Burn Injury and Burn Mass Casualty Incidents
Overview and the Importance of EMS and the Community Hospital

Randy D. Kearns
DHA MSA FACHE FRSPH CEM
Assistant Professor for Healthcare Management
College of Business Administration
University of New Orleans

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Introduction

Area of research

◦ Surge Capacity – focused on Burn Care, Role of EMS and Community Hospital

Background

◦ EMS, Paramedic Instructor, Retired Asst Professor School of Medicine at the University of North Carolina

Author (17 articles past 6 years including Dr. Jeff Carter, Burn Center Medical Director UMCNO)

◦ Annals of Burns and Fire Disasters (1 Published)
◦ EMS World (5 Published)
◦ Burns (1 Published)
◦ Journal of Burn Care and Research (4 Published)
◦ Prehospital and Disaster Medicine (1 Published)
◦ Southern Medical Journal (3 Published)
◦ Biosecurity and Bioterrorism (1 Published)
◦ American Journal of Disaster Medicine (1 Published)
Key Components

**History or Potential Disasters with a Thermal Component** – prior events, what lessons have been learned, what is applicable, and what has been retained

**Planning** – includes general planning considerations for both burn center and local EMS and hospitals
  - **Surge Planning** – important for both the burn center and local hospitals

**Education** – basic burn education, hospitals and EMS

**Transportation Resources** – distribution and redistribution of patients

**Finance** – how do you pay for a burn disaster
Quick Patient Review

Five patients
What would you do?

Airway
Breathing
  ◦ Oxygen
Circulation
  ◦ Fluid Resuscitation
Secondary Survey
Pain Management
Burn Center
Patient Two
Patient Three
Patient Four
Patient Five
What will you do?

Your scene is one of those patients?
Your scene is all of those patients?
Your scene includes 20 more patients?
The Role of EMS and the Community Hospital is Vital

9-1-1 Caller

So, that’s where we start.
### Why Burn?

**Burn** — is a time sensitive injury/illness

**Small** — but manageable patient population

**Data quality** — small, easier troubleshoot, better to understand gaps and anomalies

**Scalability** — lessons learned have applicability in other specialties

**Limited Supply of Critical Facilities**

◦ *How limited you ask?*
Limited Supply of Critical Facilities

- Change over the past six years (x)

131 Burn Centers (+8 or 15.4%) 123 (4 Burn Centers Louisiana)

- 5534 Hospitals (-71 or 1.24%) (5795 in 2012)

- 2000 Burn Beds
  - 894,574 Staffed Beds (-49,703 or 5.26%) (944,277 in 2012)

327,550,750 US Population (+4.34%) (313,914,040)
What is a Burn Disaster?

- **Type III Burn Disaster – Burn Care System Impact**
  - Isolated burn disaster such as the Station or Kiss Night Club Fires
  - Impact: Burn Care System

- **Type II Burn Disaster – Healthcare System Impact**
  - Multiple aspect disaster, such as an explosion with significant numbers of traumatic as well as burn injured patients such as the 2013 Boston, 2005 London or 2004 Madrid Bombings
  - Impact: Healthcare System

**Type I Burn Disaster – Infrastructure Impact**
- Catastrophic/wide spread event, multi-state such as 9/11 attacks or Earthquakes such as Northridge, Loma Prieta, Haiti*
- Impact: Critical Infrastructure
Disaster plans should reflect an extension of daily activities.

Planning from the burn center perspective should reflect (minimally) three levels:

**Local:** Intrafacility (your hospital/system)

**State:** Interfacility/intrastate (burn and trauma centers) (state ESF-8)

**Regional:** Interstate (burn and trauma centers) NDMS or EMAC through state ESF-8
Governmental Planning

Planning from the governmental perspective should reflect:

Local: First Responder (EMS system)

First Receiver(s) (local hospital[s])

State: Mutual Aid EMS, Intrastate regional response teams,

burn and trauma centers

Regional: Interstate Burn Centers, Regional or

Federal Response Teams through

EMAC or NDMS
Three Windows in Time, in a Burn Disaster

**Immediate**: best you can with what you have and know who to call for what you need (also referred to as a No-notice Event)

**6-120 hrs**: leaning forward with response teams, transport agencies, and push packs of equipment *(surge management)*: staff, space, stuff)

**>72-120 hrs**: high census but normal operation
Burn Centers in Louisiana

- Burn Center, Co-Located with a Level I Trauma Center
- Designated Burn Center
Threat of Fire

Case study on Fire in a small space with limited fire protection

National Institute of Standards and Technology (NIST) Simulation
The Value of Modeling:
- Test multiple hypotheses
- Inject variability
- Increased frequency of exercise

Three Types of Simulation
- Discrete Event
- Continuous

Monte Carlo

Plan Fatigue/Failure
- Plan vs. Framework
Methods

Descriptive analysis
- Self designated and self reported bed capacity
- Burn Center Surge capacity (50% above stated capacity)
- Trauma Center static capacity (temporary)

Monte Carlo Simulation (North Carolina Jaycee Burn Center 2009-10 to determine a distribution curve)
- Reported Staffed Capacity – Avg. Daily Census = Bed Availability
- Randomly perform 10,000 iterations using @Risk
Findings and Regional Applications

Confirmed Trigger points for planning tools
Activation points for transportation assets/resources
Better understanding of capacities and capabilities
6:5:6 Trigger to activate Plan
20-60 patients = Intrastate Plan Failure

425-450 patients = Interstate Plan Failure (Regional)
All Disasters are Local!
Key Steps at the Scene:

- Sufficient Resources
  - to the scene to care for and move patients to appropriate destinations
- Upstream notification
  - Receiving hospitals
  - Mutual aid ground/air ambulances

- Depending on your Destination and Triage plan will depend on your initial destination
Education (Past Experience)

Burn Prevention
  ◦ Elementary Schools (16,033 Students)

Statewide Protocols
  ◦ Common Approach to Care

Local Delivery Burn Care Core Concepts
  ◦ Courses offered (154 courses)

Local and Regional Delivery, Advanced Burn Life Support
  ◦ Courses offered (93 courses)
(Past Experience Statewide)
THERMAL BURN CARE: A Review of BEST PRACTICES

One of the greatest challenges in burn care is the initial management of burn-injured patients. There are several unique aspects that must be considered when managing this population. This article will address the basics of thermal burn injury and address the role of prehospital providers in initial management of these patients.

Burn injury involves the largest organ, the skin. The skin protects the body from injury, and dysfunction can result in systemic effects. There are over 400,000 burn injuries each year in the United States. According to the American Hospital Association (AHA), there were 5,275 hospitals in the U.S. in 2011 with 94,277 staffed beds. With 123 staffed burn centers reporting 1,395 beds collectively, this yields a ratio of approximately one burn center for every 700 hospitals and one bed for every 490 beds. Burn injuries are relatively rare, and there are very few locations where burns can be effectively managed. Regardless of prevalence, it is essential that patients with thermal injuries be managed in dedicated burn centers and not in the emergency departments which are not designed for the needs of these patients.
EMS World
Blast

May 2013
CHEMICAL BURN CARE:
A Review of
Best Practices

Chemical burns are
produced when the skin is
exposed to corrosive
materials, such as
an acidic or alkaline
substance. Exposure to a
variety of common
substances can lead to an
injury; this article will
cover several
of the more common
dangerous substances
that cause risks to the
patient.

Corrosive substances
that cause injury
to the skin can range from
non-corrosive-based sprays sold
by some companies to
commonly available
chemicals found in
household, industrial
settings and construction work sites.

The critical aspect to always consider when
responding to a patient with a known or
suspected chemical burn is the risk of
exposure to the responder by the
same causative agent.

While burns are the most common
injuries associated with
burns, other chemical
burns are caused by
injuries to the
systemic levels of the
body. These burns can
cause systemic
problems and
result in
life-threatening
conditions.

Assessment and Fringe
The first steps of the assessment are
to identify ongoing injury and determine
the extent of exposure. These steps can
be simplified to: flush and cover the
area. If appropriate, clothing is
edgeworn to the
injury site; flush the site with
water; wetting the clothing will
insulate the burn from the
water.
Electrical injury can produce unique and challenging scenarios, as well as a risk to responders.

Electrical injuries are sometimes less obvious than they appear. Injuries can range from mild to severe and electrical injuries can be caused by direct contact with an electrical source or by coming into contact with an electrical arc. In some cases, the electrical injury can result in burns, which can be classified as superficial, deep, or full thickness. Full thickness burns are the most severe and can result in tissue damage and scarring.

Responding to an Electrical Accident

If an electrical accident occurs, it is important to understand the potential risks associated with electrical injuries. Responders should be trained to handle electrical accidents and should be equipped with the appropriate personal protective equipment (PPE). PPE should include insulated gloves, boots, and clothing. Responders should also be trained in first aid and CPR, as well as in the management of electrical burns. In addition, responders should be aware of the potential hazards associated with electrical systems and should be prepared to handle these situations.

In conclusion, electrical injuries can be a significant risk to responders and communities alike. It is important to be trained and prepared to handle these situations and to ensure the safety of all involved.
Radiation Injury, Burns and Illness: A Review of Best Practices

Your approach should include identifying sources, determining exposure and managing resources.

By Randy D. Keams, DMA, MSA, NRP (ret.), Steve Sugarman, MS, CHD, CHCM, Charles B. Cahms, MD, FACEP, FAHA, James H. Holman IV, MD, FACEP, Bruce A. Cahms, MD, FACEP, & Preston B. Rich, MD, MBA, FACEP

Injuries involving radiation sources and radioactive materials are serious. When they do occur, they can be catastrophic for the patient and those who come in contact with the patient. This work will focus on radiation-related injuries as well as thermal burns produced by nuclear reactions. It will also address radiation injuries in the workplace and injury characteristics.

What is Radiation?

Ordinarily unstable atomic structures are termed radiation due to their natural tendency to release excess energy or matter to attain states of greater molecular stability. These emissions are called ionizing radiation. Radiation is emitted from its source and subsequently travels through substance, space or a combination of the two.

There are two classifications of radiation: ionizing and nonionizing. When ionizing radiation passes through a substance, it ionizes and ionizing radiation poses a larger risk. There are four sub-classifications of ionizing radiation (see Figure 2). Radiative forms of elements are called radionuclides. There are more than 100 radionuclides found naturally in the environment, while others are human-produced. Radionuclides are commonly grouped into three categories. Although quantitatively the smallest category, the human-produced sources will be the focus of this work due to their significant contribution to radiation-associated injury.

The term irradiation, often referred to as exposure, is used to describe the situation where the human body is subjected to penetrant radiation emitted from radioactive materials or a radiation-generating device. Contamination occurs when radioactive materials are deposited on body surfaces such as skin. This condition is specifically referred to as external contamination. If radioactive materials enter the body (e.g., through inhalation, ingestion, absorption or direct entry via wounds), internal contamination occurs. Exposure to radioactive materials is not an absolute indication that an individual was also contaminated. For contamination to occur, the material must be physically present on or in the body. This is an important consideration because the risk of contamination determines the need for personal protective equipment. The presence of contamination and identity of the contaminating material should be determined as soon as feasible and prior to patient transport. However, following medical care should not be delayed solely because of contamination concerns. Nonscintillating radionuclides are widely used and can include common sources of daily exposure such as cell phones and microwave ovens (Figure 2). These types of radiation, as well as others, are

A New Symbol!

In February 2007, the United Nations International Atomic Energy Commission introduced an international symbol to augment the Federal Geographic Information System layers of radiation hazards. The new symbol (with a red background) was created to help reduce accidental exposure to large radioactive sources. It is not to be used under normal use, but only if one attempts to disassemble a device that is a source of dangerous radiation, it is not to be located on building access doors, transportation packages, or containers.

Figure 5: Universal symbols for radiation
EMS World

Pending Articles and update previous articles
Key Considerations

- Know your limits, when do you need mutual aid and who do you call?
- Does the Burn Center have an “Always Open” philosophy?
- What are your regional or State Agency involvement?
Surge Capacity Definition:

Surge Capacity (and Capability) includes the
- Staff
- Space
- Stuff (Supplies, Pharmaceuticals & Equipment) (Special)

required to meet the needs of the patients.

The most important contributing factor outside of S3 is medical transportation resources.
Surge Equilibrium: all competing influences of the disaster are balanced at the point of where the patients are being managed, disaster scene or at the hospital.
Transportation Resources

Civilian
- Ambulances
- Ambulance Strike Teams
- AmBuses Units
- SCT/CCT Units
- Helicopters
- Fixed Wing

Governmental or Military
- National Guard vs. Reserves or Regular Air Force
- Coast Guard, Forest Service, Park Service
Conclusions

Plans – Relationships
  ◦ Local, State, Regional

Who to call and what can you bring?
  ◦ Staff, Space, Stuff – Transport resources

Plans – Scalability, Trigger Points, Activity, Failure

All disasters are local, so are all solutions

Education is a game changer
Thanks...Questions?

Randy D. Kearns, DHA
rkearns@uno.edu

Jeffrey E. Carter, MD FACS
jeffrey.carter@lcmchealth.org
Resources – Publications
PubMed: Kearns R

12. Kearns RD. Burn surge capacity in the south: What is the capacity of burn centers within the American Burn Association Southern Region to absorb significant numbers of burn injured patients during a medical disaster? 2011.