

# Response to Chlorine Mass/Multiple Casualties: Experiences from Iraq

CDR Duane C. Caneva, US Navy  
Emergency Medicine Physician  
[Dcaneva@who.eop.gov](mailto:Dcaneva@who.eop.gov)

# Outline

- Setting
- Conditions, Rules of Engagement (ROE)
- Incident Scenario 1
- Response & Preparedness
- Incident Management System
- Incident Scenario 2
- Conclusions

# Setting: Iraq is an historical place

- Garden of Eden
- “Cradle of Civilization”
- Home of Babylon, Assyria, Mesopotamia
- Birthplace of Abraham and Sarah
- Land of Noah (Mt Ararat in the north)
- Patron is St. Thomas who preached there

# Conditions: What we do there that you might not know...

- We take care of all patients brought to us
  - US Military/ Contractors
  - Iraqi Police and Army
  - Civilians
  - Detainees & Insurgents
- All patients are treated in order of medical need
- All patients are treated equally

# What we do that you might not hear about...

- Marines give their blood for the mission
  - On the battlefield
  - At the hospital
- Special cases of care

# Work Environment

- Standard of Care
- JPTA Joint Patient Tracking Application allows transfer of medical data
  - Some challenges
- Sandy environment
- EMS Transport

# Incidents:

- Turning points in the “Awakening”
- “Follow what God has commanded in the Torah and the Gospel and the Quran. One God. One Way”

# Incident 16 March 2007

[http://en.wikipedia.org/wiki/Chlorine\\_bombings\\_in\\_Iraq](http://en.wikipedia.org/wiki/Chlorine_bombings_in_Iraq)

- 3 separate attacks on this day, 2 in Fallujah
- Chlorine-laden truck bomb exploded at entrance to a housing estate
- 250 injured
- 6 killed
- Triage at Forward Operating Base (FOB)
  - 10 most critical sent to Fallujah Surgical for further care
- Subsequent Events 16 Mar
  - 4 Coalition Forces wounded in RPG attack against HMMWV
    - 3 critical
  - 7 Coalition Forces injured in collapse of guard tower

# 10 Patients from 16 Mar 2007 Chlorine VBIED

- # 408 50 yo male inhalation injury
- # 499 24 yo male inhalation/ shrapnel
- # 501 3 yo female inhalation DOW HD 8
- # 502 18 mos female inhalation
- # 503 3 yo female inhalation
- # 504 28 yo female inhalation
- # 505 7 yo male inhalation
- # 506 7 yo female inhalation DOW
- # 507 14 yo female inhalation
- # 508 35 yo male inhalation/shrapnel

## **#408: 50 yo Iraqi male SOB, R arm pain, d/c'd HD3**

- Lungs with coarse BS
  - CXR clear
  - ECG with acute changes
- R/o'd for MI
- CXR remained clear
- Improved over 2 days, d/c'd hospital day 3

## **#499: 24 yo Iraqi male CI inhalation and blast shrapnel, d/c'd HD8**

- In respiratory arrest
  - Lungs with coarse breath sounds
- Intubated on arrival
- CXR bilateral fluffy infiltrates c/w ARDS, bilateral pneumatoceles vs. pneumothoraces, progressed to bilateral infiltrates on HD 2
- Extubated AM HD 3, then developed respiratory distress, failure. Re-intubated that PM
- Extubated HD 5. Laryngoscopy for stridor found erythematous, swollen cords, L cord connectd to small strand of tissue. Erythematous mucosa. CXR appears worsened.
- DC HD 8 on albuterol inh, flovent. ENT consult in one month if hoarseness persists, PFT's and CXR in one month

# #501: 3 yo female CI Inhalation, DOW HD 8

- Initial pulsox= 97%, insp/exp wheezing and retractions
- Rx'd with multiple/continuous nebs, pulsox continued to decrease
- Intubated, transferred
- CXR c/w ARDS. Small pneumo noted HD1. Req' high PEEPs.
- HD2 bilat chest tubes for pneumothoraces, CXR ARDS
- Bronch HD 5: friable lung tissue
- Worsening air exchange, O2 sats, lung parenchyma on CXR
- DOW HD 8

## **#502: 18 mos female CI Inhalation, d/c'd HD 15**

- Intubated in Fallujah; high PEEP, high FiO<sub>2</sub>
- PCXR-Subcut emphysema, pulmonary edema c/w ARDS
- HD2 PCXR-R pneumothorax, bilateral chest tubes
- Tenuous course, high PEEPs, FiO<sub>2</sub>s
- HD4: Bronch aspirate GNR's and polys, started on Colistin, Meropenem, and Vanc
- HD8 extubated, attentive
- HD9 R pneumothorax noted, bilat chest tubes still in place
- HD11: O<sub>2</sub> dependent still, now febrile
- DC HD15 with O<sub>2</sub> sats 93% desat to 80% with walking

# # 503: 2-3 yo Iraqi female CI Inhalation, d/c'd HD 15

- Tachypnea, coarse breath sounds, CXR diffuse airspace disease c/w pulmonary edema, no pneumothorax
- HD3 CXR-blunting L costophrenic angle, low fever, started on Zosyn
- HD4 new bilat patchy infiltrates due to aspiration vs. pulmonary edema, changed to meropenem, vanc., colistin pending cultures, worsening course for 2 days followed by improvement
- HD 9 extubated
- HD15 d/c'd. Pulsox 97% without desat with activity

# **#504: 28 yo Iraqi female CI inhalation, d/c'd HD4**

- Pulsox 94% RA, mild SOB, coarse breath sounds
- DC'd HD4

# **#505: 7 yo Iraqi male CI inhalation in respiratory failure/ arrest. D/c'd HD 8**

- Unresponsive, BVM on presentation, intubated on arrival
- Lungs with diffuse crackles, wheezes, very stiff, difficult to ventilate, oxygenate. Placed in OR on anesthesia gases for desat and space
- HD4 develops L pneumothorax, sub-cut emphysema. CT placed bilat.
- HD5 extubated.
- HD6 R CT removed.
- HD 7 L CT removed
- HD 8 d/c'd. Noted to have nosocomial pneumonia treated with antibiotics.

## #506: 8 yo Iraqi femal CI Inh. DOW HD 9

- 8 yo I female VBIED with chlorine gas inhalation
- Mod resp distress, lungs with coarse breath sounds
- CXR c/w ARDS, bilat infiltrates
- HD 4 developed bilat pneumothoraces, bilat infiltrates, fever, elevated WBC
- Required high PEEPS, developed numerous pnuematoceles
- HD8 noted to have L dilated, fixed pupil, bradycardia, elevated BP
- Agonal rhythm, DOW HD 9

**#507: 14 yo Iraqi female CI inhalation. D/c'd  
HD 15**

- Rapidly progressing respiratory failure, intubated, poor oxygen saturation, CXR evidence barotrauma
- HD1 bilateral chest tubes placed, ARDS
- HD4 Noted worsening consolidation L retrocardiac, started on antibiotics
- Extubated HD7
- HD 10 diagnosed with depression. Slow improvement in condition
- D/c'd HD 15

# **#508: 35 yo Iraqi male CI inhalation, shrapnel injury**

- Penetrating back injury with dyspnea, chest pain, back pain
- Lungs with rhonchi, wheezing
- CXR clear, pulsox 92%, fragment in soft tissue near T5 which is fractured
- Medevac'd as a precaution (not intubated)

# Chlorine

Concentration	.32 ppm	15.1 ppm	40-60 ppm	1000 ppm
Effect	Discernable by most individuals	Least amount to cause throat irritation	Fatal after 30 minutes	Fatal after several breaths

- Greenish, yellow gas
- Approximately 2 ½ times heavier than “air”
- Pungent odor with low “odor threshold”
- Strong oxidizing agent that can react explosively with many common substances

# Chlorine—Pulmonary Agents

- Chlorine, Phosgene
- Symptoms
- Irritating effects to skin, eyes, respiratory tract
- Respiratory
  - Chest pain
  - Vomiting
  - Coughing
  - Difficulty breathing
  - Cyanosis
  - Wheezing, crackling
- Pulmonary effects progress over several hours
- Topical damage followed by pulmonary edema, ARDS
- Recovery over 7-14 days
- Can have permanent, persistent symptoms

# Chlorine Treatment

- Stop the exposure
  - Remove from environment
  - Flush with copious, tepid water for powder or liquid forms
- Supportive measures
  - Oxygen supplementation
  - Beta-agonists
  - Observation
  - Intubation
- No specific antidotes

# Preparedness

# Pragmatic Decon

- NBC Unit
- RSDL
- Fire hoses

# Airway Management Adjuncts

# Incident Management System

- At our level, all Operations and Logistics
  - Tight community, including on base and field medical providers
  - Disposition decisions relatively easy
- Span of control
- Self-organizing

# Incident 28 March 2007

- Pair of truck bombs, one containing chlorine, as part of sustained attack aimed at Fallujah Government Center.
- Initial bombings followed by small arms attack
- 14 US Forces, 57 Iraqi forces seen