Disaster Response: Caring for Patients with Chemical Exposure

What is Involved in Caring for Patients with Chemical Exposure in a Disaster Response?

› A chemical disaster involves the widespread dispersal of a toxic chemical in the environment that results in the exposure of one or more persons. In some cases the release of a toxic chemical causes an explosion or fire, which can spread the chemical to a wider area. Mass exposure to toxic chemicals can occur accidentally (e.g., caused by an unintentional action or a natural disaster) or intentionally (e.g., caused by terrorism)

• What: A disaster response to chemical exposure refers to a medical response involving performing interventions to treat patients and to minimize exposure and complications related to widespread toxic chemical contamination. Signs and symptoms can develop in as little as a few minutes after exposure or be delayed for 24 hours or more. Early recognition of chemical exposure is important so that treatment can begin as soon as possible

• How: Medical response to patients with toxic chemical exposure includes the following:
  – Initial evaluation of patient signs and symptoms
  – Providing immediate medical care and treatment for patients with conditions that are life-threatening
  – Assessing for preexisting medical conditions (e.g., asthma, which causes increased airway sensitivity to inhaled chemical agents) that can complicate treatment
  – Removing contaminated clothing to reduce exposure to the toxic chemical
  – Removing the chemical agent from the patient’s hair, skin, and eyes in order to reduce exposure to the toxic chemical
  – Evaluating the patient’s psychological status for anxiety and stress related to the chemical exposure

• Where: Care for a patient with chemical exposure can be provided by healthcare clinicians in any healthcare setting and in the community setting

• Who: All types of healthcare clinicians can be involved in caring for patients with toxic chemical exposure. It is appropriate for family members and other patient caretakers to be present during the treatment for toxic chemical exposure. Responsibilities that can be delegated to assistive healthcare staff members during medical response to widespread chemical exposure include gathering and distributing appropriate personal protective equipment (PPE) to healthcare clinicians and others who are treating affected patients to prevent further contamination and handling of bodies after death to reduce contamination of the immediate area

What is the Desired Outcome of Caring for Patients with Chemical Exposure in a Disaster Response?

› The desired outcome of caring for patients after widespread exposure to toxic chemicals is to identify and treat medical conditions related to the exposure and to minimize further exposure to the toxic agent(s)
Why is Caring for Patients with Chemical Exposure in a Disaster Response Important?

Interventions during the medical response to widespread toxic chemical exposure are important because they minimize morbidity and mortality related to the exposure.

Facts and Figures

The Disaster Mitigation Act (DMA) of 2000 is a federal law in the United States that requires State, Tribal, and local governments (e.g., county, district) to devise a written Hazard Mitigation Plan (HMP) to be approved by the Federal Emergency Management Agency (FEMA) for federal eligibility of disaster relief. The DMA took effect November 1, 2004. In a 2013 study of the FEMA database of approved HMPs, investigators found that during the period 2004–2009, approximately 33% of the U.S. local government jurisdictions met requirements to apply for FEMA mitigation assistance (Andrea et al., 2013).

During mass casualty events (MCEs) involving biologic contamination, the majority of the decontamination process is performed at hospital emergency departments rather than at the original contamination site (e.g., called the hot-zone site). In a study conducted in 2012, 50 emergency department staff nurses completed an emergency preparedness questionnaire; it was found that 75% of nurses knew accurate in-flow and out-flow processes for decontaminating patients but were not sure how to decontaminate a patient or equipment. Less than half of the study participants reported having never received participatory training on how to set up and run a decontamination operation, and did not have experience using or practicing with the pertinent equipment (Mitchell et al., 2012).

Although few incidents of bioterrorism-related chemical MCEs have occurred in the U.S., the need for concern stems from the sarin nerve gas attack on the Tokyo subway system in 1995; this attack caused the death of 11 persons and resulted in hospitalization of thousands of others (Wetter et al., 2001).

What You Need to Know Before Caring for a Patient with Chemical Exposure in a Disaster Response

Clinicians should suspect widespread exposure to toxic chemicals when large numbers of patients arrive at a clinical facility or clinical facilities for treatment of similar signs and symptoms.

Although chemical exposure is often confined to a small area, widespread dispersal can occur because of wind or intentional strategies for widespread contamination (e.g., a terrorist using a crop-duster airplane to widely disperse toxic chemicals).

Rapid response to toxic chemical exposure is more important than identifying the toxic agent involved. Early recognition of chemical exposure is important because administering treatment quickly minimizes patient exposure to the toxic agent, which reduces the severity of manifestations related to the exposure.

When providing care for contaminated patients, nurses and other rescue workers should protect themselves from contamination with the toxic chemical by:

- remaining upwind of the area of chemical contamination
- wearing appropriate PPE to prevent exposure to the toxic chemical during rescue activities

The primary objective when providing care for patients who are exposed to toxic chemicals is to rapidly decontaminate the patient’s skin, hair, and eyes. This is achieved by removing the patient’s clothing, scrubbing the skin, washing the hair, and rinsing the eyes with copious amounts of water.

- These strategies reduce the time during which the toxic chemical is in contact with the patient’s tissues
- Decontamination can be accomplished by washing the patient using a common garden hose or placing him/her in a standard or inflatable shower if such equipment is available.

Pediatric considerations include the following:

- Children are particularly vulnerable to hypothermia, which is a risk if children become chilled during the showering portion of the decontamination procedure
- Younger children are often frightened by the PPE worn by healthcare workers and by the need to be segregated from their parents or other caregivers if separation becomes necessary. Providing reassurance, praise, and distracting activities can decrease anxiety in children and promote their cooperation with decontamination efforts.

Geriatric considerations include the following:

- Multiple concurrent medical conditions that are common in many older patients can exacerbate the effects of toxic chemical exposure
- It is important to triage older adults based on the severity of their injuries and their physiologic status rather than their age.

Necessary nursing skills and areas of nursing knowledge include the following:

- Physical and psychological assessment, including assessment of the emotional state of patients.
Efficient and effective patient bathing techniques

If time permits, preliminary steps that should be performed before providing care for a patient with chemical exposure include the following:

- Review the facility/unit-specific protocol for providing care for a patient with chemical exposure, if one is available
- Review the treating clinician’s order and progress notes, if available, with careful attention to
  - the patient’s initial signs and symptoms related to the toxic chemical exposure
  - treatment that has already been provided to the patient related to the chemical incident
  - pre-existing medical conditions that can increase the patient’s response to the toxic chemical involved
- Review manufacturer instructions for all equipment to be used, and verify that the equipment is in good working order
- Verify completion of facility informed consent documents, as appropriate
  - If the procedure is performed under emergent conditions, the universally accepted standards of care provide implied consent
- If available, review the patient’s medical history/medical record for information about allergies (e.g., to latex, medications, other substances) and ask the patient/family about allergies; use alternative materials, as appropriate

Gather or coordinate the gathering of the following supplies and equipment, if available:

- PPE (e.g., nonsterile gloves, gown, mask, eye protection) appropriate for the agent involved. If the agent is unknown, use the most protective PPE available
- A decontamination room
- A shower, garden hose, or other rapid means of washing a patient (e.g., filling a container with water to pour over the patient) to promote removal of the chemical agent from the patient’s skin, hair, and eyes
- Scissors for cutting off clothing
- Biohazard bags for discarding contaminated clothing
- Equipment for physical examination
- Facility-approved pain assessment tool, analgesic medication if available and prescribed, and means for its administration
- Written information, if available, to reinforce verbal patient education

How to Care for a Patient with Chemical Exposure in a Disaster Response

- Perform hand hygiene and don PPE
- Remain outside the decontamination area when performing patient assessment and preliminary care until all preparation for the decontamination procedure is complete
- Identify the patient using two unique identifiers, according to facility protocol
- Establish privacy by closing the door to the patient’s room and/or drawing the curtain surrounding the patient’s bed, if possible
- If time permits, introduce yourself to the patient and family member(s), if present, and assess for knowledge deficits and anxiety regarding assessment and treatment of the patient with chemical exposure. Introductions and complete patient assessment can be deferred until the patient has been stabilized
  - Determine if the patient/family requires special considerations regarding communication (e.g., caused by illiteracy, language barriers, or deafness); make arrangements to meet these needs if they are present
    - Use professional certified medical interpreters, either in person or by telephone, when a language barrier exists
  - As appropriate to the patient’s status, perform the following to minimize patient/family fear, anxiety, and disorientation:
    - Explain that exposure to a toxic chemical has occurred
    - Explain your role and the role of other rescue personnel in the decontamination process
    - Briefly describe the treatment for toxic chemical exposure the patient will undergo in order (e.g., “I am going to remove your contaminated clothing by cutting it off and help you shower to quickly wash the chemical off your skin”)
- Perform the following preliminary patient care prior to decontamination:
  - Remove the patient’s clothing by cutting the clothing with scissors and pulling it away from the body
    - Pulling clothing over the patient’s head can transfer the toxic chemical from more contaminated to less contaminated areas of the patient’s skin. Cutting clothing is also performed to avoid aerosolizing the chemical agents, which can potentially contaminate others
    - As appropriate and available, provide a patient gown, sheet, or other covering to promote patient privacy and warmth
  - Place the contaminated clothing in a plastic biohazard bag and seal it. Place the plastic bag in another biohazard bag and seal it. Discard according to facility protocols or place in a designated area if in a community setting
  - Assess the patient’s general health status, including his/her pain level using a facility-approved pain assessment tool
– If available, indicated, and prescribed, administer analgesic medication
• Perform a focused assessment to identify the patient’s physical manifestations of toxic chemical exposure
– Assess for pre-existing medical conditions (e.g., asthma, which causes increased airway sensitivity to inhaled chemical agents) that can complicate treatment
– Provide immediate medical care and prescribed treatment if the assessment identifies life-threatening manifestations of chemical exposure
› Perform the following to decontaminate the patient:
• Assist the patient to the area where decontamination for the toxic chemical exposure will be performed
• Wash the patient thoroughly with large amounts of soapy water in the shower, using a garden hose, or using containers filled with water
• If the patient complains of burning eyes or blurred vision, wash his/her eyes with warm, clean water for 10–15 minutes. If the patient is wearing contact lenses, allow the water to wash the lenses out of the patient’s eyes. Do not remove the lenses if they cannot be washed out of the patient’s eyes, and do not reinsert the lenses in the patient’s eyes if removed
› Initiate treatment for physical signs and symptoms related to the chemical exposure according to facility protocol and/or orders of the treating clinician
› Assess the patient for pain and minor injury, and assess the patient/family anxiety level and coping ability
• Administer prescribed analgesics if appropriate and not previously administered
• Provide first aid and other care for minor injuries the patient sustained during or after the chemical exposure
• Provide emotional support and educate as appropriate
– Emphasize the importance of continued medical surveillance for monitoring of long-term physiologic effects of chemical exposure
– Explain to the patient/family that they might experience short- and/or long-term psychological effects related to the toxic chemical exposure incident. These effects can include fear, panic, anxiety, confusion, and depression
– Encourage referral to a mental health clinician and other healthcare professionals who are trained in counseling disaster victims, as appropriate
› Dispose of used procedure materials according to facility protocols or as designated in the community setting
› Remove gloves and discard appropriately; perform hand hygiene
› Update the patient’s plan of care, if appropriate, and document providing care for the patient with toxic chemical exposure in the patient’s medical record, including the following information:
• Date and time the patient care was performed
• Patient assessment findings such as
  – general health status
  – level of pain
  – presenting signs and symptoms
• Specific patient care that was performed (e.g., decontamination, medications administered)
• Patient’s response to assessment and care
• Any unexpected patient events, interventions performed, whether or not the treating clinician was notified, and patient outcome
• All patient/family member education that was provided, including topics presented, response to education, plan for follow-up education, barriers to communication and learning, and techniques that promoted successful communication and learning

**Other Tests, Treatments, or Procedures That Might Be Necessary Before or After Caring for a Patient with Chemical Exposure in a Disaster Response**
› Serial evaluation following decontamination includes monitoring the patient for cutaneous, respiratory, cardiovascular, and neurologic manifestations that can be related to exposure to the toxic chemical
• Exposure to a toxic chemical can cause alterations in skin integrity (e.g., blistering), cardiopulmonary status (e.g., changes in pulse and/or blood pressure; dyspnea), and neurologic status (e.g., confusion, changes in level of consciousness)
› If the patient dies as a result of exposure to toxic chemicals, the patient’s body will be cared for according to facility protocols regarding care of the deceased patient
What to Expect After Caring for a Patient with Chemical Exposure in a Disaster Response

› The patient will understand that he/she has been exposed to toxic chemicals
› The patient’s vital signs will return to normal range
› The patient will return to his/her previous physiologic status and level of functioning, including skin integrity and cardiopulmonary, respiratory, and neurologic status
› The patient might require continued psychological intervention to promote effective coping with distress as a result of the toxic chemical exposure; distress can include anxiety, fear, disorientation, and other psychological manifestations. Patients might develop post-traumatic stress disorder (PTSD)

Red Flags

› Secondary contamination of rescue workers or other persons might occur if rapid and appropriate decontamination procedures are not performed
› The patient’s physical signs and symptoms of chemical exposure can progress despite receiving appropriate medical care; patients should be educated regarding the importance of continued medical surveillance
› The patient’s psychological signs and symptoms (e.g., anxiety, panic, fear, and/or confusion) can persist despite appropriate treatment. The prescribed treatment will likely include referral to mental health services, including continued crisis counseling
› Healthcare clinicians can develop psychological manifestations (e.g., anxiety, depression, PTSD) after providing care for patients who are affected by widespread chemical exposure and other mass casualty events. All members of the healthcare team should be provided with opportunities for discussing their experiences after caring for patients in a mass chemical exposure event. Healthcare organizations should offer individual and group counseling services facilitated by mental health clinician specialists who are trained in post-traumatic counseling

What Do I Need to Tell the Patient/Patient’s Family?

› If laboratory testing or other diagnostic procedures are ordered, explain how these procedures are performed and when the results will likely become available
› Educate about monitoring for signs and symptoms that can indicate worsening status after exposure to toxic chemicals and explain the importance of seeking immediate medical attention if these signs and symptoms develop. Signs and symptoms include skin blistering; syncope and wheezing, which indicate cardiovascular compromise; and dizziness and severe headache, which indicate neurologic compromise
› Explain the importance of keeping follow-up medical appointments to allow continued medical surveillance of the patient’s status, as appropriate
› Provide written information, if available, to reinforce verbal patient education

Note

› Recent review of the literature has found no updated research evidence on this topic since previous publication on June 3, 2016

References
