Scientific Program
Free Papers Presentations

Monday 1615–1715 **Session 1 (L1)**
Resuscitation **Room 401AB**

Monday 1615 (16)
Mild Resuscitative Hypothermia for Cardiac Arrest, Shock, or Head Injury

Safar P, Leonov Yu, Sterz F, Weinrauch V, Tisherman S, Oku KI, Kuboyama K, Pomeranz S, Crippen D
International Resuscitation Research Center (IRRC), University of Pittsburgh, Pittsburgh, Pennsylvania, USA

The cerebral protective effect of moderate (30°C) hypothermia induced before circulatory arrests was established in the 1950s. Current research efforts with the use of the dog outcome models, documented the cerebral resuscitative effects of mild (34°C) hypothermia induced immediately after cardiac arrest. After 10.0 or 12.5 minutes (min) of normothermic cardiac arrest, mild hypothermia of one hour (h) duration, induced by reperfusion using brief cardiopulmonary bypass (CPB) (Leonov) or cardiopulmonary resuscitation-advanced life support (CPR-ALS) (Sterz), improved the 72–96 h post-resuscitation performance, neurologic deficit, and brain histopathology. Mild brain cooling induced during arrest was more effective than reperfusion cooling alone. No improvement seems to be achieved with start of post-arrest cooling 15 min after reperfusion (Kuboyama, preliminary data). Deep hypothermia (15°C) induced by CPB immediately post-arrest, worsened myocardial damage. Deep hypothermia with hemodilution induced pre-arrest protected against 60 min circulatory arrest (Tisherman).

In a new dog model of head trauma by simulated epidural hematoma (brain compression by balloon), preliminary data suggest that moderate to mild resuscitative hypothermia from 15 min of balloon inflation to 12 h after deflation improves 96 h outcome (Crippen).

Conclusion: Immediate post-insult, mild hypothermia is safe and can improve outcome after cardiac arrest, head injury, or shock.

Monday 1615–1715 **Session 1 (L1)**
Resuscitation **Room 401AB**

Monday 1630 (2)
Sodium Bicarbonate Improves Outcome after Ten Minutes of Cardiac Arrest in Dogs

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Introduction: The aim of this study was to determine whether treatment with sodium bicarbonate (SB) alters outcome after 10 minutes of ventricular fibrillation (VF), no flow, and cardiopulmonary resuscitation (CPR) in a dog model which includes post-arrest intensive care. The role of metabolic acidemia after restarting the heart remains undissected from its role in preventing restoration of spontaneous circulation (ROSC).

Methods: Thirty-eight dogs of 10–15 kg body weight were anesthetized with halothane/N_2O/O_2 via endotracheal tube. Catheters for monitoring were placed into the femoral and pulmonary arteries and right atrium; ECG, urine output, end-tidal CO_2 pupil size and reactivity, and EEG also were monitored. All dogs were subjected to 10 minutes (min) of VF without CPR. Resuscitation consisted of mechanical external CPR and canine ACLS protocols with and without the administration of SB. In the SB group, SB (1 mEq/kg) was given empirically, and then the base deficit was titrated to ≤5 mEq/L with the administration of additional SB as needed. In the control group (C), no SB was administered. At 24 hours (h) post-arrest, the final neurological deficit score (NDS) (0%=normal,100%=brain dead) was determined and the animals were re-anesthetized, sacrificed, and necropsied. Survival for 30 min and 24 h was analyzed with Fisher's Exact test, and all other parameters were compared with the *t*-test for independent samples.

Results: The mean value of the minimal pHa was 7.22±0.10 (SD) with SB (n=18) and 7.05±0.16 ($p<.001$) without (n=20); base deficit was 8.1±6.1 and 18.4±4.9 mEq/L respectively ($p<.0005$). ROSC was possible in all of the SB dogs but in only 15 (75%) of the C group ($p<.05$). In the SB group, 17 of 18 dogs (94%) survived 24 h versus 11 of 20 (55%) of the C group ($p<.01$). At 24 h, NDS were 27±6 in the SB group and 65±11 in the C group ($p<.0005$).

Conclusions: These results indicate a substantial benefit to the administration of SB after 10 min of cardiac arrest in dogs.

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Monday 1700 (20)
Emergency Department Misuse:
Scope and Impact of the Problem
Afilalo M, Dankoff J, Guttman A, Bergeron B, Lloyd J
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Introduction: The study was developed to define the emergency department (ED) misuses (EDM), and assess their impact on the ED.
Methods: A total of 768 ED patients (pts) were surveyed over a 14-day period. These pts were grouped into four categories: I–should be seen only in an ED; II—should be seen in the ED or elsewhere within six hours; III—should be seen within 24 hours; and IV—should be seen elsewhere in longer than 24 hours. Groups II and III were matched with other available medical resources (MR) in the region, based on the time of presentation and presenting complaint.

Results:

Group	Number (%)	Number (%) Match to MR	Number (%) No Match to MR
I	469 (62%)		
II	193 (27%)	126 (17%)	67 (9%)
III	85 (11%)	85 (11%)	0 (0%)
IV	4 (1%)	— —	— —

Discussion: Contrary to public belief, 71% could only be seen in the ED, 12% could receive safe triage at treatment from other MR, and an additional 17% could be diverted, but only after a complete ED physician evaluation. Analysis of pts' choice and health care impact/cost is in progress.

Monday 1615–1715 Session 1 (L1)
Resuscitation Room 401AB

Monday 1715 (21)
Duoderm Dressing versus Silver Sulfadiazine
in the Outpatient Treatment of Second Degree Burns
Afilalo M, Dankoff J, Guttman A, Lloyd J
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Introduction: Clinicians still are searching for the ideal burn dressing. This study compared a bilaminer membrane of polyurethane foam and hydracolloid polymer (Duoderm dressing) (DHD) with dressings made of silver sulfadiazine (SSD), bactigras, gauze, and stretchable tape (kling).
Methods: Patients were randomized into DHD or SSD groups. *Inclusion criteria:* small, second degree burns and burns requiring hospitalization. Patients were evaluated for demographic data, causative agents, percent TBSA, time for complete healing, pain and itching levels, ease of dressing change, and limitation of normal activities.
Results: A total of 48 patients were entered over 17 months. The only statistically significant differences in the two groups were the number of dressing changes—three for DHD and eight for SSD, and the ease of dressing change—DHD was easier to apply while SSD was easier to remove.
Conclusions: The only differences between DHD and SSD were in the application and removal of the dressings, and in the number of dressings changes needed.

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Monday 1615 (9)
Knowledge and Data Base on Mass Casualty Situations for Simulation Models and Expert Systems
Geva H, Bregman D, Linn S, Revach M, Wiener M, Michaelson M, Epstein L
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Preparation for mass casualty situations is an important task for each general hospital. Most hospitals lack the experience in real mass casualty situations. Simulation models and expert systems are efficient and effective tools for examining the disaster plan, and training the decision-makers in the hospital. Knowledge and a data base are the basic components of systems which have been developed for several purposes: A) Evaluating the disaster plan without physically activating the total hospital; B) Training the decision-makers; and C) Estimating the development of incidents and implications on hospital resources, organization and functioning in real disaster and mass casualty situations.

Data collection and the experience with war casualties at the RAMBAM Medical Center during wartime, as well as published material, were utilized for developing the knowledge and data base. The data processing, and the organization and development of this knowledge and data base are described. Included are: A) Casualty distribution by injuries and severity in various possible catastrophic incidents; B) Stages and time required in the diagnostic and treatment process; C) Resources required, such as manpower, equipment, etc.; D) General rules, procedures, and criteria for hospital activity, manpower, and resource allocation; and E) Hospital characteristics such as layout, departments, number and allocation of beds, operating theaters, auxiliary services, manpower resources, and equipment. Adaptation of the special characteristics of each hospital is feasible.

This knowledge and data base are part of a simulation model and expert system which has been developed.

Monday 1615–1715 Session 2 (L2)
Disaster Medicine Room 406A

Monday 1630 (10)
MASH II: Accueil Massif de Victimes Au C.H.R.U. De Lille
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Centre Hospitalier Regional De Lille, Lille, France

Le Centre Hospitalier Regional de Lille est le seul hospital d' une region de plus de 4 millions d'abitants.
Cette zone dense est soumise a d'importants risques technologiques et humains: industrie chimique lourde, tunnel transmanche, trafic maritime et ports industriels, reseau autoroutier transeuropeen.

Face a l'etendue de ces risques, le C.H.R.U. de Lille a elabore un plan specific d' accueil en cas d'afflux massif de victimes: le plan MASH. Ce plan permet la reconfiguration de l' hospital en cas d' afflux massif de victimes sans pour autant negliger le role de l' hospital au quotidien. Le systeme repose sur un poste de commandement ponctuel: "la cellule de crise" qui comprend 5 a 8 membres administratifs, techniques et medicaux ayant tout pourvoir decisionnel.

La cellule de crise a pour interlocuteurs des responsables de secteurs prealablement definis et actives si besoin est: urgences, S.A.M.U., ambulances, ingenieurs, pharmacie, accueil famille, accueil et information Presse, etc.

La reflexion et l' organisation du plan MASH s' effectuent autour de trois risques individualises: le risque chimique, le risque traumatique, le risque brule/nucleaire. Ce plan a pour ambition d' eviter toute desorganisation a l' interieur de l' institution hospitaliere qui serait en soit une deuxieme catastrophe.

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Monday 1645 (18)
Organization of International Renal Disaster Relief
Solez K, Eliahou H
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Experience with dialysis aid in recent earthquakes in Armenia and Iran, and in the change of government in Rumania, has suggested the need for a six-phase response to the renal aspects of disasters: 1) assessment of the potential for acute renal failure, with the help of local nephrologists or health officers; 2) intravenous (IV) hydration and a challenge with mannitol of patients at risk; 3) initial rapid institution of peritoneal dialysis or slow continuous ultrafiltration for those who fail to respond to hydration and mannitol; 4) establishment of a portable field laboratory to determine electrolyte and renal function parameters; 5) hemodialysis, once equipment has been set up; 6) follow-up to determine the impact of the relief efforts and the best long-term use of the dialysis equipment provided. A task force of 176 physicians from 32 countries has been established to coordinate the international response to disasters which are followed by the development of renal failure of many of the victims. The task force leaders are: D Bihari (UK); A Collins (USA); E Noji (USA); JP Wauters (Switzerland); Y Yamamoto (Japan); and VD Fedoro (USSR). The intent of this study was to identify a "key person" in each country to assist in establishing links with government and military authorities. This same person will help in the initial assessment at the disaster site. The ISN Disaster Relief Task Force will work with other established international relief organizations to provide an organized and effective response to disasters requiring dialysis aid.

Monday 1615–1715 Session 2 (L2)
Disaster Medicine Room 406A

Monday 1700 (22)
Earthquake: Some Practical Lessons from Armenia
van der Heyden WMAA
Netherlands Red Cross Society, Den Haag, The Netherlands

The entire world was shocked by the earthquake in Armenia. Assistance, both requested and spontaneous, material as well as financial was dispatched from all corners of the globe. The author spent 14 days in the afflicted area as the staff physician to the Netherlands Red Cross team in Armenia.

This study compares the earthquake damage and resultant deaths and casualties to a theoretical disaster of similar magnitude affecting the Netherlands, which approximates the same size as the area of Armenia that suffered the earthquake. The distribution of the victims according to the various triage groups was: Dead—24,888 (44%); Admissions T1 and T2—11,931 (21%); and Outpatients T3—19,348 (38%); a total of 56,157 earthquake victims injured or killed during the earthquake.

In comparison with a theoretical disaster striking the Netherlands, the breakdown of injuries and deaths would be:

Categories	Armenia	Netherlands
Inhabitants	500,000	1,771,972
Area (km2)	5,034	5,151
Density	99	344
Dead	24,888	44.31
Admissions T_1 and T_2	11,931	21.24
Outpatients T_3	19,348	34.45
Evacuated	113,931	
Evacuated outside area	74,393	
Remaining in area	255,509	
Total	500,000	100.00

	Netherlands	Percent
Dead	38,202	4.98
Admissions T_1 and T_2	42,283	2.39
Outpatients	68,568	3.87
Evacuated	403,765	22.79
Evacuated outside area	263,645	14.88
Remaining in Area	905,510	51.10
Total	1,771,972	100.00

Despite the higher infrastructure in the Netherlands as compared to Armenia, a chaotic situation would occur if disaster of similar magnitude affected this nation. The weakest link in the emergency response chain would be the hospitals.

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Tuesday 1630–1800 **Session 3 (L3)**
Emergency Medicine **Room 401AB**

Tuesday 1630 (4)
Management and Task Delivery in the Emergency Department
Campos RH, Kutner C, Blair T
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This study was designed to answer questions related to threat to provider time in the emergency department (ED) at Santa Teresa Community Hospital, a Kaiser Permanente facility, which also works on a fee-for-service, private basis. In 1989, the ED saw a total of 29,996 patients (mean=83/day). Typically, of those patients, 20% were pediatric, 20% were gynecologic, 20% were cardiac and respiratory, while the other 20% was composed of a patients with a variety of miscellaneous complaints.

Anecdotal data indicate that the ED problem develops when the necessary tasks surpass the capacity of the staff to accomplish them. Consequently, lower priority tasks are left aside and many patients must wait long periods of time. Although no tasks are neglected, many are performed in an untimely manner. This causes frustration for the physicians, nurses, patients, and families.

To verify the accuracy of this anecdotal method, a needs assessment survey was carried out in the ED. A time management and task delivery evaluation also was implemented. The results not only supported the anecdotal data, but also pinpointed three major problems as threats to provider time: triage; nurses performing non-nursing tasks; and ED physicians performing routine care.

In this project, definitions of the scope are provided along with solutions to these problems.

Tuesday 1630–1800 **Session 3 (L3)**
Emergency Medicine **Room 401AB**

Tuesday 1645 (17)
Predictors of Mortality in Severely Injured Patients
Sampalis JS, Lavoie A, Williams JI, Mulder DS, Kalina M
McGill University Departments of Surgery, Epidemiology, Biostatistics, Montréal, Québec, Department of Preventive Medicine, University of Toronto, Toronto, Ontario, and Urgencés Santé, Montréal, Québec, Canada

Introduction and Methods: The association of patient and injury characteristics with the odds of dying was evaluated in a sample of 360 severely injured patients. The study sample was selected from a cohort of patients with trauma-related injuries received by Urgencés Santé, the Montréal emergency medical system, between 1 April 1987 and 30 March 1988. Patients who fulfilled the following criteria were included in the sample: A) alive at ambulance arrival; B) transferred to hospital; and C) one or more of: 1) died within seven days; 2) survived for more than seven days and either admitted, received surgical procedure, treatment in intensive care unit (ICU), or on-site PHI•3.
Results: A significantly high unadjusted odds of dying was associated with pulmonary disease (pneumonia, COPD) (OR=2.5, 95% CI=1.0–6.4), motor vehicle accident (OR=3.6, 95% CI-2.1–6.1), firearm injury (OR=3.1, 95% CI=1.3–7.8), motorcycle rider (OR=4.3, 95% CI=1.6–11.8), pedestrian (OR=2.7, 95% CI=1.5–4.9), head injuries (OR=9.3, 95% CI=5.0–17.1). The chest injuries (OR=3.9, 95% CI=2.3–6.8), abdominal trauma (OR=1.9, 95% CI=1.1–3.3), multiple injuries (OR=4.4, 95% CI=2.4–8.2). The following were associated significantly with an increased adjusted odds of dying, while controlling for ISS, on-site care, and level of care at the receiving hospital: motor vehicle accidents (OR=1.6, 95% CI=1.2–23.9), and gunshot injuries (OR=2.4, 95% CI=1.2–4.8).
Conclusions: These results provide useful information regarding covariates to be considered in trauma care evaluation research.

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Tuesday 1630–1800 **Session 3 (L3)**
Emergency Medicine **Room 401AB**

Tuesday 1700 (24)
Work-Related Stress in Emergency Medical Care
Whitley T, Allison E, Revicki D
East Carolina University School of Medicine, Department of Emergency Medicine, Greenville, North Carolina

The work-related stress perceived by emergency medical care providers has received considerable research attention. The purposes of this presentation are to present the results of surveys we have conducted and to discuss their implications for emergency medical care. During the past several years, we have conducted cross-sectional surveys of: emergency medical technicians in North Carolina (NC); flight nurses in NC and the U.S.; and emergency medicine physicians in training in the US, the UK, and Australia; and are in the midst of a longitudinal survey of residents in the U.S. We have surveyed emergency physicians in the US and Australia, and currently are surveying accident and emergency physicians in the UK.

While personal variables have been examined, organizational variables have been emphasized, so that organizations can use the results not only to alleviate work-related stress, but also to allow the organization to serve as a source of support for individuals who are experiencing high levels of stress from other sources. For example, the relationship between clearly defined tasks and roles and lower levels of work-related stress consistently has been demonstrated. The similar impact of supervisory practices which foster communication in the work group and contribute to its cohesiveness also consistently have been demonstrated. The results of these studies have suggested avenues for further research, and have implications for stress management plans for emergency medical care providers.

Tuesday 1615–1715 **Session 4 (L4)**
Prehospital/Disaster Medicine **Room 406A**

Tuesday 1615 (1)
Recommended Improved Interview Methods and Materials for Retrospective Studies in Disaster Reanimatology
Angus D, Ricci E, Pretto E, Schorr T, Klain M, Abrams J, Safar P
International Resuscitation Research Center (IRRC) and Schools of Medicine, Public Health, and Engineering, University of Pittsburgh, Pittsburgh, Pennsylvania, USA

In a structured, retrospective interview (site visit) study of the 1988 earthquake in Armenia [Soviet Union], it was found that there existed a potential for life-saving within the first few hours after the disaster.[1] Since this study, the methods and materials have been evaluated and upgraded.[2] This presentation discusses the revisions and describes the ways in which they can be used in the study of future disasters. The revised methods and objectives include: attaining information on the detection of, extrication, and emergency medical care of seriously injured victims; description on the nature of their injuries; and pattern of dying for those who succumbed. Data will be obtained from interviews of on-site medical personnel, search and rescue workers, and lay witnesses. The respondents will be chosen from a sampling frame constructed from epidemiological mapping of the affected region.

There are five phases to the study: 1) Collection of background information; 2) The conduct of an open-ended scout survey soon after the event; 3) Construction of a sampling map (comprising pre-event demography and post-event gross damage, vital support damage, and distribution of deaths), and tailoring of the questionnaires for the principal survey; 4) Conduct the principal survey on-site with in-survey adaptation and medical record review, if appropriate; and 5) Collation and analysis of the data, and the conduct of secondary surveys as required.

The presentation will include the generic scout and principal questionnaires and the rationale for mapping, the sample sizes, and the relevance of qualitative and quantitative data collection will be discussed.

References

1. Klain M, et al: Disaster reanimatology potentials: A structured interview study in Armenia: I. Methodology and preliminary results. *Prehospital and Disaster Medicine* 1989;4:135–152.
2. Ricci E, et al: Disaster Reanimatology Potentials: A structured interview study of Armenia: II. Methodology for evaluation of medical response to major disasters. *Prehospital and Disaster Medicine* 1991;6:159–166.

Tuesday 1630 (8)
Problemes de Droit International Poses par le Franchissement des Frontieres pour l'Hospitalisation de Patients Anonymes Lors de Catastrophes
Fonrouge JM, Fonrouge G,† Sabathie M‡*
** Assistance Publique de Hopitaux de Paris, France; †D.E.S.S. Université de Bordeaux, France; ‡ Université de Médecine de Bordeaux, France*

Les auteurs présentet dans cette communication les problèmes éthiques ed juridiques posésa par l'évacuation de victimes anonymes hors des frontières d'un pays en cas de catastrophe majeure. Les exemples récents de patient gravement brûles ou de victimes ensevelies lors de tremblements de terre montrent que dans ces situations, peu de pays peuvent répondre, de façon autonome, à un afflux massif de victimes nécessitant de soins de très haute qualification: traitement des brûlés, dialyse de victimes en insuffisance rénale.

Les auteurs apportent les résultats d'une étude qui présente les obstacles administratifs et juridiques de ce type d'évacuation: sortie, transit, et pénétration du territoire d'un etat souverain par une personne unconsciente et anonyme; décès extra-territorial d'une personne anonyme; rapatriement des corps; prise en charge financiére des soins.

Les auteurs souhaitent ainsi attirer l'attention sur l'utilié d'un travail et d'un accord préalable supranational afin des pouvoir répondre lors de situations d'exception dans des délais permettant une prise en charge eficace des soins. Cette proposition ne met pasen cause les structures et la qualité des pratiques médicales intrinsèques à chaque pays mais vise à offrir une réponse orgnisée et éthique lors de catastrophes de grande ampleur.

Tuesday 1615–1715 Session 4 (L4)
Prehospital/Disaster Medicine Room 406A

Tuesday 1645 (13)
The Utility of the Time-Scale for Disaster Relief
Makishima T, Takahashi Y, Kono M
Surgical Department of the Japanese Red Cross Medical Center, Tokyo, Japan

Time is one of the most important factors for disaster relief. Therefore, a time-scale was framed to design medical support. The time-scale has been applied to the international relief action.

The time-scale for disaster relief was defined as:

Phase 0: Primary care and rescue by the people in the area;
Phase 1: Systematic relief action in the field by rescue teams;
Phase 2: Special treatment in well-equipped hospitals;
Phase 3: Rehabilitation and welfare; and
Post-
Phase 1: Continuing rescue action and sanitation work in the field.

The authors have participated in the following international relief efforts:

1) Earthquake in Mexico City in 1985 which caused more than 10,000 of deaths. Four days after the event, a medical team was dispatched for Post-Phase 1 relief.
2) Eruption of volcano in Colombia in 1985 caused 22,000 deaths. Four days after the event, a medical team was provided for Phase 2 relief;
3) Conflict in Rumania in 1989 reportedly caused 60,000 casualties. To support Post-Phase 1, a medical team was provided on the 10th day. However, the purpose was changed to Phase 3 on the spot.

These cases suggest that the time-scale is useful for designing an adequate relief team, and for changing its purpose as circumstances require.

Tuesday 1615–1715 **Session 4 (L4)**
Prehospital/Disaster Medicine **Room 406A**

Tuesday 1700 (15)
Computer-Aided EMS Priority Dispatch Triage System
Pepe PE, Mattox KL, Curka PA, Ginger VF, Sherrard R
Department of Medicine, Surgery and Pediatrics, Baylor College of Medicine and the City of Houston EMS, Houston, Texas, USA

Introduction and Methods: To test the ability of a computerized EMS priority dispatch system to exclude the need for advanced life support (ALS) safely, a retrospective study of 35,075 consecutive EMS records was conducted to see how often lone dispatches of basic EMT units subsequently involved ALS care. Using a short set of predetermined questions, dispatchers tried to identify (or exclude) signs and symptoms indicated the need for ALS.
Results: The ALS units were spared from initial dispatch in 14,100 (40.2%) of all EMS incidents, increasing their availability and utilization for more serious calls. Only 254 (1.8%) of these cases later required or involved ALS procedures; most of these cases involved an intravenous (IV) *without* volume infusion. In fact, the immediate presence of a paramedic actually would have been considered theoretically advantageous (e.g. post-traumatic arrest, hypoglycemia) in less than a dozen of the 14,100 cases and there was no discernible difference in outcome for any of these patients.
Conclusion: A computer-aided, dispatch-triage algorithm can safely identify cases requiring only BLS care. Although paramedic arrival may be delayed in a handful of "ALS cases," negative effects on patient outcome are negligible. Instead, many operational and medical care benefits are provided by the system.

Thursday 0800–0900 **Session 5 (L5)**
Pulmonary **Room 401AB**

Thursday 0800 (11)
Effects of Corticosteroid Inhalation on Respiratory Function after Chlorine-Gas Exposure
Gunnarsson M, Bloom G, Jansson I, Walther S, Lennquist S
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Introduction: One of the greatest and most difficult problems to handle within the field of Disaster Medicine is an accident in which a leakage of toxic gas(es) occurs and an extensive number of people are exposed. In this circumstance, hundreds of people may need respiratory support. In this situation, access to simple and effective methods of respiratory treatment that could be started early, would be invaluable.

With the aim of developing such methods, an experimental model was set up in which anesthetized pigs, using a closed system, could be exposed to toxic gases, and then treated and observed during long-term anesthesia Using this technique, respiratory and circulatory functions could be followed closely under standardized conditions. The aim of this experiment was to study the effects of early intrapulmonary corticosteroid treatment in pigs exposed to chlorine gas.
Method: Ten anesthetized pigs (weight 20–25 kg) were exposed to a sub-lethal dose of chlorine gas (30–40 mg). Half of the pigs were treated with a nebulized corticosteroid with a high local anti-inflammatory potency (Beclomethazone diproprionate 10 mcg/kg body weight). The corticosteroid was administered using a previously described nebulizer, which permitted adjustment of particle size and intrabronchial flow for optimal intrapulmonary distribution. The other 5 pigs were not given corticosteroids but otherwise were treated identically. Changes in lung-mechanics, gas exchange, and hemodynamics were following during a 6 hour observation period.
Results: Following exposure to chlorine gas, an increase in pulmonary arterial pressure was registered in both groups. This increase subsided progressively in the aerosol treated group and by the end of the observation period was significantly lower than it was in the control group. Arterial oxygen tension was maintained better in the treated group than in the controls. A decline in lung compliance occurred in both groups, but was significantly less pronounced in the treated group.
Conclusion: Early treatment with intrapulmonary administration of a corticosteroid with high anti-inflammatory potency, using the described technique, significantly reduced the impairment of respiratory function after chlorine-gas exposure. The treatment needs further evaluation, but could become a very useful and easily available therapeutic alternative after toxic gas exposure in mass casualty situations.

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Thursday 0815 (14)
Dose Response to Inhaled Salbutamol Administered by Metered-Dose Inhaler and Aerochamber or Wet Nebulizer in the Treatment of Acute Asthma
Guttman A, Colacone A, Afilalo M, Wolkove N, Dankoff J, Kreisman H
Emergency and Pulmonary Department, Sir Mortimer B. Davis Jewish General Hospital, McGill University, Montréal, Québec, Canada

Comparative studies of salbutamol (S) by wet nebulizer (WN) or metered-dose inhaler (MDI) have tested fixed doses of medications. This study compared the dose:response to S by WN or MDI in the initial emergency department treatment of asthma.
Methods: This randomized, double blind, placebo controlled, clinical trial tested either S 400μg by MDI or S 2.5 mg by WN administered every 30 minutes until maximal bronchodilation (MAX) was achieved.
Results: A total of 80 patients were studied; 40 patients (age 41±18 yrs; mean FEV_1=36±12% of predicted) were randomized to MDI and the other 40 (age 43±19 yrs; mean FEV_1 35±16% of predicted) were randomized to WN. Maximal bronchodilation was achieved after two doses in 26 of 40 (65%) MDI patients and in 30 of 40 (75%) of the WN patients. Maximal bronchodilation was achieved after four doses in 100% of the MDI patients and in 95% of the WN patients. Response to spirometry (p=.964), vital signs (p=.165), and dyspnea (p=.743) did not suffer between groups. Both spirometry ($DFEV_1L$; MDI= 0.72±0.49; WN=0.68±0.61) and dyspnea (DMDI=3.2±1.8; DWN=3.2±2.5) scores improved for each group between the log dose of S and MB (MDI:r=0.93; WN:r=0.96). for those patients who continued to respond, the rise in response per unit dose was similar (slopes:MDI=51.3; WN=50.8; p>.1). The drug potency ratio was about 6:1 in favor of the MDI route of administration.
Conclusion: In conclusion, adequate dosage will produce similar results to inhaled S administered by either MDI or WN in acute asthma.

Thursday 0800–0900 Session 5 (L5)
Pulmonary Room 401AB

Thursday 0830 (19)
Limiting Cardiac Evaluation in Hemodynamically Stable Patients with Suspected Myocardial Contusion
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This study prospectively examined 100 patients suspected of having a cardiac contusion. *Inclusion criteria* were: 1) unrestrained occupants in a vehicle traveling >30 mph; 2) Victims falling >30 feet; or 3) Victims involved in home or industrial accidents in whom cardiac contusion was likely. Patients were separated into two groups. Group 1 patients were hemodynamically stable, had normal ECGs on admission, were <55 years old, and with no history of cardiac disease. This group of patients received 24 hours of cardiac monitoring and a repeat ECG. If no treatable arrhythmias or CHF developed, patients were discharged. Follow-up consisted of a physical exam and ECG, one week later. Group 2 patients, on admission, were >55 years old, or had a history of cardiac disease, or were hemodynamically unstable, or had treatable arrhythmia, or had abnormal ECGs, or required surgery. These patients received serial ECGs and CPK/CK-MB enzymes, 72 hours of cardiac monitoring, and cardiac ECHO or MUGA. Group 1 contained 80% of all patients. None developed treatable arrhythmias or CHF. No follow-up patient in Group 1 had positive findings. Group 2 included 20% of the patients. They had one or more positive diagnostic findings of cardiac contusion: 25% had elevated CK-MB; 35% had a positive ECGs; and 5% had a positive ECHO. None required therapy for arrhythmia or CHF.
Conclusions: The authors conclude that patients with blunt thoracic trauma with Group 1 criteria can be monitored safely for 24 hours and discharged.

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Thursday 0845 (14)
Comparison of Albuterol Delivery in Acute Asthma
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Introduction: In acute asthma, adrenergics have long been administered by the use of nebulizers in emergency department (ED). Newer studies have demonstrated the ease and efficacy of using metered-dose inhalers with spacer attachments in the ambulatory care treatment of patients with chronic obstructive pulmonary disease and/or asthma. This prospective study compared the efficacy of albuterol administered by nebulizer versus a metered-dose inhaler (MDI) with an InspirEase® attachment (IE).
Methods: Forty-nine adult patients with acute asthma presenting to the ED, were assigned randomly to one of two treatment groups: either 2.5 mg albuterol by hand-held nebulizer (Group 1) or one puff of albuterol (0.09 mg) repeated six times by MDI with IE (Group 2). Treatments were repeated twice at 30 minute intervals.
Results: The groups were well-matched for age, gender, prior medication intake, and initial peak expiratory flow rate (PEFR). There was no statistical difference in PEFR improvement between the two groups. Group 1 (n=25) had a mean pre-treatment PEFR of 166.5+63.2 L/sec and post-treatment PEFR of 280.5+89.6 L/sec versus 159.6+56.5 L/sec and 285.0+88.0 L/sec respectively for Group 2 (n=24).
Conclusions: Albuterol administered with an MDI with IE is as effective as is a nebulizer for the treatment of acute asthma in the ED, and offers the advantage of lower cost and greater ease of administration.

Thursday 0800–0900 Session 5 (L5)
Pulmonary Room 401AB

Thursday 0900 (23)
Corticosteroid Aerosol Treatment Reduces Pulmonary Granulocyte Accumulation in Septic Pigs
Walther S, Berg S, Jansson I, Lennquist S
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Introduction: The adult respiratory distress syndrome (ARDS) secondary to septicemia is one of the most lethal complications of severe trauma. Previously, we demonstrated reduction of lung injury with better maintenance of lung compliance, arterial oxygenation, and pulmonary hemodynamics in septic pigs treated with a nebulized corticosteroid (NC). Since corticosteroids interfere with granulocyte recruitment, the aim of the present study was to examine the effects of NC on intrapulmonary granulocyte accumulation.
Methods: Pulmonary and blood activity from autologous granulocytes labelled with In111 were studied in 24 anesthetized and ventilated pigs subjected to a bolus infusion of Staphlococcus aureus (approximately 2x1010 colony forming units). Fourteen pigs received NC (beclomethasone dipropionate 10–50 mcg/kg every 6 hours) initiated after the septic insult, and 10 did not receive NC.
Results: The NC treated pigs showed a gradual decline in decay-corrected pulmonary In 111 activity. The non-treatment group displayed a more varied reaction, but most animals showed an increase in activity compared to the NC treated group. There were no significant intergroup differences in blood activity.

	1h	4h	8h	12h	44h
NC					
(%)	92	92	91**	85*	72
Range	65–138	75–105	78–96	69–94	58–110
n	6	8	8	8	6
No NC					
(%)	125	103	101	90	121
Range	123–126	89–115	94–134	83–118	93–124
n	3	7	7	7	3

Table 1: Pulmonary activity, baseline=100% Median (range) *=p<.05, **=p<.01 between groups

Conclusion: Nebulized corticosteroid reduce pulmonary granulocyte accumulation, which could explain the previously observed positive effects of NC on pulmonary function following septic lung injury.

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Thursday 0800–0900 **Session 6 (L6)**
Trauma **Room 406A**

Thursday 0800 (3)
Pharmokinetics of Epinephrine Administered via Intravenous, Endotracheal, and Intraosseous Routes
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Objective: To correlate the effects of epinephrine (E) on Blood Pressure (BP) and to characterize the pharmokinetics of E administered by the intravenous (IV), intraosseous (IO), and endotracheal (ET) routes.
Design: Prospective, laboratory investigation.
Subjects: A total of 44 swine (10–15 kg) anesthetized with ketamine and alpha-chloralose, 30-75 mg/kg.
Intervention: Animals were instrumented for BP and electrocardiograph (ECG) monitoring. Ventricular fibrillation was induced and cardiopulmonary resuscitation (CPR) was initiated after five minutes of arrest using a Michigan Instruments Thumper. Blood samples were drawn every two minutes and the plasma frozen for later measurement of [E] using HPLC. Cardiopulmonary Resuscitation was continued for 25 minutes.

Epinephrine 0.1 mg/kg was administered at 10 and 20 minutes post-arrest by the IV (superior vena cava; n=6), intraosseous (n=8), or endotracheal (n=6) route. This was repeated for E, 0.01 mg/kg, in the same number of animals. Eight animals did not receive E and served as controls. Linear regression was performed for the model:

$$V = MABP - k + \log [E] + B \text{ ramp with ramp}$$

where MABP is mean arterial blood pressure, k is a constant, and [E] is the concentration of epinephrine., and B ramp is a simple linear variable. The plasma half-life of exogenous E was calculated.
Results:

Coefficient	IV	IO	ET
(mmHg)	58	-11.9	16
Ramp	-3.58	-2.40	-2.67
Log (E)	8.6	13.7	5.8
p value	<.001	<.001	<.001
$T_{1/2}$ 0.01	3.7	2.7	—
$T_{1/2}$ 0.1 (min)	3.6	1.8	—

Conclusion: Each route of administration has a characteristic slope and $T_{1/2}$ for E. The rate of distribution and elimination is affected by other variables such as tissue hypoxia and acidosis.

Thursday 0800–0900 **Session 6 (L6)**
Trauma **Room 406A**

Thursday 0815 (5)
Microcirculatory Alterations of the Spinal Cord After Indirect Gunshot Injury
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Using an experimental model produced by wounding a dog's lumbar spine with high velocity bullets, the microcirculatory, morphological, and functional alterations of the spinal cord, and their effects on the spinal cord function were studied. Following wounding, an increase in the tissue content of Evans blue at 6 and 24 hours (h) was observed, along with increases in tissue water content, Na^+ and K^+ content in the injured area at 6 h following the injury. In addition, there was an increase of vascular permeability and tissue edematization in the spinal cord in some of the high and low zones within 4 cm of the injured spinal cord. As time elapsed, the post-traumatic microvascular and ultrastructural alterations in the spinal cord showed: 1) progressive swelling and degeneration of the endothelial cells; 2) widening of the intracellular junctions; 3) rupture of part of the microvascular wall; 4) extravascular edema; and 5) deposition of lanthanum granules around the blood vessels. The surface microcirculatory states of the spinal cord changed markedly after wounding, and showed that as the blood flow slowed and became stagnant, and paraplegic vasodilation and increased vascular permeability occurred. The plasma ANF content markedly decreased within 3 h, and then increased between 12 to 24 h after the wounding. The changes in ANF content exert an influence on microcirculatory states of the spinal cord, and might cause spinal cord ischemia. After wounding, the ANF content decrease might relate to tissue edematization and microcirculatory obstruction in the spinal cord. Post-traumatically, the ascending conduction of the spinal cord was markedly blocked, but showed a significant delay of the latent time of evoked potentials in the spinal cord.

The results demonstrate that microcirculatory obstruction is significant after an indirect gunshot injury to the spinal cord, which might cause ischemia, edema, degeneration, necrosis, and further the dysfunction of the spinal cord. Therefore, measures which improve the microcirculatory functions of the spinal cord must be considered as early as possible during the period of the clinical treatment of indirect gunshot injury to the spinal cord.

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Thursday 0830 (6)
Role of Mg^{++} in Bronchial Smooth Muscle
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Objective: To demonstrate magnesium's (Mg) role as a calcium antagonist in bronchial smooth muscle.
Design: Prospective, controlled, laboratory investigation.
Subjects: New Zealand rabbits weighing 2.4 kg, anesthetized with ketamine/xylosine (44/12 mg) and sacrificed with pentobarbital (50 mg).
Interventions: The 3 mm bronchial rings were placed in Tyrode's buffer under one gram passive stretch in Langendorff apparatus. Bronchial rings were treated with antagonists and agonists of extracellular and intracellular calcium in the presence and absence of magnesium. Effects were recorded and data analyzed using 2-way ANOVA for overall effect, and student's *t*-test for comparison of specific effects between groups. Data are reported as mean±SE.
Results: Atropine, 0.1 mM decreased resting tension by 89±43, 94±19, and 40±12 mg respectively. In the presence of atropine, 0.1 mM and $MgCl_2$ 50 mM, contractile response to $CaCl_2$ 5, 10, and 30 mM were 3±9, -23±5, and -9±8mg respectively.

A calmoducin inhibitor, CPZ 0.1 mM and $MgCl_2$ 50 mM decreased resting tension by 340±42 mg and limited the response to Bethenacel to 18±1 0 mg. $CaCl_2$ 5, 10, and 30 mM increased tension by 140±74, 80±28, and 86±29 respectively ($p<.05$).
Conclusions: Magnesium does not appear to inhibit significantly calcium ion flux at receptor operator channels or membrane-bound calcium channels. Calmoducin is a significant intracellular site of magnesium inhibition of contraction coupling in bronchial smooth muscle.

Thursday 0800–0900 **Session 6 (L6)**
Trauma **Room 406A**

Thursday 0845 (7)
Asthma Continuous versus Intermittent Nebulization
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Objectives: The purpose of this study was to compare the effects of continuous nebulization (CN) with standard, intermittent nebulization (IN) of albuterol in the emergency department.
Design: Randomized, block design in groups of 10 with open label drug administration.
Setting: Urban hospital Emergency Department (ED).
Participants: Patients ≥age 17 years with peak flow (PEFR) <200 L/min *after* treatment with albuterol 2.5 mg. *Exclusion criteria:* temperature of ≥101°; pulmonary infection; heart failure; pregnancy.
Intervention: Patients received albuterol (Solumedrol), 125 mg intravenously (IV). Patients received albuterol of 2.5 mg IN at 30, 60, 90, and 120 minutes (min) after the initial treatment. Patients received CN of nebulized albuterol, 10 mg in 70 ml of NSS delivered over 190 min. Vital signs and PEFR were recorded every 30 min. Asthma scores were calculated initially and at 120 min. Data were analyzed using ANOVA and chi-square. Data are reported as mean ±SE.
Results: A total of 52 patients were enrolled, of which 31 received albuterol CN and 20 received albuterol IN. The baseline PEFR was 134±7 and 140±9 L/min for the CN and IN groups respectively. Baseline PEFR increased to 303±18 and 250±16 for the CN and IN groups respectively at the completion of treatment (2 hours). The difference was significant ($p<.05$) over time, but not between groups. There was no difference between groups in either age or gender. Admission heart rate (HR) was 103±4 per min in the CN group and 101±5 per min in the IN group; after 120 minutes HR was 91±3 per min in the CN group and 101±4 per min in the IN group. The admission/discharge rate for the CN group was 9/31 compared to 14/21 for the IN group ($p<.05$).
Conclusions: The CN method of beta-agonist administration required less nursing and physician time, but did not offer a clinically significant improvement in PEFR. Patients receiving CN therapy exhibited less tachycardia and were less likely to be admitted.