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CE CONTINUING EDUCATION

Terrorism and the Pregnant Woman

Dotti C. James, PhD, RNC

Pregnant women and their infants are vulnerable, during and following a terrorist event. The threat poses a dual challenge: assessment and treatment of the trauma patient, and assessment and treatment of the pregnant woman. Some injuries in the pregnant woman are obvious; some injuries may not be easily observable. Obtaining an obstetric history coupled with careful nursing assessments ensure prompt and appropriate emergency treatment. Obstetricians, certified nurse midwives, nurse practitioners, and perinatal nurses are uniquely qualified to perform these assessments because of their understanding of the changes in maternal physiology and anatomy during pregnancy. The pregnant woman can sustain injuries owing to trauma or exposure to biological, chemical, or radiological agents. Following trauma, assessment of the gravid uterus is needed, as well as the use of traditional diagnostic, pharmacologic, or resuscitative procedures. The perinatal care provider must be familiar with the hematological changes that normally suppress any immune response to the fetus and how these protective changes increase the risk from biological agents, such as anthrax and smallpox. **Key words:** *biological agents*, *pregnancy*, *terrorism*, *vulnerable populations*

SEPTEMBER 11, 2001, redefined the way in which the United States viewed and prepared for disasters, and revealed that Americans were ill prepared to deal with the attacks. Cutbacks in staffing, hospital beds, and services during the past years had reduced the response capability of the healthcare system. Healthcare professionals realized that they must now become educated in appropriate response techniques, as well as the effective use of available resources to combat various terrorist threats.

Historically, terrorists have relied on conventional weapons such as guns and bombs to achieve their objectives. Conventional weapons continue to be the most accessible, but biological, chemical, and nuclear weapons are becoming increasingly available. Because of low cost and of accessibility, terrorists are more likely to use these types of weapons in the future, so preparation to care for victims of such attacks is essential. Before September 2001, biological agents had been used only once by terrorists in the United States. On September 9, 1984, cases of food poisoning with *Salmonella typhimurium* occurred in The Dales, Ore. More than 1000 people reported gastrointestinal (GI) symptoms, and 751 were confirmed cases of salmonella infection. No deaths occurred. By late November 1984, since no source had been found, the deputy state epidemiologist reported that there was no evidence of a deliberate attempt at food poisoning. A year later, authorities determined that the food poisoning was the result of a deliberate attempt by a religious cult, the Rajneeshees, to influence local elections.[1]

From the Perinatal Graduate Specialty, Saint Louis University School of Nursing, St Louis, Mo.

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Corresponding author: Dotti C. James, PhD, RNC, Perinatal Graduate Specialty, Saint Louis University School of Nursing, 3525 Caroline Mall, St Louis, MO 63104 (e-mail: Jamesdc@slu.edu).

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VULNERABLE POPULATIONS

Some groups are at increased risk during and following a terrorist event or disaster. These persons are grouped under the term *vulnerable populations.* A vulnerable population is described as "a population or aggregate susceptible to injury, illness, or premature death."[2] Vulnerable populations include individuals, groups, or communities at increased risk owing to inherent characteristics. These characteristics include age, physical, mental, emotional, cognitive, cultural, ethnic, and socioeconomic status; language; citizenship status; or circumstance that creates barriers to understanding or the ability to act or react during emergency management.[3]

There are some personal or social conditions making some persons more susceptible, and resulting in a decreased ability to manage traumatic situations. This increasing vulnerability requires more assistance during a disaster response. Pregnant women and their infants are vulnerable persons, so special attention must be paid to them during a mass casualty event.

ETIOLOGY OF INJURIES

Following an explosion or bombing, the severity and pattern of the injuries depend on 5 variables: the composition and amount of explosives used; the environment in which the blast occurred; the delivery method; the distance between victim(s) and the blast; and the presence and location of any barriers that may have absorbed some of the energy. Securing information about the victim and their location in relation to the primary blast provides valuable information about possible injuries. For example, following a terrorist bombing of a coffee shop, a woman's blast and shrapnel injuries were limited to those portions of the body that were not protected by a large man sitting between her and the door through which the bomber entered.

When determining the most effective response following the detonation of a bomb, understanding the ways in which damage occurs is helpful. Explosives are grouped under 2 categories: high-order explosives (HE) or low-order explosives (LE). High-order explosives produce a defining, supersonic overpressurization shock wave, often depicted in video representations as a great wind or blast wave that flattens surrounding areas. These waves are responsible for the damage and destruction to soft targets such as cities and their residents. Some examples of high-order explosives within this category are C-4, Semtex, nitroglycerin, and dynamite. In contrast, LE cause a subsonic explosion that does not include the overpressurization wave. Explosives in this group include pipe bombs, gunpowder, and pure petroleum-based bombs, such as Molotov cocktails.[4] Getting as much information as possible prior to the arrival of victims will enable healthcare providers to prepare appropriate supplies and personnel.

Bombs and other incendiary devices can be categorized according to whether they are manufactured with an implied standard of use, such as military weapons, or mixed by the terrorist for unconventional usage. Manufactured devices are exclusively HE-based. If a solid explosive substance is used, the transformation of this solid into a gas generates a highly pressurized wave of air that propagates radially from the site of the explosion, at the speed of sound, and is succeeded by a wave of negative pressure. The leading front of the resulting massive air movement is the "blast front" and it is responsible for the peak of high pressure that at different intensities will cause different types of damage. Most of the injuries from LE result from fragmentation or ballistics, blast winds, or thermal damage.[4] Again, it is apparent that knowledge about the suspected explosive and the location of the anticipated victims in relation to the blast front will provide valuable clues as to the types of injuries to expect.

A distinction should be made between the *blast wave* or overpressurization component and the *blast wind* or forced superheated airflow. "Blast Wave" (primary) refers to the intense overpressurization impulse created by

a detonated HE. The HE "blast wave" (overpressure component) should be distinguished from "blast wind" (forced superheated air flow). The latter may be encountered with both HE and LE weapons. Injuries from blasts and explosions can be grouped into 4 types, based on the mechanism of the blast itself. The categories are primary, secondary, tertiary, and quaternary. These classifications consider the anatomical and physiological changes resulting from the direct or reflective overpressurization force impacting the body's surface.[4]

Primary blast mechanism injuries occur only with HE. Gas-filled structures within the body are affected most frequently, such as the lungs, GI tract, and middle ear. Assessment of victims of primary blast mechanism injuries may reveal rupture of the tympanic membrane and/or globe of the eye; abdominal hemorrhage secondary to gastrointestinal rupture; and damage to the lungs. Concussions may be present without any physical signs of a head injury.[4]

In the lung, pulmonary barotraumas or *blast lung* can occur. "Blast lung" occurs as a result of the HE overpressurization wave. It is the most common fatal primary blast injury among initial survivors. Caregivers should be aware that although signs of blast lung are usually present at the initial evaluation, they can also develop as late as 48 hours after the explosion. It is characterized by apnea, bradycardia, and hypotension. Chest x-ray demonstrates injuries ranging from scattered petechiae to confluent hemorrhages, or the characteristic butterfly pattern, and should be suspected when dyspnea, cough, hemoptysis, or chest pain are seen after blast exposure. All exposed persons should have a chest x-ray to screen for blast lung. If general anesthesia or air transport is indicated and blast lung is suspected, a prophylactic chest tube (thoracostomy) is recommended before surgery or transport.

In the secondary category, injuries result from flying debris and bomb fragments. Any part of the body can be affected. Injuries range from penetrating ballistic (fragmentation) or blunt injuries. If the explosion has occurred in a confined space, or if a structure has collapsed, greater morbidity and mortality can be anticipated.

Tertiary injuries result as individuals are thrown by the blast wind. As persons are thrown and collide with solid structures or other debris, fractures, traumatic amputations, and open and closed brain injuries can occur. Finally, in the quaternary category, all the injuries that do not fit into the previous 3 categories are grouped together. It may include exacerbations or complications of existing conditions or chronic diseases affecting any part of the body. These injuries include burns, crush injuries, asthma, chronic obstructive pulmonary disease, respiratory problems, angina, hyperglycemia, and hypertension.[4]

TRIAGE

The term *triage* comes from a French word meaning "to sort." During triage, priorities and care needs are continuously evaluated and reassigned as needed treatments, time, and condition of the victims change. Following a brief assessment, victims are assigned a classification for receiving treatment according to the severity of the illness or injury. The triage process balances human lives with the realities of the situation, such as supplies and personnel. Professional nurses triage every day in a variety of situations.

When anticipating the management of large numbers of injured people, the concept of triage must be considered. The primary differences associated with disaster triage are the magnitude of the event and the focus on saving the greatest number of people. After a mass casualty event (MCE), nurses should expect an *upside down triage*. For example, in a normal postaccident situation, the most severely injured or ill patients would be treated first, and those with less serious injuries or illnesses treated afterwards. In a mass casualty situation, this treatment priority is reversed. Victims who are the most severely injured—those requiring the

expenditure of large amounts of supplies and provider time, and with little chance of surviving—are treated last.[5]

EMERGENCY MEDICAL TREATMENT AND ACTIVE LABOR ACT (EMTALA)

Most healthcare providers are aware of the Emergency Medical Treatment and Active Labor Act (EMTALA). EMTALA has been a significant influence on the emergency management and admission of patients to hospitals in the United States. This legislation prevents hospitals from denying treatment and admission to individuals because of their inability to pay. A terrorist attack creates a situation that may be complicated by conditions and weapons that were not addressed in the original EMTALA legislation, such as biological, chemical, or radiological contamination, large numbers of victims, and generalized panic. The Department of Health and Human Services has recommended the following changes during a mass casualty event.

- The use of community-based Emergency Medical Service (EMS) protocols does not violate EMTALA.
- In the event of bioterrorism or a threat of bioterrorism, EMTALA does not apply to those hospitals directly affected.
- Where hospitals follow a community-based, regional, or Centers for Disease Control and Prevention (CDC)-directed protocol, EMTALA does not apply.[6]

ASSESSMENT/DECONTAMINATION

Following the initial triage, each victim of the disaster must receive a comprehensive head-to-toe examination of the body. This brief systematic assessment yields valuable information about the severity of the victim's injuries. The examination begins with the neck to identify spinal injuries and serious injury to the trachea and proceeds by organ system until the extent of the injuries is determined. All personnel coming into contact with the patient must wear gloves and eye protection until the cause of the event and risk to the healthcare provider is determined.

If a chemical agent is suspected and a need for decontamination is anticipated, all staff coming in contact with victims before they have been decontaminated must wear personal protective equipment (PPE), which includes impermeable clothing, gloves, boots, and a gas mask. In general, few professional nurses are necessary in the decontamination area itself. Decontamination is a procedure that can be managed by trained, unlicensed personnel.

CHEMICAL WEAPONS

Chemical weapons are classified according to their mode of action or the time that they remain active in the environment, ie persistence, and lethality or kill potential.[7] Following a chemical weapons attack, providers at the hospitals or agencies will be faced with large numbers of worried well, and may encounter mass hysteria and panic.[8] A chemical weapons attack results from an intentional act with toxic substances. The most common types of chemical weapons can act in a variety of ways, so healthcare providers must be aware of symptom groups suggestive of classes of agents. When a nerve agent vapor is inhaled, the first clinical symptoms will be respiratory, with dimming of vision and miosis. In contrast, blister agents, such as sulphur mustard, are accompanied by a faint odor of mustard or garlic, and the development of large blisters on the skin.[7]

TRAUMA AND PREGNANCY

Caring for pregnant women following a terrorist event poses a dual challenge: assessment and treatment of the trauma patient and assessment and treatment of the pregnant woman. While some injuries in the pregnant woman are obvious, some of the injuries may not be easily noticed. When the pregnancy approaches viability, continuous fetal monitoring is recommended for 2 to 6 hours following trauma.[9] The nature and extent of the

event may make this type of monitoring unfeasible, requiring the nurse to rely on intermittent monitoring.

Obtaining an obstetrical history, coupled with careful nursing assessments, is needed to ensure the prompt and appropriate emergency treatment that is necessary for the safety of the woman and infant. Obstetricians, nurse midwives, nurse practitioners, and perinatal nurses are uniquely qualified to perform these assessments because of their understanding of the changes in maternal physiology and anatomy during pregnancy. For example, following an explosion or bombing, in addition to evaluating the abdominal cavity, the gravid uterus must be assessed to rule out uterine rupture, or abruptio placenta. In severe injuries, the use of open peritoneal lavage to assess for intraperitoneal hemorrhage has been used safely during pregnancy.[9] Supine hypotensive syndrome can be prevented during the initial assessment by using a wedge or positioning the patient in the lateral decubitus position to deflect the uterus off the inferior vena cava.

When planning a trauma response, it is important that all responders are familiar with needed modifications in performing cardiopulmonary resuscitation (CPR) on pregnant women. Ventilating during CPR can be complicated by the increased oxygen requirements and reduced chest compliance in pregnancy. The reduced compliance is due to rib flaring and splinting of the diaphragm by the displaced abdominal contents. In the supine position, the weight of the gravid uterus compresses the large vessels in the abdomen, resulting in vena caval and aortocaval syndromes. During CPR with a pregnant woman, maternal blood flow and cardiac output are diminished if the uterus is not displaced, so a wedge or manual displacement is needed. Hands are placed on the lower half of the sternum for compressions.

Pregnancy does not exclude the use of traditional diagnostic, pharmacologic, or resuscitative procedures. A laparotomy is not always an indication to perform a cesarean delivery. If a laparotomy is performed, the uterus should be carefully inspected for damage. Maintenance of adequate oxygenation and perfusion may enable the fetus to tolerate surgery and anesthesia, and for the pregnancy to continue. Because of the risks from trauma and surgery, Rh-negative pregnant women should be given 300 μg of anti-D immune globulin within 72 hours to protect against Rh-isoimmunization. If there is severe trauma to the pregnant woman, the Kleihauer-Betke test or other quantitative assay of fetal-maternal hemorrhage can be performed to detect a fetomaternal hemorrhage of 30 mL or more, which indicates a need for additional anti-D immune globulin.[9]

Following stabilization, a secondary assessment should be performed to more thoroughly evaluate the pregnancy. This evaluation may include ultrasonography to evaluate the placenta, fetus, amniotic fluid volume, and presence of intra-abdominal fluid.[9] It is rare to find rupture of the uterus in women who have not had a previous cesarean birth. The rate of true uterine rupture with 1 prior low-transverse scar has been reported by ACOG to be between 0.2% and 1.5% (1 of 67 to 500 women).[11] In comparison, rupture of an unscarred uterus occurs in 1 of 8000 to 17,000 deliveries.[12,13] Uterine rupture is more likely to occur with women who sustain blunt abdominal trauma. Symptoms depend on the degree of rupture and may be confused with other posttrauma conditions (Table 1).

Abruptio placenta is a complication in 40% to 50% of women who experience severe trauma. Abruptio placenta, the premature separation of a normally implanted placenta from the uterine wall, typically presents shortly after the injury. Abruptio placenta is considered an obstetric emergency and ideally should be managed as an inpatient so that delivery can be immediate if the separation is moderate (Grade 2) or severe (Grade 3). In situations of severe maternal trauma, perimortem cesarean birth after 5 minutes of unsuccessful maternal cardiac resuscitation can result in the survival of the fetus. Neonatal survival is unlikely when a postmortem cesarean delivery occurs more than 10 to

Table 1. Symptoms of uterine rupture

Non-reassuring fetal heart rate (FHR) pattern
Impairment of fetal oxygenation
Late decelerations, reduced variability, tachycardia, bradycardia
Sudden, abrupt decrease in FHR
Uterine abdominal pain—may not be severe
May describe a *giving* way
Cessation of uterine contractions
Loss of presenting part
Increased vaginal bleeding
Chest pain between scapulae or on inspiration due to irritation of blood below the diaphragm
Hypovolemic shock from hemorrhage

15 minutes after maternal death. Surviving neonates are at increased risk for adverse neurodevelopmental deficits.[9]

IMMUNOLOGICAL STATUS

During pregnancy, the woman's susceptibility to infectious agents is altered. In a normal pregnancy, there are hormonal, cellular, and humoral changes that work together to suppress the immune response to the fetus, a perceived foreign body. These normal changes are protective of the pregnancy. Typically, a humoral response, or antibody-mediated response, occurs when there are antibodies in the body fluids or humors in response to fetal antigens. In addition, during pregnancy, high circulating levels of steroids inhibit the normal humoral response.[10]

Progesterone, the relaxation hormone that affects smooth muscle, also relaxes the respiratory tract of the pregnant woman. This relaxation can lead to stasis of secretions and provide an environment conducive to an increased level of local bacterial growth.[14] Although the circulating white cell count is slightly increased during pregnancy, 3 significant changes are seen: neutrophil chemotaxis and adherence, cell-mediated immunity (lymphocytes attack what is foreign or invading), and natural killer cell activity decrease. When all of these normal changes occur, the end is an overall lowering of defense mechanisms and a woman who is more susceptible to circulating pathogens. These normal mechanisms pose unique challenges when a biological agent release is suspected.

BIOLOGICAL EVENT

Another issue to be considered when caring for pregnant women during and following mass casualty events is prophylactic vaccination. A terrorist event could include the release of biologic agents, such as smallpox or anthrax. Contracting any of these diseases during pregnancy results in significant morbidity and mortality to the pregnant woman, as well as unknown risks to the fetus. Therefore, early diagnosis is crucial (Table 2). The debate arises over whether to immunize pregnant women if release of a biological agent is confirmed or suspected. Few vaccines have been studied extensively. The measles-mumps-rubella (MMR) vaccine is contraindicated, but most other vaccines are thought to be relatively safe if the risk of the disease is truly significant.[15,16]

Smallpox

During the decision process, consider the possible effect of the disease on the pregnant woman. The CDC, in collaboration with the Department of Defense (DOD) and the Food and Drug Administration (FDA), is monitoring the outcomes of pregnancy in women exposed to smallpox vaccines. The data are summarized in the National Smallpox Vaccine in Pregnancy Registry.[17] Normally, when the virus enters the respiratory tract, it multiples and spreads to the regional lymph nodes. A 12-day incubation period begins with the prodromal phase followed by the characteristic skin eruptions. Variola can cross the placenta and infect the fetus. During pregnancy there is an increased susceptibility to the variola infection and a greater severity of illness owing to the previously discussed changes in the maternal immune system. When infected with smallpox,

Table 2. Symptoms associated with biological agents

Inhalation anthrax	*1st stage*
	Flu-like symptoms: fever, dyspnea, cough, headache, vomiting, chills, weakness, abdominal pain, and chest pain
	2nd stage
	Abrupt progression to respiratory distress with diaphoresis, possible shock, and mental status changes
	Chest x-ray changes: wide mediastinum, infiltrates, pleural effusions
Cutaneous anthrax	Painless, pruritic papule progressing to vesicles, ulcers, edematous black eschar, with possible edema and regional adenopathy
	Fever developing over 3 to 7 days
Smallpox	Rash progressing from papules, to vesicles, to pustular rash on face and extremities to trunk, to generalized hemorrhagic component with toxicity and fever
Hemorrhagic smallpox (purpura variolosa)	Fever, backache, diffuse, coppery-red rash, rapid decline in the health status
	Within 24 hours
	Spontaneous ecchymoses, epistaxis, bleeding gums, intense, erythematous rash, subconjunctival hemorrhages
Pneumonic plague	Cough, fever, dyspnea, hemoptysis, lung consolidation with possible shock
Primary septicemic plague	Sepsis, purpura, gangrene, DIC
Inhalational tularemia	Acute illness with fever, pleuropneumonitis, bronchiolitis with possible hilar lymphadenopathy, and respiratory failure
Botulism	Acute illness without fever, symmetric descending flaccid paralysis beginning in bulbar muscles, dilated pupils, dry mucous membranes, normal mental status
Fetal vaccinia	Giant dermal pox
	Diffuse necrotic lesions in the viscera and placenta
	Stillbirth or death after birth

maternal mortality approaches 50%, compared with 30% for men and nonpregnant women.[14] If infection occurs during the first trimester, it results in high rates of fetal loss. During the latter half of pregnancy, smallpox infection is associated with increased rates of prematurity.[10] Laboratory analysis during this period may demonstrate thrombocytopenia, increased capillary fragility, and depletion of coagulation factors and fibrinogen.[14] Death generally results from sepsis. In addition to increased morbidity and possible teratogenicity, infected pregnant women are more susceptible to hemorrhagic smallpox or purpura variolosa.

Generally, it is not recommended to immunize women during pregnancy. Because the smallpox vaccine is a live virus, vaccination is not recommended unless the woman is in a high-risk area. There is a theoretical risk of teratogenicity with the smallpox vaccine, but experts do not view accidental vaccination or pregnancy within 4 weeks of vaccination to be an indication to terminate the pregnancy.[16] If smallpox vaccinations are recommended for the general population prior to an actual diagnosed case, the CDC and the Advisory Committee on Immunization Practices (ACIP) recommend that a careful pregnancy history be taken and education provided about the importance of avoiding pregnancy during the month following vaccination.[18]

Vaccinia Immune Globulin (VIG) is a treatment methodology for people who have serious reactions to smallpox vaccine. VIG is made from the blood of people who have

received the smallpox vaccine more than once and contains antibodies that offer protection from vaccinia infection. It is available only from the CDC and is distributed under Investigational New Drug (IND) protocols. Currently, there is enough VIG to treat the expected number of adverse reactions resulting from the vaccination of 40 million persons.[18]

If the pregnant woman is accidentally exposed to smallpox, the prophylactic use of VIG is not indicated because of the risk of fetal vaccinia. Fetal vaccinia is a rare, serious infection of the fetus that can occur following vaccination for smallpox, often resulting in premature birth and fetal or neonatal death.[16] During epidemics of the disease, the reported incidence of congenital variola (infection) ranges from 9% to 60%. In some situations, there may be maternal immunity that protects the fetus following exposure to smallpox. There have not been sufficient studies reported to be able to say with certainty that vaccination of pregnant women for smallpox is without risk, but the smallpox vaccine itself is not known to cause congenital malformations.[19]

The few cases of fetal vaccinia infection that have been reported have usually occurred after an accidental primary vaccination of the mother in early pregnancy, or the woman becoming pregnant within 28 days of vaccination. If a pregnant woman is exposed to smallpox, she should be encouraged to contact her healthcare provider or the state health department for assistance in enrolling in the National Smallpox Vaccine in Pregnancy Registry at the CDC. Healthcare providers in private practice or from state health departments are encouraged to report all exposed pregnant women to the registry.[17] When a woman experiences complications from smallpox vaccine, administration of VIG is acceptable in pregnancy.[18]

Anthrax

There are 3 types of anthrax infections occurring in humans: inhalational, cutaneous, and gastrointestinal. The most severe form is inhalational. Cutaneous anthrax is the most common naturally occurring form. The clinical presentation of inhalational anthrax occurs in 2 stages; there may be a brief period of apparent recovery before the second stage. About 50% of victims develop hemorrhagic meningitis, with obtundation and death occuring within hours.[19–21]

There is little research available about pregnancy complicated by an infection with anthrax. However, if there is documented risk, the potential for significant morbidity and mortality offsets the risk for disease. The American College of Obstetrics and Gynecology (ACOG), the American Academy of Pediatrics (AAP), and the Centers for Disease Control and Prevention have made recommendations about care of the pregnant woman following exposure to anthrax and other biological agents (Table 3).

Table 3. Treatment recommendations for biological agents*

Disease	Drug	Dose
Anthrax	Ciprofloxacin fluoroquinolones†	500-mg PO BID × 60 d
	Penicillins‡	
	Amoxicillin × 60days	500 mg TID
Plague	Streptomycin × 5 days	
	Gentamicin for breast-feeding women	

*Adapted from References 22–24.
†If susceptible.
‡Not recommended for initial treatment; effective for prophylaxis following exposure.

A pregnant woman exposed to anthrax or other biologic agents should be referred immediately to their primary obstetric provider or, if available, an infectious disease healthcare provider. The ACOG Committee on Obstetric Practice recommends limiting the prophylactic treatment of pregnant and lactating women to those with known exposure to a high-risk source of contamination. When treatment is necessary, ciprofloxacin (Cipro) is the first-line drug for the initial prophylaxis of pregnant women exposed to anthrax, even though there have been few controlled studies of ciprofloxacin use in pregnancy. Although there are few clinical trials evaluating the effect of Cipro on pregnancy and lactation, this drug is unlikely to be associated with fetal malformations. Intravenous doxycycline is an alternative but tetracyclines are associated with toxic effects both in the liver of pregnant women and in the fetus. If doxycycline is used, periodic liver function studies should be performed. Caution should be used when prescribing doxycycline during pregnancy because it may result in staining of primary teeth, defective dental enamel, and depressed bone growth in the fetus. The CDC has approved amoxicillin for postexposure prophylaxis or inhalation anthrax only after 14 to 21 days of fluoroquinolone or doxycycline administration or if there is exhaustion of drug supplies or allergic sensitivity or contraindications to other antibiotics.[8,17,20–26]

When the woman contracts inhalation anthrax, the early administration of antibiotics, generally ciprofloxacin, is a primary determinant of maternal-fetal outcome.[10] Women who are breast-feeding should be offered anthrax prophylaxis with the same medications. The American Academy of Pediatrics also considers ciprofloxacin and tetracyclines (which include doxycycline) to be usually compatible with breast-feeding because the amount of either drug absorbed by infants is small. Following birth, the infants should be treated with an antibiotic that is safe, such as amoxicillin when *Bacillus anthracis* is known to be penicillin-susceptible.[27]

After clinical improvement following intravenous treatment for inhalational or cutaneous anthrax, oral therapy with 1 or 2 antimicrobial agents (including either ciprofloxacin or doxycycline) may be used to complete the first 14 to 21 days of treatment for inhalational anthrax or the first 7 to 10 days for uncomplicated cutaneous anthrax. The optimal oral treatment regimen is unknown.

Other Biologic Agents

During pregnancy, infection with *Yersinia pestis*, the bacteria causing plague, typically causes abortion or miscarriage. However, more favorable outcomes have been seen since the postantibiotic era, primarily in the treatment of bubonic plague.[27]

RADIATION

Little is known about the effect of radiologic exposure on the pregnant woman and her fetus. It is known that actively dividing cells are more sensitive to ionizing radiation than the cells that have completed division or differentiated cells that rarely undergo division.[28] Therefore, women exposed during the first trimester could experience greater disruption of the developing fetus. Otake and Schull suggest that following the nuclear bombing in Japan, fetal brain development was most significantly affected 8 to 15 weeks and 16 to 25 weeks following ovulation.[28] This will have negative effects on later tasks that are dependent on brain functioning. It is also known that survivors of the exposure are at increased for the development of cancer.

Following exposure to radioactive substances, there is an increased risk for developing thyroid cancer. Many people stock potassium iodide (KI) pills which protect the thyroid from the radiation exposure by flooding the thyroid with stable iodine, and lowering the uptake of the radioactive atoms. In December 2001, the FDA published a revised guide which stated that the risk of thyroid cancer is inversely related to age. Therefore fetuses and infants are increasingly vulnerable to exposure. Should a terrorist attack

include the release of a radioactive substance, the threshold for taking the KI pills would be lower for pregnant women than for others.[29]

MISCELLANEOUS EXPOSURES

Following the explosions at the World Trade Center (WTC) on September 11, more than 90,000 L of jet fuel burning at more than 1000°C resulted in a release of toxic substances such as soot, metals, volatile organic compounds, and hydrochloric acid. Following the buildings collapse, the plumes included pulverized cement, glass fibers, asbestos, lead, benzene, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAH), and building contents. Studies were performed looking at pregnancy outcomes for women who were in or near the World Trade Centers and those at a distance. One study reported that the WTC cohort had a 2-fold increased risk for small for gestational-age infants (birth weight below the 10th percentile), while the second found no difference in birth weights but a significantly shorter gestation duration in the exposed group.[30,31] One theory proposes a relationship between the smaller birth weights and high levels of PAH-DNA adducts in umbilical cord leukocytes. These are related to prenatal exposure to air pollution.[30,31]

NURSING IMPLICATIONS

Perinatal nurses can assist in community preparations for terrorist attacks and other types of disasters by providing simple, accurate education about what is needed for the pregnant woman before, during, and after an event. The Association for Women's Health, Obstetric, and Neonatal Nurses recommends that pregnant women keep a copy of the prenatal record and emergency phone numbers, an emergency birth kit, additional prescription medicines, ready-to-feed formula, and a basic disaster supply kit.[32] These preparations can minimize stress by preparing the woman and her families to meet any challenge that may arise.

The foundation for preparing professional nurses to care for victims of a mass casualty event is education and frequent exercises or drills. The chaos occurring during a mass casualty event demands a confident and rapid response. Confidence comes from knowing that preparation has been thorough, as well as current. Staging interdisciplinary exercises fosters a sense of camaraderie essential for the smooth functioning of the team, and gains perspective on obstacles to a smooth response effort. The educational programs and frequent exercise sessions are costly, both in time and monies. Practice may not be the most economical solution, but the alternative will be expensive in human and property losses

This discussion has been predicated on the ideal situation, where sufficient intensive care and general medical beds are available. A caveat must be given that this discussion also assumes an intact civil infrastructure. This infrastructure includes telephones, water, gas, electricity, civilian transportation, adequate sanitation services, and roads and bridges that are unaffected and functioning. During regular preparedness exercises, creators of the scenarios must create situations that assume the loss of one or more of these critical services. Only by planning for these contingencies can the healthcare system continue to function adequately. The responsibility for staging and evaluating these situations is part of the responsibility of the professional nurse, functioning as a member of the interdisciplinary team preparing each community and setting for the unexpected. The responsibility of responding to a terrorist event cannot rest solely with emergency and intensive care nurses. There is a role for each nurse, and perinatal nurses meet an important need because of their expertise in working with pregnancies, newborns, emergent situations, and situations where an immediate response is needed to save lives.

Women who are not directly involved in the event also experience significant stress during pregnancy that can negatively affect pregnancy outcome. Following September 11,

doulas, massage therapists, childbirth educators, lactation consultants, midwives, and chiropractors in New Jersey and lower New York State, aided by the media efforts of the March of Dimes, organized and provided their services to the widows of September 11 during pregnancy, labor, birth, and during the postpartum period.[33] These efforts by the birthing community provided invaluable services to women during periods of intense grief. This one incident resulted in more than 60 women giving birth as widows, and thousands giving birth during a period of national mourning.

SUMMARY

Becoming involved in the disaster response planning at the practice site will result in a more confident responder and decrease the possibility of significant clinical symptoms being overlooked during a mass casualty event. Effective involvement requires preparation. This preparation should begin in schools of nursing through incorporation of disaster nursing within each specialty course. The science of biological, chemical, and radiological weapons should be integrated within basic and continuing education in nursing. As professional nurses, continued education comes from the specialty organizations, as well as hospitals and clinics. There is an opportunity for participation at many levels at all facilities. Examine the response plan at your agency and become active in its implementation. Accept the challenge and share your clinical expertise to protect mothers and infants should a threat become a reality.

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