

## ANTHRAX ATTACKS: LESSONS LEARNED ON THE 10TH ANNIVERSARY OF THE ANTHRAX ATTACKS

### To the Editor

With the 10-year anniversary of the multiwave, multisite, lethal anthrax attacks, it makes sense to reflect on the lessons that have been learned from this experience and assess current priorities on biodefense preparedness and community resilience. What follows are the observations of a physician who has evolved from an emergency medicine (response-based) posture to one of protecting the health of the community through smart policy and preventive services.

It is interesting to note the abundance of information logged before October 2001 about anthrax as an important threat. There is the World Health Organization 1970 estimate that 250 000 people would die following the theoretical aircraft release of 50 kg of anthrax over an urban population of 5 million.<sup>1</sup> This is followed up by a 1993 report from the US Congressional Office of Technology Assessment that estimates that up to 3 million deaths could follow the release of 100 kg of anthrax spores upwind of Washington, DC, thereby matching the lethality of a hydrogen bomb.<sup>2</sup> Then there is the 1999 JAMA Consensus Statement from the Working Group on Civilian Biodefense on biological threats.<sup>3</sup> This landmark effort presented several important attributes of the anthrax weapon that are worth repeating.

Anthrax powder is odorless and invisible and can travel many kilometers before dissipating.<sup>1,4</sup> After an outdoor release of anthrax, people indoors could be similarly threatened as those outdoors.<sup>5</sup> Inhaling spore-bearing particles of 1 to 5  $\mu\text{m}$  into the alveolar spaces of the lung is the most deadly form of anthrax disease.<sup>6</sup> In addition, the Working Group takes special care to point out that, "Antibiotic resistance to penicillin- and tetracycline-class antibiotics should be assumed," and reminds the reader that natural resistance of *Bacillus anthracis* strains exists against sulfamethoxazole, trimethoprim, cefuroxime, cefotaxime sodium, aztreonam, and ceftazidime. Finally, these experts promote prevention with their advice to consider the vaccination of some essential service personnel if and when increased production capacity could make vaccine available.

After the 2001 anthrax letters attacks, even more information has become available. For example, in the Hart Senate Office Building attack on Senator Tom Daschle's staff, 6 of 9 hazardous materials professionals were infected despite donning personal protective equipment (PPE).<sup>7</sup> This attack did have a defined hot zone, but because anthrax is easily reaerosolized,<sup>8</sup> the safe zone in which to don the PPE could not be demarcated, and in a wide-area anthrax release, the hot zone will be unknown. PPE is not fail-safe.

Antibiotic-resistant anthrax and vaccine supply are 2 points worth further examination. Articles in the recent medical literature have

explored the issue of antibiotic resistance in the anthrax microorganism. Five separate research groups have demonstrated that with simple microbiological techniques, anthrax can be made resistant to all of the antibiotics designed to treat the anthrax infection. The most comprehensive study demonstrated that anthrax could be made resistant to 18 different antimicrobials, including all the antibiotics in the Strategic National Stockpile (SNS).<sup>9</sup> This multidrug resistance issue is addressed exhaustively in the US Department of Health and Human Services Aerosolized Anthrax Response Playbook.<sup>10</sup> Response-biased planning falls short and does not hardwire preexposure vaccination strategies to match the microbiological science, however. Case-fatality estimates for inhalation anthrax are extremely high, approximately 75%, even with appropriate antibiotics and supportive care.<sup>11</sup> Imagine the carnage if no civilian emergency responders were vaccinated and the anthrax weapon is resistant to antibiotics.

Continuing this policy is fundamentally unscientific. No vaccine can be expected to confer immunity once victims are exposed and/or infected. Instead, it is prudent to heed the prescient advice of the 1999 Working Group on Civilian Biodefense and embrace the 2010 Centers for Disease Control and Prevention Advisory Committee on Immunization Practices' final recommendation, which supports offering the anthrax vaccine, "for persons involved in emergency response activities including but not limited to, police departments, fire departments, hazardous material units, government responders, and the National Guard."<sup>12</sup>

Regarding vaccine supply, in 1999, manufacturing capacity was spotty and all of the vaccine doses were promised to the Department of Defense. Twelve years later, ample vaccine is available to begin protecting essential service personnel. The manufacturer is consistently producing 8 to 9 million doses each year (K. Connolly, personal communication, March 2010). Moreover, 500 000 doses of the anthrax vaccine in the SNS are being destroyed every month because their shelf life has expired. This is a waste of approximately \$180 million/y. Rather than being allowed to expire, these doses could be rotated out and offered to emergency responders and other personnel at high risk to anthrax bioterrorism. The currently licensed vaccination regimen is 5 doses for 18 months with annual boosters but the Food and Drug Administration is reviewing a change to a 3-dose series with a booster every 3 years. With this new schedule, 2 million emergency responders could be vaccinated with 1 year's worth of discarded SNS vaccine.

The anthrax vaccine is licensed by the Food and Drug Administration as effective and safe.<sup>13</sup> More than 2.5 million people have received more than 10 million doses of the anthrax vaccine. The Institute of Medicine states that the rate of adverse events for this vaccine is similar to rates in other adult vaccines (influenza, hepatitis A virus, tetanus).<sup>14</sup> In a study of 1 349 327 doses administered to more than 400 000 subjects, the rate of adverse events was 1 in 25 000 injections and the chance of a serious adverse event (disability, hospitalization,

threat to survival, or death) was 1 in 200 000 injections.<sup>15</sup> To put this statement into perspective, a person living 80 years has a 1 in 10 000 chance of being struck by lightning.<sup>16</sup> This forces the question, why not use short-dated anthrax vaccine to protect US civilian emergency responders?

The goal is community resilience. The threat is nothing short of antibiotic-resistant anthrax. The solution is to properly equip indispensable emergency responders with voluntary, preventive vaccination before exposure.

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## A COMMENT ON MANAGEMENT OF SPINAL INJURIES IN THE OCTOBER 2005 PAKISTAN EARTHQUAKE

### To the Editor

We read with interest the letter by Butt et al about the experience of a makeshift spinal cord injury (SCI) rehabilitation center established after the 2005 Pakistani earthquake.<sup>1</sup> We were with 1 of the teams that supervised the management and rehabilitation of hundreds of patients with SCI in the earthquake and have described our experiences in several articles.<sup>2-6</sup> As residents, we regularly visited the makeshift spinal centers to facilitate their management. We make the following observations:

- The team of Butt and colleagues was a mix of senior and junior consultants, registrars, residents, and house officers, all from the Department of Internal Medicine. Their dedication was commendable and their team spirit unsurpassed. To the best of our knowledge, there is no report in the biomedical literature in which physicians in internal medicine successfully supervised the management and rehabilitation of such a large number of patients with SCI in postdisaster scenarios.
- At the time of the 2005 disaster, SCI rehabilitation in Pakistan was literally nonexistent, with only a few centers. The majority of patients with SCI were received in the hospitals in Rawalpindi and Islamabad; however, apart from the Armed Forces Institute of Rehabilitation Medicine, initially, no rehabilitation specialists were available to facilitate SCI rehabilitation.<sup>2</sup> Ours was the only equipped spinal rehabilitation unit in Islamabad and Rawalpindi. We expanded our indoor bed capacity from 100 to 140 in 2 weeks and dedicated approximately 70 beds to patients with SCI. Nevertheless, reportedly 650 to 750 more patients with SCI could not be accommodated at this single center, hence the need for makeshift spinal centers.
- Three makeshift spinal centers were established and admitted more than 300 patients. Only 1 of the centers, at the National Institute of Rehabilitation Medicine, was upgraded to a permanent facility; the rest were closed. These centers helped to save hundreds of paralyzed patients who otherwise were "the most neglected of all patients injured in the earthquake."<sup>7</sup>
- Good intentions can never replace medical expertise. This was the case with the makeshift spinal centers, which were managed by medical physicians and even gynecologists.<sup>5</sup> Although they saved lives in the acute postdisaster phase, adequate SCI rehabilitation could not be provided to all of the patients. The rate of complications, notably pressure ulcers, urinary tract infections, and deep vein thrombosis, was high,<sup>2,4,6,8</sup> and there were concerns about inadequate and inaccurate assessments of these patients.<sup>5</sup>
- Patients with SCI under primary physiatrist care had a reduced incidence of complications, better functional outcomes, and community reintegration as compared with patients under nonphysiatrist care, including in the makeshift spinal centers.<sup>2,5</sup>