Approach to the **C**BRN Event: A Framework for Patient Care & Movement

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Inside the Mind of the Terrorist

- What characteristics of CWA would be most suitable for use in an attack?
  - High volatility
  - Fast & effective absorption via skin and respiratory system
  - Rapid onset
  - Lethal / incapacitating effects

Chemical-Warfare Agents (CWAs)

Table 1. Classes of Chemical-Warfare Agents (CWAs) Likely to Be Used in a Civilian Attack.

Class	Representative Agents	Last Known Use or Attempted Use as a CWA*
Nerve agents (cholinesterase inhibitors)	G-series (sarin, soman, cyclosarin, tabun), V-series (VE, VG, VM, VX), organophosphates	Syria, 2017: sarin; Malaysia, 2017: VX
Asphyxiants (blood agents)	Hydrogen cyanide, cyanogen chloride	New York City subway, 2003: cyanide
Opioid agents	Fentanyl, carfentanil, remifentanil	Moscow theater, 2002: fentanyl or carfentanil (used to subdue terrorists)
Anesthetic agents	Chloroform, halothane, nitrous oxide	No known use as CWA
Anticholinergic (antimuscarinic) agents	3-Quinuclidinyl benzilate (BZ), Agent 15 (chemically the same as or related to BZ), atropine	Syria, 2012: Agent 15
Vesicant agents	Mustards (nitrogen and sulfur), lewisite, phosgene oxime	Syria and Iraq, 2016: mustard gas
Caustic agents (acids)	Hydrochloric acid, hydrofluoric acid, sulfuric acid	London, 2017: sulfuric acid
Riot-control agents	Chloroacetophenone (CN), chlorobenzylidenemalononitrile (CS), bromobenzylcyanide (CA)	Falkland Islands, 1982: "tear gas" used on British troops
Trichothecene mycotoxins	T-2 toxin	Possible use in Vietnam War, 1970: T-2
Pulmonary agents	Chlorine, phosgene, diphosgene	Syria, 2017: chlorine
Botulinum toxin	Botulinum toxin	Tokyo, 1995: botulinum toxin used by Aum Shinrikyo

Ciottone GR. Toxidrome Recognition in Chemical-Weapons Attacks. N Engl J Med. 2018 Apr 26;378(17):1611-1620. doi: 10.1056/NEJMra1705224. PMID: 29694809.

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The Objective!

- The classes of chemical-warfare agents that are most rapidly lethal (i.e., **nerve agents, opioid agents and asphyxiants**), should be quickly identified with the use of a toxidrome-based system of rapid triage

DOES A FRAMEWORK ALREADY EXIST FOR MANAGEMENT OF CASUALTIES?

ZONES OF CARE

Hot Zone (DTC)

Warm Zone

Cold Zone

Primary Objectives:

- Complete the mission
- Treat the casualty
- Avoid additional casualties

Management Objectives:

- Massive hemorrhage control
- Casualty positioning
- Auto-injector antidotes

ZONES OF CARE

Hot Zone

Warm Zone (ITC)

Cold Zone

Management Objectives:

- Airway Management
- Respirations
- Circulation
- Head Injury
- Hypothermia

ZONES OF CARE

Hot Zone

Warm Zone

Cold Zone (EVAC)

Management Objectives:

- Evacuation to definitive therapy
- Frequent reassessment

HOW CAN WE ADAPT THAT FRAMEWORK FOR THE CBRN ENVIRONMENT?

MARCHE^2

- M – Mask up
- A – Antidotes
- R – Rapid Spot Decontamination
- C – Countermeasures
  - Antidotes are challenging in the HOT ZONE
  - Medical management
- H – Hypothermia
- E – Extrication

*DeFeo DR, Givens ML. Integrating Chemical Biological, Radiologic, and Nuclear (CBRN) Protocols Into TCCC Introduction of a Conceptual Model - TCCC + CBRN = (MARCHE)2. J Spec Oper Med. 2018 Spring;18(1):118-123. PMID: 29533446.

ZONES OF CARE

Hot Zone (DTC)

Warm Zone

Cold Zone

What are the Primary Objectives?

- Don PPE
- Move casualty to safer position
- MARCHE[2]

What are the Management Objectives?

- Mask up
- Stop the poisoning (spot decon)
- Toxidrome-specific antidotes (limited)

Hot Zone (DTC)

- **M** – Mask up

- **A** – Antidotes (toxidrome-specific)
  - ATNAA/CANA
  - Naloxone IN/IM
  - Amyl Nitrite
- **R** – Rapid Spot Decon
  - *Life-threatening hemorrhage controlled*
  - Remove visible contamination
  - Apply RSDL on affected areas
  - Do NOT breach clothing further in HOT ZONE

What is the Purpose of Decon?

Medical countermeasure that mitigates the conversion of an exposure to a dose

ZONES OF CARE

Hot Zone

Warm Zone (ITC)

Cold Zone

What are the Management Objectives?

- Gross decon will occur
- MAR**CHE**[2]
- If an intervention can be improved via vascular access, gain access AFTER decon
- Take note of interventions performed in the HOT ZONE / WARM ZONE before decon

Warm Zone (ITC)

- TQ assessment, downgrade/conversion, decontamination
  - TQ exchange is situation dependent
  - Effective and necessary vs. source of ongoing exposure for the casualty

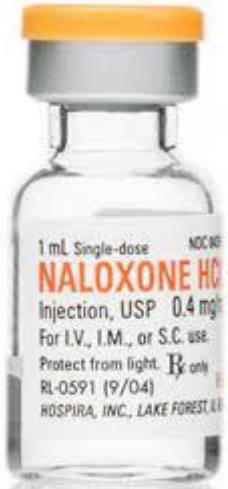
Warm Zone (ITC)

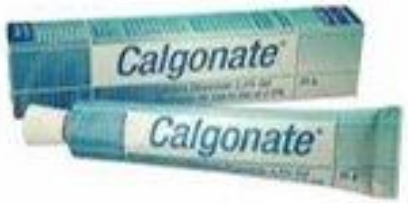
C - Countermeasures

- Antidotes
  - Atropine
  - CANA (additional)

- Airway Management
  - Secure airway
  - Replace interventions prior to decon

Warm Zone (ITC)





C - Countermeasures

PEEP!

- Respiration
  - Nerve Agents
    - Atropine
  - Opioids
    - Naloxone (10 mg)
  - Cyanide (Asphyxiants)
    - Hydroxocobalamin
  - Hydrofluoric Acid (Caustics)
    - Calcium gluconate
    - Bronchodilators
  - Blister Agents
    - Bronchodilators

Warm Zone (ITC)

- **H** – Hypothermia
  - Minimize heat loss
  - Address "wet and naked"
  - Cover burns

Warm Zone (ITC)

- **E** – Extrication

ZONES OF CARE

Hot Zone

Warm Zone

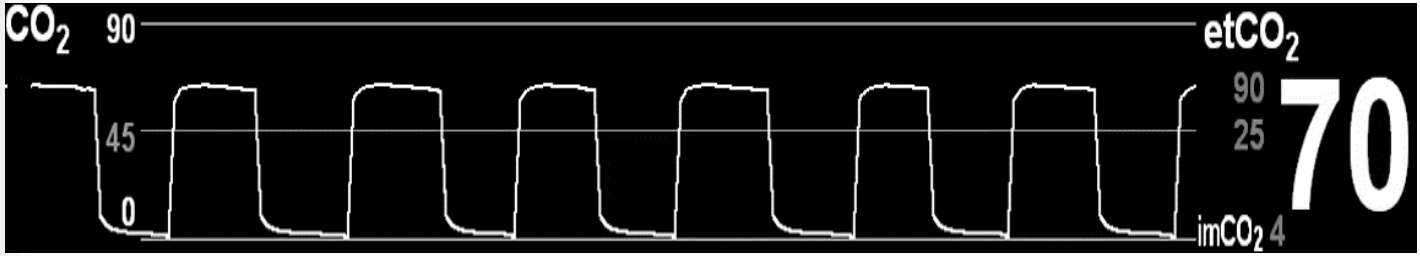
Cold Zone (EVAC)

What are the Management Objectives?

- Reassessment of interventions
- Enhanced monitoring
- Considerations of delayed onset presentations
- Pain management

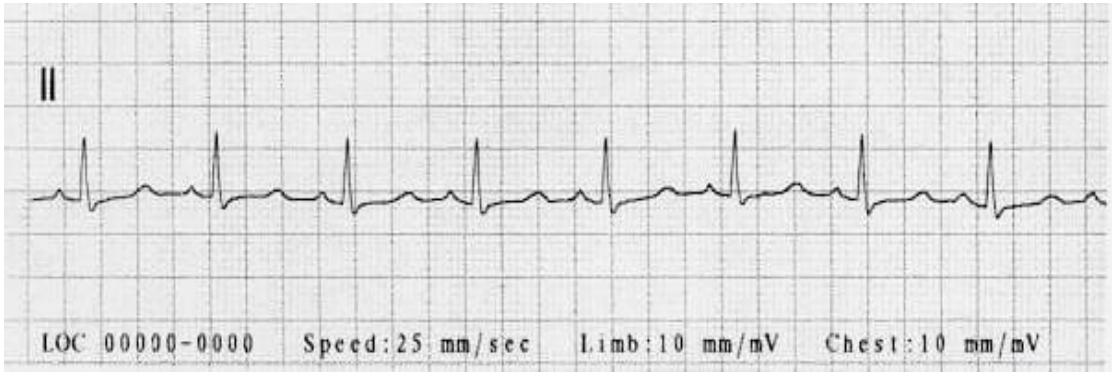
Cold Zone (EVAC)

- Definitive airway control
- Use of oxygen
- Cardio-resp monitoring



Cold Zone (EVAC)

- Cardio-resp monitoring
- Delayed Respiratory failure



1.5 mL of a 10% calcium gluconate injection to 6 mL of sterile water in nebulizer

Cold Zone (EVAC)

- Delayed burn presentation
- Pain management

Let's Summarize

- Decon – *Medical countermeasure* that mitigates the conversation of an exposure to a dose
- Toxidrome-based approach for recognition and rapid management of suspected chemical-warfare agents
- MARCHE^2 is dynamic
- Hot Zone – **M**ask, **A**ntidotes, **R**apid spot decon
- Hot Zone Antidotes – ATNAA/CANA, Naloxone IN/IM, Amyl Nitrite
- Warm Zone – **C**ountermeasures based on suspected toxidrome, preventing **H**ypothermia, initiating **E**xtraction
- Cold Zone – Reassessment and advanced monitoring