Biological and Chemical Warfare – What Does it Mean to Me?

Created by Jean Stoy, PhD, MSN, RN, CST
- Acquire knowledge (define) of chemical and biological warfare
- Identify history of chemical and biological warfare
How does biological and chemical warfare affect the O.R.?

- Apply knowledge of chemical and biological warfare to anticipate trauma, radiological, and chemical injuries that may be seen in the O.R.

Other Effects

- Identify the role of the Surgical Technologist
History of Chemical Weapons

- Chemical weapons have been in use for centuries with records related to their use existing before and during the Civil War, but their modern form starts with World War I when large scale "gas attacks" were part of both German and Allied tactics.
History of Chemical Weapons

- Those attacks used common industrial chemicals
  - Typically delivered by artillery shells and distributed by the wind
  - Relatively crude technology with uncertain results
- Public outcry against the use of gas (actually aerosols or vapors) led to the Geneva Protocol of 1925 under which nations agreed to not be the first to use such weapons
Although both Nazi Germany and the Allies stockpiled chemical weapons, there was no reported use made of them in World War II.

A few smaller conflicts have seen the use of chemical munitions, in particular Iraq against Iran in 1983 through 1986 as well Iraq's use against its own Kurdish population in 1988.
History of Chemical/Biological Warfare

- Doctors of Death – 50 minutes
  - History of Japanese and others using chemical and biological agents
  - [http://youtu.be/6qBivSrb1hM](http://youtu.be/6qBivSrb1hM)
  - Sarin Gas release – August, 2013
    - Damascus, Syria
History of Chemical/Biological Warfare

- World War I and World War 2 (even against U.S.)
  - [http://youtu.be/tWtETJ0Pt4g](http://youtu.be/tWtETJ0Pt4g)
  - [http://youtu.be/mp0P1y8AeXw](http://youtu.be/mp0P1y8AeXw)
Under the 1997 Chemical Weapons Convention (CWC), the United States, Russia, India, and South Korea have declared that they possess CW and have accepted an obligation to destroy these weapons.
China and several other countries have declared abandoned chemical weapons on their territory, primarily left over from World War II.
U.S. use of chemicals

- Agent Orange and Agent Blue
- Continue to use same type chemicals in war on drugs in South American countries
- Reports (not verified by U.S. Government) of biological/chemical agent testing in small U.S. towns during 1930’s – 1940’s
The use of chemical weapons and the accumulation of stockpiles as a deterrent was confined to nations until the Japanese terrorist cult Aum Shinrikyo used sarin in a 1995 attack on the Tokyo subway.
Chemical Warfare

- The use of chemical weapons by terrorists is one of the major threats in the 21st century
Congress Mandates Destruction of Outdated Chemical Weapons

- The amount of stockpiled chemical warfare agents in the United States is thought to have reached nearly 40,000 tons by 1968. These chemical warfare agents were stored in bulk containers or as assembled weapons and ammunition at nine sites in the United States.
- During Operation Cut Holes and Sink ‘Em (CHASE) from 1967 to 1970, thousands of tons of unwanted chemical warfare agents and ammunition were disposed of by loading them onto old ships that then were intentionally sunk at sea.
- In 1970, Congress passed PL 91-121/441 (50 USC 1521). This law directed what is now the Department of Health and Human Services (HHS) and the Office of the Surgeon General (OSG) to review plans made by the Department of Defense (DoD) to transport, test or dispose of lethal chemical agents, and to recommend actions to protect the public’s health and safety during such activities.
- Congress passed Public Law (PL) 92-532 (33 USC 1401) in 1972 because of environmental concern about dumping chemical weapons in the sea. Known as the Marine Protection, Research, and Sanctuaries Act of 1972, this law prohibits the kind of dumping done during Operation CHASE.
- HHS and OSG assigned responsibility for reviewing DoD plans to transport, test, or dispose of lethal chemical agents to the National Center for Environmental Health (NCEH) at the Centers for Disease Control and Prevention (CDC). Since 1983, NCEH’s Environmental Public Health Readiness Branch has reviewed plans of DoD’s chemical weapons demilitarization program. After these reviews, NCEH recommends actions to ensure protection of public health and safety when chemical warfare agents are destroyed.
- In 1986 as part of PL 99-145 (50 USC 1521), Congress required that all stockpiles of U.S. chemical warfare agents be destroyed. U.S. stockpiles totaled approximately 30,500 tons, according to the 1997 Organisation for the Prohibition of Chemical Weapons (OPCW) inventory. Nonstockpile chemical warfare items, such as recovered chemical weapons and chemical agent identification sets, were estimated to exist at more than 200 sites in the United States and its territories.

U.S. Signs International Chemical Weapons Convention Treaty

- In 1997, the United States ratified the United Nations International Chemical Weapons Convention treaty. By participating in the treaty, the United States agreed to destroy its stockpile of aging chemical weapons—principally mustard agent and nerve agents—by April 29, 2007. However, the final destruction deadline was extended to April 29, 2012, at the Eleventh Session of the Conference of the States Parties to the Chemical Weapons Convention at The Hague on December 8, 2006.

Disposal of Stockpiled Chemical Warfare Agents

- DoD stored chemical warfare agents, either in bulk containers or as assembled munitions, at eight locations in the continental United States. The remainder of the stockpile was transferred to Johnston Atoll, a small remote island in the Pacific Ocean (southwest of the Hawaiian Islands).
- All chemical warfare agents have been destroyed at three sites, and those sites are closed:
  - Johnston Atoll
  - Aberdeen Chemical Agent Disposal Facility
  - Newport Chemical Agent Disposal Facility

- Disposal of all chemical warfare agents is complete at four other sites. Those sites are in closure. Read more about Closing U.S. Chemical Warfare Agent Disposal Facilities.

- Destruction facilities are under construction at the two remaining sites.

Disposal of Nonstockpiled Chemical Warfare Agents

- Nonstockpile chemical warfare materiel includes:
  - Former chemical weapons production facilities
  - Recovered chemical weapons
The U.S. national stockpile of lethal chemical warfare agents primarily involves six chemicals:

- **Nerve Agents**
  - GA - Tabun or ethyl N,N-dimethyl phosphoroamidocyanidate, CAS 77-81-6
  - GB - Sarin or isopropyl methylphosphonofluoridate, CAS 107-44-8
  - VX - O-ethyl-S-(2-diisopropylaminoethyl)-methyl phosphonothiolate, CAS 50782-69-9

- **Vesicant, or Blister Agents**
  - H, HD - Sulfur mustard, bis-(2-chloroethyl)sulfide, or di-2-chloroethyl sulfide (HD), CAS 505-60-2
  - HT - bis(2-chloroethylthioethyl) ether (HT), CAS 63918-89-8
  - L - Lewisite or dichloro 2-chlorovinylarsine, CAS 541-25-3
Chemical Warfare

- **Chemical warfare**
- Intentional use of lethal or nonlethal chemical agents to
  - Produce casualties
  - Harass or temporarily incapacitate and demoralize personnel
  - Contaminate or destroy areas, equipment, and supplies
4 Types of Chemical Agents

- Choking
- Nerve
- Blood
- Blister
Choking Agents

- First used in World War I, these agents produce an action on the respiratory system that results in the accumulation of fluid in the lungs and may lead to death.
Specific Chemical Agents

Choking agents

- Most common are phosgene and diphosgene
- Another example of a choking agent may be Chlorine CL, which is a yellow gas
  - Smells like pineapple or pepper
Choking Agents

- Exposure causes severe irritation of upper and lower respiratory tracts.
- Can produce immediate dryness of the throat, coughing, choking, tightness in the chest, headache, nausea, and watering of the eyes.
Choking Agents

- A mild exposure accompanied by immediate symptoms can cause fluid to accumulate in the lungs within 2 to 24 hours after exposure.
- Anoxia and development of fatal pulmonary edema within 2 – 24 hours.
Chemical Agents – Nerve Agents

- Nerve Agents
  - Most toxic of known chemical agents
  - Death within minutes due to respiratory obstruction and cardiac failure
  - S/S: rhinorrhea, extreme difficulty breathing, apnea, seizure, paralysis, LOC
HOW NERVE AGENTS WORK

![Diagram showing the mechanism of nerve agents]

**LEGEND**
- acetylcholine
- receptor
- acetylcholinesterase
- nerve agent
Nerve Agent Sites of Action

- Nausea
- Contracting pupils (miosis), flow of tears
- Increases salivation, vomiting
- Cramp of respiratory muscles, breathing difficulties
- Involuntary defecation
- Cramps
Nerve Agents

- As a group, nerve agents are probably the most effective because only small doses are needed to produce death.
Nerve Agents

- Even in low concentrations
  - Pupils of the eyes may constrict
- Tightness of the chest may be noticed
  - Increased deep breathing
- Liquids penetrate the skin and poison the body
- A 1 - 5 minute exposure may cause difficulty with a person's vision
Nerve Agents

- Liquid concentrations of Nerve agents to the skin are a real hazard
- Sweating and twitching of the muscles at the site of contamination may be noticed
Nerve Agents

- One example of a Nerve agent would be Sarin Gas - a colorless, tasteless liquid with almost no odor in its pure form.
Victims exposed to large doses of Sarin will experience convulsions, paralysis and respiratory failure.

Like all nerve agents, Sarin prevents proper operation of enzymes that control body's 'off switch' for glands and muscles.

Without an 'off switch,' the glands and muscles are constantly being stimulated.
Nerve Agent Exposure

- "People exposed to a low or moderate dose of Sarin by breathing contaminated air, eating contaminated food, drinking contaminated water, or touching contaminated surfaces may experience" headaches, blurred vision, drooling or excessive sweating, chest tightness, rapid breathing, nausea and confusion.

- The effects of Sarin can be spread by coming in contact with a victim's clothing.
Nerve Agents

- Small amounts of liquid, left in contact with the skin, can cause death in a matter of minutes
- A lethal dose would include getting liquid into the eyes and inhaling concentrated vapors
Nerve Agent Attacks - Sarin

- Was used in 1994 and 1995 by a Japanese religious cult Aum Shinrikyo
- Twelve people were killed in a Tokyo subway after the gas was released there on March 20, 1995
- August, 2013 in Damascus, Syria
Sarin Gas Exposure: Immediate Signs and Symptoms:

- Runny nose
- Watery eyes
- Small pupils
- Eye pain and blurred vision
- Drooling
- Excessive sweating
- Chest tightness
- Difficulty breathing
- Diarrhea
- Frequent urination
- Confusion
- Drowsiness
- Weakness
- Headache
- Slow or fast heart rate
- High or low blood pressure.

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"Sarin is the most volatile of the nerve agents. This means it can easily and quickly evaporate from a liquid into a vapor and spread into the environment. “ (CDC, 2013)

Since it evaporates so quickly, Sarin presents an immediate but short-lived threat

Recovery from Sarin exposure is possible with treatment, but to be effective, the antidotes available must be used quickly
"If people think they may have been exposed, they should

- Remove their clothing
- Rapidly wash entire body with soap and water
- Get medical care as quickly as possible

Mildly exposed people usually recover completely
Severely exposed people are less likely to survive
Nerve Agents

- Slides 37 - 43
  - Additional news reports regarding use of Sarin and/or other nerve agents
Sarin - Syria

- CNN, September 2, 2013
- http://youtu.be/3VzzVvQN1Qc
“…Syria for allegedly carrying out an Aug. 21 chemical weapons attack on its own citizens. The U.S. is accusing Syrian President Bashar al-Assad's government of using sarin on civilians in an attack that killed more than 1,400 men, women and children.

If the claims are true, this was the first time sarin has been used on such a massive scale since the deadly nerve agent was outlawed by the Chemical Weapons Convention of 1993. Iraqi forces employed sarin several times against Iranian soldiers in 1988 at the end of the Iran-Iraq War.”
It appears that Sarin was used on a much larger scale in Syria. A nine-page French intelligence report maintains that Assad's forces launched ground and air attacks involving the "massive use of chemical agents" on several suburbs in Damascus, according to a Sept. 2, 2013 New York Times story.
Uncredited / AP

Aug. 21, 2013, provided by Shaam News Network, which has been authenticated based on its contents and other AP reporting, purports to show several bodies being buried during a funeral in a suburb of Damascus, Syria.

More Information

U.N. provides details of Syrian chemical attack other accounts could not

Syrian official calls U.S.-Russia chemical weapons deal a victory for Assad

Israelis cautious about U.S.-Russia deal on Syria’s chemical weapons

Syrian opposition stands to lose in U.S-Russian deal to disarm Assad

UN report on the investigation into Syrian Chemical Weapons

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5 days, 9 hours ago:  Syria sends UN pledge to give up chemical weapons as U.S., Russia begin tense talks

6 days, 14 hours ago:  0 Comments | Print UN team confirms sarin gas used against civilians in Syria
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WASHINGTON -- A U.N. inspections team found “clear and convincing” evidence that Sarin gas was used against civilians in an Aug. 21 attack outside of Damascus, according to a report submitted today to the United Nations Security Council.

The report, considered the most authoritative and neutral to date in the Syrian chemical weapons controversy, said that banned chemical weapons were used “on a relatively large scale” in the conflict that’s now well into a third year.

U.N. Secretary General Ban Ki-moon submitted the findings along with a statement that called the Aug. 21 attack on the suburb of Ghouta a war crime and “the most significant confirmed use of chemical weapons against civilians since Saddam Hussein used them in Halabja in 1988.”
There is no mention of culpability – that wasn’t part of the inspectors’ mandate – but it’s clear Ban was eager to put to rest theories that chemicals weren’t used and that dozens of videos of dead or dying Syrians were staged. The U.N. report says the timing of the attack, between 2 and 5 a.m., maximized casualties because low temperatures helped the gas seep into basements where families took shelter.

“The results are overwhelming and indisputable,” Ban said. “The facts speak for themselves.

”Read more here: http://www.sacbee.com/2013/09/16/5740732/un-team-confirms-sarin-gas-used.html#storylink=cpy
Blood Agents

- Blood agents interfere with the distribution of oxygen by the blood
- Symptoms of blood agents depend on the concentration of the agent, and duration of exposure
- Typically either death occurs rapidly or recovery takes place within a few minutes after removal from the contaminated area
Blood Agents

- After inhaling a blood agent, the victim begins to breathe deeply and has violent contractions after only 20 to 30 seconds.
- The heart can stop after only a few minutes.
Blood Agents

- Long exposure and low concentrations may result in damage to the central nervous system
- One example of a blood agent may be Hydrogen Cyanide
  - Colorless gas or liquid
  - Smells like bitter almonds
Hydrogen Cyanide (old HAZMAT label)

Hydrogen Cyanide
Colorless gas; faint bitter almond odor. Poison. Irritating to respiratory tract. Also causes: headache, weakness, confusion, rapid/difficult breathing, convulsions, coma, death. Chronic: enlarged thyroid, fatigue, nervous instability, colic. Flammable.

CAS No. 74-90-8
Hydrogen Cyanide (new HAZMAT label)
Specific Chemical Agents

- Vesicants
  - “Blister agents”
  - Commonly known as mustard gas
  - S/S: skin blisters; burning skin and eyes; airway injury causing difficulty breathing; conjunctivitis of varying severity
Blister Agents

- Immediate exposure to blister agents produces no noticeable symptoms.
- Exposure for more than half hour produces a gritty feeling in the eyes, then soreness, and a bloodshot look.
- Eyelids become red and swollen, and infections are frequent.
Blister Agents

- Burns caused by blister agents are particularly bad in moist areas of the body
  - Armpits
  - Groin
  - Bends of elbows and knees
- Intense itching and blisters may occur accompanied by swelling and stiffness
Blister Agents

- The throat may be very sore, and pneumonia may develop.
- If the entire body is exposed to blister agents, the victim usually goes into shock followed by nausea and vomiting.
Blister Agents

- One example of a blister agent would be mustard gas or liquid.
- Mustard liquid is dark yellow.
  - Has musty or fish-like smell.
Radiological Injuries

- Radiological Dispersal Devices (RDDs) or “dirty bombs” consist of radioactive material combined with conventional explosives.
- Their force is so powerful they can disperse such material over an area as large as multiple city blocks.
Radiological Injuries

- RDDs are primarily used to produce psychological rather than physical harm by inducing panic and terror in the target population.
People in the immediate area may be killed or injured initially from the effects of the blast.

**NOT** from radioactivity.
Radiological Injuries

- The clinical presentation of exposed casualties will mostly resemble conventional injuries.
- This is because the clinical effects of all but the most severe radiation exposures are delayed.
Radiological Injuries

- Radiological injuries greatly increase morbidity and mortality of patients
  - Decrease body’s hematopoietic and immune responses to injuries
- Surgical procedures may have to be delayed until immune response can recover a little
Radiological Injuries

- Trauma wounds may have to be left open to heal by secondary intention
- Recommendation is for surgical debridement and closure within 36-48 hours
Biological Warfare

- Bioterrorism
  - Intentional use of infectious agents or germs to cause illness
Biological Warfare

- Intentional use of living organisms to
  - Disable or destroy people or their domestic animals
  - Damage crops
  - Deteriorate their supplies

- Biological warfare elements are difficult to detect and slow to identify
Biological Warfare

- The earliest known (recorded) use of biological warfare as a weapon in history had a profound impact.
- In the 14th century Tatar warriors catapulted the bodies of sick people over the walls of Caffa, a Black Sea port.
- The illness spread throughout the town.
Biological Warfare

- Examples of this type warfare agents would include anthrax, ebola, smallpox, and plague.
- Anthrax does not spread from human to human, but the spores that cause the disease can be easily stored for up to a century.
- Scattered over a large city from a light aircraft, 110 lbs of anthrax spores could cause 250,000 cases and 100,000 deaths.
- Iraq is known to have mass produced anthrax spores prior to the Persian Gulf war, and the whereabouts of much of that material today is not clear.
Biological/Chemical Warfare

- As far as is it known, there has been no open attempt by any country to use this form of attack
- [http://youtu.be/LHoPRIxLKYk](http://youtu.be/LHoPRIxLKYk)
Diseases that pose the most risk to nations

- Anthrax
- Smallpox
- Plague
- Botulism
- Viral hemorrhagic fevers
- Tularemia
Why Focus On These Diseases?

- Easily disseminated and/or transferred from person to person
- Potential for high mortality rates or major health impact
- Potential to cause panic and disrupt social structures
- Placement of focus on pooling resources and investing in public health preparedness
Biological Warfare

- Standard and isolation precautions
- Disinfection and/or sterilization of equipment used on patient
Emergency Indications

- Emergency surgery
- Anticipation/preparation
- Recognize emergencies
Objectives

- How does biological and chemical affect the O.R.?
  - Apply knowledge of chemical and biological warfare to anticipate trauma, radiological, and chemical injuries that may be seen in the O.R.
  - Timeline for O.R. involvement
  - Personnel
  - Identify the role of the Surgical Technologist
Indications of Emergency Situations

- ST frequently called to work in emergency situations or to react appropriately when elective surgery becomes an emergency
- ST must be able to anticipate and prepare effectively for emergencies
Emergency Situation Objectives & Priorities

- Preserve life
- Prevent further deterioration of patient condition
- Provide whatever care necessary to restore patient to his/her previous lifestyle
- Care prioritized to fit objectives as soon as emergency situation identified
Priorities

- Emergency situation identified
- Surgical team activated for assistance
  - May be outside the O.R. suite
- Treatment follows in priorities of care
Priority order after cardiac and airway

- Chest injuries
- Shock
- Wound protection/closure
- Fractures
- V/S monitoring
- Provision of reassurance and comfort for the conscious patient
Surgical Setting

- ST’s priority is to protect the sterile field
- Remain sterile
- Keep tables/operative area sterile
- Pack wound and cover with sterile drape
- Keep track of instruments, sponges, needles
- May become secondary to lifesaving in emergency situations
Review

Nuclear, Biological, Chemical Warfare

http://youtu.be/MGE_oMVJ50I
Objectives Covered

- Acquire knowledge of chemical and biological warfare
- Identify history of chemical and biological warfare
- Apply knowledge of chemical and biological warfare to anticipate radiological and chemical injuries that may be seen in the O.R.
- Identify the role of the Surgical Technologist
• How does biological and chemical warfare affect the O.R.?
• What is the role of the Surgical Technologist?
Questions?
Comments?
Thanks for coming and for your attention
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