Northern Virginia Emergency Medical Services Council

Performance Improvement and Trauma Committee
FY24 Q4
Wednesday, September 18, 2024
9:00 am

Meeting hosted via Zoom

AGENDA

Type of Meeting: Collaborative exchange of information and reporting of regional performance improvement (PI) and trauma initiatives

Facilitators: Dr. Stephen Varga, Inova Fairfax Hospital
Dr. Babak Sarani, George Washington University

1. Call to order.

2. Approval of June 12, 2024, committee minutes

3. Case Presentation on Blast Injuries: Dr. Reed Smith, Arlington County Fire Department

4. The topic is Blast Injuries. Data will be for June 2021 – June 2024

    - Please share your agency/facility information/protocols on Blast Exposures.

    - EMS Agencies: age, gender, mechanism of injury, whether this was work-related, and the destination where the patient was transported.

    - Hospitals: age, gender, mechanism of injury, injury location. Was this work-related? How did the patient arrive: POV or EMS, etc.? Length of stay, activation, and disposition.

5. Discuss future Topics (the minutes have previous topics at the end)

6. Dates for 2024

    Wednesday, December 11, 2024

7. Adjournment

Northern Virginia EMS Council
Trauma and Performance Improvement Committee
Meeting held virtually via Zoom
September 18, 2024 Meeting Minutes

Those present were (All attendees were present via Zoom):

Alfred Pacifico	alfred.pacifico@loudoun.gov
Andrew Sanders	asanders@pwcgov.org
Brian Orndoff	brian.orndoff@fairfaxva.gov
Becca Wilson	rwilson@manassasva.gov
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Tom Arnoto	tarnoto@pwcgov.org
Tracy Lane	tracy.lane@loudoun.gov

Dr. Stephen Varga called the Trauma and Performance Improvement Committee meeting to order at 9:02 am.

Approval of the Minutes

Minutes from the June 12, 2024, meeting were sent via email before the meeting for review.

- Motion to approve the minutes as written by Leddyanne Dell

Northern Virginia EMS Council
Trauma and Performance Improvement Committee
September 18, 2024 Meeting Minutes

Approval of the Minutes

Minutes from the June 12, 2024, meeting were sent via email before the meeting for review.

- Motion to approve the minutes as written by Leddyanne Dell
    - Seconded by Alfred Pacifico
    - ***The Motion was unanimously approved***

Trauma Topic – Blast Injuries

Presentation by Dr. Reed Smith with Arlington Fire Department on the Burlington Street incident. A copy follows these minutes.

Dr. Smith presented a December 2023 incident at a duplex residential house where an officer heard gunshots and found a reclusive resident shooting a flare gun. A warrant was obtained for the resident's arrest, but the situation escalated when an explosion occurred in the basement, demolishing the house and damaging nearby properties. The explosion was determined to be a gas fuel vapor explosion, likely ignited by the resident. Dr. Smith also detailed the aftermath of the explosion, which involved 24 personnel from the ACDF and ACFD, with 8% exposed during the incident. He emphasized the importance of ear protection, as some personnel experienced ear effects during the incident.

Dr. Smith discussed the effects of a blast on individuals with and without cover, noting higher hearing effects, headaches, and nausea in those without cover. He highlighted the changing nature of symptoms over time and the challenges faced by the team in handling primary overblast and concussion cases. Dr. Smith outlined a new policy for assessing suspected concussion cases and emphasized the importance of treating symptoms and impairments following a concussion. He also discussed the health issues faced by a group of individuals after a concussive event and the need for a graded return to activity. He noted that some individuals were still experiencing symptoms months after the event, which he attributed to post-concussive syndrome and linked to depression and anxiety.

Dr. Smith discussed the concept of blast injury, emphasizing its importance for emergency physicians and trauma surgeons. He clarified that blast injury is not solely determined by the integrity of a person's eardrums, as previously believed. Dr. Smith explained the overpressure effect of an explosive substance, which can cause primary blast injuries in gas-filled spaces and blunt cardiac effects in solid organs. He also mentioned the potential for secondary and tertiary blast effects, such as fragmentation and being thrown by the blast. Dr. Smith concluded that primary blast injuries were the main concern in their case.

Dr. Smith discussed the nature of concussions, emphasizing that they are a temporary alteration in brain function without any visible structural damage. He explained that concussions result from microscopic damage to neurons, leading to decreased blood flow and oxygen supply to the affected areas. This causes the brain to compensate, leading to symptoms such as fatigue, headaches, and irritability. He also highlighted the importance of understanding the physiology of concussions to

improve treatment and management in the fire department. He concluded by categorizing the symptoms of concussions into four areas: emotional, physical, cognitive, and sleep-related.

Dr. Smith discussed the unpreparedness of their team for primary overpressure injuries, leading to a reevaluation of their protocols and health and safety measures. He emphasized the importance of recognizing the effects of overpressure, advocating for team members, and understanding the needs of affected individuals. He highlighted the need for awareness and appropriate treatment for concussion victims, particularly in high-risk professions. He shared that Arlington has now implemented the baseline impact testing for their firefighters and police officers at their annual physical.

Data Discussion following presentation:

- EMS teams to implement standardized concussion assessment protocols for blast injury patients.
- ER departments to review and update protocols for evaluating and managing blast injury patients, including appropriate use of CT scans and referrals to concussion clinics.
    - EMS and hospital staff will receive additional training on recognizing and managing primary blast injuries, including concussions.
- Fire and police departments to conduct baseline impact testing for all personnel as part of annual physicals.
- Medical directors to advocate for and oversee proper evaluation and follow-up of first responders involved in blast incidents.
- Trauma centers to improve documentation and follow-up of blast injury patients, including referrals to concussion clinics when appropriate.
    - Inova Concussion Clinic worked with Arlington to get their patients in a reasonable time period. Having this connection is key.

- Hospitals
    - Inova Loudoun
        - 5 cases (2 considered soft cases)
            - Lithium battery charger explosion, house fire
            - MVC, fire, possible vehicle explosion, entrapment
            - 3 patients from the Sterling house explosion
                - involving a firefighter with shoulder and ankle injuries
                - a homeowner thrown by the blast with a wrist laceration
                - a firefighter later found to have a splenic laceration and shoulder fracture
                - Three patients were full activations, one modified, and one arrived by private vehicle.
                - The firefighter and homeowner from the house explosion were sent to the concussion clinic.
        - Please see report at the at the end of the minutes

- Sentara
  - 2 blast injuries in July
    - They were from the same family
    - 24 yr female (mom) and 2 month child
    - From camping propane stove in house that exploded
    - Came in POV
    - Mom had over 33% total body surface area burned to her back, posterior neck, hair caught on fire, and face
      - She was activated full alpha and transferred to Medstar.
    - Baby had second-degree superficial thickness to the face transferred out on high flow to Children's National
- Inova Fairfax
  - 6 cases
    - 5 males and 1 female
    - All sustained burn injuries and were transferred to Washington Hospital Center's Burn Center
    - Mechanism of injury: Firework explosion, electric panel explosion, gasoline explosion, pressure cooker explosion and two from propane tanks.
  - Patient # 1
    - 47 male s/p firework sparkler exploding in his hands; arrived via POV
    - Sustained multiple burns over palm and palmar of fingers
    - Transferred to WHC Burn Center
    - Evaluated at WHC and discharged home same day with follow-up to Burn Clinic
  - Patient #2
    - 33 male s/p explosion while pumping gas into vehicle ; arrived via POV
    - Sustained 14.5% TBSA burns to BUE, neck, face
    - Transferred to WHC Burn Center
    - Hospitalized for 10 days; required OR for excision and grafting with dermal substitute to bilateral arms and hands
  - Patient #3
    - 26 male s/p explosion while working on electrical panel; arrived via POV
    - Sustained burns to face, mouth, lip and BUE
    - Transferred to WHC Burn Center
    - Hospitalized for 1 day; did not require operative intervention
  - Patient #4
    - 58 female s/p pressure cooker explosion; arrived via POV
    - Sustained burns to chest wall and L forearm
    - Transferred to WHC Burn Center

        - Evaluated at WHC and discharged home the same day with follow-up in Burn Clinic
    - Patients #5 & #6
        - Propane tank explosion involving 2 patients; both 45 males; both arrived via POV
        - Patient 1 sustained 50% TBSA, and Patient 2 sustained 27% TBSA burns, including burns to face /perioral areas, both required intubation for airway protection
        - Both transferred to WHC Burn Center, follow-up not available

EMS Agencies:

- Loudoun County Fire & Rescue
    - 6 cases
        - All were male
        - Two cases in April of last year. Two men working on high tension and scaffolding struck power lines
            - Each required intubation and went to WHC and needed fasciotomies
        - One case in May – trimming trees, crane touched wire
            - Patient had bilateral buttock injuries, thigh injuries
        - Two simple injuries while working on wires/power box.
            - Both went to Lansdown

December 2024 Topic Suggestions

- Resuscitation before Intubation
    - Dr. Ferrada will come present to the group
    - For the data collection, pulling all trauma bay arrests that occur after intubation and looking at vital signs prior to intubation to see if resuscitation could have potentially improved the outcome
        - Same with EMS
        - Look at the data for the two years
    - Bruce Ruggeri, PHI, has been collecting data nationwide and locally. He will share data and protocols that they have adapted.

- Other 2024 considerations
    - When to activate RHCC?
        - Fairfax County FRD had an incident in February with seven patients, with multiple reds and one traumatic arrest. Upon arrival at Fairfax Hospital, they learned there was another significant incident, and those units were bringing four reds at the same time

- While this doesn't fall inside the MCI Manual guidelines of 10+ patients, those two incidents quickly overwhelmed Fairfax Hospital
- Fairfax is considering adding to its process the notification of RHCC when five or more patients need to go to trauma centers from the MPI category, simply to say, "Take them where you want," or to give us better guidance.
- Dr. Sarani added that DC DOH is undergoing personnel changes, the doctor overseeing HEPRA is retiring, and there will be a new medical director for HEPRA soon. One of these months, we should discuss the alignment between DC and NOVA for mass casualty events. It may look good on paper, but does it work operationally?
    - At the COT meeting, they refer to a vast topic: regional medical consortia. The two biggest pushes are regional medical consortia. Maybe in the next six months or so, we can put it on the agenda to talk about it. He will look at DC, and someone here can look at Virginia, and we'll see if we can align on both sides of the Potomac

The 2024 Regional Trauma/PI meeting is scheduled for:

- **Wednesday, December 11, 2024**

Previous Topics

June 2024	Electrocution
March 2024	Limb salvage and amputation / Surgical Strike Team
Dec. 2023	There wasn't a meeting held
Sept.2023	Tourniquet usage comparing trends from 12/2020
June 2023	Pediatric Trauma (trauma, burns, etc.), ESO Presentation on HDE
March 2023	Thoracostomy, Presentation on Fauquier County MVA Patient
Dec. 2022	Pedestrian Struck/Vision Zero
Sept. 2022	Mass Casualty Incidents**/** RHCC Northern Virginia Region had a presentation about its functions and capabilities.
June 2022	Falls from ground-level (looking at ages 55 and older)/ Education and prevention programs – what does your agency/facility have? (e.g. are patients enrolled before or after admission for falls?
March 2022	*Discussion of the committee*
Dec. 2021	NOVA ReTSCO meeting – Hospital Diversion
Sept. 2021	NOVA ReTSCO meeting – Trauma Transfer
June 2021	NOVA ReTSCO meeting
March 2021	Falls from greater than 20 feet (Systems: Body Armor/Vests)
Dec. 2020	Tourniquet/ Concealed weapons policy – do you have one for patients, providers, agency, hospital?

Sept. 2020	Pedestrian Struck/ Loudoun County and Arlington County gave presentations on storing and utilization of blood in the field.
June 2020	How has the 2019 Novel Coronavirus (nCoV) COVID-19 affected the Trauma Centers? How has the virus affected the center? / What public education is being done in each locality or hospital? –CPR? Hands-Only CPR? Stop the Bleed?
March 2020	Entrapment – MVC's (not industrial or other types of entrapment injuries) / 2019 Novel Coronavirus (nCoV) COVID-19

The meeting was adjourned at 10:10 a.m.

CERTIFICATION OF PERFORMANCE IMPROVEMENT AND TRAUMA MEETING

Northern Virginia EMS Council
7250 Heritage Village Plaza, Ste. 102
Gainesville, VA 20155

I, Laura Atwell, Administrative Coordinator of the Northern Virginia EMS Council, certify that the above minutes are a true and correct transcript of the Performance Improvement and Trauma Meeting of the Northern Virginia EMS Council on September 18, 2024. The minutes were officially approved on December 11, 2024, at the Committee meeting.

Laura Atwell 12/11/2024

Laura (Vandegrift) Atwell
Northern Virginia EMS Council

Date

Explosive Overpressure and Concussive Effects

First…. What is an explosive?

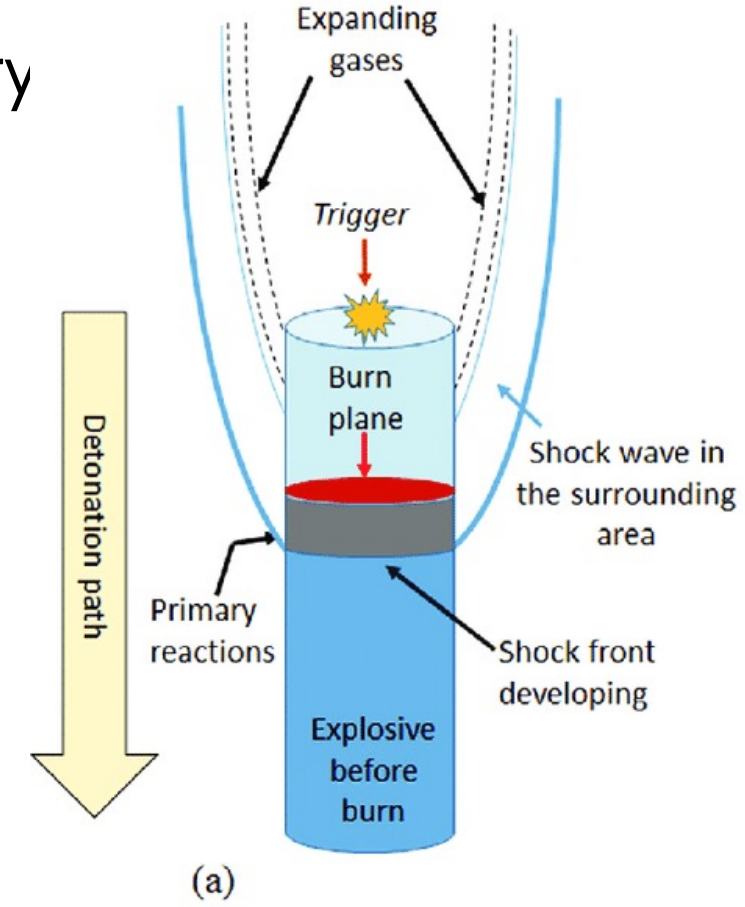
- A reactive substance that contains a great amount of potential energy that can produce an explosion if released suddenly
  - Usually accompanied by the production of **light**, **heat**, **sound**, and **pressure**

Physiology of Explosions

- Energy released in an explosion causes:
  - Blast over-pressure wave
  - Fragmentation
  - Blast wind
  - Incendiary thermal effect

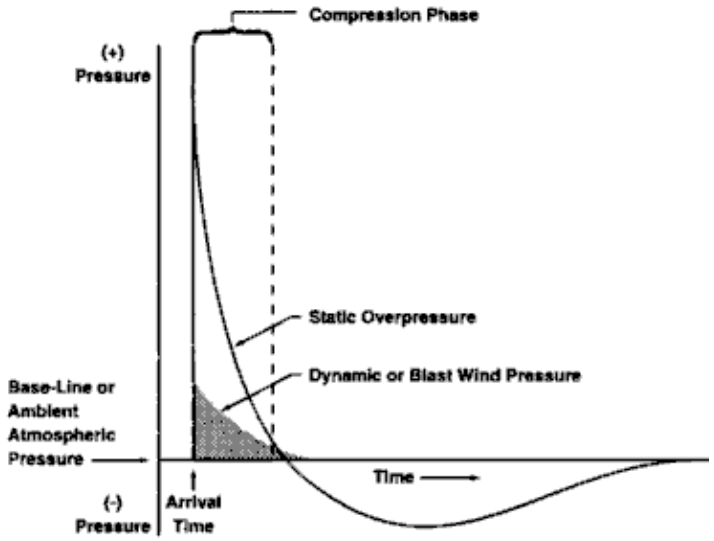
Blast Over-Pressure Wave

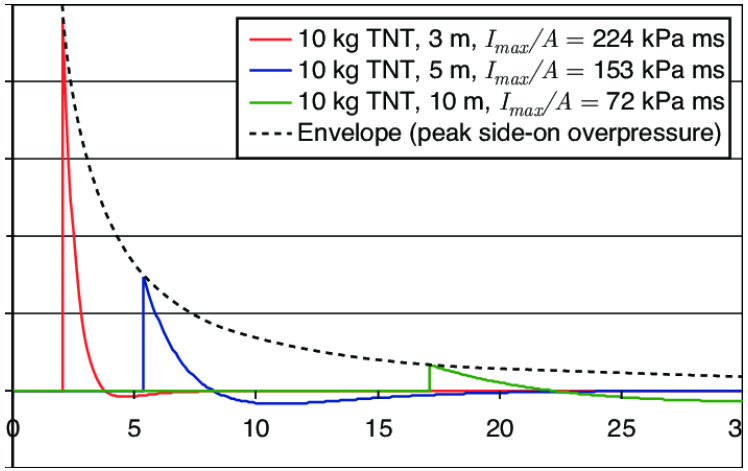
- Instantaneous conversion to gas at primary reaction zone moving through material
- Released energy compresses surrounding medium (e.g. air) into high pressure ridge
  - Expands and propagates outward rapidly in all directions
    - Up to 4 million pounds psi
    - Can travel at thousands of meters per second (TNT = 6,940 m/s)

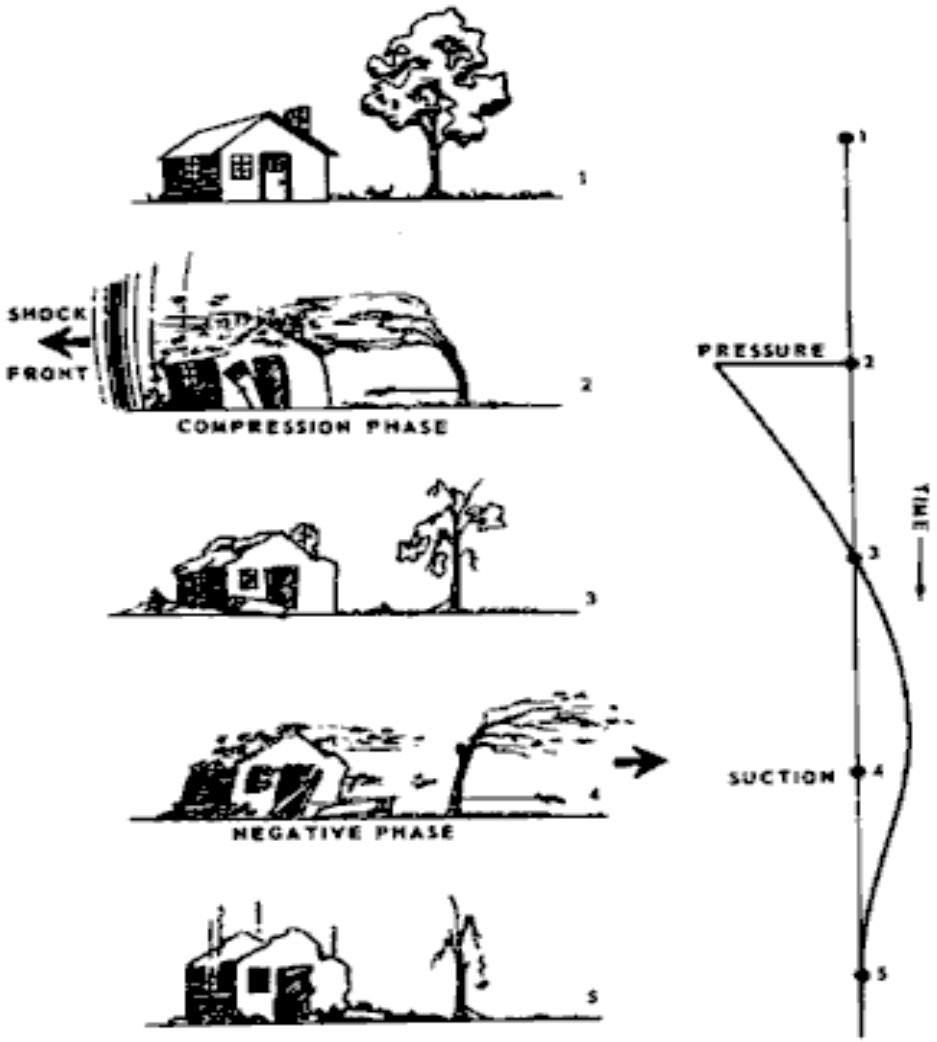


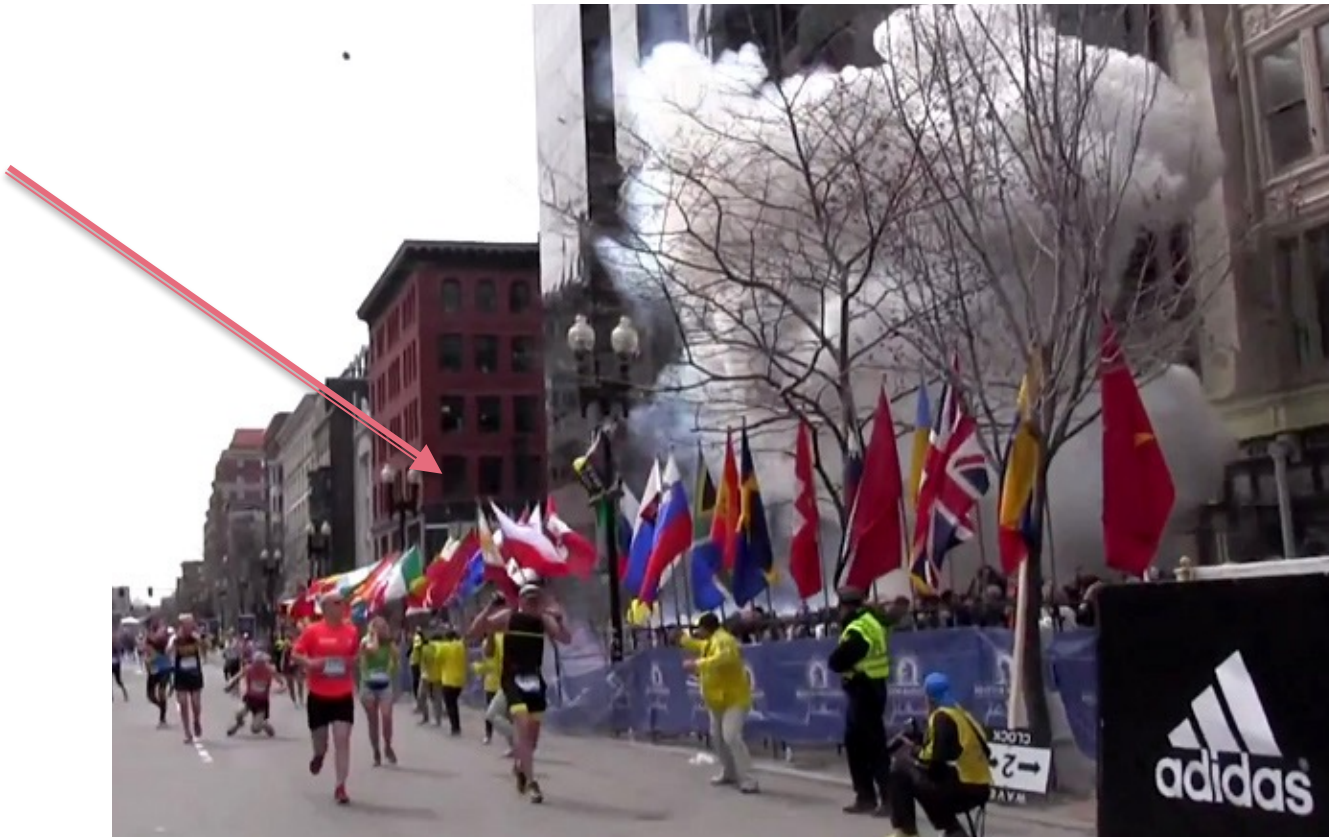
Blast Over-Pressure Wave

- Friedlander Wave
  - Instantaneous sharp rise in pressure within the air
  - Over-pressure falls exponentially as blast wave propagates and loses energy
    - Degrades over distance
  - Followed by under-pressure due to inertial effect of air molecules






SHOCK FRONT
COMPRESSION PHASE
NEGATIVE PHASE
PRESSURE
SUCTION
TIME
1
2
3
4
5


adidas

Secondary Blast Pressure Effects

- Solid surfaces will reflect and magnify blast waves
  - Additive effect increases overpressure
- Examples include:
  - Walls
  - Corners
  - Buildings
  - Vehicle/bus interiors
  - Body armor

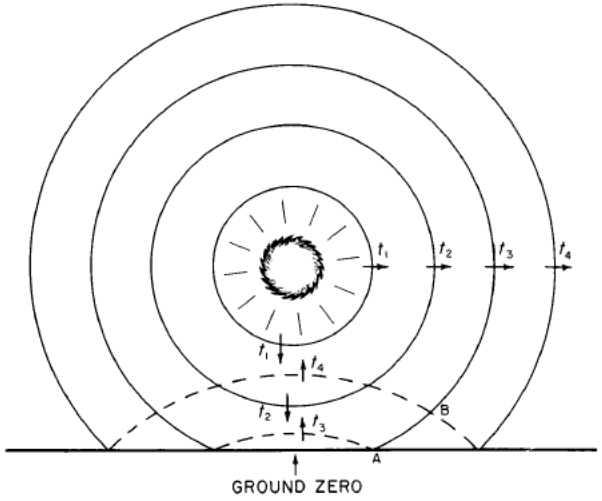
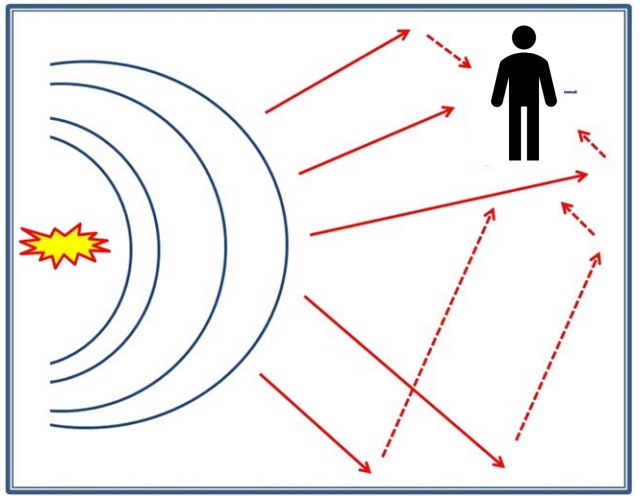


Figure 3.21. Reflection of blast wave at the earth's surface in an air burst; t_1 to t_4 represent successive times.

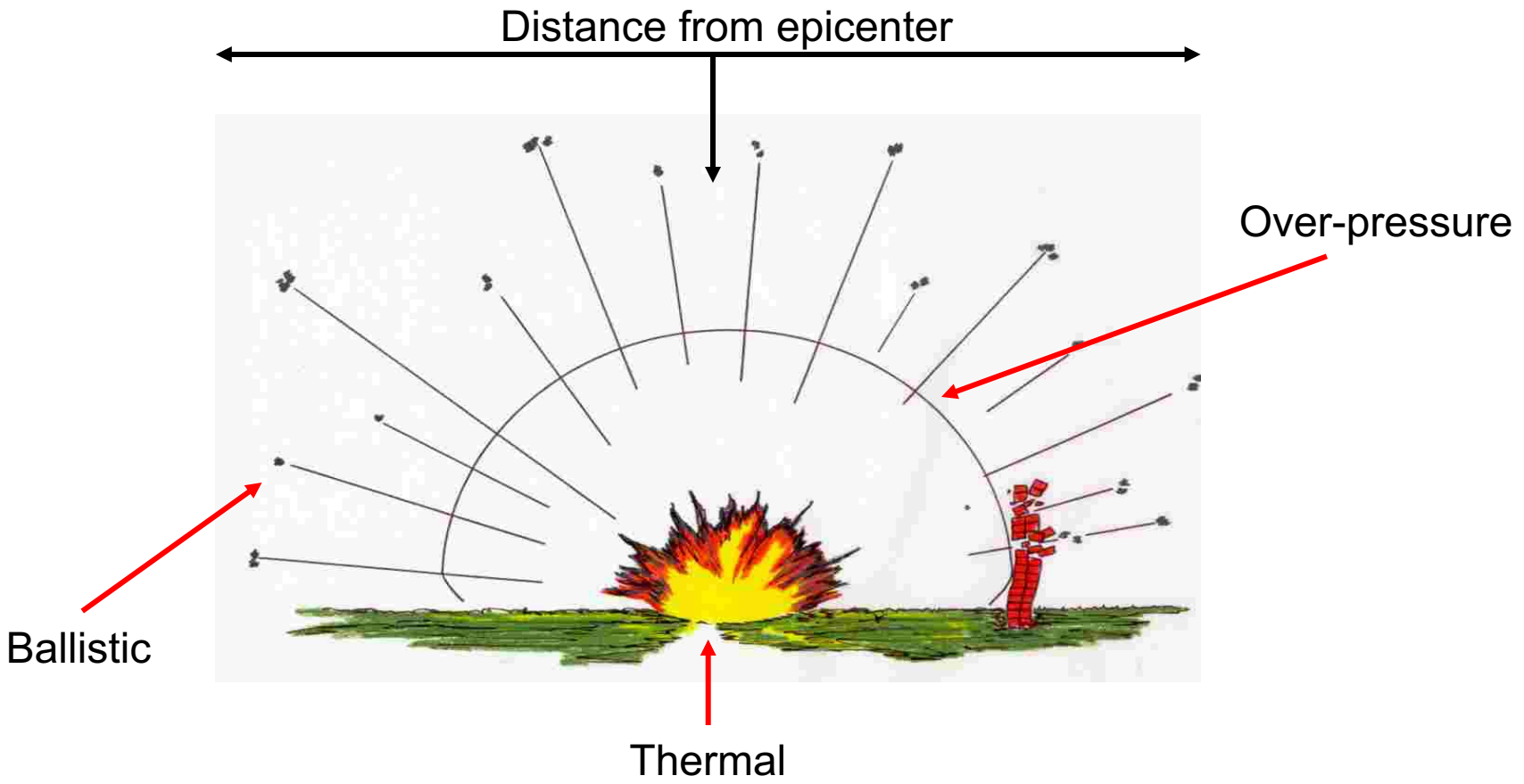


Explosive Injury Pattern

- Produces specific multisystem injury patterns
- Results from:
  - Type of explosive
  - Distance of patient from blast
  - Environment, open or closed space
  - Surrounding protective barriers/walls

Explosive Injury Pattern

- Related to the distance from the epicenter

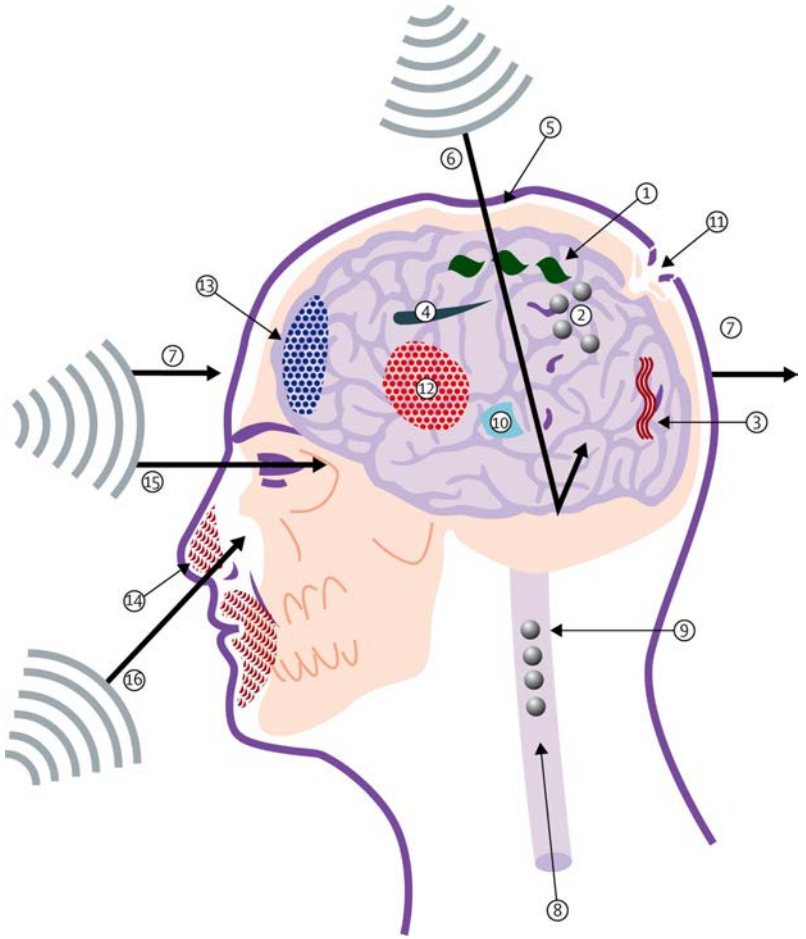


Explosive Injury Pattern

- Injuries categorized according to underlying mechanism
  - **Primary blast injury**
    - Impact of over-pressure wave on body
      - Gas filled spaces (lungs, ear, GI), cardiac, brain
  - **Secondary blast injury**
    - Due to flying debris, bomb fragments
  - **Tertiary blast injury**
    - Injuries from victim being thrown by blast
  - **Quaternary blast injury**
    - Any explosion-related injury not listed above and any exacerbation/complications of pre-existing illness

Primary Blast Injury: Neurologic

- Overpressure can cause concussion, mild-moderate brain injury and loss of consciousness without other outward signs of injury
- Coup/contra-coup injuries and diffuse axonal injuries reported with high levels of overpressure
  - Much more severe symptom complex



Traumatic Brain Injury Definitions

- Concussion (75% of all TBI)
  - Subcategory on the less severe end of the spectrum
  - Complex pathophysiological process induced by traumatic biomechanical forces
  - Resulting in alteration of brain function **without identifiable abnormality in standard structural imaging**
  - Evaluated in the **immediate aftermath** using screening tools

Concussion Pathophysiology

- Temporary loss of normal brain function due to movement of brain inside skull causing microscopic damage to neurons
- Combination of metabolic, physiologic, and microstructural injuries to the brain
  - Creates a pathophysiological cascade of events
    - Microscopic axonal and vascular injury
    - Decreased cerebral blood flow
    - Mitochondrial dysfunction
    - Dysregulation of potassium and calcium within neural cells

(Simple) Pathophysiology of Concussion

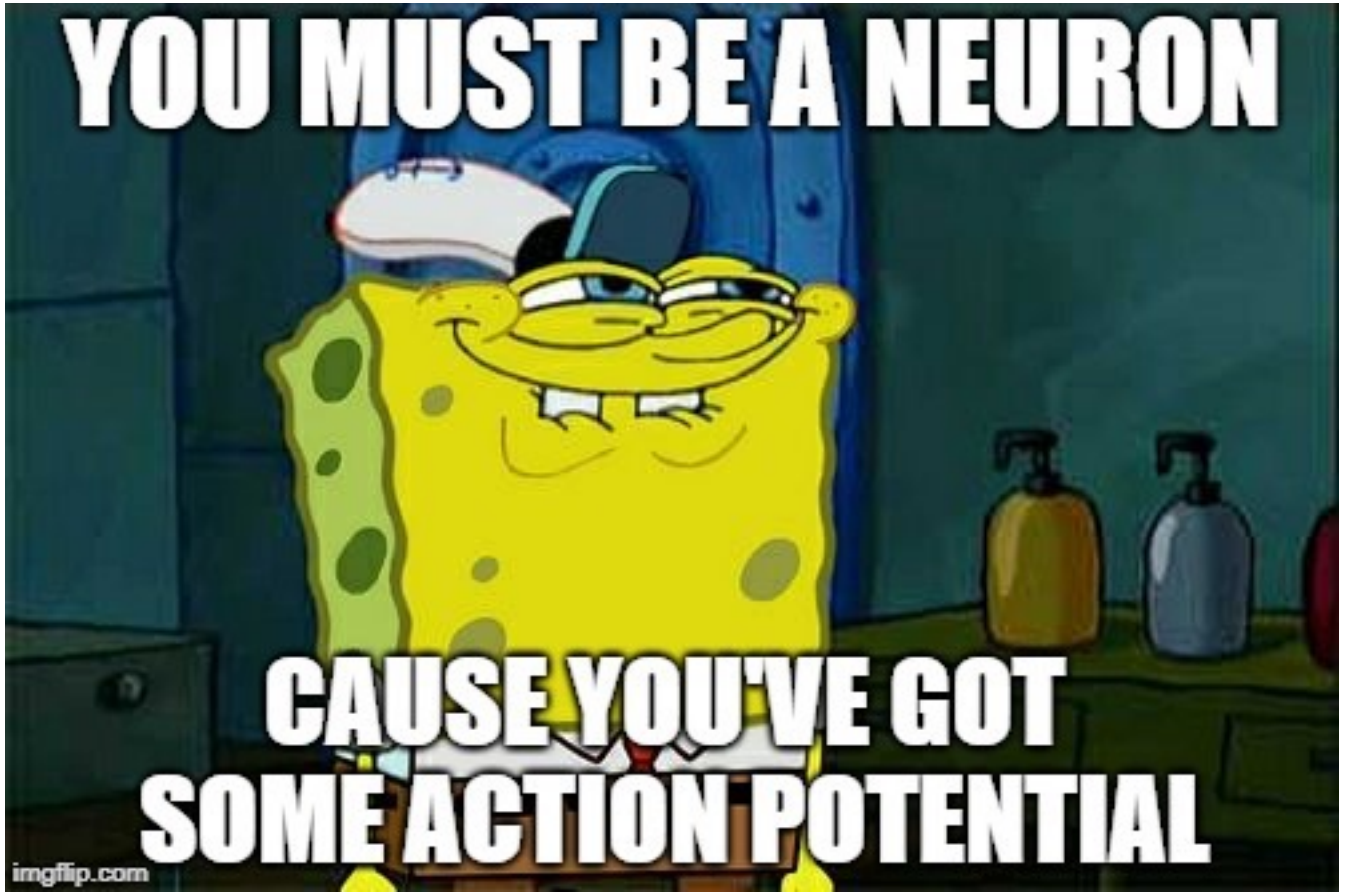
- Dysfunctional coupling between neurons and supply blood vessels
  - Inflammation after injury affects the cells surrounding the neuron causing alterations in microvascular blood supply
  - Causes decreased amount of oxygen delivery to neuron
  - Decreased O2 causes affected neurons to be less effective or outright malfunction
  - Brain compensates by using other areas for those functions but overall is less less effective
    - Leads to fatigue, headaches, feeling overwhelmed, irritability, etc

(Simple) Pathophysiology of Concussion

Increased energy demand
+
Decreased CBF (50%)
&
Impaired
cellular efficiency

↓

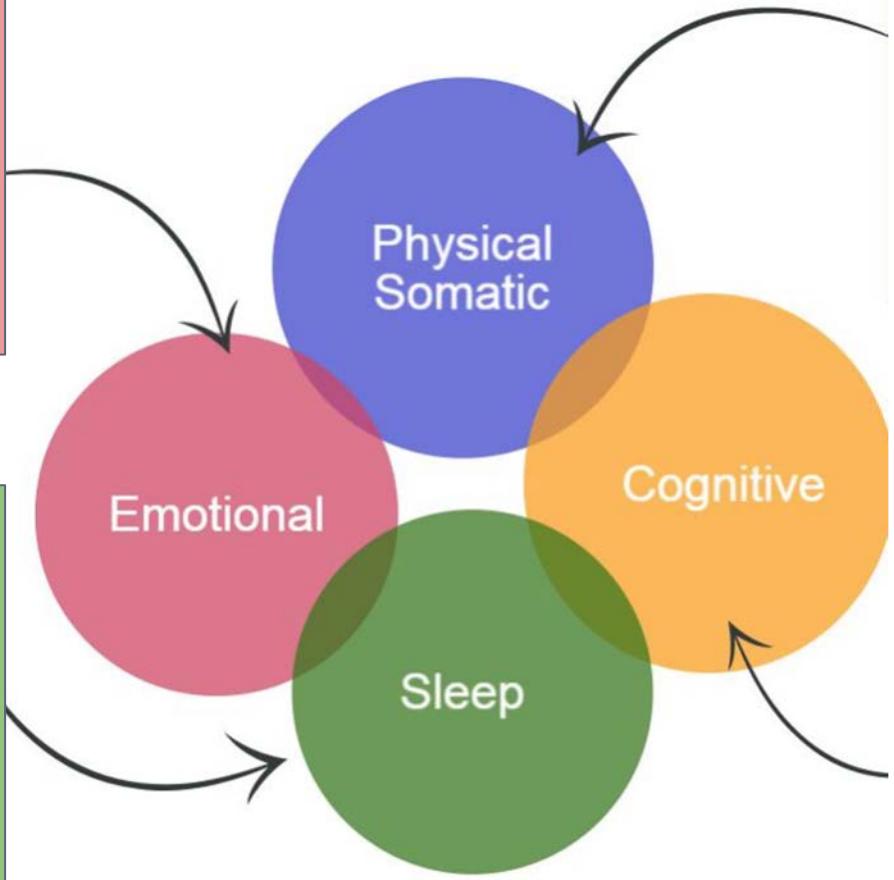
ENERGY CRISIS in Neurons



Concussive Syndrome

Irritability
Sadness
More emotional
Nervousness

Drowsiness
Sleeping more than usual
Sleeping less than usual
Difficulty falling asleep



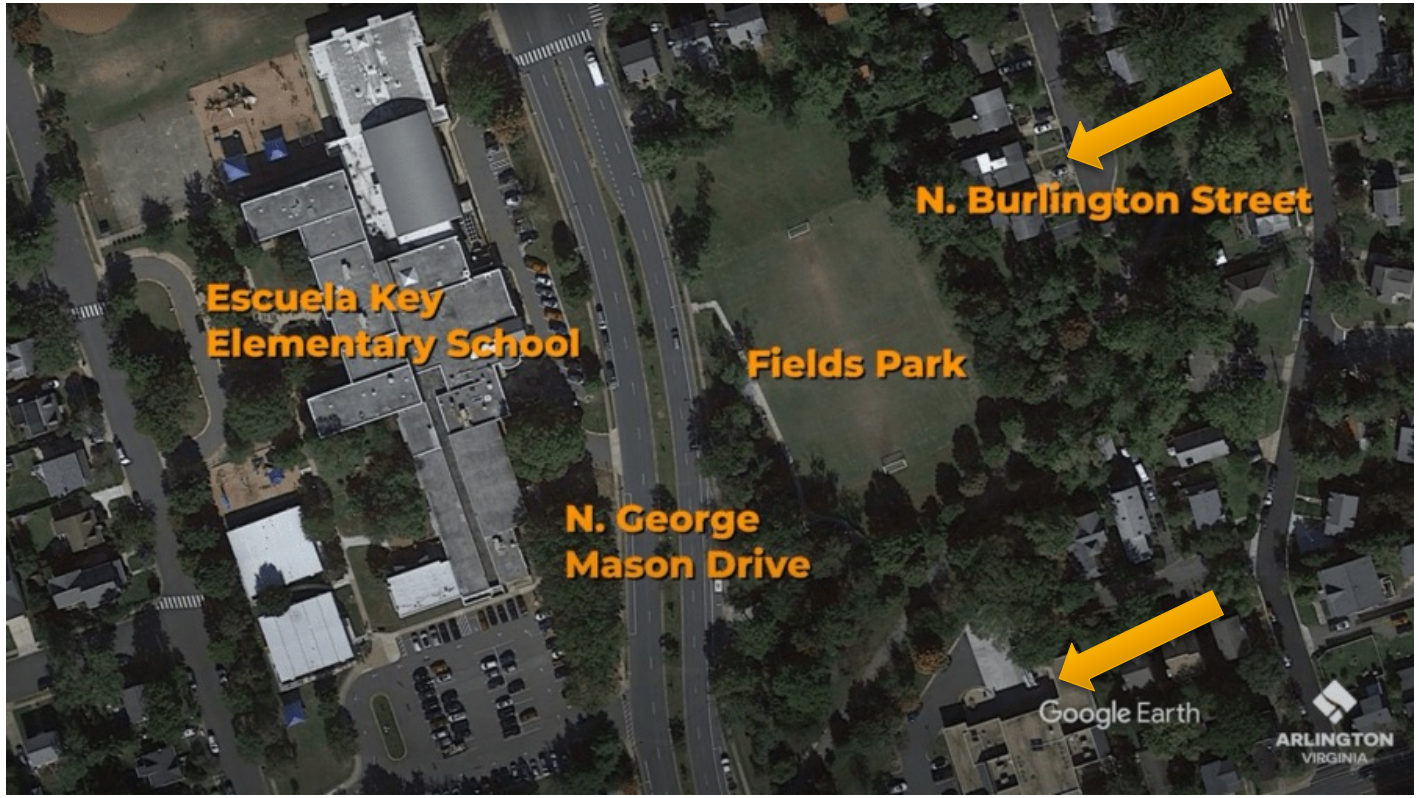
Headache
Nausea
Vomiting
Dazed
Stunned
Fatigue
Light Sensitivity
Sound Sensitivity
Balance problems
Vision Problems

Feeling "foggy"
Feeling slowed down
Difficulty concentrating
Difficulty remembering
Confused about recent events
Answers questions slowly
Repeats Questions

PEDIATRICS Vol. 126 No. 3 September 1, 2010

ACPD/ACFD Burlington Street Event

- Duplex residential on a cul-de-sac



ACPD/ACFD Burlington Street Event

- At 8:24 p.m., approximately three hours and forty minutes after officers first arrived at 844 N. Burlington St., an explosion began in the basement and demolished the residence, as well as most of the adjoining property of 846 N. Burlington St. Several other residences sustained some degree of damage.

ACPD/ACFD Burlington Street Event

ACPD/ACFD Burlington Street Event

- The subsequent investigation revealed the source of the explosive to be gas vapor / fuel explosion originating in the basement

- Within 150 yards of the house were 24 ACPD and ACFD personnel
  - 8% in the open/exposed
  - 70% with cover (inside armored vehicle, behind structure)
  - Various body positions (8% standing, 4% kneeling, 1% laying)

Burlington Street Post-Event Analysis

- 24 respondents – SWAT, TEMS, and Fire Marshals
- Most were wearing typical LE PPE:
  - Eye pro (46%)
  - Soft ballistic vest without ceramic plate (13%)
  - Soft ballistic vest with ceramic plate (71%)
  - Ballistic helmet (46%)
  - Ear pro (46%)

Within 50ft of blast with cover (vehicle, armor)

	0-12h
Headache	81%
Nausea	18%
Vertigo	36%
Tinnitus	36%
Disorientation	72%
Memory Loss	36%
Sleep changes	72%
Fatigue	63%
Depression	18%
Myalgias	9%

Within 50ft of blast exposed (all body positions)

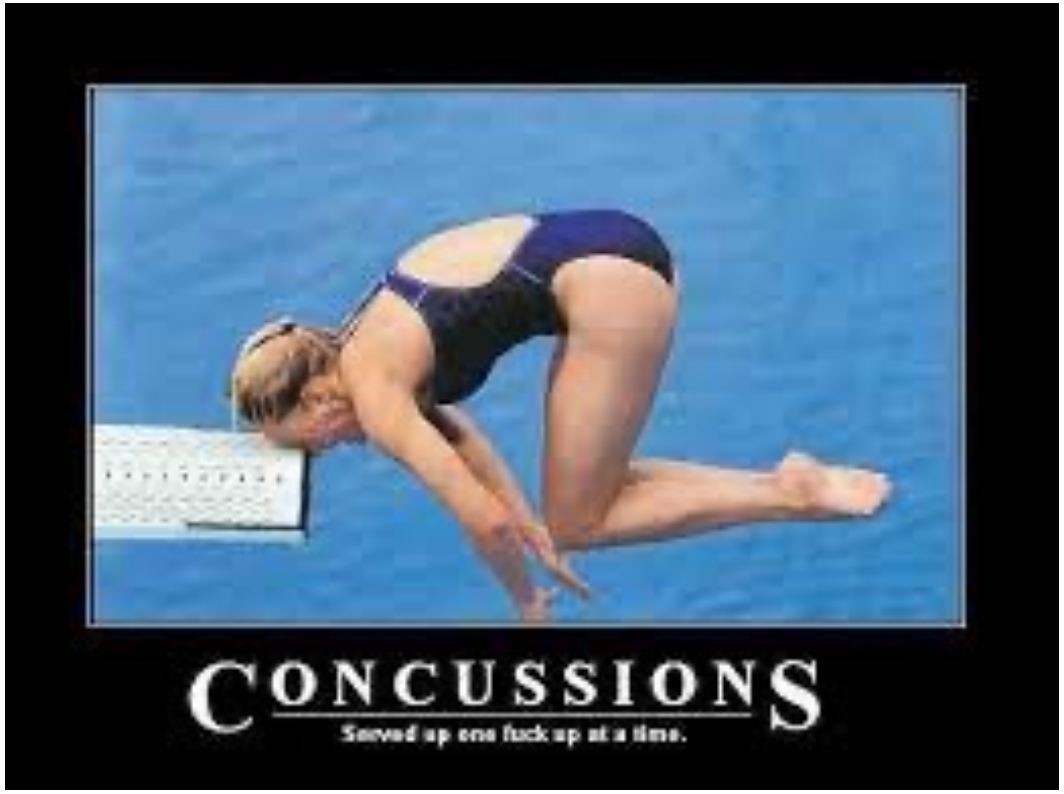
	0-12h
Headache	**83%**
Nausea	50%
Vertigo	33%
Tinnitus	**67%**
Disorientation	50%
Memory Loss	17%
Sleep changes	17%
Fatigue	50%
Depression	17%
Myalgias	0%

Acute Concussion Management

- Headache, fatigue, dizziness, and taking longer to think were most common symptoms at presentation
  - Sleep disturbance, frustration, forgetfulness, and fatigue most likely to develop within days to weeks but not initially
  - Emotional symptoms tend to develop later in the recovery period

Brain Metabolism following mTBI

- Metabolic chain reaction produces an initial hypermetabolic state followed by a metabolic depression
  - **Changing metabolism** explains some symptoms delay in onset or worsening over time
  - Patients who are asymptomatic at rest can become symptomatic during physical or cognitive exertion



Brain 2010; 133(11): 3232-3242.

Within 5oft of blast with cover (vehicle, armor)

	0-12h	12-48h	48+h
Headache	81%	**100%**	75%
Nausea	18%	4%	17%
Vertigo	36%	**50%**	42%
Tinnitus	36%	25%	25%
Disorientation	72%	**75%**	50%
Memory Loss	36%	25%	17%
Sleep changes	72%	**75%**	50%
Fatigue	63%	**67%**	58%
Depression	18%	8%	8%
Myalgias	9%	17%	17%

Within 50ft of blast exposed (all body positions)

	0-12h	12-48h	48+h
Headache	**83%**	**83%**	**50%**
Nausea	50%	33%	17%
Vertigo	33%	**50%**	17%
Tinnitus	**67%**	**67%**	**67%**
Disorientation	50%	67%	33%
Memory Loss	17%	33%	33%
Sleep changes	17%	**0%**	**0%**
Fatigue	50%	**67%**	0%
Depression	17%	17%	17%
Myalgias	0%	17%	10%

Burlington Street – All Effected

- 2 people had no symptoms at all
  - Both >50 yards away with cover

- Of the 22 with symptoms immediately, first medical eval:
  - 2 were not evaluated at all
  - 14 were seen in the ED (58%)
  - 1 was seen in Urgent Care (4%)
  - 1 was seen by Primary Care (4%)
  - 4 were seen in Concussion clinic (17%)

Burlington Street – All Effected

- Medical follow-up despite clear symptoms
  - Only one had formal medical evaluation within 12 hours
    - Many were 'checked out' by medic after event stabilized
  - 30% evaluated by medical after 12-24 hours
  - 65% 24hrs – 1 week after event

- Only 33% were seen by concussion specialist in follow-up
  - Most referred by OMD or Health/Safety Officer
  - Only 1 was referred to concussion clinic by ED
    - Most in ED were diagnosed without any follow up or RTD instructions

Concussion Assessment

- Any individual suspected of having a concussion (**injury plus displaying ANY sxs**) should be removed from the activity and assessed by a medic
  - After ruling out emergency issues, perform 'sideline' screening test
  - When capable, perform more comprehensive concussion assessment SCAT6
- If no provider is available, return to the activity is not permitted and urgent referral to a physician should be arranged

Quick Assessment: SAC

Standardized Assessment of Concussion (SAC)

ORIENTATION — Score: ____ / 5

What month is it?	0 ☐	1 ☐
What is the date?	0 ☐	1 ☐
What day of the week is it?	0 ☐	1 ☐
What year is it?	0 ☐	1 ☐
What time of day is it? (*w/in 1 hour*)	0 ☐	1 ☐

IMMEDIATE MEMORY — Score: ____ / 15

Form A	Form B	Form C	Form D
Elbow	Candle	Baby	Monkey
Apple	Paper	Monkey	Penny
Carpet	Sugar	Perfume	Blanket
Saddle	Sandwich	Sunset	Lemon
Bubble	Wagon	Iron	Insect

	Trial 1	Trail 2	Trail 3
Word 1	0 ☐ 1 ☐	0 ☐ 1 ☐	0 ☐ 1 ☐
Word 2	0 ☐ 1 ☐	0 ☐ 1 ☐	0 ☐ 1 ☐
Word 3	0 ☐ 1 ☐	0 ☐ 1 ☐	0 ☐ 1 ☐
Word 4	0 ☐ 1 ☐	0 ☐ 1 ☐	0 ☐ 1 ☐
Word 5	0 ☐ 1 ☐	0 ☐ 1 ☐	0 ☐ 1 ☐

NEUROLOGIC SCREENING

Loss of Consciousness: *(occurrance, duration)*

Retrograde Amnesia

Antegrade Amnesia

Strength

Sensation

Coordination

CONCENTRATION: *Digits Backwards* — Score: ____ / 5

Form A		
4-9-3	6-2-9	0 ☐ 1 ☐
3-8-1-4	3-2-7-9	0 ☐ 1 ☐
6-2-9-7-1	1-5-2-8-5	0 ☐ 1 ☐
7-1-8-4-6-2	5-3-9-1-4-8	0 ☐ 1 ☐
Form B		
5-2-6	4-1-5	0 ☐ 1 ☐
1-7-9-5	4-9-6-8	0 ☐ 1 ☐
4-8-5-2-7	6-1-8-4-3	0 ☐ 1 ☐
8-3-1-9-6-4	7-2-4-8-6-5	0 ☐ 1 ☐
Form C		
1-4-2	6-5-8	0 ☐ 1 ☐
1-8-3-1	3-4-8-1	0 ☐ 1 ☐
4-9-1-5-3	6-8-2-5-1	0 ☐ 1 ☐
3-7-6-5-1-9	9-2-6-5-1-4	0 ☐ 1 ☐

Months in Reverse Order

Dec_Nov_Oct_Sept_Aug_ Jul_Jun_May_Apr_Mar_Feb_Jan

0 ☐ 1 ☐

DELAYED RECALL — Score: ____ / 5

Word 1	0 ☐ 1 ☐
Word 2	0 ☐ 1 ☐
Word 3	0 ☐ 1 ☐
Word 4	0 ☐ 1 ☐
Word 5	0 ☐ 1 ☐

SCORE TOTALS

Orientation = ____ / 5

Immediate Memory = ____ / 15

Concentration = ____ / 5

Delayed Recall = ____ / 5

Overall Score

/ 30

Acute Concussion Management

- Remove from activity and relative rest for 3-5 days
  - Graded activity is better than complete rest
- Full neurocognitive evaluation by concussion specialist within few days of injury
- Limited activity to decrease symptom burden
- Treat impairments found on examination

Acute Concussion Management: Decrease symptom burden

- **Nausea**→ avoid reading or looking at phone in the car
- **Photophobia**→ sun glasses, adjust seating away from windows, turn out lights when possible
- **Blurry vision**→ limit reading to small amounts. Limit computer/ gaming
- **Vestibular Ocular Motor Impairment, nystagmus**→ Vestibular PT, Limit reading until improves

Acute Concussion Management

- **Drowsy**→ allow naps as needed if not affecting sleep overnight.
- **Neck spasms**→ Physical Therapy, neck stretching
- **Impaired Concentration/Memory**→ May need accommodations to repeat assignments/instructions, may need repetition/assistance
- **Impaired Balance**→ Balance training, avoid bike riding, elevated surfaces

Acute Concussion Management

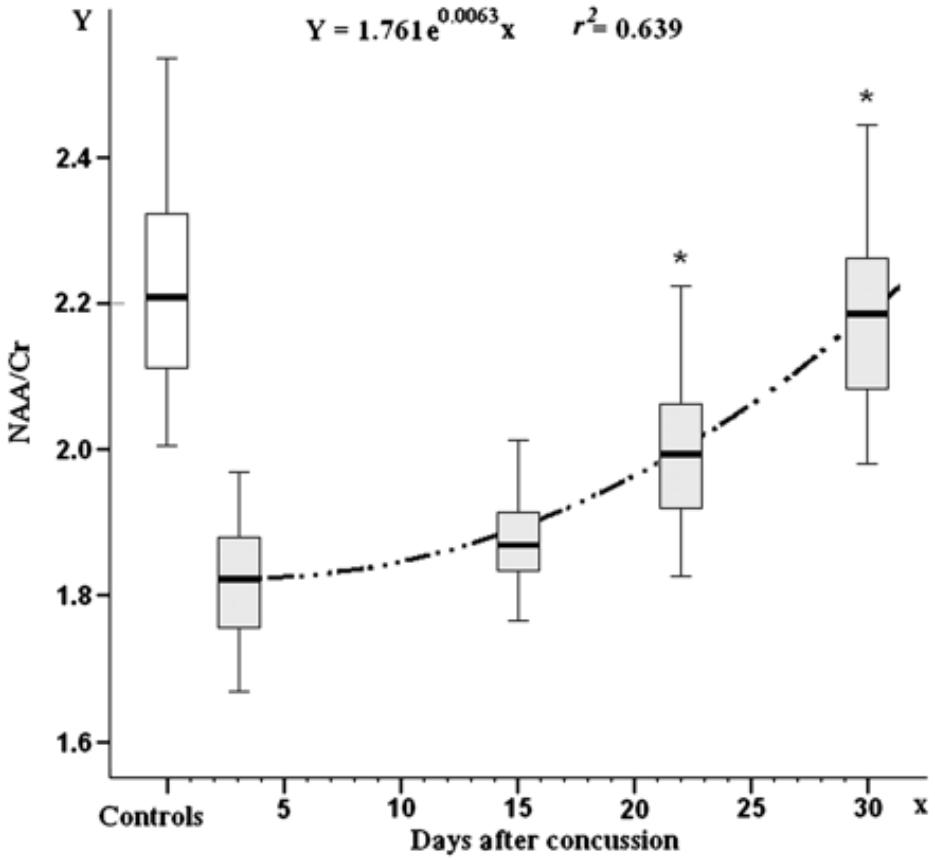
- Remove from activity and relative rest for 3-5 days
- Full neurocognitive evaluation by specialist
- Decrease symptom burden
- Treat impairments found on examination
- Gradual return to work
- Return to Activity protocol when symptom free
  - Graded increase in physical activity over 24-hr increments

Acute Concussion Management

- Median duration of symptoms
  - Irritability – 16 days
  - Sleep disturbance – 16 days
  - Frustration – 14 days
  - Poor concentration – 14 days
  - Nausea, depression, dizziness, and double vision abate most quickly

Brain Metabolism following mTBI

- Recovery of neuronal metabolism in 40 athletes following concussion
  - Window of brain vulnerability from cellular energetic metabolism impairment
    - Symptom recovering 3-15 days
    - Normalized metabolism by 30 days



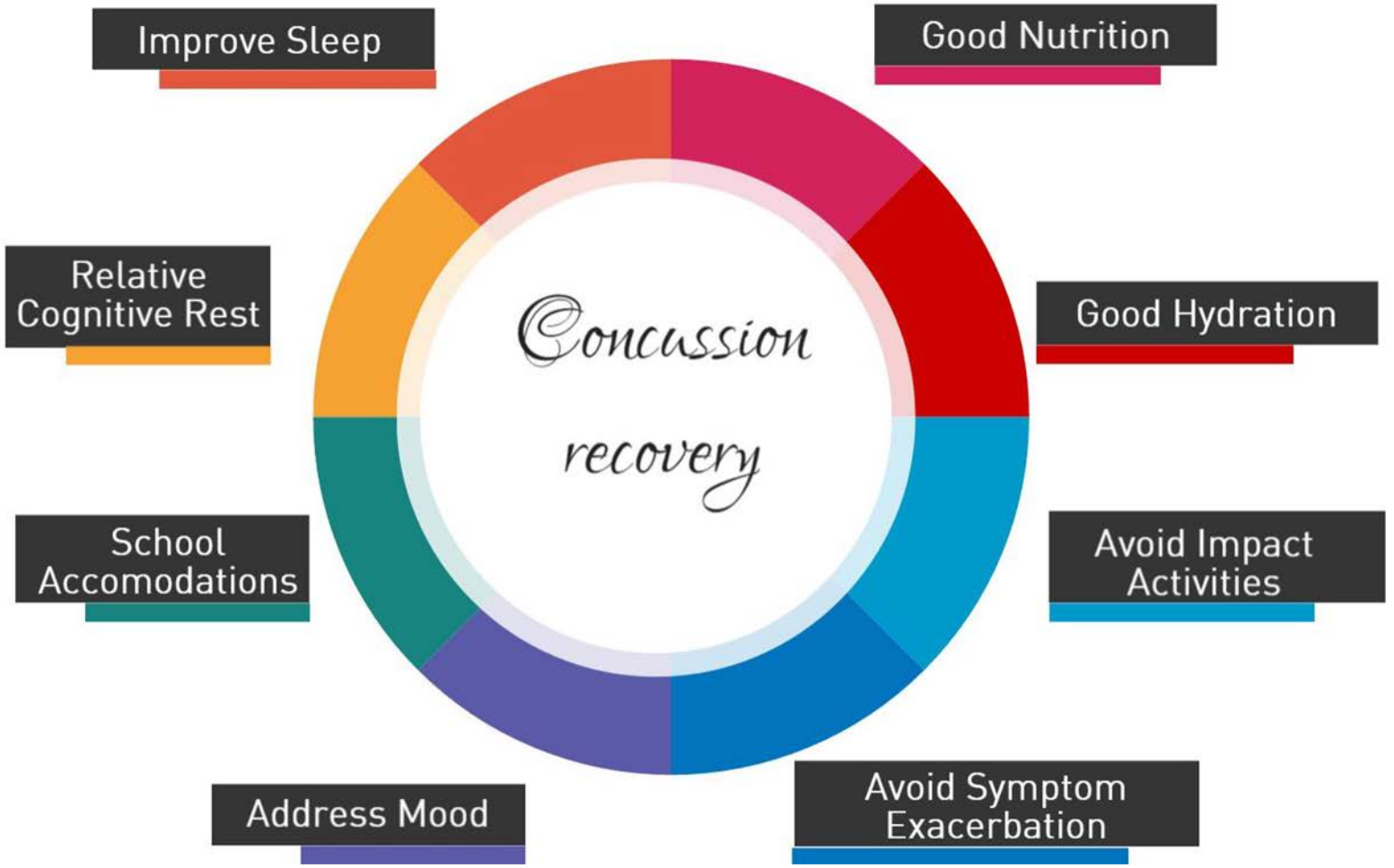
Brain 2010; 133(11): 3232-3242.

Burlington Street – All Effected

- Symptoms resolution
  - 24-48h (4%)
  - 48h-1wk (25%)
  - 1-2wks (29%)
  - 3-4wks (13%)
  - 1-6 month (8%)
  - Some still report occasional tinnitus, vertigo, and fogginess
- 1 respondent reported SOB,dyspnea >48hr after exposure

Concussion Management

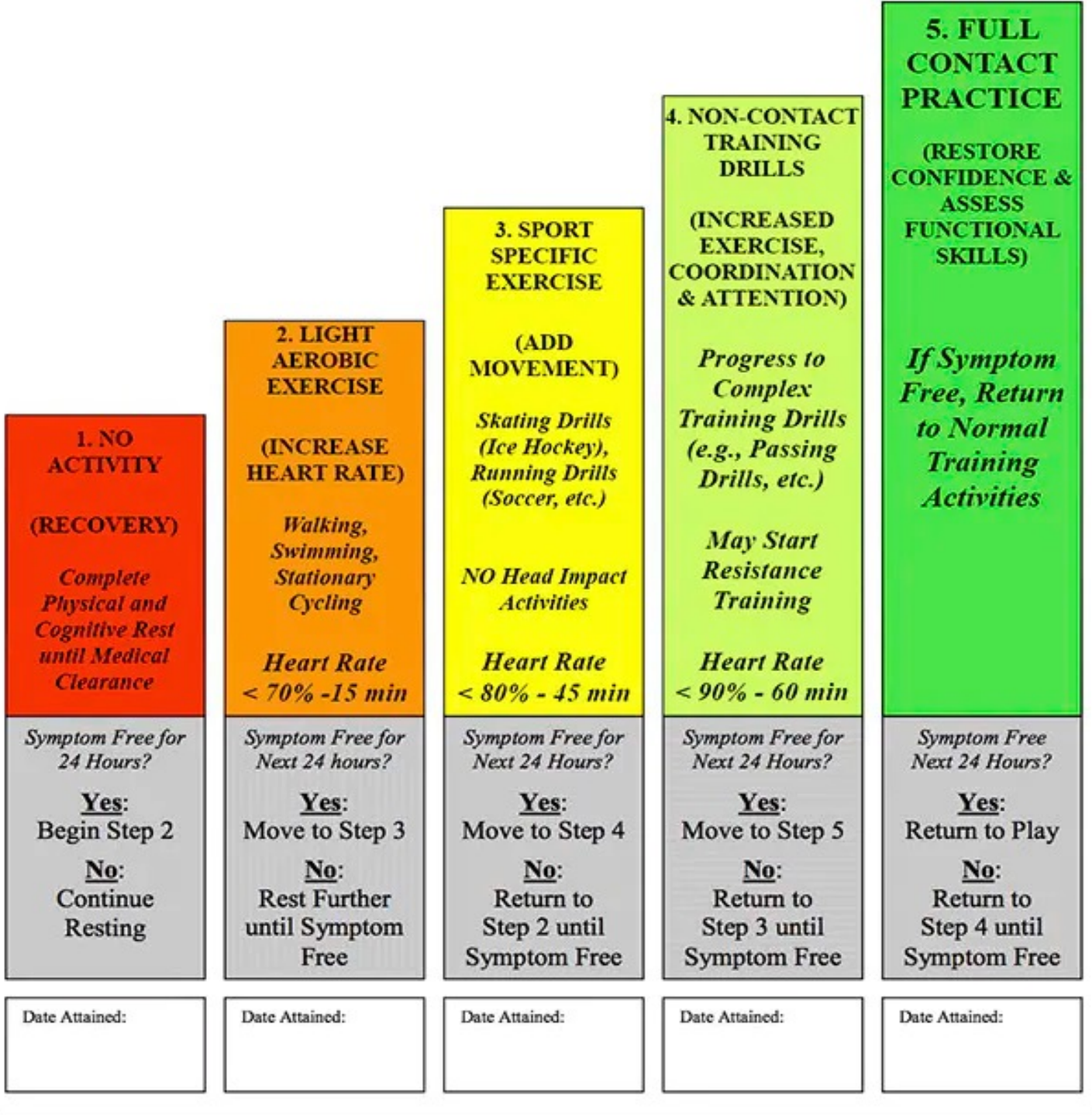
Prevent Injury & Decrease Symptom Burden



Returning to Activity After Concussion

- Requirements to begin RTA Progression:
  - Normal neurologic examination
  - Full resolution of all symptoms and off of all analgesics for at least 24 hours
  - Back to full normal activity without symptoms exacerbation or cognitive difficulties
  - Back to cognitive baseline (no confusion, mental fog, fatigue…)

Concussive Syndrome: Graduated Return to Activity



Post-Concussive Syndrome (PCS)

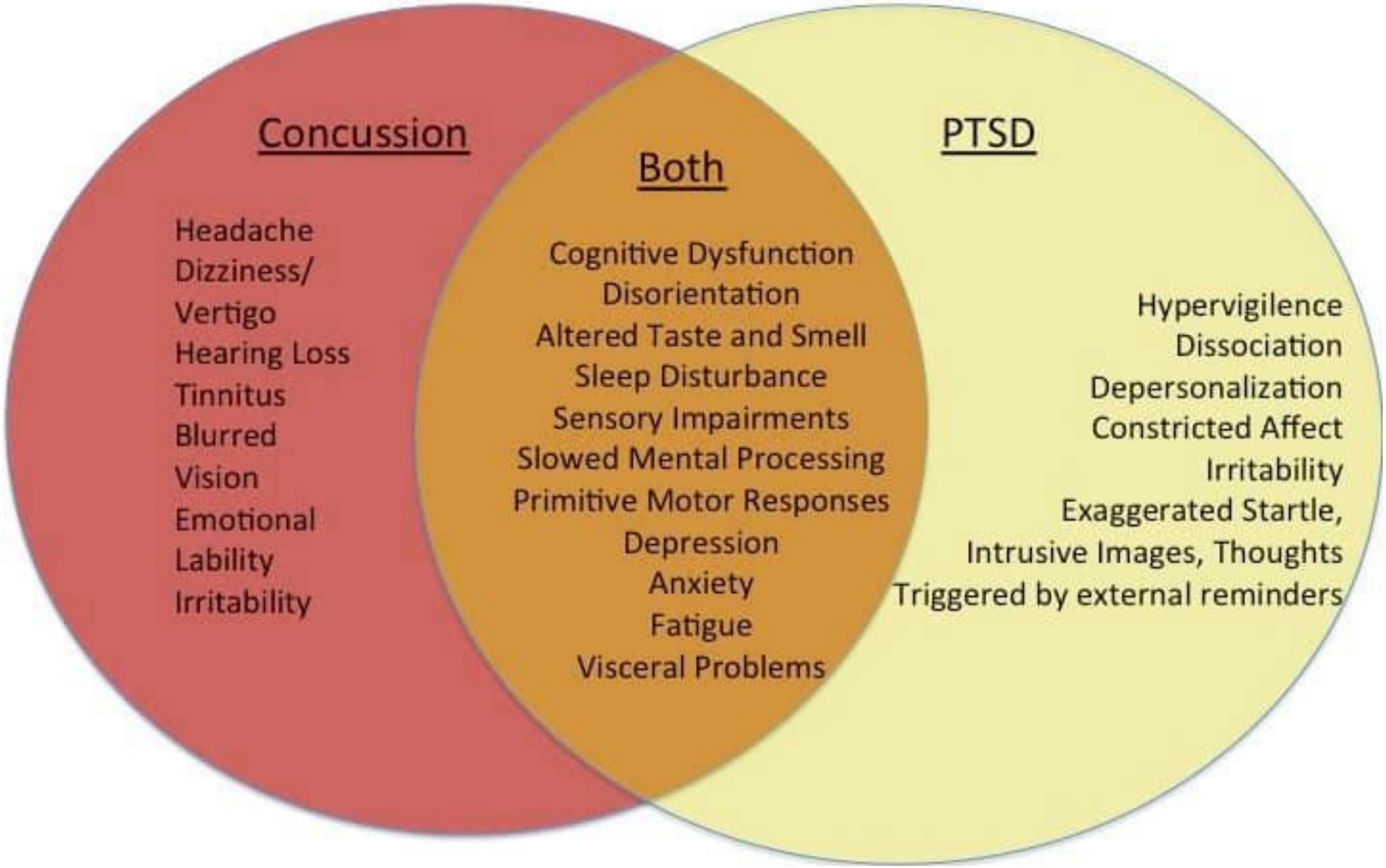
- Defined as by delayed recovery with persistent symptoms weeks to months post-injury
  - Presence of three or more lasting symptoms (HA, dizziness, fatigue, irritability, insomnia and decreased memory or concentration)

- 5-10% experience concussions symptoms that persist beyond 6 weeks (***8% in Burlington Street cohort***)
  - There is no known cause for persistent symptoms after a concussion
  - A prior history of concussions increases the likelihood of PCS

Post-Concussive Syndrome (PCS)

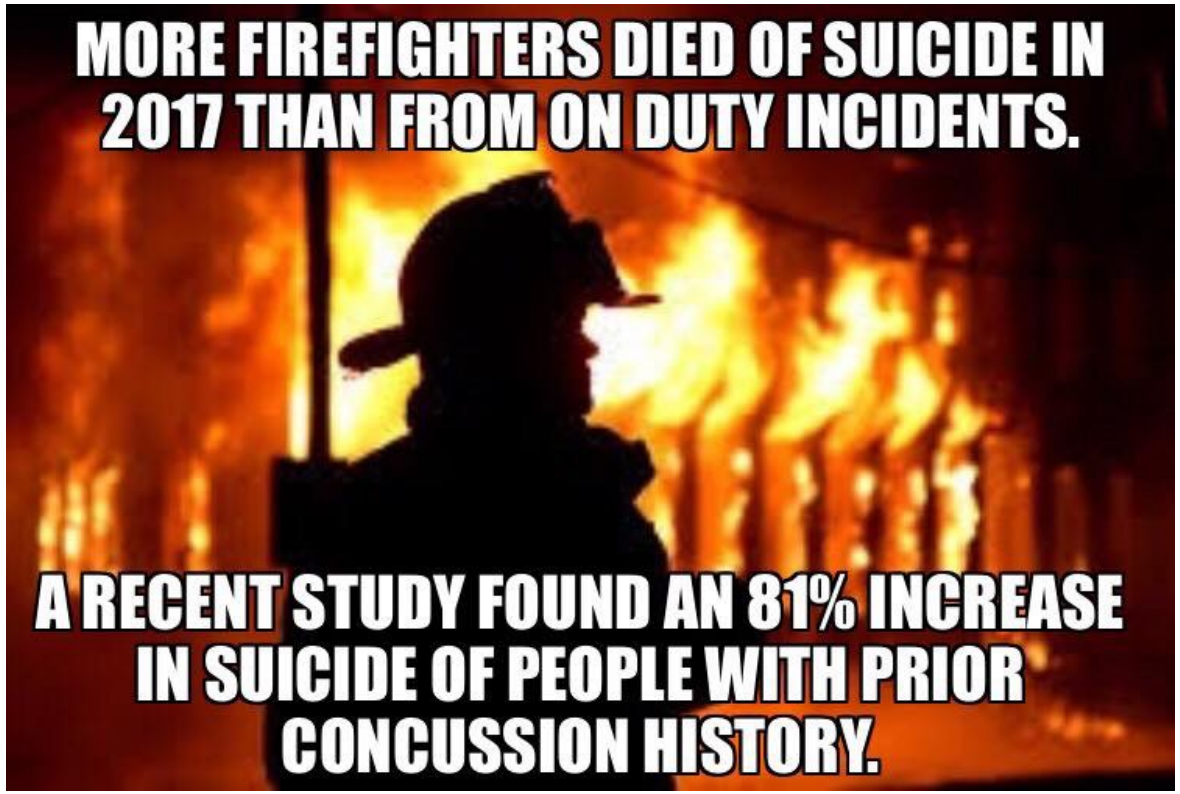
- Depression and anxiety linked to multiple concussions and post-concussive syndrome
  - Can worsen pre-existing mental illness or cause new symptoms
- Etiology often neuropsychological (combination of physical and emotional factors) including:
  - Physiological changes in your brain
  - Brain's natural reaction to trauma
  - Symptoms such as poor sleep that exacerbate mental symptoms.
  - Dysregulation of your autonomic nervous system
- Symptoms often overlap with PTSD

Symptoms


Concussion
Headache
Dizziness/
Vertigo
Hearing Loss
Tinnitus
Blurred
Vision
Emotional
Lability
Irritability
Both
Cognitive Dysfunction
Disorientation
Altered Taste and Smell
Sleep Disturbance
Sensory Impairments
Slowed Mental Processing
Primitive Motor Responses
Depression
Anxiety
Fatigue
Visceral Problems
PTSD
Hypervigilence
Dissociation
Depersonalization
Constricted Affect
Irritability
Exaggerated Startle,
Intrusive Images, Thoughts
Triggered by external reminders

Post-Concussive and Psychiatric Symptoms

- Systematic review of recent literature
  - High prevalence of acute depressive syndromes
  - Link between repeated concussions and major depressive disorders
- 2019 study: "the risk of suicide was two-fold higher for people diagnosed with at least one concussion/mild TBI compared with those not diagnosed with a concussion/TBI"



Post-Concussive and Psychiatric Symptoms

- Study: Depression and Neurocognitive Performance After Concussion
  - Increased depression scores up to 14 days as well as neurocognitive decrements in reactive time and visual memory
    - 20% reported depressive symptoms within 5 days (as soon as 48 hours)
    - Recommends mood assessments after concussion to help monitor and enhance recovery
  - May be a normal part of the acute post-concussive syndrome

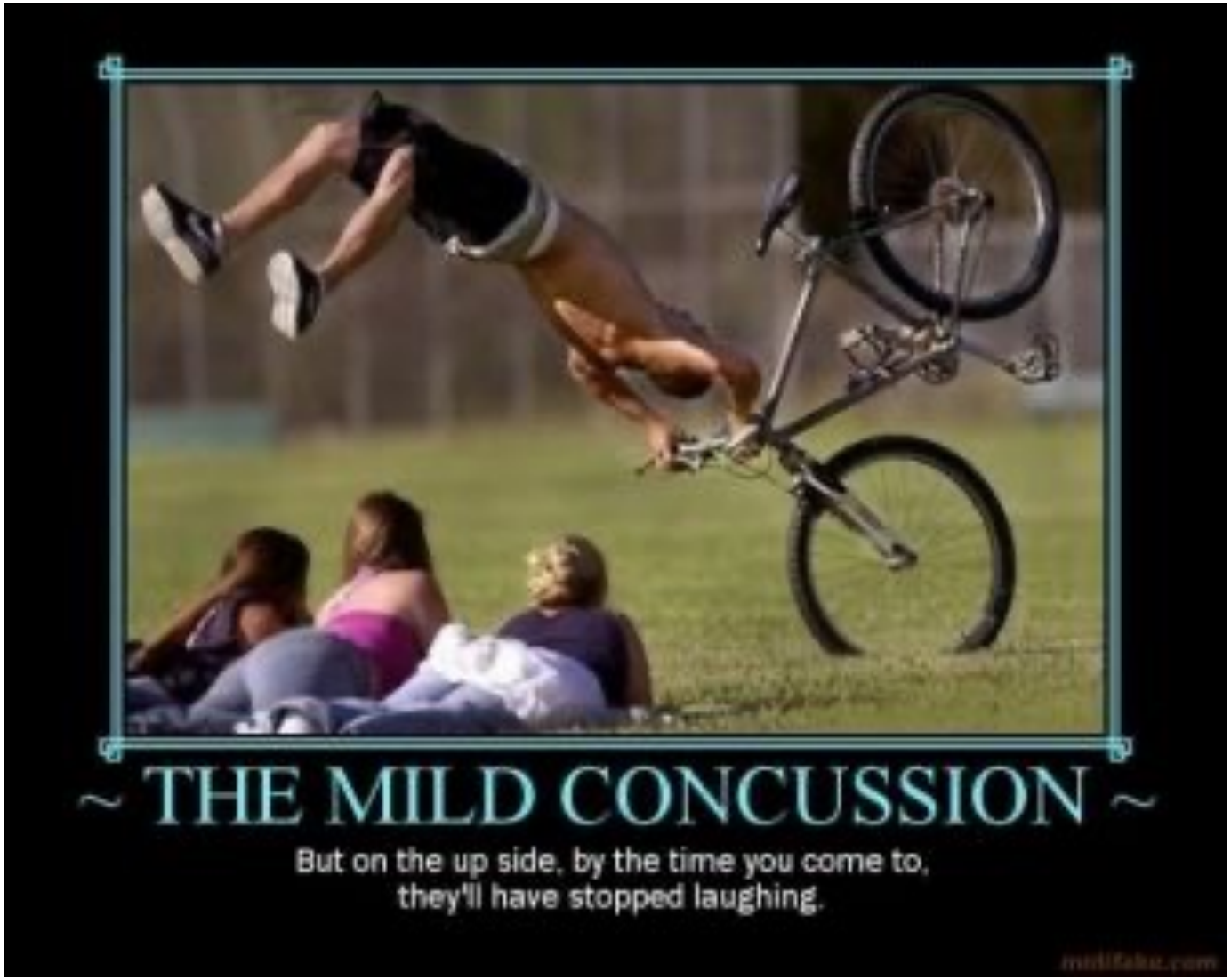
Post-Concussive and Psychiatric Symptoms

- Highest prevalence caused by a brain injury include **depression, anxiety**, PTSD, and a slew of emotional changes:
  - Some patients (or caregivers) think their personalities changed after TBI
  - Social anxiety
  - Teariness
  - Irritability and anger
  - Mood swings
  - Feelings of overwhelm
  - Impulsivity
  - Hyperactivity

Post-Concussive and Psychiatric Symptoms

- Treatment approaches for mental health struggles after brain injury include:
  - Medication
  - Neurorehabilitation
  - Psychotherapy (especially cognitive behavioral therapy)
  - Lifestyle changes
  - Natural remedies
    - B12 (helps with mental fatigue and irritability)
    - Curcumin (anti-oxidant and anti-inflammatory)
    - Magnesium (nerve impulse conduction and helps headaches)

Questions??


~ THE MILD CONCUSSION ~
But on the up side, by the time you come to,
they'll have stopped laughing.

September 18th, 2024

Explosion/Blast Injuries

Northern Virginia EMS Council Meeting FY24
Inova Loudoun Hospital Trauma Services
Patient Arrival: June 1, 2021 – June 2024

Inova™

Inova Loudoun Hospital – Level III Trauma Center

Hospital Arrival Date: June 2021-June 2024

6,715

Total Patient Volume

4,148

Total Trauma Activations

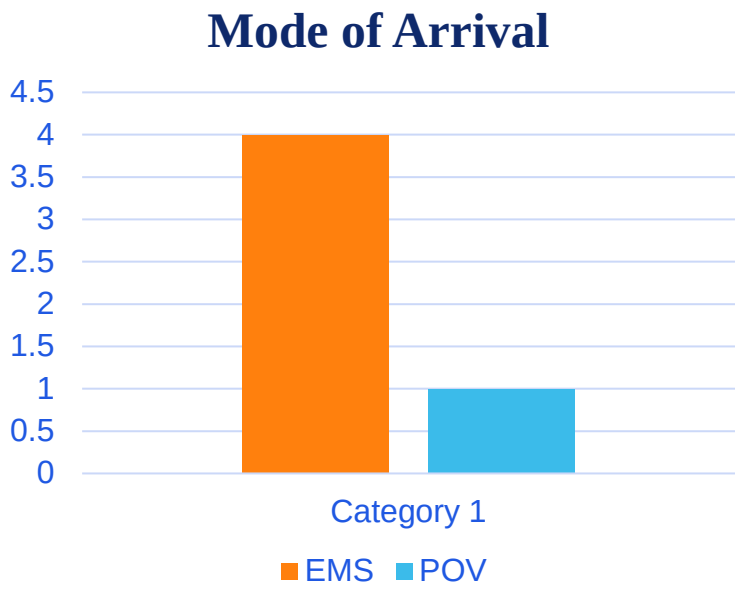
2,837 **(‘23/’24)**

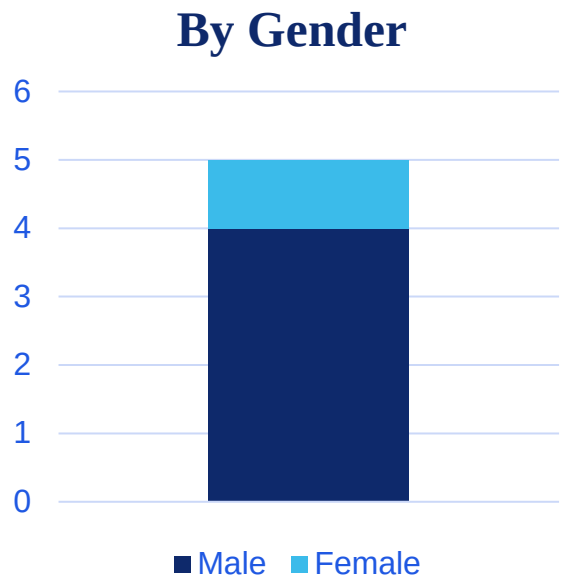
Total EMS Pts

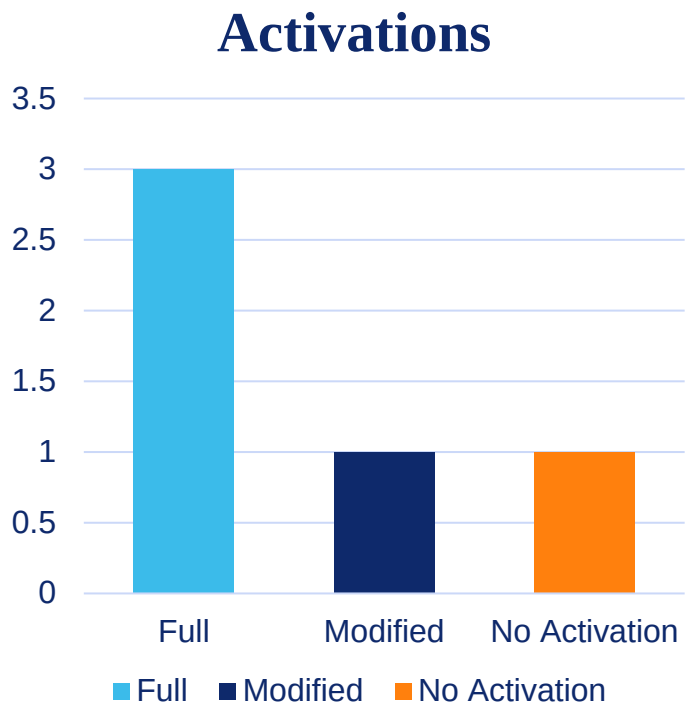
(82% of Patients in 2023 and 2024)

Explosion Cases- 5 total

- Lithium battery charger explosion, house fire
- MVC, fire, possible vehicle explosion, entrapment
- 3 patients from the Sterling house explosion







Cases- 2023

Case 1: 47yo male trapped in house with lithium battery explosion

EMS care: Cyanide kit given in field, intubated, CPR imitated for short period until ROSC

Full Activation

Notable findings: no thermal burns noted, soot around mouth and nose, carboxyhemoglobin 50.5% Attempted transfer to MWHC, declined transfer due to poor prognosis. ISS 25

Patient was an organ donor

Valor Award to the EMS and Fire Units

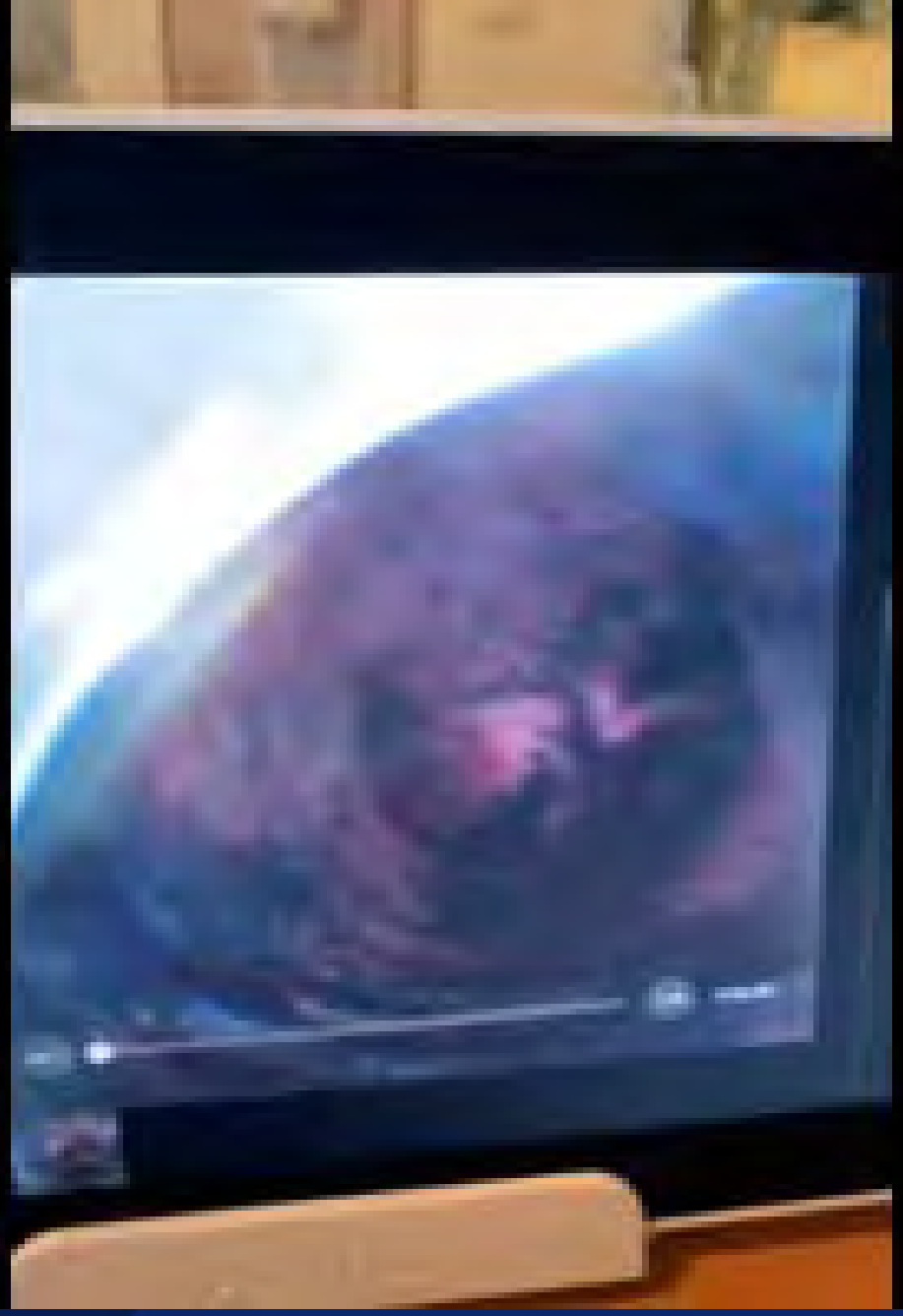
Case 2: 47yo male trapped in Tesla, possible explosion, fire

EMS Care: Prolonged extrication, provided O2

Modified Activation

Notable findings: Patient tolerated CT however upon return to the ED began wheezing and required emergent intubation. Patient was upgraded to Full Activation. Transferred to MWHC. ISS 10. Case was discussed at peer review.

Valor Award to the EMS and Fire Units



Cases- 2024

Case 3: 52yo male firefighter involved in Sterling house explosion. Does not recall events, c/o left shoulder pain, left ankle pain.

EMS care:
Pain medication

Full Activation

Notable findings: multiple abrasions, ruptured tympanic membrane. Discharged the following day.

Case 4: 44yo female involved in Sterling house explosion. C/O head pressure, eye irritation, neck, and upper back pain. Unsure of LOC.

EMS Care: Prolonged extrication, provided O2

Full Activation

Notable findings: left wrist laceration requiring sutures

Discharged home that evening.

Case 5: 36yo male firefighter involved in Sterling house explosion. States he was knocked unconscious after explosion- awoke in ambulance. Transferred to local hospital, treated, imaged and discharged. Presented to ILH 3 days later with abd pain.

EMS Care: NA

No Activation

Notable findings: Patient had grade III splenic laceration that was treated medically. Repeat imaging remained stable throughout hospitalization as did his Hgb. Also had shoulder fracture with rotator cuff tear- to be managed by ortho outpatient.

Thank you!

Questions?

Inova™