, Canada's only French-speaking province, has not seen Emergency Medical Systems (EMS) develop as elsewhere in North America. For almost eight years, Montreal, its main city and home to a third of the population, has been served by Urgences-santé, a system whose mainstay is the physicians working in the prehospital setting. However, the rest of the province has lagged behind in the rate of development of EMS. Poorly trained and equipped emergency medical technicians worked for private ambulance companies that provide levels of care below those expected for the population.

During the period from 1987 to 1989, a process took place which resulted in the passage of legislation that is the equivalent of an EMS law which allows all areas to have access to high-quality prehospital care in a system controlled by state agencies. The main tool chosen was enhancement of emergency medical technicians' status through: improved working conditions; increased training; and participation in system management, including partial ownership of the ambulance fleet through cooperatives.

During the debates surrounding the creation of this new law, medical experts lobbied for national standards for medical care and for medical leadership in the evaluation of quality of care processes. This paper described the competition between professionals seeking to achieve performance-related objectives and other lobbies, such as civil servants, private enterprise, and unions. Factors associated with the success or failure of these processes in the promotion of an increased quality of care were described, and lobbying strategies discussed.

### A Survey as an Aid to Planning an Emergency Department

Hadas N\*, Waron M\*\*, Kochavi D\*\*\*

*\*Assaf Harofeh Medical Center, \*\*Medical Corps, Israeli Defense Forces, \*\*\*Malam Systems, Israel*

As an aid to planning a new Emergency Department (ED), a survey was conducted on 4,839 consecutive patients and the 140 physicians who cared for them during a 24-hour-a-day, 28-day period. Each patient was accompanied by an interviewer who collected data on patient demographics, referral sources, the diagnostic and treatment processes, visit justification, satisfaction, and patient disposition. The average number of visits per day was 285; the highest frequency of visits per day (16.6%) was on Sunday; the busiest hours were 10 AM to noon and 5 PM to 8 PM (20.5 visits/hour). There was an average of 1.1 escorts/hour and an average of 1.1 escorts/patient. To accommodate patients, 34 beds and 21 chairs were required (60 additional chairs for escorts): internal medicine—20 beds, 2 chairs; trauma—11 beds, 7 chairs; pediatrics—3 beds, 12 chairs. Within the examining room, 94.3% of the public behaved well. Accuracy of triage, performed by receptionists, was 97.8%. Of the responding patients, 93.7% expressed satisfaction with the system and the quality of care provided. In addition to the above findings, we also must consider the increasing ED population due to such factors as growth and aging of the area population, the rising number of legal claims against physicians, and the channeling of an increasing number of patients from the community health care system to the Emergency Department.

### Life-Supporting First Aid (LSFA) by Laypersons: Education and Innovations

Safar P, Bircher N, Laerdal T, DonMichael A

*International Resuscitation Research Center (IRRC) and Department of Anesthesiology, University of Pittsburgh, Pittsburgh, Pa., USA*

#### Introduction

Life-Supporting First Aid (LSFA) by uninjured bystanders is the most

critical first link in the life support chain of everyday emergency medical services and disasters. It includes: head tilt (mouth open, jaw thrust); finger sweep; mouth-to-mouth (nose) ventilations; pulse checks; chest compressions; control of external hemorrhage with positioning of the victim's body for coma and shock; and emergency extrication.

It is becoming increasingly apparent that as many of the world population as possible should learn LSFA. Achieving LSFA capability for the majority of populations, starting age 10–12 years, will require self-training or semi-self-training methods. Some of these will have been proven to be feasible and effective. However, the most cost-effective, self-training method for millions of people, including the need for re-training, remains to be determined.

#### Ventilation

Direct mouth-to-mouth ventilation has been shown to be teachable and effective in over 30 years of worldwide field experience. Needs include head injury, which can cause transient impact apnea followed by airway obstruction. The practice of mouth-to-mouth ventilation currently is being threatened by the AIDS paranoia.

More than 30 different exhaled air ventilation adjuncts are available for use by first responders and laypersons. They range from the "Resusci-Face Shield," the "Kiss-of-Life" mask, and the "Microshield," to the valve pocket mask with optional oxygen and various pharyngeal tubes. Evaluation methods were discussed. In severe hemorrhagic shock, O<sub>2</sub> inhalation prolonged survival.

#### Cooling

In a prolonged cardiac arrest model in dogs, mild head-brain cooling (34°C) during and following cardiac arrest significantly reduces neurologic deficit and cerebral morphologic damage. Head-brain cooling methods could become part of LSFA. In a severe hemorrhagic shock model in rats, moderate systemic cooling (30–32°C) also prolonged survival time. LSFA for polytrauma might include supplemental O<sub>2</sub> plus mild cooling while waiting for the ambulance or helicopter.

### Artificial Intelligence and Emergency Medical Services Systems

Farand L, Leprohon J

*Urgence-santé and McGill University, Montreal, Quebec, Canada*

Over the last four years, we have been investigating the use of Artificial Intelligence (AI) for quality assurance, decision support, and education in the Montreal Emergency Medical Services (EMS) systems, Urgences-Santé. This has led to the development of three prototype systems: 1) an expert system for telephone triage of chest pain calls; 2) intelligent interface for emergency vehicle dispatching; and 3) a data acquisition program for complex clinical situations. In this paper, these three programs serve to illustrate our proposal of a general framework for the use of AI technology in EMS systems.

In the area of quality assurance, a systemic approach to the evaluation of performance in EMS systems was presented as a means to identify those tasks which can most benefit from decision support and/or educational interventions. In this context, we demonstrated how we combined qualitative modeling of the organization with AI technology in order to implement quality assurance, and how each of the three programs contributed to this process.

Regarding decision support, we presented the indications of AI versus more traditional techniques (flowcharts, decision analysis, bayesian inference). Since AI is not a monolytic field, it is important to understand the various tools that it provides for building decision support systems. In particular, using examples, we contrasted the expert system and intelligent interface approaches.

The application of AI technology to education in EMS systems was introduced, emphasizing the complementarity between expert systems and intelligent tutoring systems. In this context, we described the conceptual and technical continuum of computational models of expertise between, at one end, performance-oriented expert systems and, at the other end, competence-oriented representations typical of intelligence tutoring systems' expert modules.

Finally, we discussed the limitations of this work. With reports of our ongoing research activities concluded, we presented our view of AI in tomorrow's EMS systems.



### Impact of Full-time Physician Supervision on an Urban EMS System

Pepe PE, Mattox KL, Prentice FD

Baylor College of Medicine, Houston EMS, Harris County Medical Society, Houston, Texas, USA

The effective use of emergency medical services (EMS) programs often are gauged by systems data (e.g., paramedic numbers, response times). However, these data are not a reflection of the true endpoint—the quality of patient care. In 1979, the City of Houston (population 1.7 million; area 600 sq miles) implemented a well-planned paramedic program. Yet, 10 years later, despite 33 “two-paramedic units” with an average response time of less than 5 minutes, the survival rate for out-of-hospital sudden death (ventricular fibrillation or tachycardia associated cardiac arrest) was negligible. Then, in 1983, a new state law mandated the designation of an accountable, physician supervisor for every paramedic service in Texas. This resulted in the hiring of Houston’s first full-time (salaried) EMS physician. This physician provided intensive training, direct supervision, and continuous system monitoring, including frequent on-scene oversight of EMS personnel, without adding significant cost. These actions resulted in an increase in successful resuscitation rates, from 3% in 1983 to 42% in 1987, and a survival rate (discharged alive from the hospital) from none in 1983, to 16% in 1987, and to 21% in 1989. Although this study involves a historical control, the one new factor (full-time physician supervision) clearly was associated with better patient care, particularly when one considers the previous decade of zero survivorship and that most other factors (budget, paramedic numbers, response times) worsened during the comparison periods.

### The Problem of Diagnosis in Myocardial Infarction as Emergency

Ding ZC, Li LH, Jia L, Yao QY

Chinese PLA General Hospital, Military Post-Graduate School

The clinical histories of 101 cases of acute myocardial infarction (AMI) were reviewed. It became apparent that the promptness and accuracy of diagnosis in the emergency clinic is very important and can be accomplished. The key is to evaluate the three diagnostic items correctly which were used mostly in emergency clinics and to use them appropriately.

- 1) Proper evaluation of the role of the main symptoms;
- 2) Utilizing ECG the right way; and
- 3) In emergency clinic one should not depend too much on enzymologic changes in diagnosing AMI, because of the rather low positive rates in the particular setting of the emergency clinic.

Some critical clinical features hinted the diagnosis of AMI:

- 1) Severe arrhythmias or syncope that appeared suddenly in a middle-aged person;
- 2) Sudden dizziness, profuse sweating, and hypotension; and
- 3) Sudden palpitations, cyanosis, and/or orthopnea.

### Patient Controlled Analgesia for Pain Research

Kenny GNC

University Department of Anaesthesia, Glasgow Royal Infirmary, Glasgow, Scotland, UK

It is difficult to measure the quality of pain and analgesia. However, by allowing the patient to determine the dose of morphine required to produce acceptable pain relief, the factors influencing morphine requirements and the morphine sparing effects of supplementary non-opioid analgesics can be determined objectively.

As an illustration of this concept, the morphine-sparing effect of several non-opioid analgesics have been studied in patients who were scheduled to undergo operations requiring upper abdominal incisions. All patients were provided with patient controlled analgesia (PCA) systems which they used to deliver bolus doses of morphine IV. The patients were allocated randomly to receive either the active agent under evaluation or a matching placebo.

The results indicated that the active drugs reduced the morphine requirements compared with patients who had received placebo. The use of PCA allowed all groups of patients to titrate themselves to the required level of analgesia and thus provided an unbiased objective assessment of the efficacy of the supplementary analgesic agent.

Also, PCA can be used to study the effects of patient characteristics on requirements for post-operative analgesia. The morphine demands of 100

patients following upper abdominal surgery were evaluated. Hourly and cumulative 24-hour requirements were analyzed for possible correlations with patient characteristics and of consumption by the patients throughout the 24-hour study period. The level of pain relief was assessed by linear analogue pain scores at 4–6 hours and 24 hours.

Male patients required significantly more morphine than females to achieve similar levels of pain relief. There was an inverse correlation between age and morphine consumption to both males and females. No correlation was found between morphine consumption and patient weight. The pattern of hourly morphine consumption appeared to follow a diurnal rhythm, with peak times of demand at 0900 hr and 2000 hr. The variations in requirements for analgesia between patients and with time of day must therefore be considered when prescribing a regime for post-operative analgesia. Perhaps, this can be achieved best by patient-controlled analgesia, which offers the most flexible form of providing pain relief.

The use of PCA systems provides the clinician with an improved method of providing analgesia. However, it also provides clinical researchers with a unique tool to obtain unbiased data. All patients receive the best possible therapy so that it is ethical to compare active agents with placebo.

## Part III Disaster Medicine

### The Role of Health Sector in the Natural Disaster

Shao XH

Department of Emergency Medicine, PUMC Hospital, Chinese Academy of Medical Sciences, Beijing, PRC

China is a large, geographically and climatically diverse country that encounters many natural disasters annually. The most serious and destructive disasters include floods, typhoons, and earthquakes. Drought-related famine, though widespread, is more or less predictable. Floods, typhoons, and earthquakes tend to be unpredictable—they strike nearly without warning.

The loss of lives and financial losses are extremely great. For instance, in the People’s Republic of China (PRC), the 1985 typhoons killed or injured more than 40-million persons and resulted in a total financial loss of approximately RMB 500-million yuan. An earthquake in Tangshan resulted in the death of 242-thousand people, and injuries to 164-thousand.

In consideration of its importance, the role of the health sector in natural disaster is now winning greater public recognition. When Professor Michael F. Lechat was invited to attend the 3rd International Conference on Earthquakes at Bled, Yugoslavia in 1981, two points struck him: there was no health care section and he was the only physician invited.

There are two main points to consider in managing conditions with mass casualties: development of an efficient organization; and “self and mutual rescue.”

The emergency medical service organization for disaster areas is dependent entirely upon the severity of the destruction and the number of the victims. The principal procedures for the management of mass casualties are: triage and tagging; distribution of victims; and transfer of severely injured victims to the base hospitals.

The planning for disaster preparedness should include:

- 1) Implementation of a regular Emergency Medical Services System (EMSS) for management of sick patients and injured victims using normal, day-to-day operations, and persons qualified to treat victims during disasters;
- 2) Special training also is necessary for persons other than paramedics, such as police and fire personnel, public service attendants, students, and others;
- 3) Conduct periodic drills for mass casualty management, especially in areas where disasters are likely to occur; and
- 4) Each hospital must develop a disaster plan, and it would be good to establish courses in disaster medicine at the medical colleges.

### Search and Rescue in the Shanghai “3:24” Train Collision Accident

Hua TF, Yao J, Jiang J, Wen D

Shanghai Medical University, Shanghai Health Bureau, Shanghai Second Medical University, Nanxiang Hospital, Shanghai, PRC

Assuring the requirement for medical rescue in a great disaster, Shanghai

has formed a preliminary system for responding to mass casualties. It includes a central medical *salvage* [rescue] station and 20 branch stations covering the various districts and counties of the city. A total of 58 ambulances are ready to respond on a 24-hour basis. In addition, 35 alternate ambulances are available. The salvage radius in the city is 4.5 km and for the county 19 km. After receiving an emergency call, ambulances can be dispatched within 2 minutes and arrive at the scene in an average of 8 minutes. Each ambulance is equipped with radio communications.

For a municipal hospital, usually it is possible to organize a special medical team in 15 minutes. In case of an accidental disaster, an emergency medical care command center will be organized immediately. It is designed to be highly efficient, well-staffed with experts, and particularly familiar with proceedings of urgent disaster management.

Medical salvage during great disaster requires good, working cooperation with the Public Security Bureau, Fire Brigades, the traffic communications, and so forth.

In the afternoon of 24 March 1988, two trains collided head-on in a Shanghai suburb. One rail coach partly telescoped into the other, resulting in the wounding of 127 persons of which 29 were fatal. Immediately after the accidents, a salvage team organizing command center was established quickly. Medical rescue teams, security sections, fire-men squads, and even the martial brigades all rushed to the accident scene.

#### **Analysis of 411 Cases of Severe Heatstroke in Nanjing**

Mao Z, Wang Y

*Nanjing Railroad Hospital, Nanjing Medical College, Nanjing, PRC*

The results of a survey of 411 cases of severe heatstroke in Nanjing during the days of megathermal period (July 4-20) in 1988 were reported.

These cases consisted of 179 males and 232 females. Age ranged from 2.5 to 93 years. It was found that the incidence of severe heatstroke was significantly higher (22.4%) in age group of 60-69 years and (24.3%) for the age group of 70-79.

There were 124 patients that died and the mortality rate was 30%. These 411 cases were complicated by: hypertension (24.5%); coronary heart disease (24.3%); diabetes mellitus (6.1%); and adiposity (5.8%).

The rescue measures used were discussed.

#### **The Explosion Accident in Flax Factory as a Testing Emergency Ability of Emergency System of Harbin**

Zhang GL, Wang M, Qu YL, Feng XS

*Harbin Red Cross Emergency General Station, Harbin, PRC*

At 2:39 AM, 15 March 1987, a disastrous explosion involving three workshops at the Harbin Flax Factory injured 185 people (52 male, 133 female). There were 177 people burned, of which 20 sustained cranio-cerebral injuries. Of the 177 burn victims, 88 were minor (burn area <29% or third degree burn <9%), 32 had moderate burns (burn area 30-49% or third degree burn 10-29%), and 39 sustained major burn injuries (burn area 50-59% or third degree burn 20-29%).

The explosion set three workshops on fire. After the explosion, most of the windows and doors collapsed and deformed. The flames, smoke, confusion, and explosive materials all made it impossible for the victims to exit.

The major rescue team was the Red Cross General Station of Harbin. The leaders of the General Station were graduates from regular medical college and have received special rescue training. Moreover, there is a network of general hospitals under the command of the General Station whenever there are mass casualties or natural disasters. In other words, the emergency medical service in Harbin is like that of EMSS in more advanced countries. However, the equipment and facilities are preliminary and simple. Gradually, it is developing properly.

#### **Analysis of First Aid in Lancang Earthquake**

Feng ZT

*Neurosurgical Department of Yunnan Provincial Hospital, Kunming, PRC*

An earthquake occurred in Lancang County, Yunnan Province, on 6 November 1988. It resulted in 643 deaths and 3,585 injured. All of the victims were treated locally with a three-step rescue system: 1) Rescue at disaster site; 2) Set up of temporary [field] hospitals; and 3) Transfer of severely injured victims to base hospitals.

The first step involved rescue on site by village doctors and frontier corps who took responsibility for victim rescue in wrecked houses and debris. The

more seriously injured victims were transferred to the field hospitals.

The second step involved the use of village clinics or the set-up of temporary buildings as transient hospitals where simple surgical operations could be carried out.

The third step involved the transfer of critically injured victims to better-equipped base hospitals.

These experiences can be summarized as follows:

- 1) Medical rescue centers can be set up in the county hospitals.
- 2) The three-step rescue system has been proven to be the best system for rescue in mass casualty situations in China;
- 3) Classification by type and condition of victims (triage) before transferring them to different levels of medical center is very important;
- 4) Yunnan Province is subject to frequent earthquakes, therefore a disaster preparedness plan should be developed;
- 5) New buildings should be built to withstand shocks of Richter scale magnitude 9.0, especially the county hospital.
- 6) A helicopter station for emergency service is necessary for Yunnan Province, a mountainous area.

#### **Disaster Reanimatology for National Disaster Response, Medical System (NDMS) Planning, and Response: Interview Studies of Earthquakes**

Safar P, Klain M, Ricci E, Semenou V, Gazetov B, Michaelyan A, Pretto E, Tisherman S, Crippen D, Comfort L, Abrams J, et al

*International Resuscitation Research Center (IRRC) and Department of Anesthesiology, University of Pittsburgh, Pittsburgh, Pa., USA, and Institute of Reanimatology, Academy of Medical Sciences, Moscow, USSR*

What is the life-saving potential of modern resuscitation in mass disasters such as major earthquakes during the first minutes and hours? Of the victims who died slowly, how many were accessible and resuscitable? Hypothesis: Extrication (where necessary), simultaneous and immediate Life Supporting First Aid (LSFA) by uninjured bystanders, triage, advanced trauma life support by medical teams within 6 hours, prolonged life support during transport, and resuscitative surgery, all in the form of a life-support chain, can reduce significantly the mortality in major earthquakes.

We sought answers with unstructured interviews of eyewitnesses (survivors) of the earthquakes in Peru (1970), Italy (1980), and Mexico (1985); and with structured interviews and record searches concerning the earthquake in Armenia of December 1988. For the earthquake in Armenia, a field study (in March 1989) applied research instruments found useful in the past for emergency medical services' evaluations (questionnaires, checklists). The academic research team from Pittsburgh, Moscow, and Armenia consisted of 16 physicians of several specialties, a professor of engineering, and a professor of political science. They interviewed eyewitnesses (victims, families, rescuers, nurses, physicians and administrators) and collected and analyzed data from hospital and governmental records: numbers and types of injuries; resources applied, accessibility; extrication; dying patterns; causes of death; advanced life support available and used; and time factors.

Some people counted among the dead died slowly over hours or days. Many of those were not accessible for early resuscitation. The data include causes of early and late death (e.g., asphyxiation, hemorrhage, cold exposure, dust inhalation, polytrauma with head injury, crush injuries, wound infection). The major limiting factor was that extrication attempts were difficult, late, and sometimes injurious. There were considerable differences in dying patterns and extrication problems for victims buried under building debris in Latin America (adobe), Italy (reinforced concrete), and Armenia (prefabricated concrete panels). However, in each of these, basic resuscitation needs were the same. Preliminary data, conclusions and recommendations were presented. Immediate LSFA by laypersons, simultaneous with application of novel (still to be designed) extrication techniques, applied as early as possible; some advanced life support components at the scene and in hospitals; and early resource determination and allocation would have saved some victims in each of the four events studied. Some specific resuscitation components should be included in NDMS planning.

#### **A Model for a Nationwide Emergency Response Program to Support First Response Personnel at Chemical Accidents**

Thrasher C

*Ecology and Environment, Lancaster, New York, USA*

The sudden, unexpected release of highly toxic or hazardous materials randomly places firefighters, police, emergency medical personnel, and community hospitals at great risk. Few units have adequate resources to

respond. Without immediate access to additional outside resources, most response units and hospitals cannot adequately protect themselves, those they are dispatched to rescue, or the general population from the effects of the released chemicals.

This paper discussed a nationwide chemical, radiation, and biological emergency response system currently in operation in the United States. The purpose of this system is to react immediately (within the first sixty minutes of the incident) to provide the first response personnel with information and direction. This is followed by the transport of technical experts and instrumentation to the site as soon as possible. The objectives of such actions are to prevent further chemical injuries and to rapidly and effectively solve problems of confinement, containment, and medical treatment of injured persons.

This system employs simple, easily duplicated techniques to prepare response personnel to perform basic hazard and risk analysis, and to generate response plans for possible incidents. The training component integrates local, regional, and national training options to bring personnel to the desired level of competence. Modern, although not technically complex, methods of communications and computer data base operation link scarce technical expertise with any field-response person anywhere in the nation.

Any chemically injured person has the opportunity to be treated with medical consultation from national authorities within 20 minutes of injury. This response system also places qualified chemical emergency experts on site to work with the first responders. These experts bring toxic air monitoring equipment to help provide definitive solutions to the problems created by the release of the involved chemicals.

Variations of this model may be implemented in any region of the world and may be linked to other systems to improve access to information and hard assets.

#### Prehospital Care for Mass Casualties in Disaster

Lu G, Ding W, Ma D, Yang Z

Chongqing Emergency Medical Center, Chongqing, PRC

The formation of modern emergency medical service systems (EMSS) has shifted initial medical care for mass casualties to the scene of the misfortune. Based on a well-organized system, evaluation, triage, basic life support, and transport of the casualties are performed at the disaster site.

The EMSS of Chongqing has established a primary disaster plan involving Chongqing Emergency Medical Center (CEMC) that includes organization of receiving hospitals into a network, establishment of radio communication facilities, transfer procedures for victims, and disaster preparedness training at normal times. The activities are coordinated centrally through CEMC with a central communication system.

Three disasters were reviewed. The first was the accidental crash of an airplane resulting in 108 victims. Within 45 minutes, five medical teams from various hospitals were dispatched to the scene. The second was a road traffic accident that injured 38. Four hospitals sent rescue teams to the scene to give primary treatment. The third was the collapse of a highway overpass that was under construction, which injured 14 persons. All victims were transferred to hospitals after being treated on-site. The prehospital management of these three accidents was analyzed and evaluated in terms of factual details from the viewpoint of disaster medicine.

## Part IV Critical Care

#### The Effect of Oxygenated Volume Expanders in Hemorrhage Shock

Yao Z, Gao S, Chen BC, Tu Z, Lin D, et al

First Affiliated Hospital of Hubei Medical College

The basic pathophysiology of shock is tissue oxygen deficiency and exhaustion of cellular energy. The purpose of our research is to break the vicious cycle of tissue anoxia during shock using an oxygenated volume expander. The changes that occur in CPK, LDH, serum lactate, blood gases, hemodynamics, and ultrastructure of lung and skeletal muscle were observed in 3 groups of hemorrhagic-shock dogs. Group A received non-oxygenated, crystalloid solutions; Group B, oxygenated, crystalloid solution; and Group C, an oxygenated n3 perfluorocarbon emulsion (PFCO<sub>3</sub>).

The results showed that except in stroke volume (SV), the hemodynamics of group B were restored more rapidly than in either groups A or C

following the administration of volume expander. At the second hour after volume expansion, the mean arterio-venous PO<sub>2</sub> difference was 13.8 kPa (104 mmHg) in group B, but 7.5 kPa (70.2 mmHg) and 10 kPa (74.8 mmHg) in groups A and C, respectively. The level of serum lactate elevation averaged from 25.5 to 44.0 mg/dl after shock and returned to normal levels by the second hour after volume expansion. The CPK was increased by 150–200% in all groups by the fourth hour after volume expansion and reached a mean peak value of 5696 iu/L by the 24–28th hour after volume expander administration. The mean value remained 1,000 iu/L by the 72nd hour.

The changes of pulmonary ultrastructure in hemorrhagic shock included loosened junctional complexes between squamous (type I) epithelial cells; decreased microvilli on the free apical surface of septal cells (type II), and loosened the tight junctions between endothelial cells. These findings were less marked in group B than in groups A and C.

According to the above findings, the effects of oxygenated crystalloid solutions were better than with non-oxygenated crystalloid solutions. Therefore, the oxygenated crystalloid solutions protect organic cells from hypoxic injury.

#### Diagnosis and Management of Acute Respiratory Failure in General Surgical Patients: A Discussion on Diagnostic Criteria, Category, and Ventilation Support

Hou KY, Chen HH

Third University Hospital, Beijing Medical University, Beijing, PRC

Forty-four cases of acute respiratory failure (ARF) or adult respiratory distress syndrome (ARDS) were analyzed. The incidence in hospitalized general surgical patients was 1.1% and 25.9% in the surgical ICU.

The patients were classified into two groups: 1) patients with potentially curable underlying diseases; and 2) patients with incurable or advanced stages of the underlying diseases. The total mortality rate was 54.6%, while the rate for Group 1 was 4.8% and 100% for Group 2.

The term of ARF was used in this paper because some of the cases had previous pulmonary diseases and deterioration of the respiratory system in association with the development of critical surgical conditions. A new set of criteria for diagnosis was used in our clinical trials. It was based primarily on the clinical features, blood gas analyses, and the trends of these criteria. A concept of the "initial" phase of the disease was proposed and was considered as an earlier phase. An appropriate treatment of the disease in the earlier phase resulted in significant decrease in mortality. The application of the ventilatory support and indications for termination of the supportive measures and weaning methods also were discussed.

#### Cerebral Hemorrhage and Sudden Death

Zhang WW, Huang FY, Xu JS, Zhang SL, Jin RK, Li CS

Provincial Hospital of Henan, Zhengzhou, Henan, PRC

A total of 281 patients with acute cerebral hemorrhage were admitted into our department within 6 hours (mean = 2.3 ± 1.4 hours) after the sudden onset of accidents. Of these, 65 patients (23.1%) died within 6 hours of the accidents. The data suggest that sudden death after cerebral hemorrhage may be predicted by some clinical features including elder age, prior history of heart disease, systolic blood pressure ≥ 30.7 kPa (230 mmHg), diastolic blood pressure ≤ 16.0 kPa (120 mmHg), comatose status, cerebral herniation, paralysis or spasmus tonicus of 4 limbs, bilateral pathological signs, sinus bradycardia or tachycardia, leukocytosis, upper alimentary tract bleeding, escape rhythm and various types of ventricular arrhythmias (frequent VPC, multifocal VPC, ventricular tachycardia, etc.). Patients with such manifested features should be observed closely with appropriate monitors. The concept of "sudden cerebral hemorrhagic death" is suggested and its importance discussed.

#### The Clinical Use of High Frequency Jet Ventilation (HFJV) in the Treatment of Respiratory Failure

Liu YJ, et al

Second Hospital of Chongqing Medical College, Chongqing, PRC

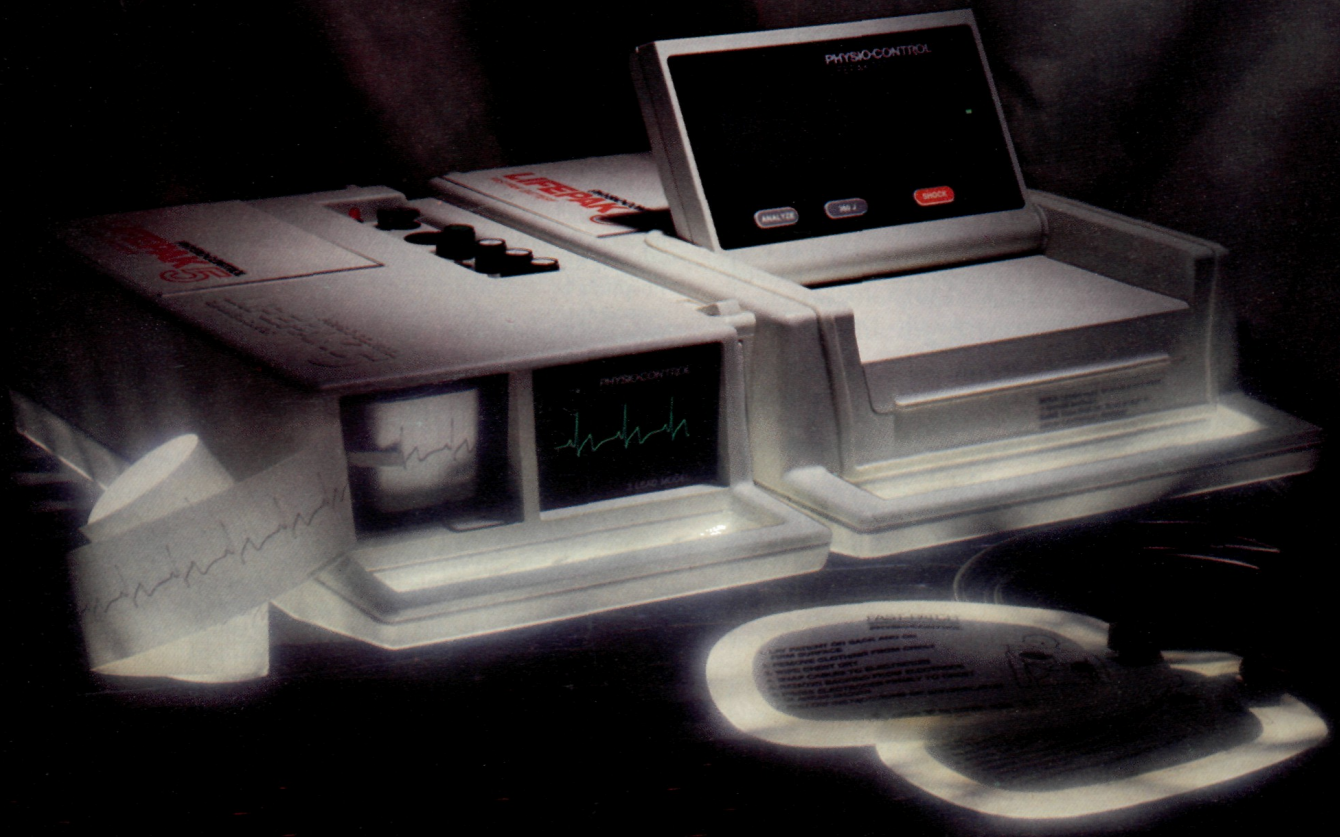
This paper reports on the use of HFJV to treat respiratory failure type I and type II compared with the conventional oxygen therapy.

In type I respiratory failure after application of HFJV for one to four hours, PaO<sub>2</sub>, oxygen saturation, and the symptoms of hypoxemia were improved markedly (p < 0.01). PaCO<sub>2</sub> was increased slightly.

In type II respiratory failure, HFJV corrected the hypoxemia promptly,



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but the PaCO<sub>2</sub> increased from 61.3±13.0 mmHg to 68.4±16.5 mmHg. Hence, patients with type II respiratory failure must be observed with frequent blood-gas analysis.

The indications for HFJV are: 1) Type I respiratory failure; 2) COPD with spontaneous pneumothorax; and 3) Type II respiratory failure.

### Technical Rescue in Spinal Injury

Schou J, Jerger M

Städt. Krankenhaus, Lörrach, FRG

Paraplegia may develop some time after the causative spinal injury. If this occurs, then a "transport trauma" may have contributed to the tragic outcome.

Techniques for the extrication and transportation of patients suspected of spinal injury with the cooperation among airborne and ground rescue services, the fire service, and the police were demonstrated. Simultaneously, extrication of a confined trauma victim was described.

The neck collar, scoop stretcher, and vacuum mattress are essential for rescue. However, their principal use in suspected spinal injuries has not received sufficient attention. A second fracture some distance from the symptomatic one occurs in about 20% of paraplegic patients. This makes stabilization of the entire spine mandatory. In difficult circumstances, the Kendrick extrication device offers important supplementation. The use of compressor-powered instruments was demonstrated in a car wreck. In about 5 minutes, the fire-service cut the roof of a wrecked vehicle, facilitating the rescue of confined victims; then using a scoop stretcher placed behind the victim's back, he was lifted out vertically. Other ways for cooperation with the fire service were demonstrated.

Over shorter distances, air transport provides more stability than does the land ambulance and should be preferred for patients suspected of having spinal injury. Since prevention of further injury is essential, it would not be reasonable to restrict the use of air transport only for patients with definite neurologic symptoms.

The admitting clinic also must possess the tools necessary to be able to continue the stabilization of the spine initiated in prehospital rescue service. Unfortunately, a number of cases are known where this continuity was interrupted on admission, either because of ignorance or the rescue service wanted their equipment back.

### Prospective Controlled Clinical Trials of the Pneumatic Anti-Shock Garment in the Urban Setting

Pepe PE\*\*, Mattox KL\*, and Bickell WH\*

\*Baylor College of Medicine, \*\*Houston Emergency Medical Services and Resuscitation Center, Houston, Texas, USA

Despite widespread use, the efficacy of the pneumatic antishock garment (PASG) has yet to be proven in scientific, controlled, clinical studies. Therefore, over a 3-year period, approximately 1,000 injury victims (n=911) whose initial prehospital blood pressure (BP) was 90 mmHg or less, were entered prospectively into a controlled study of patient outcome after prehospital PASG application in a large urban center. Patients were evaluated within various sub-categories including penetrating thoracic injuries (FTI), penetrating abdominal injuries (PAI), isolated penetrating cardiac injury (IPCI), and those with significant hypotension (HYPO) whose initial BP was less than 70 mmHg. All patients received care from the same paramedic service and trauma center facility. PASG application was randomized and the study groups were evaluated prospectively in terms of demographic data such as age, sex, anatomic injury, injury scores, fluids infused, as well as response, scene, and transport times. The results demonstrated that control and study groups were well-matched, even within sub-categories. Overall, the PASG offered no advantage in terms of survival (successful hospital discharge), morbidity, or cost. Specifically, even in those with HYPO, there was no difference in survival rate between the PASG (26 of 37) and control (27 of 37) groups. The results were similar in PTI (42/74 vs 56/78), PAI (67/97 vs 81/104), and IPCI (7/33 vs 16/24). There was a trend toward higher mortality, particularly in those with pericardial tamponade receiving PASG. We concluded that the PASG is not indicated in an urban paramedic-trauma center system that emphasizes aggressive airway care along with rapid evacuation and surgical intervention. Similar studies in other clinical settings are recommended.

### Prehospital and Disaster Medicine

## Part V Trauma

### The Investigation and Analysis of 1,000 Cases of Traffic Injury Emergency Treatment in Five Cities in China

Chen CL, Wang HC, and Shao XH

Liaoning Province Emergency Center, Shenyang, PRC

Traffic injury emergency care research is a national cooperative project supported by West Pacific Regional Office of WHO and is directed by some specialists. This study is the first project in this field in our country. Its purpose is to provide some scientific basis for preventing traffic injuries and giving better treatment to the victims.

The investigational materials came from the hospitals accepting traffic emergency cases in five large and medium-sized cities in China. The research project and injury treatment were done according to a unified standard. Each investigation form was filled in by experienced doctors. All 1,000 cases were picked up accordingly and the data were computerized.

The following data are of great importance: a) The highest rate is with the youth group. Head injuries are the most severe and account for over half of total; b) The age range of greatest number traffic injuries is 16–45 years, which is similar to that of other areas; c) It is necessary to transfer the injured victims to better-qualified hospitals after receiving prehospital care; d) Among traffic injured cases, only 14.3% were transferred to general hospitals by ambulances, and only half of them received simple first aid management. Therefore, the prehospital care for traffic injury victims should be upgraded in China.

It is suggested that traffic management stations and Emergency Centers or Central Ambulance Stations should be set up. In other words, it is necessary to implement an emergency medical services system.

### The Evaluation of Trauma Severity with TRISS Method: A Report of 80 Cases

Han Vuxi, Hu Nanfang, Lin Zhangtung, Li Yung seng

Tongji Hospital, Tongji Medical University, Wuhan, PRC

Along with the development of traumatology, there has been a pressing need for methods and standards for estimating the severity of wounds of traumatically injured patients. These methods and standards would allow surgeons to proceed with treatment, ascertain its results, and would facilitate academic exchanges. In 1984, Bits developed the TRISS method on the basis of the work of Flora, Baxt, and Champion. Since then, it has received great attention from more and more people.

The TRISS method provides a quantitative assessment of the probability of survival of the patients after injury on the basis of anatomical, physiological, and age factors. It has been regarded as a quite satisfactory method for assessing the condition of traumatically injured patients. In 1987, Carl recommended the use of the TRISSCAN Chart, which he developed through the analysis of data from a great number of trauma patients using the Walker-Duncan regression.

In the same year, we started using this chart with a few revisions for the estimation of the conditions of traumatically injured patients. A total of 80 cases of multiple traumatic injuries were chosen at random (1987–1988). The overall confirming rate of survival estimated was as high as 99.4%. The greater the ISS/RTS ratio, the less severe the injuries. A drastic rise of mortality rate occurs when the value of this ratio is greater than 7.0.

### Clinical Experience with Diagnosis and Management of Abdominal Wounds in 516 Patients

Song JN, Sun ZV

Xi'an Medical College, Xi'an, PRC

Diagnosis of abdominal injuries is not easy, and it may result in misdiagnosis or missed diagnosis. The reasons include: 1) symptoms and signs may be masked by other serious wounds; 2) when the patient is in critical condition, the history and physical examination may be difficult to take; 3) the apparent severity may not coincide with the seriousness of the internal injuries; 4) when injury occurs to a hollow viscus, the symptoms and signs may not be observable in the early stage; and 5) extensive abdominal wall wounds bring about false features.

The following procedures may be helpful in making correct diagnosis: a) obtain as accurate a history as possible; b) repeated and careful physical examinations; c) diagnostic peritoneocentesis; and d) abdominal explora-



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tion.

The following principles for the management of abdominal injuries were recommended:

1) *Liver trauma*: total of 118 cases, among them 54 cases were operated with debridement, bleeding stanching, and suture of the wound with great omentum plugging; in case of large area and deep injury of liver, thorough resection of the devitalized tissue and plugging and suturing of the wound with the great omentum after ligation of the wound surface and drainage of the external liver surface were the treatments of choice;

2) *Injury of the spleen*: total of 124 cases, 112 underwent splenectomy;

3) *Pancreatic injury*: total of 23 cases, the suture and drainage were mainly used, although, in more severe cases pancreatectomy might be necessary;

4) *Injury of colon*: total of 72 cases, primary suture for light cases and colostomy for more severe cases were the common therapeutic procedures used.

### The Iran-Iraq War: Some Spin-off in Maxillofacial Surgical Techniques

Shuker ST

Karkh Emergency Hospital, Baghdad, Iraq

Modern warfare, with its sophisticated weaponry, results in severe and multiple injuries which justify and dictate some compromises in immediate management.

This paper deals with eight years of experience in the recent Iraq-Iran war, in which new techniques were adapted and used successfully in the immediate management of severe maxillofacial injuries.

1) In severely avulsed mandibular body and symphysis, Kirschner wires were used routinely for bridging the bone defects and preservation of soft tissue position. Small and large pieces of denuded bone fragments, which would otherwise be wasted, also were used in reconstruction. Furthermore, there was no need for tracheostomy unless the injuries were associated with middle third injuries.

2) Immediate stabilization in avulsed mandibular injuries, which prevents the serious complications, was successful for prevention of tongue prolapse.

3) Immediate surgical management for severe war baso-ethmoido-maxillary complex injuries included the use of molded protex tracheostomy tube as scaffolding in severe avulsed nasal injuries. The tubes ensure stability and provide a foundation for lacerations and immediate canthopexy to intercanthal spaces, orbital floor, and maxillary bones.

### Computer-Assisted Nutritional Support in Trauma and Surgical Cases

Schloerb PR

University of Kansas Medical Center, Kansas City, Kansas, USA

As reported by Alexander, early nutritional support of patients with burns and perhaps other forms of trauma may reduce hypermetabolism and catabolism. Prompt definition of adequate caloric and nutritional needs therefore are important. This paper presented a nutritional support system programmed for small computers.

The program calculates total body water and other components of body composition. Carbohydrate (CHO) requirements are calculated as 14 grams of CHO per kg. Body Cell Mass (BCM). Protein is calculated from a calorie:nitrogen ratio of 125. The remaining calories are provided as fat. The program includes a data base of several enteral and parenteral, dietary formulations, which may be given singly or in any combination. The computer output is provided on the monitor screen or on adhesive-backed labels which can be placed in the progress note section of the chart. A body composition label lists major components of body composition for a normal individual of the same age, height, and weight as the patient, together with compositional abnormalities in fluid overload and hypoalbuminemia. A nutritional prescription output lists the various nutritional intakes, with nutritional and caloric constituents, as well as derived values. The program reduces the time required and therefore reduces cost while providing improved and consistent nutritional care.

### Role of Zinc in the Management of Flap Lacerations of the Leg in the Elderly

Maritra AK

Royal Victoria Infirmary, University of Newcastle upon Tyne, UK

It is known that wound healing is impaired in zinc-deficient men and animals, and the zinc concentrations in serum and tissues increase when zinc oxide is applied as paste, powder, or tape. The zinc oxide paste bandage

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("Viscopaste") in conjunction with sterile adhesive tapes ("Steristrip") had been shown to shorten healing time of flap lacerations of the leg in elderly patients. It was thought that the paste bandage acted physically by controlling tissue edema and thereby hastening healing.

A prospective study of 50 flap lacerations of the legs of 49 patients was undertaken to investigate the role of zinc in the healing of these lacerations:

1) The mean serum zinc levels of all patients with flap lacerations were measured;

2) The mean serum zinc levels of a group of control patients without lacerations also were determined; and

3) The serum zinc levels of the patients were correlated with the healing times of the respective lacerations.

The mean serum zinc level of the patient group was lower (9.8 mmol/L) than was that of the control group (11.3 mmol/L). There was negative correlation between zinc level and healing time ( $r = .20, P = .02$ ). Patients with healing time of 30 days or less had a higher mean zinc level (10.2 mmol/L) than did those with longer healing time (9.4 mmol/L). There was moderate absorption of zinc from the paste bandage in just over half the patients irrespective of healing time.

The study suggests that elderly patients with flap lacerations may be zinc deficient and the use of zinc oxide paste bandage is a rational approach to the management of this condition. However, the bandage probably works by its mechanical effects rather than by its zinc content.

## Part VI Experimental Research

### Experimental Study of Prevention of Myocardial Reperfusion Injury by Deferoxamine, Scopolamine, and Lidoflazine

Li Y, and Wang Y

Nanjing Medical College, Nanjing, PRC

Evidence suggests that oxygen-free radicals and intracellular calcium overload play an important role in myocardial reperfusion injury. This study was designed to investigate whether the protection afforded by a hypothermic,

crystalloid, cardioplegic solution could be enhanced by the addition of deferoxamine, scopolamine, or lidoflazine. Thirty-two isolated, non-circulating, Lanfendorff rabbit hearts, arrested by procaine-free, St. Thomas cardioplegic solution, were subjected to 90 minutes of global ischemia followed by 15 minutes of reperfusion with Locke's solution. These hearts were divided into 4 groups at random: C group as control; and D, S, and L groups as treated groups at random.

The level of malondialdehyde (MDA), a degradation product of lipid peroxidation, was measured in samples of the coronary effluent by a modified TBA assay and served as an index for determining the damage of membranes caused by oxygen free radicals. A Bleomycin assay was employed to evaluate the level of free iron in coronary effluent. The calcium content of left ventricular myocardium was assessed by means of atomic absorption spectroscopy.

This study confirms that the initial stage of reperfusion, oxygen free radicals are generated. Free iron catalyzes the initiation of oxygen radical-mediated lipid peroxidation, and calcium homeostasis is altered during ischemia and early stage of reperfusion. The results indicate that administration of deferoxamine or scopolamine can reduce iron-dependent lipid peroxidation. Their use may be efficacious clinically in protecting myocardium against reperfusion injury. Lidoflazine increases coronary flow. Each of these effects is beneficial to post-ischemic tissue perfusion.

### Comparative Study of Free-Radical Injury in Various Organs in Sepsis: An Experimental Study of Multiple Organ Failure

Meng X, Zhang P

Institute of Basic Medical Science Research, General Hospital of PLA, PRC

Although the hemodynamic, metabolic, and immunologic changes of Multiple Organ Failure (MOF) are being clarified with in-depth investigations, we still are confronted with such fundamental questions as: what are the initiating factor or factors that trigger the sequential failure of organs that are anatomically and physiologically diverse from each other? and what are the associations among these failing organs?

Many humoral mediators potentially have been implicated as being responsible for metabolic and other aspects of evolving MOF including: complement, arachidonic acid metabolites, and oxygen-free radicals. Among

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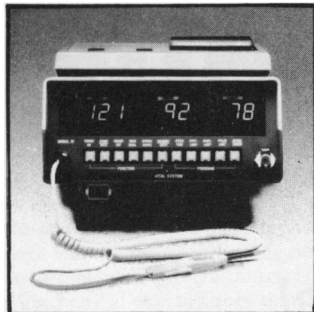


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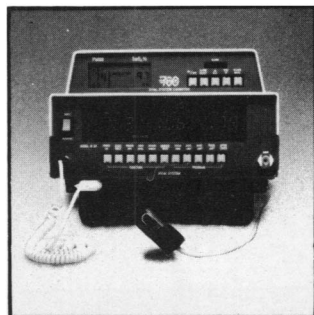
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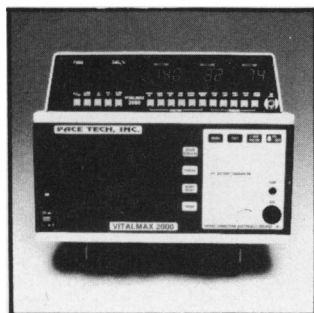
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these, free radicals are common and result from an oxidative burst of polymorphonuclear leukocytes and macrophages by complement activation and acceleration of the cascade of arachidonic acid.

This study was designed to investigate the generation of injury, and the role of scavenging of free radicals in different organs of septic rats with an aim to prove its possible significance in the development of MOF.

### **The Chance and Course of Treatment by HBO for Cerebral Resuscitation: A Report of 6 Cases**

*Zhou SR*

*Jiangsu Province People's Hospital, PRC*

Since 1978, the author successfully has used long courses of hyperbaric oxygenation (HBO) for cerebral resuscitation for six cases. These cases were not saved perfectly on the spot. The patients did not receive HBO therapy soon after the event because of the need to transfer them from one hospital to another. Therefore, the duration of coma before treatment was quite long. Thus, long-term HBO treatment was used.

The author has noticed increasingly the value of application HBO for cerebral resuscitation after cardio-pulmonary arrest and recognizes that the application of HBO therapy is worthy of further research. If HBO is used as early as possible following the event, prognosis might be improved.