

14. The Impact of Chemical and Biological Terrorism on Children and the Role of Pediatricians

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DR. CARPENTER: We're fortunate today to have as our next speaker, Dr. Sophie Balk. Dr Balk is the associate editor of the American Academy of Pediatrics Handbook on Pediatric Environment Health. I actually have a copy in my practice. A family comes in, and the dog's really sick, and it's obvious that the dog's got into some organophosphate poisoning, and you notice that the kid is sitting there and he has a runny eye and a runny nose. And you think about whether that kid been chewing on that dog's collar, or did the mom use the same bathtub to bathe the kid that she bathed the puppy in? So Dr. Balk's book has been flashed around veterinary circles here in Texas, and almost everybody in the Texas Veterinary Medical Association, knows of her and her book.

And she's going to talk about the bioterrorism threat to children. Thank you.

DR. BALK: Good morning, everyone. I want to thank Janie for inviting me here. I just want to give you a little bit about my background. I'm a general pediatrician, which means my day job is that I see patients in the office. I work for Montefiore Medical Center in a community-based health center, and I see patients who come in for checkups and have asthma. I personally do a lot of counseling on smoking cessation for parents to try to do something about that particular environmental toxin.

I became interested in environmental health issues about 15 years ago, and about ten years ago had the privilege of starting to work with the American Academy of Pediatrics and joined the committee on environmental health of the Academy in 1995, and became chair in 1999.

And as you may know, the American Academy of Pediatrics is an organization of 57,000 pediatricians. One of the things these committees do is write policy statements that educate pediatricians and others and guide practice for pediatricians all over the nation. Another thing our committee did was to put out the Handbook of Pediatric Environmental Health, which is available free of charge to Academy members.

But I'm here today to talk about chemical-biological terrorism and its impact on children and the role of the pediatrician. About four years ago in one of our committee meetings, we decided this would be a good topic to address, so we put out a statement in March 2000, and it is available in print and on the Web.

We all know that terrorism is a real public health threat. Some people use the acronym BNICE—biological, nuclear, incendiary, chemical, and explosive terrorist threats. (Figure 14-1) As we heard, the goals of terrorism are death, injury, fear and chaos, and the last point is especially important for us as pediatric health care providers. Dr. Blanck just said that terrorism is not new and gave numerous examples found in history. Let me give you some relatively recent examples. In 1984 a religious cult in Oregon intentionally spread salmonella to salad bars in an attempt to sway the results of an election. More than 700 people were sickened. In 1995, terrorists in Tokyo used the subway system to disseminate the nerve agent Sarin, resulting in 12 deaths and injury to more than 5,000 people. Included among the casualties were 16 children and five pregnant women. There were also many injuries to pre-hospital or hospital staff, some due improper handling of victims. And of course, we're all familiar with the recent anthrax attack, which was spread through the mail in this country, and resulting in 22 cases and five deaths.

Going through some of the agents of concern briefly, we'll start with the chemical agents. These are some of the agents that are felt to be good candidates for weaponization. (Figure 14-2) The list includes Sarin, which is a nerve gas that's similar to pesticides. It's an organophosphorus agent. Sarin is volatile so it's vaporized, but it also has a high vapor density. It's about five times denser than air, so it falls to the ground and it's close to where children are breathing.

Vesicants are blistering agents. Other agents are irritants and corrosives, including chlorine. There are choking agents, cyanogens (including hydrogen cyanide), CNS depressants, anticholinergics and lacrimators such as tear gas, which can be used as incapacitants.

Biologic agents include bacterial agents such as anthrax, plague, brucella, and tularemia. And as we heard, anthrax is considered one of the most likely for biological release. The viral agents include smallpox, Ebola, and other hemorrhagic viruses. Smallpox was eradicated globally in 1980. Children haven't been immunized for more than two decades, so most adults and all children are considered susceptible. And the rash of smallpox may be mistaken for chickenpox in its initial stages. The final agents are rickettsia and preformed toxins. Botulism toxin is one agent that's considered likely for use as a weapon. And toxins have the characteristics of chemical agents which produce illness within hours of exposure, and the toxins aren't infectious. The organisms considered most likely to be used as weapons are anthrax, plague, tularemia, smallpox, botulism and the viral hemorrhagic fevers.

What are some of the characteristics of likely chemical agents? Well, they're generally easy to synthesize. They don't require sophisticated delivery systems, and they include weapons of opportunity. This can be confiscated from industry by transport vehicles rather than being manufactured by the terrorists themselves.

As was mentioned, casualties occur immediately or almost immediately and are likely to generate a response from emergency medical systems. What are some of the clinical characteristics? Well, these agents produce illness rapidly. They're highly toxic, and they're well absorbed through intact skin.

And so protection of health care workers becomes a major issue in responding to these victims, because standard equipment used for universal precautions, such as surgical masks and latex gloves, don't provide protection from nerve agents. Health care workers must wear protective gear and self-contained breathing apparatus.

Biological weapons are called the poor man's nuclear bomb, because they can kill or injure hundreds of thousands, and they also don't require sophisticated delivery systems. Perfume atomizers or crop dusters may be very effective. And casualties can simulate an infectious disease outbreak.

Who knows what this is? (Figure 14-3) Smallpox, right. Here you see an infant with severe rash. You don't see the whole infant, but one of the characteristics of smallpox that differentiates it from chickenpox is that it's got a centrifugal distribution. The distribution of smallpox is on the face, the arms, and the extremities, as opposed to chickenpox, which tends to concentrate on the trunk and not so much on the extremities and face. If you see one of these, this is an international public health emergency.

With biological agents, you've got delayed onset of symptoms, and the illness may not be recognized in its initial stages. It may be contagious, and for example, with plague or smallpox, someone gets on a plane and it's all over the world. There is a tremendous concern for possible widespread secondary exposure. Smallpox is contagious, plague is contagious. Anthrax is not. Early detection is key, and that's where physicians and other health care providers come in. Exposure can occur through inhalation, and that can result in infection with an agent such as anthrax or smallpox. It can result in lung injury with a corrosive agent such as chlorine, and it can result in systemic effects if you've got an agent such as cyanide. Exposure can occur through ingestion of contaminated food or water, as we saw in the incident in Oregon. Exposure can occur through dermal exposure, as with viscous nerve agents.

What are some of the early symptoms? This is important for clinicians. These symptoms may be missed unless you have a high index of suspicion. For example, with nerve agents, exposure can produce symptoms that can mimic flu with nausea, vomiting and weakness. Biologic agents, again, flu-like symptoms.

I'd like to turn to what I think is a very instructive case, and it's an example from pediatrics, which is good for an audience in this conference. In New York, in September 2001, right after the World Trade Center attacks, a seven-month-old boy was hospitalized with arm swelling and a painless, weeping lesion of the elbow. (Figure 14-4)

You can see this is quite an extensive, impressive-looking area of redness and swelling of the arm. What's interesting is that it's painless. A history was taken, and the baby had played in the park and also visited his mother's office, and she was a producer at ABC in New York City. These pictures can be found in the New England Journal of Medicine.

The baby was hospitalized and a workup was done, including an MRI (magnetic resonance imaging), which showed severe swelling, severe edema, from the hand extending to the chest wall. (Figure 14-5) Physicians were looking for what it could be. Could it be a tumor? But the MRI didn't show bone involvement, or soft tissue gas, or fluid collection, or a mass, and no abscess. The working diagnosis was a brown recluse spider bite with surrounding cellulitis.

The baby was treated with antibiotics, and then anthrax was found at another TV network. And this made people think, Could this be anthrax? A punch biopsy was done, and *Bacillus anthracis* was found. And subsequently, anthrax spores were found in the mother's office. Now, just to point out to you that this baby had really severe symptoms, which is unusual. (Figure 14-6) He had hemolytic anemia. He had renal involvement. He had coagulopathy; he was using up his clotting factors. And he had hyponatremia, which is low serum sodium, which from what we've read is not typical of cutaneous anthrax, raising the possibility that infants are more susceptible to severe symptoms when they get cutaneous anthrax.

Now, at the time, who would have thought of this in New York City? No one. Who would have thought that a baby in New York could have gotten cutaneous anthrax? There had been some cases reported in the United States, but none in children.

And all that changed in 2001. The epidemiology changed, and we now know more than we ever thought we would about anthrax. We know there are three forms—the cutaneous form, the inhalational form, and the gastrointestinal form. All forms can be fatal. So the lesson for clinicians is to consider bioterrorism with any kind of unusual infection. (Figure 14-7) Pediatricians may be the first to encounter the victims of a covert biologic attack.

And as suggested by the AMA and JAMA, it's incumbent upon us to learn about the signs and symptoms of common biologic weapons because the early recognition will have an effect, as was mentioned in the anthrax case. Early diagnosis and treatment will save lives. This leads me to special considerations in infants and children. Let's turn to what makes kids more susceptible. We're always talking about how children are different from adults and that children are not little adults.

We need to consider these principles when thinking about chemical and biological terrorism and when planning for a response. What are some of the considerations? Well, as we heard, children have an increased respiratory rate, so with aerosolized agents, such as Sarin, chlorine, and anthrax, children will receive a relatively greater dose.

Children are short, so their breathing is closer to the ground, where toxicants such as Sarin tend to accumulate. They also play on the ground, possibly resulting in more exposure. This might have been the source of exposure for the seven-month-old who might have been put on the ground in the ABC studios.

Infants have a larger surface to weight ratio than adults, which can increase cutaneous exposure. For the same reason, kids lose heat more rapidly and may become hypothermic more rapidly when showered as part of contamination efforts. The skin of young infants also is thinner and possibly more permeable to some of these agents.

Young infants have immunologic immaturity compared to older children and adults, and they may be more susceptible to pulmonary disease.

We all know about developmental vulnerabilities. Infants, toddlers and young children may not have the motor abilities to escape from the site of an attack. They may not have the cognitive abilities to know which direction to flee in. They're dependent on parents, but parents may be injured or dead.

And of course, there are psychological effects. Children are at risk for psychological injury, such as post-traumatic stress disorder, from experiencing or living under the threat of terrorism. In a mass casualty incident, children would witness injuries and death, possibly of their parents, which would produce short- and long-term trauma. How about treatment needs? There's always an issue in pediatrics of assessing a young pre-verbal child, because he can't tell you what's wrong. And also, you can't explain to a young child what you're doing.

There are treatment and medication issues. Children require different dosages of medications. Unlike adults, where it's generally one dose of an antibiotic, we dose milligrams per kilo, so we have to know the medications and what the doses are. Many medications, are not approved for children. Most vaccines that we're talking about have not been tested in children. There's different equipment. Children come in greatly different sizes, so people have to know how to use that equipment—equipment for intubation, equipment for intravenous access.

Children may need special decontamination efforts: We have to think about these things. For example, kids may become hypothermic quickly after showering compared to adults. And think about starting an IV on a small child while suited up in a bulky, personal protective equipment.

What's the role of pediatricians? (Figure 14-8) We have roles in planning and in the detection of sentinel events. There's medical management and psychological issues. On a regional and national level, pediatricians' input is key in ensuring that kids' needs are considered.

We're going to go through each of these. (Figure 14-9) Pediatricians should help with protocols in hospitals and offices for disasters.

For example, isolation and decontamination procedures, mobilizing staff, and preventing injuries to responders. Schools may be needed as secondary sites for triage and treatment, so pediatricians may be consulted by schools in developing plans for evacuations, and also developing in-school shelters in cases of disaster.

How about detection and management? (Figure 14-10) It's important to have a high index of suspicion. This is an X-ray that you'd see in a patient with inhalational anthrax. This area of the chest is called the mediastinum; it's where there are blood vessels and lymph nodes. Typically with inhalational anthrax, there is a widened mediastinum, because the lymph nodes are infected with anthrax and they swell and they bleed.

And once there's been an event, we have a role in securing personal protection, making sure there's personal protective equipment, proper early decontamination and isolation procedures, proper antidotes, and chemoprophylaxis and general supportive care.

Just a point on enhancing early recognition. (Figure 14-11) This material comes from an article that just came out in the *Journal of Pediatrics* by some pediatricians who publish widely on terrorism. How do we recognize patients who present at the first wave of a chemical or biological attack? Well, we look for epidemics. Pediatricians see lots of kids. What if we see something that's out of proportion for the time of the year, for example, flu in the summertime? Flu-like symptoms—lots and lots of kids coming in with flu-like symptoms. This should raise our index of suspicion. There may be a common exposure history. Perhaps the patients are all from the same geographic area or they've all seen a certain cloud or vapor. Exotic disease presentation refers to the fact that many illnesses caused by biological and chemical weapons, particularly in the late stages, have unusual characteristics—things we don't usually see, like the cutaneous anthrax in the case I showed you.

Now, regarding psychological issues, pediatricians are often the first responders examining families after a disaster. We are in a unique position to help parents communicate with children after a disaster, and we can facilitate help through mental health referrals when needed.

We may need to speak to parents after a disaster about taking care of their own needs, their own emotional needs, so they can take care of their children's needs—similar to being on a plane and putting on your oxygen mask first. Watch for any signs that the child is in distress—nightmares, changes in appetite, obsessive play and behavioral changes. Encourage talking to the child, asking what he or she understands about what's happened. Explain to the child what has happened, based on the child's developmental stage. Older children will want a more detailed explanation. Limiting TV viewing, where the event is played over and over again; young children may not understand that this is just a TV show, not the event actually happening over and over again. Encouraging questions from children.

Turning to regional and national planning, the pediatrician's input is recommended at every organizational level.

Because children's hospitals are likely to get lots of casualties, pediatric health care facilities should be included in all aspects of preparation, and governmental agencies should work to ensure that there are adequate supplies of antibiotics, antidotes, and vaccines available to children.

Just a word about what the Academy of Pediatrics has been doing. Shortly after 9/11, the Academy created a task force on terrorism with the goal of providing information to pediatric clinicians, ensuring that children's needs are met in planning and response efforts, ensuring linkages with national, state, local, and private entities. The tool kit was produced in the fall of 2002. It's got some written information and a helpful piece from CDC with pictures about how to distinguish smallpox from chickenpox. There's also a website regarding this whole area.

So in summary, (Figure 14-12) the things I'd like you to take away are that pediatricians may be the first to recognize a covert attack, that children have unique vulnerabilities, unique treatment needs, unique psychological needs, and that pediatricians have key roles in detection, management, planning, and advocacy.

Here are some resources. This is the terrorism website. (Figure 14-13) CDC has wonderful resources. Poison centers are very important, particularly with chemical events. And the policy statement is available. By the way, we are working on one on radiation disasters.

Thank you.