AMERICAN COLLEGE OF EMERGENCY PHYSICIANS
SCIENTIFIC ASSEMBLY
1999

EMS and EMS-C Literature Update: The Need for Outcomes-Based Research

Things change rapidly in medicine, and out-of-hospital care is no exception. This course is designed to educate emergency physicians on the latest emergency medicine research findings and to stress the importance of outcomes-based research.

- Discuss the key pieces of literature relevant to prehospital care that were published the during past year.
- Discuss the importance of outcomes-based research as it applies to the out-of-hospital setting.
- Describe the strengths and weakness of these studies and how the information may affect your practice.

WE-137
Wednesday, October 13, 1999
10:00 AM - 10:55 AM
Room # N209
Las Vegas Convention Center

FACULTY

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I. INTRODUCTION

A. History of Emergency Medical Services (EMS)

1. First Century, AD: Caesar appoints designated battlefield medics
2. Napoleon's chief surgeon Jean-Dominique Larrey develops the first "MASH unit"
3. Civil War: horse-drawn ambulances
4. Early 1900's: the motorized ambulance (hearse) is used to transport sick patients to hospitals
5. 1964: J.F. Pantridge First Mobile Coronary Unit (Ireland)
6. 1966: National Highway Traffic Safety Act
7. 1967: First paramedics are trained in Miami, Florida
8. 1968: AT&T establishes 9-1-1 as the emergency code throughout the US
9. 1968: ACEP is founded
10. 1971: Jack Webb's TV series "Emergency!" debuts
11. 1973: Emergency Medical Services Act
    a. High level of funding
    b. No research
12. 1970's: Block grants
    a. High level of federal funding
    b. Little research
13. 1976: ABEM is established
14. 1979: Emergency Medicine is recognized as the 23rd medical specialty
15. 1981: The federal EMS initiative through the EMS Systems Act is discontinued
16. 1984: EMS-C program is started
17. 1993: National Academy of Sciences' Institute of Medicine reveals study showing continuing deficiencies in pediatric emergency care across the country
18. 1994: NHTSA convenes a workshop on the Methodologies for Measuring Morbidity Outcomes in EMS
19. 1995: Spaite DW, Criss EA, Valenzuela TD, et al. Emergency Medical Service Systems Research: Problems of the Past, Challenges of the Future. *Ann Emerg Med* 1995;26:146-152.
20. 1996: "EMS: Agenda for the Future" is released by NHTSA (National Highway Traffic Safety Administration).
21. 1997: Spaite DW, Criss EA, Valenzuela TD, et al. Developing a Foundation for the Evaluation of Expanded-Scope EMS: A Window of Opportunity That Cannot Be Ignored. *Ann Emerg Med* 1997;30:791-796.
22. 1997: Callaham M. Quantifying the Scanty Science of Prehospital Emergency Care. *Ann Emerg Med* 1997;30:785-790.
23. 1998: Implementation Guide for the "EMS: Agenda for the Future" is released by NHTSA (National Highway Traffic Safety Administration).

B. EBM: examines the strengths, weaknesses, validity and clinical relevance of the medical literature.

Sackett DL, Richardson WS, Rosenberg W,et al. Evidence-based Medicine: How to Practice and Teach EBM. New York:Churchill Livingstone, 1997.

1. Ask a clinical question which can be answered
2. Search for the best evidence (beyond Medline)
    a. Determine the purpose, validity and importance of evidence about a diagnostic test, prognostic marker, treatment intervention, etc.
    b. Methodology: dependent on type of study (i.e., treatment)
        1) Randomized assignment of patients to the treatment group
        2) Appropriate accounting for all patients entered into the study
        3) Clinicians and patients blinded to the treatment received
        4) Appropriate population, appropriate population size and similar patients in the treatment and the control groups
        5) Experimental and control groups are treated equally
        6) Outcomes defined and clinically important (NNT)
        7) Evidence about harm is valid and important (NNH)
        8) Economic evaluation
3. Can this valid, important evidence be used to care for patients?
4. Evidence-based literature
    a. Metaanalysis of well-designed randomized controlled trials (RCTs)
        1) Cochrane collection
    b. Well-designed RCT
    c. Well-designed controlled studies: cohort studies > case control studies > surveys
5. Non evidence-based literature
    a. Descriptive studies
    b. Case series or case reports
    c. Studies using non-randomized historical controls
    d. Expert opinion
    e. Common medical practice before EBM
6. Examples of EMS practices not well supported by the critical review of the scientific literature
    a. MAST suite for hypotension
    b. HDE (High-Dose Epinephrine) in CPA (cardiopulmonary arrest)
    c. Aggressive hyperventilation for head trauma
7. Critical appraisal: distinguishes definitive from preliminary studies

C. EMS Research

1. Different communities may have different out-of-hospital needs
    a. Population density
    b. Rural vs. suburban vs. urban
    c. Economic realities

2. Hospital research and practices cannot simply be extrapolated to the out-of-hospital setting
   a. Hospital patients usually have empty stomachs before going to the OR
   b. Out-of-hospital medications are limited
   c. Out-of-hospital equipment is limited and must be "durable and light"
      1) ETT confirmation: Large syringe or CO_2 color changer vs. expensive anesthesia CO_2 Monitor
      2) Cardiac monitors
   d. Controlled environment in the hospital vs. unpredictable environment in the field
   e. Additional help and expertise in hospital
3. Study design
   a. Purpose of the study
   b. Observational vs. experimental
      1) Case controlled
      2) Cross-sectional
      3) Cohort
      4) RCT
   c. Internal and external validity
   d. Error
      1) Random (chance)
      2) Systemic (bias)
   e. Sample size
   f. Pilot study (exploration) vs. definitive study (confirmatory)
   g. Consent
   h. Financing (multi-centered studies)
   i. RCTs
      1) Cannot randomize who gets ALS and who does not (OPALS-see section II-G)
      2) Financing (i.e., multi-centered studies)
   j. Uncontrolled studies -"the expected, predictable results of an uncontrolled trial is a positive outcome," i.e., high incidence of F(+) Callaham M. Quantifying the Scanty Science of Prehospital Emergency Care. *Ann Emerg Med* 1997;30:785-790.
      1) January 1, 1985 → September 1, 1997: 5,842 publications on EMS (4,633,000 citations indexed by NLM)
         a) 54 RCTs
            (1) 7% (4) showed harm and decreased survival from the new therapy
            (2) 74% (40) showed no effect from the new therapy
            (3) 13% (7) showed a positive outcome of the intervention and were not contradicted by larger or multiple other studies of the same intervention

(a) 1/7 with a positive impact showed actual improved survival
(b) 1/7 with a positive impact compared the intervention with a placebo

b) 5,788 are uncontrolled trials with an 11% likelihood of being correct when they report positive outcomes

k. Outcomes

1) Spaite D. Editorial: Intubation by Basic EMTs*:* Lifesaving Advance or Catastrophic Complication? *Ann Emerg Med* 1998;31:276-277.
a) EMS practice has traditionally preceded knowledge
b) Lack of outcome studies
c) Lack of economic impact studies

2) Maio RF, Garrison HG, Spaite DW, et al. Emergency Medical Services Outcomes Project I (EMSOP I): Prioritizing Conditions for Outcomes Research. *Ann Emerg Med* 1999;33:423-432.
a) Goals
(1) Identify conditions/diseases with high priority in prehospital care so that outcome research could focus on these conditions
(2) Develop measures for risk adjustment and outcomes for these high priority conditions
(a) Outcomes measures
(i) Survival to discharge from hospital
(ii) Impaired physiology
(iii) Limit disability
(iv) Alleviate discomfort
(v) Satisfaction
(vi) Cost-effectiveness (patient and society)
b) Pain management is a top priority condition for adults and children
(1) Adults
(a) Minor trauma: discomfort
(b) Respiratory distress: discomfort
(c) Chest pain: discomfort
(2) Pediatrics
(a) Minor trauma: discomfort
(b) Respiratory distress: discomfort

3) Cairns CB, Garrison HG, Hedges JR, et al. Development of New Methods to Assess the Outcomes of Emergency Care. *Acad Emerg Med* 1998;5:157-161.
a) Quality of care
(1) Relief of pain/anxiety
(2) Improved functional status
(3) Satisfaction with care
(4) Appropriateness of follow-up plans
b) Costs of care
c) Quality of life

4. Collecting the correct, most accurate and meaningful data
   a. Are histories and physicals accurate in the field? The following articles study the reliability of out-of-hospital personnel's clinical assessment skills
      1) Hsieh M, Gutman M, Haliscak D. Abstract #199: Out-of-Hospital Personnel Agree Poorly with Emergency Physicians on Clinically Excluding Cervical Spinal Injury. *Acad Emerg Med* 1998;5:438.
      2) Domeier RM, Swor RA, Evans R, et al. Abstract #281: Multicenter Prospective Validation of Out-of-Hospital Clinical Spinal Clearance Criteria. *Acad Emerg Med* 1997;5:435.
      3) Kothari RU, Pancioli A, Liu T, et al. Cincinnati Prehospital Stroke Scale: Reproducibility and Validity. *Ann Emerg Med* 1999;33:373-378.
      4) Smith WS, Isaacs M, Corry MD. Accuracy of Paramedic Identification of Stroke and Transient Ischemic Attack in the Field. *Prehospital Emergency Care* 1998;2:170-175.
      * * Conclusion: Clinical assessment skills vary among the different EMS systems
   b. Inaccuracies of interval times
      1) Ornato JP, Doctor ML, Harbour LF, et al. Synchronization of Timepieces to the Atomic Clock in an Urban Emergency Medical Services System. *Ann Emerg Med* 1998;31:483-487.
         a) Random sampling of EMS timepieces immediately before, and two time intervals (1 and 4 months) after, attempted synchronization to the US atomic clock standard
         b) Before standardization there was a mean error of 2 minutes difference; 1 month after standardization there was a 0.9 min error difference; and 4 months after standardization there was a 1.7 minutes mean error difference
5. Uniform Data Collection
   a. Chamberlain D, Cummins RO, Abramson N, et al. Representing Taskforce of Representatives from the European Resuscitation Council, American Heart Association, Heart and Stroke Foundation of Canada, and Australian Resuscitation Council. Recommended Guidelines for Uniform Reporting of Data from Out-of-Hospital Cardiac Arrest: the 'Utstein style'. *Resuscitation* 1991;22:1-26.
      1) Examples of core elements:
         a) Outcome measure: survival to hospital discharge
         b) Definition of 'response intervals'
      2) Glossary of essential items for researchers
   b. Cone DC, Jaslow DS, Brabson TA. Now That We Have the Utstein Style, Are We Using It?. *Acad Emerg Med* 1999;6:923-928.
      1) 40% (41/102) of the out-of-hospital cardiac arrest research used the Utstein guidelines (uniform terms and definitions for out-of-hospital resuscitation)

2) Editorials on Cone's study
   a) Cummins RO. Commentary: Why Are Researchers and Emergency Medical Services Managers *Not* Using the Utstein Guidelines? *Acad Emerg Med* 1999;6:871-875.
      (1) Critical of EMS research
   b) Swor RA. Commentary: Out-of-Hospital Cardiac Arrest and the Utstein Style: Meeting the Customer's Needs? *Acad Emer Med* 1999;6:875-877.
      (1) Build on the Utstein criteria
      (2) Convene a "Utstein II"?
3) Zaritsky A, Nadkarni V, Hazinski MF, et al. Recommended Guidelines for Uniform Reporting of Pediatric Advanced Life Support: The Pediatric Utstein Style. *Ann Emerg Med* 1995;26: 487-503.
   a) Uniform definitions of key terms such as: cardiac and respiratory arrest, CPR, Advanced Life Support, outcomes measure (which includes discharge from hospital and functional outcome)
   b) Uniform reporting of time intervals, age groups and outcome categories

c. Human factor: very important in the out-of-hospital uniform data collection process (interest and motivation)

II. EMS SYSTEM: Well organized and adequately funded EMS systems with experienced medical directors save lives

A. OPALS

1. Stiell IG, Wells GA, Spaite DW, et al. The Ontario Prehospital Advanced Life Support (OPALS) Study: Rationale and Methodology for Cardiac Arrest Patients. *Ann Emerg Med* 1998;32:180-190.
   a. Design: before-after design of all eligible cardiac arrest patients (excludes: patients <16 years old, patients who are obviously dead, trauma victims, and non-cardiac arrests)
      1) Phase I: Observational cohort study of baseline survival status after introduction of ambulance automatic external defibrillators (AEDs) (retrospective data for the 36 months prior to phase II)
      2) Phase II: Assesses survival after implementation of rapid defibrillation (12-month period)
      3) Phase III: Assesses survival after implementation of full ACLS program: ETI, IV therapy and IV pharmacological use (36-month period)
   b. Reporting and definitions followed Utstein style guidelines

c. Outcomes Measurements
    1) Primary measurement of survival to hospital discharge
    2) Secondary measurements:
        a) Quality of life
            (1) 1 year neurological function assessment
            (2) 1 year quality of life assessment
        b) ROSC
        c) Admission to hospital
        d) Health economic analysis

2. Stiell IG, Wells GA, DeMaio VJ, et al. Modifiable Factors Associated with Improved Cardiac Arrest Survival in a Multicenter Basic Life Support/Defibrillation System: OPALS Study Phase I Results. *Ann Emerg Med* 1999;33:44-50.
    a. Observational cohort study (ambulance defibrillation not first responder defibrillation)
    b. Baseline survival status after the introduction of the AED program in the study communities and is based on retrospective data, 36 months before phase II
    c. Factors which were associated with survival (187/5335 patients)
        1) Age: OR 0.81 (95% CI: 0.73-0.89)
        2) Witnessed arrest: OR 4.05 (95% CI: 2.78-5.90)
        3) Bystander CPR: OR: 2.98 (95% CI: 2.07-4.29)
        4) Fire or police CPR: OR: 2.20 (95% CI: 1.46, 3.31)
        5) Response interval (RI) (from 911 call received to vehicle arrival at patient's side): OR: 0.76 (95% CI: 0.71-0.82).
            a) 167/187 (89%) of the surviving patients had RI < 8 minutes

3. Stiell IG, Wells GA, Field BJ, et al. Improved Out-of-Hospital Cardiac Arrest Survival Through the Inexpensive Optimization of an Existing Defibrillation Program: OPALS Study Phase II. *JAMA* 1999;281:1175-1181.
    a. Assess survival in a 12 month period after introduction of rapid defibrillation (survival: 85/1641)
    b. Improved survival to discharge from hospital: 3.9%→ 5.2% P=.03 (33% increase in survival). OR: 3.0 (95% CI: 1.8-5.1)
        1) Rapid defibrillation
            a) Call received → responder next to patient with defibrillator took </= 8 minutes in 90% of the calls
                (1) Reduction of dispatch time intervals
                (2) More efficient deployment of ambulances
                (3) Firefighters performing defibrillation
        2) Optimization of EMS response times < 8 minutes
            a) Phase I (76.6%); Phase II (92.5%) P< .001
        3) Witnessed arrest: OR: 3.9 (95% CI: 2.7-5.5)
        4) Bystander CPR: OR: 3.7 (95% CI: 2.6-5.1)
        5) Fire or police CPR: OR: 1.6 (95% CI: 1.1-2.3)

c. Economics
    1) $39,400/100,000 residents to start rapid AED program ($46,900/life saved)
    2) $2,000/100,000 residents annually for upkeep of AED program ($2,400/life saved)

4. Stiell IG, Wells GA, Spaite DW, et al. The Ontario Prehospital Advanced Life Support (OPALS) Study Part II: Rationale and Methodology for Trauma and Respiratory Distress Patients. *Ann Emerg Med* 1999;34:256-262.
    a. Objective: Assess the incremental benefit in survival to discharge from the hospital with the introduction of ALS for patients with major trauma and respiratory distress and the economic evaluation of adding the ALS programs
        1) Minimum essential elements of ALS
            a) Endotracheal intubation
            b) Intravenous therapy
            c) Administration of IV drugs
        2) Minimum ALS response criteria
            a) Critical care cases must have ALS response within 11 minutes 90% of the time
            b) Intubation success rate must exceed 90%
        3) Population (age >16 years)
            a) Trauma
                (1) Injury by any mechanism
                (2) ISS >12
                (3) Transported by land ambulance within the study communities
                (4) Entered in the Ontario Trauma Registry Comprehensive Data set
            b) Respiratory
                (1) Chief complaint of shortness of breath
                (2) Prehospital assisted ventilation
                (3) Abnormal RR >/=24 or </=10
    b. Study design: before/after, 36 months for major trauma patients and 6 months for respiratory distress compared to OPALS Phase II data

5. DeMaio VJ, Stiell IG, Wells GA, et al. Abstract #001: Optimal Defibrillation Response Intervals for Maximum Prehospital Cardiac Arrest Survival Rates. *Acad Emerg Med* 1999;6:369.
    a. Prospective cohort study (obtained from the OPALS I and II data)
    b. Plotted survival as a function of defibrillation response interval (DRI)
        1) Steep drop off in first 4 minutes of the survival curve
        2) 8 minutes target time is not supported by OPALS data as the optimum EMS DRI for cardiac arrests
        3) EMS systems should consider optimizing their 90% DRI below 8 minutes

B. Medical Direction

1. Wydro GC, Cone DC, Davidson SJ. Legislative and Regulatory Description of EMS Medical Direction: A Survey of States. *Prehospital Emergency Care* 1997;1:233-237.
    a. Tremendous variation in qualifications for physician participation in EMS medical direction at the ALS level

C. Standing and Radio Failure Orders

1. Eckstein M. Abstract #111: Implementation of Standing Field Treatment Protocols (SFTP) in Los Angeles. *Ann Emerg Med* 1998;32:S29.
    a. SFTP used in 2177 incidents
        1) Outcome data on 1450 incidents
        2) 5 cases of incorrect treatment with no adverse effect on the patient
    b. Conclusion: Standing field treatment protocols can be safely implemented in a large EMS system

D. Appropriateness of EMS Transport

1. Richards JR, Ferrall SJ. Inappropriate Use of Emergency Medical Services Transport: Comparison of Provider and Patient Perspectives. *Acad Emerg Med* 1999;6:14-20.
    a. Prospective cross-sectional study of a consecutive sample of patients arriving by ambulance
    b. Survey: 887 surveys completed
        1) 501 EMS providers felt the transport was appropriate
        2) 689 patients felt the transport was appropriate
            a) 76/198 patients who felt they had a non-emergency had alternate transportation
            b) No outcome data was collected on the patient's ultimate diagnosis or course of treatment
2. Krohmer JR. Commentary: Appropriate Emergency Medical Services Transport. *Acad Emerg Med* 1999;6:5-7.
    a. Excellent summary of the issues surrounding appropriate EMS transport
3. Foltin GL, Pon S, Tunik M, et al. Pediatric Ambulance Utilization in a Large American City: A Systems Analysis Approach. *Pediatr Emerg Care* 1998;14:254-258.
    a. 2,633 patients between the ages of birth and 18 years who arrived by ambulance to one of two hospitals (retrospective review)
        1) 214 different PANE (Pediatric Ambulance Need Evaluation) diagnoses were identified by a panel of 6 physician experts in Pediatric EMS. Each diagnosis was placed into one of three categories (ALS, BLS, LAT{less acute mode of transport})
            a) 59 required ALS
            b) 62 required BLS
            c) 93 required non-ambulance transport

            {weighted K = 0.793 for agreement among panel members}

b. Measure of external validity examined the admission rates of those patients assigned to the ALS category and compared them to the admission rates for the BLS and LAT categories
   1) 22% of all patients arriving by ambulance were admitted vs. 7% of all patients arriving by all other methods
c. 57% of all patients arriving by ambulance (ALS and BLS) were appropriate
d. 50% of the patients assigned an ALS unit by telephone triage did not need ALS according to the PANE tool
e. 197/705 (28%) patients were assigned a BLS unit by telephone triage which according to the PANE tool required an ALS unit
f. PANE tool will help identify and therefore allow improvement in the utilization of ambulances for Pediatric patients

4. Rosenberg N, Knazik S, Cohen S, et al. Use of Emergency Medical Service Transport System in Medical Patients up to 36 Months of Age. *Pediatr Emerg Care* 1998;14:191-193.
   a. 438 patients (341 medical and 97 trauma)
   b. Arbitrary criteria based on the retrospective review of Emergency Department ordering of blood work, parenteral injection, inhalation therapy or admission/transfer
   c. Acuity of patient difficult to determine

E. ALS: Does It Improve Outcomes?

1. Stratton S, Niemann JT. Effects of Adding Links to "The Chain of Survival" for Prehospital Cardiac Arrest: A Contrast in Outcomes in 1975 and 1995 at a Single Institution. *Ann Emerg Med* 1998;31:471-477.
   a. Between 1975 and 1995 the EMS system added:
      1) 911 access and dispatch
      2) Paramedic endotracheal intubation
      3) EMT AEDs
      4) Out-of-hospital standing orders
      5) Introduction of AHA ACLS algorithms
   b. No demonstrable difference in survival rate in 1975 versus 1995
   c. Unable to use Utstein style guidelines for historical control populations because the important historical determinants of outcomes were not collected
2. Kuisma M. Cardiac Arrests Witnessed by EMS Personnel in a Multitiered System: Epidemiology and Outcome. *Am J Emerg Med* 1998;16:12-16.
   a. Prospective cohort study (consecutive patients)
   b. 108 EMS witnessed arrests
      1) 94 had resuscitation efforts
      2) 15 survived to hospital discharge with only 1 poor neurological outcome
   c. Conclusion: If witnessed EMS arrest and patient survives to discharge most patients will have good neurological outcomes

3. Eisen JS, Dubinsky I. Advanced Life Support vs Basic Life Support Field Care: An Outcome Study. *Acad Emerg Med* 1998;5:592-598.
   a. Convenience cohort study (retrospective chart review)
   b. 1,494 patients met inclusion criteria (did not include major trauma patients)
   c. Compared among seven different diagnostic groups: Emergency Department length of stay (LOS), admission rate and hospital LOS between patients with similar acuity who were brought in by ALS vs. BLS
      1) Diagnostic groups: CP, ALOC, SOB, abdominal pain, MVA, falls and other
   d. No outcome differences in the metropolitan Toronto area between ALS and BLS (had AEDs) transport in this urban environment

F. Dispatch and Response Times

1. Eckstein M, Alo K. The Effect of a Quality Improvement Program on Paramedic On-Scene Times for Patients with Penetrating Trauma. *Acad Emerg Med* 1999;6:191-195.
   a. 7,103 sustained penetrating traumas over the 4 year study period
   b. Charts that had on scene time (OST) > 20 minutes were extensively reviewed and a re-education process then took place with the involved paramedics
      1) Median OST was 11 minutes for the study period
      2) First 12 months: 56/1,363 (4.1%) OST was > 20 minutes
         a) Mortality rate was 5.1% amongst these patients
      3) 1997 (last 12 months) 13/867 (1.5%) OST was > 20 minutes
         a) Mortality rate was 0.8% amongst these patients
   c. Conclusion: the QI process works for improving OST
2. Nichol G, Stiell IG, Laupacis A, et al. Abstract #139: A Cumulative Meta-Analysis of the Effectiveness of Emergency Medical Services for Sudden Cardiac Arrest. *Acad Emerg Med* 1998;5:418-419.
   a. 43 eligible studies
   b. Survival decreased as response time interval increased from 6→11 minutes
3. Demetriades D, Chan L, Cornwell E, et al. Paramedic vs. Private Transportation of Trauma Patients: Effect on Outcome. *Arch Surg* 1996;131:133-138.
   a. Retrospective review of 4,856 EMS transported patients vs. 926 non-EMS transported patients using a trauma registry. Poor data collection as only 21% of the EMS charts had recorded the time of injury.
   b. Identified problem with the EMS system. The average prehospital time was 37 minutes (does not include time of injury to 911 call) and on scene time > 20 minutes
   c. Conclusion: EMS system needs to focus on OST vs. authors' conclusion that patients with severe trauma transported by private means had a better survival rate than those transported by the EMS system.

4. Lights and Sirens
    a. Lacher ME, Bausher JC. Lights and Siren in Pediatric 911 Ambulance Transports: Are They Being Misused? *Ann Emerg Med* 1997;29:223-227.
        1) 622 ambulance call tapes reviewed
            a) 504/622 calls met criteria for inclusion
                (1) Exclusion criteria
                    (a) Unknown status of ambulance
                    (b) Inadequate communication
                    (c) Sirens not heard for the duration of the call
                (2) Lights and sirens were used in 312/504 calls
                    (a) Lights and sirens were considered inappropriate for 123/312 of the patients (patients had normal vital signs, normal mental status, no significant abnormality on physical exam. EMS personnel also felt the patient was comfortable and stable)
    b. O'Brien DJ, Price TG, Adams P. The Effectiveness of Lights and Siren Use During Ambulance Transport by Paramedics. *Prehospital Emergency Care* 1999;3:127-130.
        1) Convenience sampling of 75 ambulance runs using lights and sirens on the way to the hospital
        2) Lights and sirens shortened transport times but 95% of the time did not have any clinical benefit
        3) If paramedics are in an ambulance, there is much less need for lights and sirens in medical (non-trauma) patients, i.e., paramedics can intubate, start IV treatments, and shock
        4) Effective and safe code three transport criteria should be used
            a) Example: Kupas DF, Dula DJ, Pino BJ. Patient outcome using medical protocol to limit "lights and siren" transport. *Prehosp Disaster Med.* 1994;9:226-229.

III. OUT-OF-HOSPITAL AIRWAY MANAGEMENT

A. Basic

1. Appropriate airway management
    a. Oxygenation
    b. Suction
    c. Positioning
2. BVM
    a. Henderson DP, Gausche M, Goodrich SM, et al. Abstract #171: Education of Paramedics in Pediatric Airway Management: Effects of Different Retraining Methods on Self-Efficacy and Skill Retention. *Acad Emerg Med* 1998;5:429.
        1) Paramedics were initially trained in Pediatric Airway Management (PAM) and then retrained by 1 of 4 methods (no instruction-control, videotape, self instruction or lecture/demonstration)

2) Paramedic failure rate for PAM after retraining
   a) BVM skills = 33.4%
   b) ETI skills = 61.39%
3) PAM skill performance deteriorates significantly after 6 months
4) Paramedics who failed both BVM and ETI skill testing after retraining (>95%) reported confidence and lack of anxiety in ability to perform PAM

B. Advanced

1. Intubation (technical and cognitive skill)
   a. Gausche M, Lewis RJ, Stratton SJ, et al. Abstract #168: A Prospective Randomized Study of the Effect of Out-of-Hospital Pediatric Intubation on Patient Outcome. *Acad Emerg Med* 1998;5:428.
      1) Randomized BVM/ETI by calendar day
      2) Hospital survival
         a) BVM: 116/384 (30%)
         b) ETI: 112/430 (26%)
      3) Median scene time
         a) BVM: 8 minutes
         b) ETI: 11 minutes
      4) Complication Rate
         a) BVM: 46%
         b) ETI: 49%
      5) No improvement in outcome between ETI and BVM
   b. Lewis RJ, Gausche M, Abdi M. Abstract #169: Subgroup Analysis of Data from a Prospective Randomized Study of Out-of-Hospital Airway Management in Children Using Classic and Bayesian Techniques. *Acad Emerg Med* 1998;5:428.
      1) Data from above Gausche study
      2) No subgroup did better with ETI
   c. Sayre MR, Sakles JC, Mistler AF, et al. Field Trial of Endotracheal Intubation by Basic EMTs. *Ann Emerg Med* 1998;31:228-233.
      1) Prospective clinical trial
      2) 10 hour course over 2 weeks
      3) 66 EMT-Bs (Emergency Medical Technicians-Basic) finished ETI course (similar to 1994 EMT-B curriculum) and completed 10 mannequin intubations. They were then allowed to attempt field intubation (>15 years old)
         a) 103 patients
         b) 53 intubated by EMT-Bs
         c) EMT-Bs were unable to intubate 50 patients
            (1) 44 intubated by back-up paramedics on-scene
            (2) 6 cases not intubated
         d) Low intubation success rate

d. Bradley JS, Billows GL, Olinger ML, et al. Prehospital Oral Endotracheal Intubation by Rural Basic Emergency Medical Technicians. *Ann Emerg Med* 1998;32:26-32.
   1) Nonrandomized controlled trial using historical controls
   2) EMTs unable to achieve ETI success rates similar to paramedics
e. Larmon B, Schriger DL, Snelling R, et al. Results of a 4-Hour Endotracheal Intubation Class for EMT-Basics. *Ann Emerg Med* 1998;31:224-227.
   1) 94% success rate on mannequins
   2) 83 EMTs: 1 hour of didactic, 1 hour of demonstration, and 90 minutes of supervised practice on mannequins
f. Katz SH, Falk JL, Wash M. Abstract #170: Misplaced Endotracheal Tubes by Paramedics in an Urban Emergency Medical Services System. *Acad Emerg Med* 1998;5:429.
   1) Prospective observational study (age not defined)
   2) 27/108 patients had improper placement of ETT
      a) 18/27 in the esophagus
      b) 9/27 the tip of the ETT was lying above the level of the cords in the oropharynx

2. Rapid Sequence Intubation (RSI)
   a. Wayne MA, Friedland E. Prehospital Use of Succinylcholine: A 20 year review. *Prehospital Emergency Care* 1999:3:107-109.
      1) Retrospective case studies without control group
      2) No outcome data showing increased survival to discharge with RSI
      3) 95.5% ETI success rate
      4) Selection and recall bias
      5) Conclusion: "The prehospital use of succinylcholine is safe and effective, as adjunct for ETI, when used by trained paramedics with strong medical control."
         a) How can this data help us?
         b) Can we make any generalizations from this data?
   b. McDonald CC, Bailey B. Out-of-Hospital Use of Neuromuscular-Blocking Agents in the United States. *Prehospital Emergency Care* 1998;2:29-32.
      1) National Survey of EMS directors
      2) 29 states used out-of-hospital RSI (11 just aeromedical)
      3) Conclusion: "This trend suggests the use of paralytic drugs by paramedics is becoming standard of care in many out-of-hospital systems."
         a) How can this data help us?
         b) Can we make any generalizations from this data?

C. Alternative Methods for Failed Endotracheal Intubation or Initial Airway Management (research needed)

1. Better basic airway skills (BVM)
2. LMAs
3. Combitubes

IV. ELECTRCITY

A. Defibrillation

1. Questions:
   a. Optimum wave form: Monophasic vs. Biphasic
      1) Scheatzle MD, Menegazzi JJ, Allen TL, et al. Evaluation of Biphasic Transthoracic Defibrillation in an Animal Model of Prolonged Ventricular Fibrillation. *Acad Emerg Med* 1999;6:880-886.
         a) BDW (Biphasic Defibrillation Wave) had higher rate of ROSC in this swine model
   b. Appropriate shock energy and optimal time constant
      1) White JB, Walcott GP, Wayland JL, et al. Predicting the Relative Efficacy of Shock Waveforms for Transthoracic Defibrillation in Dogs. *Ann Emerg Med* 1999;34:309-320.
         a) Develop a model to predict the relative defibrillation efficacious of monophasic and biphasic waveforms delivered transthoracically
         b) Determine the optimal time constant for the model when applied to transthoracic defibrillation

B. Automated External Defibrillators (AEDs)

1. Auble TE, Manegazzi JJ, Paris PM. Effect of Out-of-Hospital Defibrillation by Basic Life Support Providers on Cardiac Arrest Mortality: A Metaanalysis. *Ann Emerg Med* 1995;25:642-648.
   a. BLS defibrillation can reduce the relative risk of death for out-of-hospital cardiac arrest victims in ventricular fibrillation
   b. Most of the studies have weak designs
2. Sweeney TA, Runge JW, Gibbs MA, et al. EMT Defibrillation Does Not Increase Survival from Sudden Cardiac Death in a Two-Tiered Urban-Suburban EMS System. *Ann Emerg Med* 1998;31:234-240.
   a. Prospective controlled crossover study of consecutive cardiac arrest
      1) 243 patients with bystander witnessed arrests
         a) 5/110 (4.6%) with AED survived to hospital discharge
         b) 7/133 (5.3%) without AED survived to hospital discharge
         Note: No statistical difference in survival to hospital discharge.
         Note: There was an average of 2 minutes delay in calling 911. Response times from 911 to First Responder averaged 6.2 minutes and response intervals significantly increased with the adoption of a new computerized dispatch system

   b. Conclusion: The addition of AEDs to this EMS system did not improve survival from sudden cardiac death. EMS systems must optimize bystander CPR, EMS dispatching and first responder use of AEDs to see any positive effects of adding AEDs to their system
3. Stapczynski JS, Svenson JE, Stone CK. Population Density, Automated External Defibrillator Use, and Survival in Rural Cardiac Arrest. *Acad Emerg Med* 1997;4:552-558.
   a. Retrospective observational study of 311 out-of-hospital cardiac arrests
   b. Univariate predictors to hospital discharge
      1) RI < 8 minutes
      2) Defibrillation by AED
      3) Initial rhythm: ventricular fibrillation
      4) BLS services within areas with population densities </= 100/sq mile sustain little benefit from the addition of AEDs
   c. EMS response intervals:
      1) Survivors: 4.6 +/- 2.5 minutes (19/311)
      2) Died: 7.4+/-5.3 minutes
4. Mosesso VN, Davis EA, Auble TE, et al. Use of Automated External Defibrillators by Police Officers for Treatment of Out-of-Hospital Cardiac Arrest. *Ann Emerg Med* 1998;32:200-207.
   a. Improved survival to hospital discharge
   b. 26% decrease in call to shock interval after AED placement with police

C. Public Access AEDs

1. Nichol G, Hallstrom AP, Kerber R, et al. American Heart Association Report on the Second Public Access Defibrillation Conference, April 17-19, 1997. *Circulation* 1998;97:1309-1314.
   a. Recommendations
      1) First responder curriculum for AEDs should be reviewed
      2) Inclusion of children in CPA > 8 years old should be considered for AED use
      3) Clinical trial evaluating the effectiveness, safety, and cost effectiveness of PAD (Public Access Defibrillation)
      4) Modify legislation in the US so that early defibrillation is permissible everywhere
      5) Continuous discussion about the implementation and safety of early defibrillation should occur
2. Becker L, Eisenberg M, Fahrenbruch C, et al. Public Locations of Cardiac Arrest: Implications for Public Access Defibrillation. *Circulation* 1998;97:2106-2109.
   a. Retrospective cohort study: 1130 arrests in public areas.
   b. 10 location categories with 172 sites had an annual CPA incidence > 0.03/year

1) Placement of 276 AEDs in these 172 sites would have provided treatment for 134 arrests/5 years
   a) 60% in ventricular fibrillation
   b) 10-40% survival rate
   c) Save 4-32 lives/5 years
2) Need to place AEDs in 71,000 sites to cover the other arrests

c. Placement of AEDs in public locations can be guided by the site specific incidence of arrest

V. OUT-OF-HOSPITAL CPR

A. Cobb LA, Fahrenbruch CE, Walsh TR, et al. Influence of Cardiopulmonary Resuscitation Prior to Defibrillation in Patients with Out-of-Hospital Ventricular Fibrillation. *JAMA* 1999;281:1182-1188.

1. Observational before (639) / after (478) study [adults]
2. Standard AED use versus 90 seconds CPR before AED use
3. Highest benefit of CPR prior to AED was in patients with > 4 minutes of downtime: (P=.01) OR: (1.42 95% CI: 1.07-1.90)
   a. Standard AED use: 17% survival to discharge (56/321)
   b. CPR prior to AED: 27% survival to discharge (60/220)
4. Overall survival to discharge: (P=.04)
   a. Standard AED use: 24% survival to discharge (155/639)
   b. CPR prior to AED: 30% survival to discharge (142/478)
5. Discharge with favorable neurological recovery
   a. Standard AED use: 17% survival to discharge (106/634)
   b. CPR prior to AED: 23% survival to discharge (109/474)

B. Stiell IG, Wells GA, DeMaio VJ, et al. Modifiable Factors Associated with Improved Cardiac Arrest Survival in a Multicenter Basic Life Support/Defibrillation System: OPALS Study Phase I Results. *Ann Emerg Med* 1999;33:44-50. (see II for details)

C. Stiell IG, Hebert PC, Wells, GA, et al. The Ontario Trial of Active Compression-Decompression Cardiopulmonary Resuscitation for In-Hospital and Prehospital Cardiac Arrest. *JAMA* 1996;275:1417-1423.

		501 received ACD	510 received standard CPR
1.	Prehospital patients:		
2.	1 hour survival:	18.2%	16.5%
3.	Hospital discharge:	4.6%	3.7%

Note: no significant difference in discharge from hospital between study groups

D. Plaisance P, Lurie KG, Vicaut E, et al. A Comparison of Standard Cardiopulmonary Resuscitation and Active Compression-Decompression Resuscitation For Out-of-Hospital Cardiac Arrest *N Engl J Med* 1999;341:569-575.

1. The use of a suction device to actively decompress the chest wall decreases intrathoracic pressure and thereby enhances venous blood return
2. Random (odd/even day) prospective study:

	373 received ACD	377 received standard CPR
3. Hospital Discharge: (without neuro impairment)	6%	2% [P=0.01]
4. One Year Survival:	5%	2% [P=0.03]
5. Neuro Baseline:	71% (12/17)	43% (3/7) [P=0.34]

Note: All patients who survived to one year had a witnessed arrest

VI. OUT-OF-HOSPITAL 12-LEAD EKG

A. Selker HP, Zalenski RJ, Antman EM, et al. An Evaluation of Technologies for Identifying Acute Cardiac Ischemia in the Emergency Department: A Report from a National Heart Attack Alert Program Working Group: Prehospital ECG. *Ann Emerg Med* 1997;29:20-24.

1. Emergency Department diagnostic performance: Quality of Evidence: A and accuracy: ++
2. Emergency Department clinical impact: Quality of Evidence: B and accuracy: +

B. Kass LE, Alicandro JM, Cassara G, et al. Abstract #307: On-Line Physician Interpretation of Prehospital ECGs Shortens the Time to Thrombolytic Administration. *Acad Emerg Med* 1999;6:473.

1. Prospective observational study
2. 164 patients with CP had out-of-hospital EKGs received and reviewed by online physician
   a. 25 EKGs were interpreted as an MI
   b. Hospitals notified
3. 174 patients with CP did not have EKGs received (technically could not)
4. 54.2 (EKG group) vs. 84.4 (no EKG) minutes from 911 call to thrombolytic therapy

C. Kudenchuk PJ, Maynard C, Cobb LA, et al. Utility of the Prehospital Electrocardiogram in Diagnosing Acute Coronary Syndromes: The Myocardial Infarction Triage and Intervention (MITI) Project. *J Am Coll Cardio* 1998;32:17-27

1. Out-of-hospital EKGs were obtained on 3,027 consecutive patients with a suspected MI
   a. 362 were randomized to prehospital vs. hospital thrombolytics
   b. 2,665 did not participate in the randomization

1) Serial EKGs in these patients starting with out-of-hospital EKG improved diagnostic sensitivity (80-87%) for acute coronary artery syndromes with a fall in specificity (60-50%)
2) Evolving: ST depression/elevation, T wave inversion, developing Q waves or LBBB

D. Canto JG, Rogers WJ, Bowlby LJ, et al. The Prehospital Electrocardiogram in Acute Myocardial Infarction: Is Its Full Potential Being Realized? *J Am Coll Cardio* 1997;29:498-505.

1. 3,768/66,995 patients in the National Registry of MI 2 database had a prehospital EKG
2. Retrospective data owned by Genetec
3. In-hospital mortality rate was 8% with out-of-hospital EKG and 12% without out-of-hospital EKG

VII. OUT-OF-HOSPITAL NEUROLOGICAL ASSESSMENT

A. Head Trauma

1. Winchell RJ, Hoyt DB. Endotracheal Intubation in the Field Improves Survival in Patients with Severe Head Injury. *Arch Surg* 1997;132:592-597.
   a. 1092 patients with severe head trauma GCS < 8 transported by ground ALS
      1) 36→26% decreased mortality to Emergency Department but no affect on rate of discharge home
      2) Conclusion: "Broadening indications for field intubation by paramedics has great potential to improve outcomes in patients with severe head injury."
         a) How can this data help us?
         b) Can we make any generalizations from this data?

B. C-spine Assessment in Trauma Patients

1. Cone DC, Wydro GC, Mininger CM. Current Practice in Clinical Cervical Spinal Clearance: Implications for EMS. *Prehospital Emergency Care* 1999;3:42-46.
   a. Questionnaire: 173/300 returned on Emergency Department and EMS clearance of spinal injuries
   b. Tremendous variation in c-spine clearance in practice of Emergency Medicine
2. Brown LH, Gough JE, Simonds WB. Can EMS Providers Adequately Assess Trauma Patients for Cervical Spinal Injury? *Prehospital Emergency Care* 1998;2:33-36.
   a. Prospective study: 740 patients enrolled (167 patients did not have available paired patient assessments)

b. Data form filled out in field by EMS providers (neck pain/tenderness, altered mental status, loss of consciousness, drug or alcohol use, neurological deficit and distracting injuries). Same data form filled out in Emergency Department at time of presentation by Emergency physicians.
c. 740 patients enrolled but only 573 of the patients had complete data forms
   1) The Emergency physicians would have immobilized 44 (7.7%) of the patients that would not have been immobilized by EMTs.
d. No neurological outcome data was gathered

3. Domeier RM, Swor RA, Evans R, et al. Abstract #281: Multicenter Prospective Validation of Out-of-Hospital Clinical Spinal Clearance Criteria. *Acad Emerg Med* 1997;5:435.
   a. Using prospectively defined clinical criteria, EMS personnel can identify trauma patients that do not require rigid spinal immobilization
   b. 8,975 trauma patients had a data sheet filled out by EMS personnel, 107/108 patients with a cervical spinal injury that required treatment were identified by having 1 or more of the following: altered mental status, neurological deficit, spinal pain or tenderness, evidence of intoxication, suspected long bone extremity fracture (distracting injury)
4. Meldon SW, Brant TA, Cydulka RK, et al. Out-of-Hospital Cervical Spine Clearance: Agreement Between Emergency Medical Technicians and Emergency Physicians. *The Journal of Trauma: Injury, Infection, and Critical Care* 1998;45:1058-1061
   a. Prospective observational study of consecutive blunt trauma patients transported by EMS
   b. Evaluate the level of agreement between EMT's and Emergency physicians for clinical cervical spine injury (CSI) clearance
      1) Criteria: mechanism of injury consistent with CSI, abnormal mental status, distracting injury, neck pain or tenderness, neurological deficit, neck pain with motion
   c. Overall disagreement occurred in 44/190 patients (23%)
      1) 27/190 patients were cleared by EMT-Ps but did not meet the clinical clearance criteria as determined by the Emergency physician
   d. Interrelator agreement between Emergency Physicians and EMT-Ps
      1) K=0.29 (95% CI, 0.15-0.43)
   e. Five patients had cervical spine injuries and all five were immobilized by the paramedics

C. Stroke: Recognition and Treatment are Time Critical. Can Prehospital Evaluation and/or Treatment Improve Outcomes? Are Paramedics Trained to Recognize and/or Treat These Patients?

1. Kwiatkowski TG, Libman RB, Frankel M, et al. Effects of Tissue Plasminogen Activator for Acute Ischemic Stroke at One Year. *N Engl J Med* 1999;340:1781-1787.
   a. Patients with an acute stroke who met criteria for TPA had a sustained clinical benefit at 12 months

2. Crocco TJ, Kothari RU, Sayre MR, et al. Abstract #206: A Nationwide Out-of-Hospital Stroke Survey. *Acad Emerg Med* 1998;5:440.
    a. Greater than 50% of EMS providers are unaware of the therapeutic window for thrombolysis and 25% did not recognize the need for emergent transport in acute stroke.
3. Smith WS, Isaacs M, Corry MD. Accuracy of Paramedic Identification of Stroke and Transient Ischemic Attack in the Field. *Prehospital Emergency Care* 1998;2:170-175.
    a. Retrospective review of charts over 6 months identified 96 patients
        1) 81 charts met the diagnosis of stroke or TIA by chart review
        2) Paramedics identified 49 patients with a stroke (sensitivity of 61%)
            a) 32 (39%) of the patients with a stroke were not identified
            b) 15 (19%) patients with a disease other than stroke or TIA were identified as a stroke or TIA by paramedics
    b. Patients and /or family members with a stroke or TIA waited 2.5 (+/-3.6) hours before calling 911
4. Kothari R, Hall K, Brott T, et al. Early Stroke Recognition: Developing an Out-of-Hospital NIH Stroke Scale. *Acad Emerg Med* 1997;4:986-990.
    a. Prospective observational cohort study
    b. NIH stroke scale obtained on all patients by one Emergency physician
    c. 299 patients evaluated: facial palsy, arm weakness and abnormal speech
        1) If all three items were positive there was: sensitivity = 100% and specificity = 88% for identifying patients with stroke
5. Kothari RU, Pancioli A, Liu T, et al. Cincinnati Prehospital Stroke Scale: Reproducibility and Validity. *Ann Emerg Med* 1999;33:373-378.
    a. Convenience sample of 171 patients (Emergency Department and neurology inpatients and 49 of them had a diagnosis of a stroke or TIA)
        1) Correlation in identifying patients with a stroke or TIA using the out-of-hospital NIH stroke scale
            a) Between EMS providers = 89 (95% CI=.87-.92)
            b) Between EMS providers and physicians = 92 (95% CI = .89-.93)
        2) If one out of three of the above criteria were identified as positive by the physician there was: sensitivity = 66% and specificity = 87% in identifying a stroke patient (facial droop, arm drift and speech)
    b. Limitations
        1) Population somewhat different than prehospital patient mix
        2) EMS personnel were taught how to use the scale prior to the exercise. EMS personnel only scored the findings. They did not try to elicit the findings.
        3) Not studied in the out-of-hospital environment

VIII. OUT-OF-HOSPITAL MEDICATIONS

A. IV Fluids

1. Bickell WH, Wall MJ, Pepe PE, et al. Immediate Versus Delayed Fluid Resuscitation for Hypotensive Patients with Penetrating Torso Injuries, *N Engl J Med* 1994,331:1105-1109.
   a. Prospective randomized trial of 598 patients
      1) 203/289 (70%) patients with delayed fluid resuscitation vs. 193/309 (62%) patients with immediate prehospital fluid resuscitation survived to hospital discharge (P=0.04)
      2) 56/238 (23%) of the patients who survived to post-op in the delayed resuscitation group had complications vs. 69/227 (30%) of the patients who survived to post-op in the immediate fluid resuscitation group had complications (P=0.08)
   b. Delay of aggressive fluid resuscitation until operative intervention improves outcomes for hypotensive patients with penetrating torso injuries
2. Gausche M, Tadeo RE, Zane MC, et al. Out-of-Hospital Intravenous Access: Unnecessary Procedures and Excessive Cost. *Acad Emerg Med* 1998;5:878-882.
   a. Retrospective case review (one urban hospital) of 452 patients
   b. Expert panel opinions
      1) Physicians agreed with EMS use of IVs for 166 patients
      2) 253 patients were over-treated
      3) 33 patients (majority children) were under-treated

B. Epinephrine

1. Gueugniaud P-Y, Mols P, Goldstein P, et al. A Comparison of Repeated High Doses and Repeated Standard Doses of Epinephrine for Cardiac Arrest Outside the Hospital. *N Engl J Med* 1998;339:1595-1601.
   a. 3327 patients randomly received either 5 mg or 1 mg coded ampules of epinephrine (patients received up to 3 ampules)
      1) 1677 HDE: 40.4% had ROSC, 26.5% survived to Emergency Department, 2.3% discharged from hospital
      2) 1650 SDE: 36.4% had ROSC, 23.6% survived to Emergency Department, 2.8% discharged from hospital
      3) No difference in neurological outcome in patients discharged from hospital
      4) Data also shows a poor outcome if patient's initial rhythm is asystole or 2-3 counter shocks fails to restore circulation for patients in ventricular fibrillation

2. Callaham M, Madsen CD, Barton CW, et al. A Randomized Clinical Trial of High-Dose Epinephrine and Norepinephrine vs Standard-Dose Epinephrine in Prehospital Cardiac Arrest. *JAMA* 1992;268:2667-2672.
   a. Randomized prospective double-blind: 816 patients met study criteria
   b. 1 coded identical vial contained either HDE = 15mg, HDNE = 11mg or SDE = 1mg. This vial was used when epinephrine was indicated
   c. Improved ROSC but no change in rate of hospital discharge or neurological outcome
3. Stiell IG, Hebert PC, Weitzman BN, et al. High-Dose Epinephrine in Adult Cardiac Arrest. *N Engl J Med* 1992;327:1045-1050.
   a. Randomized controlled trial comparing 7mg vs 1 mg every 5 minutes (up to 3 dosages) to cardiac arrest patients (out-of-hospital patients only received defibrillation if needed before getting to hospital)
      1) HDE (n = 317) 3% discharge from hospital
      2) SDE (n = 333) 5% discharge from hospital

C. Amiodarone

1. Kudenchuk PJ, Cobb LA, Copass MK, et al. Amiodarone for Resuscitation after Out-of-Hospital Cardiac Arrest due to Ventricular Fibrillation. *N Engl J Med* 1999;341:871-878.
   a. Prospective double-blind study using admission to hospital as the outcome measure.
   b. Inclusion criteria
      1) Adult patients having an initial rhythm of ventricular fibrillation (pulseless ventricular tachycardia) or these rhythms anytime during the course of the resuscitation
      2) 3 or more unsuccessful precordial shocks
      3) IV access
      4) Patients were intubated
      5) 1 mg of epinephrine was given prior to randomization into the placebo versus Amiodarone group (300mg IV bolus)
      6) Paramedics carried the study vials
   c. 667 patients with non-traumatic CPA met inclusion criteria and 504 patients were enrolled in the study
      1) 246 patients received Amiodarone
      2) 258 patients received placebo
      3) All patients received standard ACLS
   d. Results
      1) 44% patients who received Amiodarone survived to hospital admission
      2) 34% patients who received placebo survived to hospital admission
         P value = 0.03
      3) The trial did not have sufficient statistical power to detect difference in survival to hospital discharge

2. Chandrasekaran S. Steinberg JS. Efficacy of Bretylium Tosylate for Ventricular Tachycardia. *The American Journal of Cardiology* 1999;83:115-117.
    a. 20 consecutive patients who had inducible ventricular tachycardia in catheterization lab and treated with Bretylium (10mg/kg over 30 minutes and then 2 mg/min drip)
        1) 2 patients had to drop out of study because of severe hypotension
        2) All 18 patients after loaded with Bretylium still had inducible ventricular tachycardia
3. Wood MA, Gilligan DM, Ellenbogen KA. Acute Pharmacologic Management of Cardiac Arrhythmias: "Changing of the Guard". *Cardiology in Review* 1997;5:233-242.
    a. Review of the Amiodarone literature
    b. Amiodarone is more effective in treating destabilizing ventricular arrhythmias and has a better side-effect profile as compared to Bretylium.
4. Gonzalez ER, Kannewurf BS, Ornato JP. Intravenous Amiodarone for Ventricular Arrhythmias: Overview and Clinical Use. *Resuscitation* 1998;39:33-42
    a. Excellent review of IV Amiodarone
    b. Class III antiarrhythmic (K channel blocker)

D. Narcan

1. Wanger K, Brough L, Macmillan I, et al. Intravenous vs. Subcutaneous Naloxone for Out-of-Hospital Management of Presumed Opioid Overdose. *Acad Emerg Med* 1998;5:293-299.
    a. Prospective, sequential, observational, cohort study. 196 patients with suspected Opioid overdose comparing 0.4 mg IV [historical control (n=74)] vs. 0.8 mg SQ (n=122) for respiratory depression (RR< 10/minute)
    b. Nonrandomized and did not look at outcome at hospital discharge

E. Droperidol

1. Rosen CL, Ratliff AF, Wolfe RE, et al. The Efficacy of Intravenous Droperidol in the Prehospital Setting. *The Journal of Emergency Medicine* 1997;15:13-17.
    a. Randomized prospective double-blind study
    b. 23 patients received 5 mg Droperidol and 23 patients received saline
    c. Droperidol was an effective agent to control agitated patients in the out-of-hospital setting. There were no significant side effects noted.

F. Thrombolytics

1. Weaver WD, Cerqueira M, Hallstrom AP, et al. Prehospital-Initiated vs Hospital-Initiated Thrombolytic Therapy: the Myocardial Infarction Triage and Intervention Trial. *JAMA* 1993;270:1211-1216.
    a. 360 patients met thrombolytic criteria and were randomly given Alteplase either in the field or the Emergency Department

1) All information, including EKG, transmitted to Emergency physician before randomization
   b. No improvement in outcome with out-of-hospital thrombolytics
   c. In-hospital thrombolytic patients that were identified by paramedics had a door-to-needle time reduced from 60 minutes to 20 minutes
   d. Treatment within 70 minutes decreased infarct size (may be role for thrombolytics in rural environment with long transport times)
2. European Myocardial Infarction Project (EMIP) Group. Prehospital Thrombolytic Therapy in Patients with Suspected Acute Myocardial Infarction. *N Engl J Med* 1993;329:383-389.
   a. 5,469 patients randomly to receive anistreplase in field (2750) or Emergency Department (2719)
   b. All mobile emergency units had a physician on duty in the ambulance
   c. Patients in field received thrombolytics 55 minutes earlier
   d. No significant reduction in 30 day mortality (9.7% prehospital vs 11.1% Emergency Department administration)
3. Brouwer MA, Martin JS, Maynard C, et al. Influence of Early Prehospital Thrombolysis on Mortality and Event-Free Survival (The Myocardial Infarction Triage and Intervention [MITI] Randomized Trial). *Am J Cardiol* 1996;78:497-502
   a. 360 patients met criteria for prehospital (175) or hospital thrombolysis (185)
   b. Thrombolysis (TPA) administered 336 patients (24 patients did not receive thrombolytics after being randomized)
      1) Followed for 34 months (+/- 16 months)
      2) 82/336 had thrombolysis in 70 minutes or less from onset of symptoms
   c. No significant difference in long term survival (2 years) associated with TPA treatment occurring within 70 minutes of onset of symptoms

IX. EMS-CHILDREN

A. Gausche M, Lewis RJ, Stratton SJ, et al. Abstract #168: A Prospective Randomized Study of the Effect of Out-of-Hospital Pediatric Intubation on Patient Outcome. *Acad Emerg Med* 1998;5:428. (see III for details)

B. Lewis RJ, Gausche M, Abdi M. Abstract #169: Subgroup Analysis of Data from a Prospective Randomized Study of Out-of-Hospital Airway Management in Children Using Classic and Bayesian Techniques. *Acad Emerg Med* 1998;5:428. (see III for details)

C. Henderson DP, Gausche M, Goodrich SM, et al. Abstract #171: Education of Paramedics in Pediatric Airway Management: Effects of Different Retraining Methods on Self-Efficacy and Skill Retention. *Acad Emerg Med* 1998;5:429. (see III for details)

D. Brownstein D, Shugerman R, Cummings P, et al. Prehospital Endotracheal Intubation of Children by Paramedics. *Ann Emerg Med* 1996;28:34-39.

1. Retrospective review of 654 children intubated (15 years and under)
    a. Only able to match prehospital and hospital records in 355/654 patients
        1) No data on failed intubations
        2) 22.6% of the 355 patients had a complication from intubation
    b. Out-of-hospital use of Succinylcholine occurred in 47% (167/355) of the patients who had a hospital and prehospital record located
    c. *Author concludes pediatric intubation in prehospital care improved outcomes and paramedics should be allowed to apply liberal indications for pediatric intubation and should be able to use Succinylcholine for intubations*
        a) How can this data help us?
        b) Can we make any generalizations from this data?

E. Murdock TC, Knapp JF, Dowd DD, et al. Bridging the Emergency Medical Services for Children Information Gap. *Arch Pediatr Adolesc Med* 1999;153:281-285.

1. 7,296 Pediatric EMS transports reviewed (<15 years)
2. Kansas children using EMS are more likely to be infants, from low-income zip code areas, and are Medicaid or uninsured patients.
3. Questions: Is increased usage secondary to greater incidence and severity of illness/injury vs. lack of transport or lack of education? Are there other factors involved?

F. Gausche M, Henderson DP, Brownstein D, et al. The Education of Out-of-Hospital Emergency Medical Personnel in Pediatrics: Report of a National Task Force. *Prehospital Emergency Care* 1998;2:56-61.

1. Objectives
    a. List major topics (i.e., patient assessment) and essential skills (i.e., airway management) for inclusion in Pediatric curriculum for out-of hospital providers
    b. Identify areas of controversy in education and clarify terminology (i.e., scope of practice for pediatric airway management and need for vascular access)
    c. Define the methodology optimal for the development of a Pediatric curriculum for paramedics
        1) Assessment focused curriculum
        2) Treatment based on physiological status (ABCs) vs. specific diagnosis
    d. Outline continuing education guidelines in Pediatrics for paramedics
        1) Study retention of assessment and patient management skills
        2) Recommended annual review of assessment and technical skills

2. Curricula reviewed
    a. Pediatric Airway Course
    b. National Standard Curriculum/EMT-Paramedic
    c. Pediatric Education for Paramedics (PEP) course
    d. Teaching Resource for Instructors in Prehospital Pediatrics (TRIPP)

G. Kumar VR, Bachman DT, Kiskaddon RT. Children and Adults in Cardiopulmonary Arrest: Are Advanced Life Support Guidelines Followed in the Prehospital Setting? *Ann Emerg Med* 1997;29:743-747.

1. Retrospective cross-sectional cohort design of patients in CPA transported to the Emergency Department
    a. Children n = 47 (children aged 2 days to 15 years)
    b. Adults n = 94 (16-95 years)
2. Results
    a. 100% BLS for children and adults
    b. Cardiac Monitoring: 42/47 (89%) children vs.100% adults
    c. ETI: 26/47 (55%) children vs. 87/94 (93%) adults
        1) 13/21 (62%) of the not intubated children were failed attempts
        2) 6/7 (86%) of the not intubated adults were failed attempts
    d. IV access: 18/47 (38%) children vs. 78/94 (83%) adults
    e. Epinephrine: 30 children and 91 adults had an IV and/or ETT
        1) 12/30 (40%) children were not given epinephrine
        2) 6/91 (7%) adults were not given epinephrine
3. Scene time
    a. Children: 7.4 minutes (1-28 minutes)
    b. Adults: 22.6 minutes (3-45 minutes)
4. Why a difference?
    a. TRAINING
    b. INFREQUENCY of Pediatric CPA

H. Seidel JS, Henderson D, Tittle S, et al. Priorities for Research in Emergency Medical Services for Children: Results of a Consensus Conference. *Ann Emerg Med* 1999;33;206-210.

1. Consensus data
2. Priority topics for a research agenda in EMS-C (top 6)
    a. Management of major clinical entities (shock, respiratory distress, brain injury, multiple organ trauma, seizures, poisoning etc.)
    b. Develop outcome measures
    c. Injury prevention
    d. Develop medical informatics for EMS
    e. Develop effective QA process for EMS care and EMS systems
    f. Physical and emotional pain prevention and relief

I. Young KD, Seidel JS. Pediatric Cardiopulmonary Resuscitation: A Collective Review. *Ann Emerg Med* 1999;33:195-205.

1. Metaanalysis impossible
   a. Studies did not use Utstein criteria
   b. No outcome endpoints
   c. Most of the literature was case studies
2. Observations noted
   a. Children < 12 months old account for half the cardiac arrests (survival rate 6%)
   b. Overall out-of-hospital cardiac arrest survival rate: 8.4%
   c. Poor outcome if patient requires multiple dosages of Epinephrine and/or CPR > 30 minutes
   d. Out-of-hospital witnessed arrest and bystander CPR have higher survival rates
   e. Pure respiratory arrests have much better survival rate than cardiac arrests

J. Zaritsky A, Nadkarni V, Hazinski MF, et al. Recommended Guidelines for Uniform Reporting of Pediatric Advanced Life Support: The Pediatric Utstein Style. *Ann Emerg Med* 1995;26: 487-503. (see I for details)

K. Sirbaugh PE, Pepe PE, Shook JE, et al. A Prospective, Population-Based Study of the Demographics, Epidemiology, Management, and Outcome of Out-of-Hospital Pediatric Cardiopulmonary Arrest. *Ann Emerg Med* 1999;33:174-184.

1. Prospective population based study of all children < /=17 years in CPA (apneic and pulseless)
   a. 300 patients
      1) 213 non-injury (15 patients had pre-existing illness)
      2) 87 injury or submersion
      3) 54% < 12months old
      4) 60% of the CPA occurred at home
2. Males and Blacks are at a significantly higher risk of cardiac arrest in childhood
3. Family members infrequently perform CPR on children. 31/181 (17%) arrests which occurred at home had CPR initiated by family members
4. 33/300 (11%) had ROSC (22-noninjury and 11 submersion or injury)
   a. On scene ROSC was 100% associated with survival
   b. 85/300 patients had arrest intervals documented
      1) ROSC (n=11) had 8 minute median time
      2) No ROSC (n=74) had 10 minute median time

5. Survival to discharge from hospital was 6/300 (2%) and 5 of the 6 survivors had significant neurological sequelae
   a. 100% patients had on scene definitive airway management
   b. 0% patients received any pharmacological intervention (including epinephrine)
   c. 5/6 children had only CPR and intubation
   d. 1/6 children had CPR, intubation and defibrillation
   e. 100% patients had on scene ROSC

L. Committee on Pediatric Equipment and Supplies for Emergency Departments, National Emergency Medical Services for Children Resource Alliance. Guidelines for Pediatric Equipment and Supplies for Emergency Departments. *Pediatric Emergency Care* 1998;14:62-64.

M. National Association of EMS Physicians. NAEMSP Model Pediatric Protocols 1999.

X. OUT-OF-HOSPITAL TRAUMA ASSESSMENT

A. Committee on Trauma: American College of Surgeons. Resources For Optimal Care of The Injured Patient: 1999. Chapter 3: Prehospital Trauma Care. Chicago: American College of Surgeons, 1998, pp. 13-17.

B. Minimal Ambulance Equipment and Supplies
1. ACEP and ACS-COT are drafting a combined document

C. O'Connor RE, Domeier RM. An Evaluation of the Pneumatic Anti-Shock Garment (PASG) in Various Clinical Settings. *Prehospital Emergency Care* 1997;1:36-44.
1. Review article on PASGs

D. Bickell WH, Wall MJ, Pepe PE, et al. Immediate Versus Delayed Fluid Resuscitation for Hypotensive Patients with Penetrating Torso Injuries, *N Engl J Med* 1994,331:1105-1109. (see VIII for details)

E. Winchell RJ, Hoyt DB. Endotracheal Intubation in the Field Improves Survival in Patients with Severe Head Injury. *Arch Surg* 1997;132:592-597. (see III for details)

F. Frankel H, Rozycki G, Champion H, et al. The Use of TRISS Methodology to Validate Prehospital Intubation by Urban EMS Providers. *Am J Emerg Med* 1997;15:630-632.

G. Champion HR, Copes WS, Sacco WJ, et al. The Major Trauma Outcome Study: Establishing National Norms for Trauma Care. *The Journal of Trauma* 1990;30:1356-1365.

XI. TERMINATING OUT-OF-HOSPITAL ALS

A. Levine RL, Wayne MA, Miller CC. End-Tidal Carbon Dioxide and Outcome of Out-of-Hospital Cardiac Arrest. *N Engl J Med* 1997;337:301-306.

1. Prospective observational study: 150 consecutive patients (>/= 18 years) with electrical activity but no pulse (primary cardiac arrests)
2. Patients intubated and ALS for 20 minutes
   a. ROSC in 35 patients (all within 20 minutes of ALS)
      1) 19 died in hospital
      2) 16 discharged from hospital
         a) 14 alive at 6 weeks (one patient with significant neurological deficit)
3. An end tidal CO_2 of 10 mmHg or less measured after 20 minutes of ALS accurately predicts death in these patients (authors suggest a conservative approach using less than 7 mmHg to terminate an out-of-hospital code after 20 minutes of ALS)
4. Does an end tidal CO_2 of 10 hg or less predict a poor outcome or do resuscitations efforts > 20 minutes predict a poor outcome?

B. Bonnin MJ, Pepe PE, Kimball KT, et al. Distinct Criteria for Termination of Resuscitation in the Out-of-Hospital Setting. *JAMA* 1993;270:1457-1462.

1. 1322 consecutive cases of unmonitored out-of-hospital primary cardiac arrests
2. Normothermic adults
3. All survivors achieved a sustained 5 minute ROSC within 25 minutes of paramedic arrival

XII. EMS AND PUBLIC HEALTH

A. Pirrallo RG, Rubin JM, Murawsky GA. The Potential Benefit of a Home Fire Safety Intervention during Emergency Medical Services Calls. *Acad Emerg Med* 1998;5:220-224.

1. Retrospective review, consecutive, case series of Milwaukee Fire Department alarm responses in 1994
2. 169 households had more than one EMS call, subsequent structural fire and a complete data sheet filled out (including economic losses)
   a. 80/169 (47%) households had a smoke detector present
      1) 29/169 (17%) households had a functioning smoke detector
      2) In 1994, there were losses totaling $1,963,020 and 32 injuries from these 169 house fires
   b. Are there missed opportunities for home fire safety intervention?

XIII. MINIMALLY CHARTED EMS RESEARCH AREAS

A. Special Needs for the Elderly

1. Nationally the elderly population account for 20% of all Emergency Department visits and 43% of all acute hospital admits. How do we ensure appropriate EMS service to this rapidly expanding group?

B. Alternative Destination / Transportation

1. Alternative Destinations. *EMS Insider* August 1999, p. 7.
   a. Non peer reviewed data from Kings County, Washington
2. Appleby J. Cover Story: Kaiser Plan Widely Watched. *USA Today*, August 24, 1999.
   a. Kaiser / AMR Pathways program

C. No Transport

1. Mechem CC, Kreshak AA, Barger J, et al. The Short-term Outcome of Hypoglycemic Diabetic Patients Who Refuse Ambulance Transport after Out-of-Hospital Therapy. *Acad Emerg Med* 1998;5:768-772.
   a. Prospective descriptive study: 132 (lost 29 patients to follow-up)
   b. Not all eligible patients enrolled
   c. Excluded patients on oral hyperglycemic medicines
   d. 9% recurrence rate of hypoglycemia in contacted patients
      1) 3 patients subsequently hospitalized (1/3 of the hospitalized patients died of hypoglycemia)
2. Hunt JD, Gratton MC, Campbell JP. Abstract # 230: Prospective Determination of Medical Necessity for Ambulance Transport by On-scene Paramedics. *Acad Emerg Med* 1999;6:447
   a. Paramedics and Emergency physicians agree that a significant number of patients do not require transport.
   b. The agreement between paramedics and physicians on which patients did not need transport was only 76.2% (kappa=0.42) based on the medics filling out a data sheet in the field and the Emergency physicians filling it out upon presentation in Emergency Department (patients need for prehospital intervention, need for expedient transport, potential for self harm, severe pain and other)
3. Mechem CC, Barger J, Shofer FS, et al. Abstract #311: Short-term Outcome of Seizure Patients Who Refuse Transport After Prehospital Stabilization. *Acad Emerg Med* 1999;6:474-475.
   a. Prospective observational cohort study of patients with known seizure disorders who returned to baseline mental status after a seizure and refused transport to the hospital by EMS
   b. 63 patients enrolled
      1) 52 (82.5%) were reached for follow up
      2) 3 patients had another seizure within 72 hours
      3) No deaths or serious complications
      4) One patient was subsequently admitted to the hospital

4. Jaslow D, Barbera JA, Johnson E, et al. EMS-Initiated Refusal and Alternative Methods of Transport. *Prehospital Emergency Care* 1998;2:18-22.
    a. EMS systems in the 200 largest cities in United States telephoned and surveyed on EMS-initiated refusal policies
        1) 34/200 (17 %) of the systems have written protocols that allow the EMS providers to refuse transport with patients who have minor illnesses or injuries
            a) 21/34 (62%) do not require on-line physician approval
            b) 7/34 (21%) of those that allow refusal have a formalized alternate transportation program in place
            c) Only 9/34 (26%) of these agencies perform 100% chart reviews on the patients who were not transported
            d) No information on "no transport" patient outcomes

D. Critical Care Transport

1. Selevan JS, Fields WW, Chen W, et al. Critical Care Transport: Outcome Evaluation After Interfacility Transfer and Hospitalization. *Ann Emerg Med* 1999;33:33-43.
    a. Retrospective review of 3298 patients with cardiac problems transferred from out-of-plan hospital to Kaiser Hospital and compared outcomes with 3298 patients admitted directly to Kaiser with cardiac problems
    b. Hospital Mortality rate: 3.4% of transported patients and 3.3% of control patients
    c. Results: Appropriate patient selection, pre-transfer stabilization equipment and personnel allowed transfer of these patients without adverse impact on clinical outcomes
    d. Need a prospective study to validate criteria used to select which patients can be safely transferred, and better definitions of high risk patients

E. Effect of Managed Care on EMS

1. Koenig KL, Salvucci AA, Zachariah BS, et al. Position Paper: EMS Systems and Managed Care Integration. *Prehospital Emergency Care* 1998;2;67-69.
    a. NAEMSP position paper
2. ACEP's Safety Net Report
    a. Brennan JA, for the EMS Committee, American College of Emergency Physicians (ACEP). "The Safety Net and Emergency Medical Services," Defending America's Safety Net. Dallas: ACEP, 1999, pp. 23-24.

F. Number of ALS personnel needed on an ALS vehicle

1. American College of Emergency Physicians. Policy Statement: Medical Direction for Staffing of Ambulances. *Ann Emerg Med* 1999;34:421-422.

G. Disaster Medicine

1. Hogan DE, Waeckerle JF, Dire DJ, et al. Emergency Department Impact of the Oklahoma City Terrorist Bombing. *Ann Emerg Med* 1999;34:160-167.
   a. Epidemiological study, retrospective review
   b. 33% (90/272) patients who came to the hospital by EMS and these had a higher admission rate (64.4% vs. 5.8%; P<0.0001)
   c. Spinal immobilization, field dressings and IV treatment were the most common EMS treatments
2. Garshnek V, Burkle FM. Telecommunications Systems in Support of Disaster Medicine: Applications of Basic Information Pathways. *Ann Emerg Med* 1999;34:213-218.
   a. Use of telemedicine for disaster relief and humanitarian assistance
3. American College of Emergency Physicians. Policy Statement: Support for National Disaster Medical System. *Ann Emerg Med* 1999;34:422.

H. Biological, Chemical and Nuclear Disasters

1. Keim M, Kaufmann AF. Principles for Emergency Response to Bioterrorism. *Ann Emerg Med* 1999;34:177-182.
   a. Educating emergency responders on the current CDC Guidelines for isolation precautions in hospitals seems appropriate for the level of risks involved with aerosolized biological threat agents
2. Richards CF, Burstein JL, Waeckerle JF, et al. Emergency Physicians and Biological Terrorism. *Ann Emerg Med* 1999;34:183-190.
   a. Reviews planning and response issues central to a potential bioterrorism event
3. Brennan RJ, Waeckerle JF, Sharp TW, et al. Chemical Warfare Agents: Emergency Medical and Emergency Public Health Issues. *Ann Emerg Med* 1999;34:191-204.
   a. Overview of the risks of chemical warfare agents to the civilian population
   b. Discusses the emergency medical and emergency public health issues related to preparedness and response

XIV. SUMMARY

A. EMS Research

1. May not be able to logistically do a RCT in the field
2. Cannot transfer hospital data to out-of-hospital usage
3. The strength of a study's findings is based on the methodology of the study

B. Established Positive Effect on Patient Outcomes

1. EMS system
2. CPR
3. Defibrillation
4. Airway management

C. There is a unique body of information and skills required to oversee, improve and advance an EMS System.

D. Well organized and adequately funded EMS systems with experienced medical directors save lives.

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