

EMSC Connects

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September 2016

Emergency Medical Services for Children Utah Bureau of EMS and Preparedness

Special points of interest:

- Utah Preparedness
- Anatomy of blast injury
- Burn management of blast injury

Inside this issue:

Pedi Points	2
From the Field	2
Expert Input	4
Happenings	5
News From National	5
Calendar	6
The Last Word	7

A Word From Our Program Manager

A few weeks ago, I spontaneously hopped in the car and took family for a drive along the Mirror Lake highway. It was a clear, bright sunny day and at least 10 degrees cooler than our record setting July and August days along the Wasatch Front. Though the wild flowers were scarce along the drive, Lily Lake and the pond next to the campground, surpassed my expectations with massive amounts of lily pads in bloom. The Upper Provo River falls was exceptionally picturesque, which was the backdrop for a recently engaged couple. However, many, many other people had the same idea to escape the heat and enjoy the beauty in this area of our state. Since there was no place to park by the many lakes in this area, we headed down the mountain.



Off in the distance I could see some smoke. Apparently, there is a fire in the Kamas area. I learned this morning that it has been burning for some time. This made me think of all the wildland fires throughout the west this summer and how close some of them got to homes and how some homes were actually destroyed. It made me think about what I would carry out of my own house, how I would do it, if I had time, how I could communicate with others, and where I would go. I realized I didn't have good answers for many of these questions and it's my individual responsibility to be prepared.

Fortunately, at all levels of local, county and state government, disaster plans are in place with some specific pediatric training and preparedness planning also occurring. At the state level, we have pediatric strike teams and equipment to respond to many types of disasters in a region or the state. We are also involved with a multi-state regional pediatric preparedness coalition, to plan, train and share resources in the event of a catastrophic disaster.

What can we do individually or in our local communities? I recently learned of a preparedness program for kids that can be implemented locally. The American Red Cross at www.redcross.org/get-help/prepare-for-emergencies/resources-for-schools#/the-pillowcaseproject has a program for 3rd-5th graders that teaches students about personal preparedness. The project is sponsored by Disney and provides them with a one hour presentation and a pillow case to build their own disaster kit. Contact the local Utah Chapter to find out more.

There are many great resources that can be searched on the internet. The American Academy of Pediatrics at www.aap.org and the National Pediatric Disaster Coalition at www.npdcoalition.org

have some good information on preparedness for family and kids. There are many federal and national resources available that are too many to list. [Be Ready Utah](#) is a valuable state resource for personal preparedness, as well. Again, tap the internet, for more resources. Since September is National Preparedness month. I am rummaging through and updating my own personal emergency supply kits and encourage you to do the same. Like the old phrase, "it's not a matter of if, it's a matter of when" a disaster is going to happen. A single home fire is a disaster to that family. We all need to be prepared, and to prepare and protect some of the most vulnerable in our population... the children.

As always, thank you for the compassionate and skilled healthcare you provide to the children and the diverse services you provide in your communities related to health, prevention and preparedness. Most importantly, please take care of yourselves and be safe out there.

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To submit or subscribe to this newsletter

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“These events present complex triage, diagnostic, and management challenges for the health care provider”



The Boston Marathon

Pedi Points

Tia Dalrymple RN, BSN

September is the first month of fall and it is our traditional preparedness month. This year the health department is continuing emphasis on preparedness for youth- especially teens, older adults, and people with disabilities and others with access and functional needs. We're excited about the opportunity to help you and your family learn more about emergencies and how to be prepared whenever or wherever they strike.

As is the tradition, each week of National Preparedness Month has a designated theme:

- **Week 1 (August 28-September 3):** Promote National Preparedness Month
- **Week 2 (September 4-10):** Preparing Family and Friends
- **Week 3 (September 11-17):** Preparing Through Service
- **Week 4 (September 18-24):** Individual Preparedness
- **Week 5 (September 25-30):** Lead-up to National PrepareAthon! Day

More information about each of these themes is available on Ready.gov/september, where you can also find social media content, 2016 NPM logo, graphics, and more to share with your friends and family.

In past issues we have focused on preparing children for disasters, on common pediatric vulnerabilities, and on jumpSTART triage for kids during mass casualty incidents (MCIs). For this issue we have some great insight into blast injury. Blast injuries result from explosions. They cause multisystem, life-threatening injuries in single or multiple victims simultaneously. These events present complex triage, diagnostic, and management challenges for the health care provider. In this month of preparedness we can take a close look at this type of event and *prepare* our response.

From the Field

The Anatomy of Blast Injury

Cory Oaks, Fire and Rescue, Fire Captain

For most of us, the mention of explosion brings visions of bombs or improvised explosive devices when in reality they can be much more common than we would believe. Frequently across the country propane, natural gas, combustible solids, and industrial or chemical plant fires can yield explosions equivalent to that of the most efficient commercial or improvised explosives. Why is this important? To effectively predict and treat our patients we must understand what I refer to as the anatomy of an explosion.

Several factors influence an explosion. The two big ones:

The explosive or energetic material involved: referred to as “high” and “low”, these terms are assigned based on how fast the material burns or detonates. High explosives like Dynamite, C4, Nitroglycerine and PETN burn much faster than their low explosive counterparts Ammonium Nitrate and Fuel Oil (ANFO) as well as commercial black and smokeless powder.

The geography of the explosion: injuries are compounded when the explosion occurs in a confined space.

When dissecting the anatomy of an explosion you can break it into a step by step process. The first of these steps after detonation is the formation of a positive pressure “wave” which moves out in 360 degree pattern from the blast site. This wave is an actual, tangible wave that can be seen and felt as it moves in the air. In comparison it is similar to the bass you feel at a concert, only magnified hundreds of times. The type of explosive used determines the speed of the wave and the amount of damage done. Low explosives yield a slower wave with a pushing or heaving action. The faster waves of high explosives create a breaking action. Think of it as hitting an object with a slower, heavier sledge hammer versus a lighter ball peen hammer.

The second step of our “anatomy” is the negative pressure wave. This wave is slower, longer in duration and often times more forceful than the positive pressure wave. As the detonation takes place at “ground zero” the positive pressure wave displaces the atmosphere outward

From the Field –continued

creating the blast wind. This leaves a void, creating a vacuum which draws the atmosphere back into the core, resulting in the negative pressure wave. In photos taken around ground zero during the Oklahoma City bombing of the Murrah Building, the effects of the negative pressure wave can be seen within a radial mile. Room contents had been pulled toward windows and curtain/blinds had been sucked out of windows were seen hanging on the exterior of buildings. Why is the anatomy of a blast important? When we are able to understand the kinematics of the blast, we can see that the positive and negative pressure waves can create a “double tap” or coup contra coup injury pattern as our patients are hit by two separate forces.



These waves moving through the air create the **primary injury** in our patients.

Primary blast injury is often lethal. The most susceptible body parts are the ears and the hollow organs, like the lungs. Additionally, patients will present with burn injuries when close to the blast. These primary injuries are more widespread and harder to diagnose than the more obvious and distracting burn injuries. Injury to the tympanic membrane is common as well as rupture and middle ear injury. Ear injury can occur with wave pressures as little as 5 psi. The average blast pressure is around 300 psi when measured at 25’ from a detonation of 300 pounds of ANFO. Luckily, although the most common injury, it is also the least life threatening.

Blast Lung Injury (BLI) is the most serious injury pattern we see. The pressure wave moves through the body, compressing the hollow organs and vessels. In the case of the lungs that pressure travels between the tissues causing ruptured blood vessels and damaging the air/tissue interface. This damage leads to alveolar hemorrhage and in some instances air embolism. As responders we treat this as any other case of respiratory distress, however our challenge comes in the delayed onset of symptoms as the injury process develops and progresses. Most BLI patients initially present as our green or “walking wounded” when initiating our START Triage for mass casualty. They can decompensate quickly, often times after all resources have been exhausted. To adapt we can utilize an upside down triage and direct our patient care to the yellow and red patients while at the same time arranging for rapid “green appropriate” mass transport of our walking wounded to definitive care, pre decompensation. As a rule of thumb, we can usually expect to see double the number of patients in the second hour post blast as we did in the first.

“Positive and negative pressure waves can create a “double tap” or coup contra coup injury pattern as our patients are hit by two separate forces.”

Secondary blast injuries are also a real killer, caused by impact with flying debris and bomb components. Fragments can travel a long distance!

- A small abrasion or wound may hide a much more extensive injury
- In penetrating trauma, injuries are produced as tissues are crushed and separated along the path of the penetrating object
- It is not unusual for embedded fragments to number in the hundreds

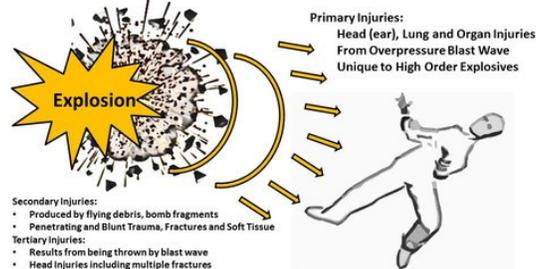
Tertiary Blast Injuries occur when individuals are thrown by the blast wind or from structural collapse and fragmentation of buildings

- Fractures, brain and crush injury, blunt and penetrating trauma
- Can range from simple contusion to impalement

Quaternary injuries include all other explosion related injuries or diseases and includes exacerbation or complications of pre-existing conditions

For those of us in the rural setting, these types of injuries can easily overwhelm our resources. We have to be masters of resource management and call for any additional help early on. Understanding the “anatomy” of an explosion will help us prepare the most effective response.

Blast Injury Components



Adapted from: <http://www.bt.cdc.gov/masscasualties/blastinjuryfacts.asp>

Expert Input

Annette Matherly RN CCRN

University of Utah Healthcare Burn Center, Outreach / Disaster Coordinator

Burn Management in the Blast Injured Patient

As observed in Boston, Madrid and multiple other locations, blasts can produce horrific injuries to patients with the burn component and amputations being the most obvious at first contact. Burn injuries are categorized as a quaternary injury type, and all blast waves include a thermal component, although the temperature of the wave can vary depending on the chemical reaction. In actuality, most bomb-related burns cover less than 20% of the total body surface area (TBSA), but the combination of primary, secondary, tertiary and quaternary injuries sustained can make this patient very challenging to care for, particularly when aggressive fluid resuscitation is required for the patient with a blast injured lung. Patients who have survived an explosion in a confined space are also at increased risk of inhalation injury (18%), which further complicates their care.

While burn injuries are important, they can distract from the primary cause of patient morbidity and mortality. It is therefore essential to adhere to the standard principles of trauma management and to established triage protocols whilst considering potential airway compromise from progressive edema formation.

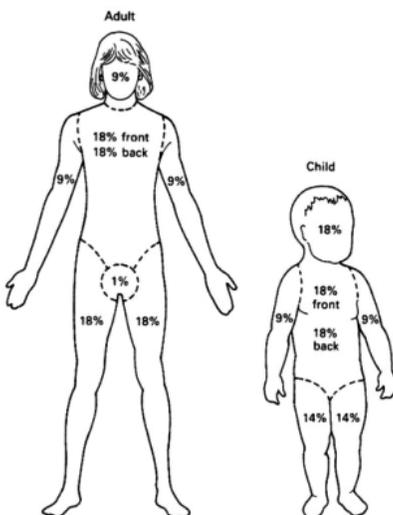
“the combination of primary, secondary, tertiary and quaternary injuries sustained can make this patient very challenging to care for”

Initial Pre-Hospital Management

- Stop the burning process and remove smoldering clothing
- Follow the standard principles of trauma and triage management and do not allow the burn to become the focus so that underlying traumatic injury is neglected
- Consider early intubation if there is airway compromise (singled nasal hair alone, does not necessarily warrant intubation).
- If intubation is necessary ensure the ETT is secured well (positive pressure may increase the risk of arterial gas embolism (AGE) in the patient with a blast lung injury)
- IV/IO line may be inserted if necessary thorough burned tissue, be sure to secure the line
- Starting points for fluid resuscitation rates in the *primary survey* are as follows:

5 years or younger:	125 ml/hr. LR/NS
6-13 years:	250 ml/hr. LR/NS
14 years or older:	500 ml/hr. LR/NS

- The appropriate fluid infusion rate is then calculated in the *secondary survey* after the TBSA has been determined, and any life threatening injuries have been managed. Patients with traumatic injuries may require additional fluids
- Burn patients are typically alert and oriented, if deficits exist consider traumatic injury
- Keep the patient warm and dry to prevent hypothermia
- Give all narcotics IV for pain management. This can be challenging in the patient with a potential head injury. Always adhere to local protocols
- Circumferential chest burns may require an escharotomy due to constriction of the underlying tissue. Utilize the DOPE mnemonic to be sure that ETT dislodgement, obstruction, a pneumothorax and equipment issues are not factors impeding ventilation. Follow local protocols, and consult medical control if an escharotomy in the field is essential
- Wounds can be covered with a dry dressing to prevent secondary wound contamination and decrease pain, but this is not crucial. If fast transfer and transport is required a clean blanket is sufficient



Estimating burn BSA

Expert Input—continued

Treatment for most quaternary injuries follows established protocols for that specific injury, and burn is no exception. One important consideration for a mass casualty incident is that those burn patients who are initially triaged as green or yellow may need to be monitored closely and re-triaged due to fluid needs, edema formation and potential airway compromise. Rapid evacuation increases the chance of survival.

“At any given time 2/3 of the worlds population are awake and they are up to no good”

Unknown Military General

References/Resources

<http://emergency.cdc.gov/masscasualties/blastinjury-mobile-app.asp>

<http://www.cdc.gov/masstrauma/preparedness/primer.pdf>



Happenings

Joining Forces Conference

In the fall PREVENT CHILD ABUSE UTAH presents our Joining Forces Conference. This two and a half day premier regional conference focuses on prevention, investigation, prosecution and treatment with nationally renowned keynote speakers and multiple daily lectures on a range of timely topics. Whether you are a law enforcement officer, teacher, social worker or concerned citizen, this conference will help open your eyes to the reality of child abuse and provide you the tools and knowledge to help prevent it. For conference registration and information please [click here](#).

Prevent Child Abuse Utah is making a real difference.

[Check out our video](#)

In 2011, there were 3,598,000 reported cases of child abuse in the United States. Approximately 681,000 children were victims of maltreatment.

News from National

Think Safety When Picking, Packing School Backpacks

Many students use backpacks to carry their school books and supplies, but improper use can lead to muscle and joint injury, neck and shoulder pain, as well as posture problems, child health experts warn.

The American Academy of Pediatrics (AAP) suggests that: parents and kids choose a lightweight backpack with wide, padded shoulders; two shoulder straps; a padded back; and a waist strap. A rolling backpack might be a good choice for heavy loads, but they may be hard to roll in snow and must be carried up stairs.

For more tips check out Healthfinder.gov



September 2016

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1 PGR	2	3
4	5	6	7	8 PGR Milford Memorial Hospital Health Fair	9 Utah Trauma Network Eastern UT Emergency Services Symposium →	10 PEPP renewal -Wasatch
11	12 Joining Force Con. →	13	14	15 Peds EMS lecture PGR	16 PEPP-Roosevelt →	17
18	19	20	21 ECHO	22 PGR	23	24
25	26	27	28	29 PGR	30 Bryce Canyon PEPP →	

Pediatric Education Around the State

Pediatric Grand Rounds (PGR) are educational/CME offerings webcast weekly (Sept-May) you can watch live or archived presentations. It is geared towards hospital personnel. But will qualify for BEMSP CME Access at <https://intermountainhealthcare.org/locations/primary-childrens-hospital/for-referring-physicians/pediatric-grand-rounds/>

- Sept 8 *State of Department of Pediatrics* Edward B Clark, MD
- Sept 15 *Diagnosing the common and rare anemias in neonates* Robert Christensen MD
- Sept 22 *Zika Virus- A Public Health Emergency of Olympics Proportions* Andrew Pavia MD
- Sept 28 *The Epidemic of Pediatric and Young Adult Sudden Cardiac Death—Advocating for Recognition and Prevention* Robert Campbell, MD

EMS Grand Rounds (EGR) This offering alternates with Trauma Grand Rounds every other month, it is geared towards EMS. Live viewings qualify for CME credit.

There are 2 ways to watch

1. Live real time viewing via the internet at: www.emsgrandrounds.com If you would like to receive CME for viewing this presentation live, email Zach Robinson (Zachary.robinson@hsc.utah.edu)
2. Delayed viewing at your personal convenience, a week after the presentation at: www.emsgroundrounds.com

Peds EMS Lecture Series Free monthly pediatric CME/CEU presentations from Primary Children’s Emergency Department

Attending Physicians to Utah’s EMS. Offered every 3rd Thursday. Contact Lynsey.Cooper@imail.org for info

Sept 15 *Pediatric Shock* David Chaulk, MD

Project ECHO Burn and Soft Tissue Injury (ECHO) has a pediatric and adult component. CME/CEU and MD CME available <https://crisisstandardsofcare.utah.edu> click request access and follow instructions.

Sept 21 *Burn care across the continuum: Liberian and American burn care challenges and similarities*

Upcoming Peds Classes, 2016

For PEPP and PALS classes throughout the state contact Andy Ostler Aostler@utah.gov

For PALS and ENPC classes in Filmore, Delta and MVH contact Kris Shields at shields57@gmail.com

Save the Date

October 6-7, 2016 [Issues in Pediatric Care Conference](#)

October 10, 2016 Burn Care and Mass Casualty Course (BCMCC) Southwest region - The sign up for this will be on UTrain soon. Attendees from the SW region are encouraged as the training will be specific to that region, but those in other regions are welcome. Contact Annette.Matherly@hsc.utah.edu

Emergency Medical Services for Children

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Follow us on the web
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and on Twitter: EMSCUtah

The Emergency Medical Services for Children (EMSC) Program aims to ensure that emergency medical care for the ill and injured child or adolescent is well integrated into an emergency medical service system. We work to ensure that the system is backed by optimal resources and that the entire spectrum of emergency services (prevention, acute care, and rehabilitation) is provided to children and adolescents, no matter where they live, attend school or travel.

The Last Word



No words needed

taken by EMSC Garfield County Coordinator Tammy Barton