

ROLE OF PRIMARY CARE PHYSICIANS IN CHEM-BIO INCIDENTS

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SUMMARY

The anthrax outbreak in the United States starting in October 2001 and resulting in 22 cases of anthrax demonstrated the reality of modern use of a biological agent to inflict harm. Casualties from such intentional harm present with non-specific symptoms to their primary care physicians. The Bioterrorism Readiness Plan, jointly produced by the APIC Bioterrorism Task Force and the CDC Hospital Infections Program Bioterrorist Working Group in 1999 was used as a template to define the role that primary care physicians need to play. Such doctors have four key service roles to play. Firstly, they must be able to recognise the first cases as unusual events. Next, they must be able to manage suspected cases pending confirmation making sure that further contamination of people or the environment will not occur if the cases turn out to be a real intentional biological incident. Thirdly, post exposure victims including healthcare staff need to be appropriately managed. Finally, primary care physicians play a central role in reducing fear and panic amongst in the community. A working strategic plan and drills that hone the responses of everyone including the primary care physicians may need to be organised if the perceived need arises.

INTRODUCTION

The outbreak in the United States starting in October 2001 and resulting in 22 cases of anthrax demonstrated the reality of modern use of a biological agent to inflict harm (Malecki et al, 2001) ¹.

In 1999, the APIC (Association for Professionals in Infection Control and Epidemiology) Bioterrorism Task Force and the CDC Hospital Infections Program Bioterrorist Working Group jointly produced a Bioterrorism Readiness Plan as a template for Health Care Facilities. This document can be downloaded from the CDC website. The URL of the file is <http://www.cdc.gov/ncidod/hip/Bio/13apr99APIC-CDCBioterrorism.PDF> (English et al, 1999)².

The document proved to be an excellent template in defining the service roles of primary care physicians using the Bioterrorist Readiness Plan. Primary care physicians form the frontier line of defence when it comes to the intentional use of biological agents. These physicians include doctors who run the ambulatory care clinics, the emergency care clinics as well as the smaller number who look after the inmates of home and elderly care institutions.

It is important to include them into the country's readiness plan and appropriate response strategy. To be effective, like other healthcare providers, they must come forward for training when called upon to do so. Only then will the defence line be intact.

The training should cover:

- κ Reporting requirements and contact information in its readiness plan
- κ Potential agents – chemical, biological and nuclear – that may be used intentionally
- κ Detection of outbreaks caused by agents of terrorism
- κ Management & reduction of likelihood for further contamination or transmission
- κ Post exposure management
- κ Fear and panic reduction techniques

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Pareto principle

Like in all things, it is important to remember the idea behind the Pareto principle, also called the 20-80 rule: pay attention to 20% of the things and it will take care of 80% of whatever you need to worry about. One may be side-tracked by the myriads of potential agents that may be used to inflict harm.

It can be argued that knowing the top four biological agents well is a big step forward in being prepared. Adding to this list another 6 key ones will more or less be sufficient for the time being. The top four consist of two bacteria, one virus and one toxin – anthrax, smallpox, plague and botulinum toxin. The next 6 contending ones of importance are three bacteria, one group of viruses and two toxins – tularaemia, Q fever, brucella, viral haemorrhagic fevers and viral encephalitides, staph B endotoxin and ricin which comes from the castor oil bean. Some reference will be made to the clinical features of these too.

SERVICE ROLES

It is in the service roles as frontier guards that the primary care physicians will render the best defence because they are the first contact points by the victims. There are four such roles.

The First Service Role – Consider Bioterrorism And Raise Alarm

The first service role of primary care physicians is to consider bioterrorism when a case with unusual symptoms is encountered. More likely, it will be groups of non-specific illnesses clustered in time or place that will raise suspicion.

CLINICAL SYNDROMES

In their daily professional duties, primary care physicians should be on the lookout for the following syndromes:

- κ Febrile, pulmonary syndrome – intentional attack using biological attacks are likely to present this way because the aerosol route is usually the chosen route for attack by biological agents. Thus, of the 10 agents listed in Table 1, no less than eight will have fever and cough as clinical features³.
- κ Gastrointestinal syndrome – this syndrome is also possible because contamination of food or water may be the chosen route. Salmonella contamination, *E.coli* or even cholera contamination are examples. Such attacks may have psychological effects but are not lethal and easy to put right.
- κ Other syndromes – Aerosolised botulinum toxin causes a flaccid paralysis of muscles resulting in difficulty in swallowing, blurred vision and respiratory difficulty. It is therefore fairly specific. Viruses may only result in a febrile illness at the beginning and only the evolution of the illness will tell that it is not an ordinary febrile viral episode; this underscores one more reason why patients should not doctor-hop.

Report immediately

An important point to make is this: even when a single case of an unusual disease is identified, alarm must be raised. It is better to have a false alarm than too late an alarm.

The following two statements bear repeating – Report all suspected cases, even if it is a single case. Do so even if incident occurs out-of-hours, evenings or weekends. Have all the telephone numbers, faxes and email addresses at hand all the time so this can be done speedily.

Table 1: Summary of the potential agents of bioterrorism

Agent	Incubation period (average)	Clinical syndrome	Diagnostic assay
Bacteria:			
Anthrax	2–60 days	Nonspecific viral syndrome followed in 2–5 days by severe respiratory distress, mediastinitis, shock, and death	Widened mediastinum on CXR, Gram stain, culture (blood)
Plague	2–3 days	Acute onset of fever, cough with bloody sputum, may develop respiratory failure sputum	Gram stain and culture of blood
Tularemia	3–5 days	Acute febrile illness, often pneumonia, may develop respiratory failure	Culture of blood, sputum; difficult to isolate, largely a clinical diagnosis
Q fever	10–40 days	Nonspecific, fever, cough, pleuritic chest pain	ELISA or IFA on serum
Brucella	5–60 days	Irregular fever, headache, fatigue, osteoarticular involvement	Blood and bone marrow culture (hold 6 weeks); serum agglutination test
Viruses:			
Smallpox	7–17 days	Acute fever, followed in 2–3 days by macules progressing to pustules, most on extremities and face, synchronous	Pharyngeal swab, scab material for PCR (reference laboratory only)
Viral encephalitides	VEE: 2–6 days EEE, WEE: 7–14 days	Systemic febrile illness, encephalitis	Leukopenia, lymphopenia, serology: ELISA
Toxins:			
Botulinum	1–5 days	Blurred vision; diplopia; dry mouth; ptosis; symmetrical, descending, flaccid paralysis	Largely clinical, serum and stool for detection of toxin by mouse bioassay if oral route of exposure
Staphylococcal enterotoxin B	3–12 hours	Fever, headache, nonproductive cough	Clinical
Ricin	18–24 hours	Weakness, fever, cough, pulmonary edema, respiratory failure, and death	Clinical, serology on acute and convalescent serum can confirm

Source: CDC. Preventing emerging infectious diseases: a strategy for the 21st century. Atlanta, Georgia: U.S. Department of Health and Human Services, 1998.

THE SECOND SERVICE ROLE – MANAGE SUSPECTED CASES APPROPRIATELY

The second service role is to deal with suspected cases appropriately. In the absence of confirmation, precautions will have to be observed.

Observe standard precautions

In any suspected case, the minimum precautions to take will be the standard precautions:

- κ Wash hands – after touching patient or body fluids
- κ Use gloves – when touching body fluids
- κ Use masks and face shields – when procedure may result in a splash of blood or secretions
- κ Observe patient placement and transport arrangements – minimise contamination of environment
- κ Clean, disinfect, sterilise equipment and environment when the suspected case is handed over
- κ Discharge only when deemed non-infectious or no risk of contaminating others
- κ Communicate precautions when deaths occur – communicate precautions to caretakers on contamination by body fluids and secretions and what action to take

Other precautions

Standard precautions will not be enough when dealing with plague or smallpox or indeed other infectious agents with unknown virulence. Table 2 describes the precautions needed for the top four biological agents.

Droplet precautions

Droplet precautions are used for patients known or suspected to be infected with microorganisms

transmitted by large particle droplets, generally larger than 5µ in size, that can be generated by the infected patient during coughing, sneezing, talking or during respiratory-care procedures. Droplet precautions require healthcare providers and others to wear a surgical-type mask when within 3 feet of the infected patient. These will be needed in the contacts with a suspected plague patient.

Airborne precautions

Airborne precautions are needed for patients known or suspected to be infected with microorganisms transmitted by airborne droplet nuclei (small particle residue, 5µ or smaller in size) of evaporated droplets containing microorganisms that can remain suspended in air and can be widely dispersed by air currents. Airborne precautions require health care providers to wear respiratory protection when entering the patient's room. These will be needed in the contacts with a suspected smallpox patient.

Contact precautions

Contact precautions are used for patients known or suspected to be infected or colonized with epidemiologically important organisms that can be transmitted by direct contact with the patient or direct contact with potentially contaminated surfaces in the patient's care area. Contact precautions require healthcare providers and others to wear clean gloves upon entry into patient's room; wear gown for all patient contact and for all contact with the patient's environment; gown must be removed before leaving the patient's room; and wash hands using an antimicrobial agent. These will be needed in smallpox infection and also in dealing with the skin lesions in anthrax.

Table 2: Infection control practices for patient and environment

Biological agent	Anthrax	Botulinum	Plague	Smallpox
Transmission	Not transmitted from person-to-person	Person-to-person does not occur	Pneumonic plague can spread from person to person by droplet transmission (e.g. coughing and sneezing)	Potentially transmissible from person to person by exposure to respiratory secretions, contact with pox lesions, and fomites (though not efficiently)
Isolation precautions	SP; Routine use of gloves for non-intact skin	SP	SP plus DP for pneumonic plague until 72 hours of appropriate antibiotics and there has been favourable response	SP plus AP plus CP Patient should not be considered for non-infectious until all scabs have separated (about 3 weeks)
Patient placement	Private room not necessary; airborne transmission does not occur; Skin lesions may be infectious on direct contact	Private room not necessary	Private room or cohorted DP Special air handling or negative-pressure rooms are not necessary; door can be left open.	Room that meet the ventilation and engineering requirements for AP
Patient transport	SP	SP	DP – patient transport limited to essential medical purposes only	Mask for patient; limit patient transport to essential medical purposes only
Equipment and environment	SP	SP	SP Scrupulous handwashing in addition to gloves when touching non-intact skin	Dedicated equipment; CP
Discharge management	SP for home care providers	No special discharge instructions	Complete 72 hours of antibiotics before discharge; no special discharge instructions	Not discharged until not infectious (infectious from onset of rash till scabs separate; thereafter no special instructions)
Post-mortem care	SP Eye and face mask protection against accidental splatter of body fluids	SP	SP and DP	AP and CP

Key: SP=standard precautions; DP=droplet precautions; AP= airborne precautions. Source: English et al, CDC, 1999

Treatment may also need to be considered depending on the degree of clinical urgency and the strength of the suspicion. The number of casualties may also require some quick anticipation of the stocks of medications that need to be indented to deal with the onslaught and the treatment points that may have to be set up. Table 3 gives a summary of treatment regimes of the top biological agents.

The Third Service Role – Manage Post Exposure Subjects and Environment to Prevent Infection or Further Contamination

The third service role that follows if the index case turns out to be a true bioterrorism casualty then the ability to manage post exposure subjects and

environment appropriately to decontaminate patient and environment as well as prevent further infection taking place becomes crucial. There are two tasks to do well:

- κ Decontaminate environment – Remove contaminated clothing, shower with soap and water but avoid potentially harmful practice such as bathing patients with bleach solutions – these are unnecessary and should be avoided
- κ Provide prophylaxis and post-exposure immunisation – where such actions are relevant. Table 4A shows the persons that need prophylaxis and Table 4B shows the vaccine and prophylaxis regimens of the top biological agents. There is no prophylaxis for brucella, the viral infections, botulinum toxin, staphylococcal enterotoxin B and Ricin.

Table 3: Summary of treatment regimens for potential agents of bioterrorism

Agent	Treatment
Bacteria:	
Anthrax	Ciprofloxacin 400 mg IV q 12 h or doxycycline 200 mg IV, then 100 mg IV q 8–12 h for 60 days w/o vaccine
Plague	Streptomycin 30 mg/kg IM qid in 2 divided doses X 10 d (or gentamicin) or doxycycline 200 mg IV, then 100 mg IV q 8–12 h
Tularemia	Streptomycin 30 mg/kg IM qid in 2 divided doses 2 10–14 d or gentamicin 3–5 mg/kg/d 2 10–14 d
Q Fever	Tetracycline 500 mg po qid X 7 d or doxycycline 100 mg po bid X 7 d
Brucella	Doxycycline 200 mg/d po plus rifampin 600–900 mg/d po q 6 wk
Viruses:	
Smallpox	Supportive care; cidofovir has activity in experimental animals, in vivo
Viral encephalitis	Supportive care
Toxins:	
Botulinum	Trivalent equine antitoxin (serotypes A,B,E) (licensed, CDC)
Staphylococcal enterotoxin B	Supportive care
Ricin	Supportive care; gastric decontamination if ingested

Source: APIC Textbook of Epidemiology, 2000

Table 4A: Exposed persons requiring prophylaxis

Agent	Definition of exposed persons requiring prophylaxis
Anthrax	<p>An exposed person is one who is exposed to B anthracis aerosol; inhalational anthrax is not transmitted person to person</p> <p>Initiation of antibiotic therapy quickly after exposure has been shown to markedly reduce the mortality of inhalational anthrax in animal studies.</p> <p>The best available prophylactic regimen is combination antibiotic therapy and anthrax vaccination.</p>
Plague	<p>An exposed person is one who is exposed to aerosolized <i>Y.pestis</i> or in close physical contact with a confirmed case-patient (contact at less than 2 m during a period when the case is asymptomatic and before the case had received 48 hrs of appropriate antibiotic therapy)</p> <p>Household contacts and exposed healthcare workers should receive prophylaxis.</p>
Smallpox	<p>An exposed person is one who has been in close personal contact with a patient with suspected or confirmed smallpox.</p> <p>Close personal contact includes persons residing in the same household with the case-patient or persons with face-to-face contact with the patient after the patient developed fever.</p> <p>Persons who had been previously vaccinated against smallpox during childhood should not be assumed to be currently protected against smallpox.</p> <p>All exposed persons should be placed in strict quarantine and respiratory isolation for 17 days after last contact with suspect or confirmed smallpox case</p> <p>All exposed persons, including all household contacts and face-to-face contacts of patients, should be vaccinated immediately, if vaccine is available.</p>
Botulinum toxin	<p>An exposed person is one who has been exposed directly to botulinum neurotoxin; there is no person-to-person transmission of this agent</p> <p>Post-exposure prophylaxis for botulinum toxin is not currently available.</p>
Tularaemia	<p>An exposed person is one who has been exposed to the release of Francisella tularensis-containing aerosol; this infection is not transmitted person to person</p> <p>Antibiotic therapy should begin as soon as possible after exposure and is most effective if begun within 24 hours; persons who have been exposed for more than 24 hrs previously should be advised to monitor their temperature and seek medical evaluation and treatment for sudden onset of fever greater than 38.5°C accompanied by flu-like symptoms.</p>
Q fever	<p>An exposed person is one who has been exposed to the release of Coxiella burnetii containing aerosol; this infection is not transmitted person to person</p> <p>Antibiotic prophylaxis is very effective and will prevent clinical disease if administered 8-12 days after exposure</p> <p>Starting prophylaxis immediately after exposure can delay onset of the disease but does not prevent symptoms from occurring.</p>

Source: APIC Textbook of Epidemiology, 2000

Table 4B: Summary of vaccine and prophylaxis regimens for potential agents of bioterrorism*

Agent	Vaccine	Prophylaxis
Bacteria:		
Anthrax	0.5 ml SC at 0, 2, 4 wk and 6,12,18 mo plus annual booster; (licensed but not readily available)	Ciprofloxacin 500 mg po q 12 h or doxycycline 100 mg po q 12 h for 30 d and 3 doses of vaccine or for 60 d w/o vaccine
Plague	Greer inactivated vaccine available (licensed), 1.0 mL then 0.2 mL boost at 1-3 and 3-6 mo – but not protective against aerosol in animals	Tetracycline 500 mg po qid X 7 d or doxycycline 100 mg po bid X 7 d
Tularemia	Live attenuated vaccine; scarification (investigational, IND)	Tetracycline 500 mg po qid X 14 d or doxycycline 100 mg po bid X 14 d
Q Fever	Inactivated whole-cell vaccine, 0.5 mL SC dose X 1; skin test first (investigational; IND)	Tetracycline 500 mg po qid or doxycycline 100 mg po bid; begin 8-12 d after exposure X 5 d
Brucella	None available	Prophylaxis for aerosol exposure unclear
Viruses:		
Smallpox	Calf lymph vaccinia vaccine; scarification (licensed, limited supply)	Vaccinate within 7 days after exposure
Viral encephalitides	Several IND vaccines, poorly immunogenic, highly reactogenic	None available
Toxins:		
Botulinum	Pentavalent toxoid (A–E), 0,2,12 wk SC, yearly booster (IND, USAMRID)	No chemoprophylaxis, toxoid if available
Staphylococcal enterotoxin B	No vaccine available	None available
Ricin	No vaccine available	None available

Source: APIC Textbook of Epidemiology, 2000

The Fourth Service Role – Reduce Fear And Panic

In all these events, the ability to reducing fear and panic is a vitally important role. The ability of the primary care physician to reach out the many people in his professional work puts them in vantage point to shore up the emotional fabric of the community.

In doing this type of work, there is a need to reach out and work with the coordinating authority

to dealing with psychological repercussions. Both the public and the healthcare workers need to be attended to. The coordinating committee may need some persuasion of the value of this kind of work in order that it will accord this type of work its due priority.

Work on the public

The tested approach to minimise panic in the public requires the following actions:

- κ Explain risks clearly, offer careful but rapid medical evaluation/treatment, and avoid unnecessary isolation or quarantine
- κ Treat anxiety in unexposed persons who are experiencing somatic symptoms
- κ Circulate clear, consistent understandable information to patients, visitors, and the general public
- κ Use fact sheets to remind the public of the correct facts and steps to take
- κ Run press conferences to inform the public of ongoing developments
- κ Set up forum for information exchange
- κ Use broadcasts to reach out to the public to stabilize moods and calm unfounded fears.

It is important to recognize that often not all the answers are available. It is all right to let the public know that the information required is not complete but that something is being done to get the missing information and more definitive answers will be announced when new information becomes available.

Work on healthcare workers

Often it is those nearest to the centre of action that has the least information about the latest, the decisions and the next few steps to do. They become panicky. Work at reducing fear and panic amongst healthcare workers:

- κ Address their fears – provide bioterrorism readiness education, including frank discussions of potential risks and plans for protecting healthcare providers
- κ Invite active, voluntary involvement in bioterrorism readiness planning process – this help to reduce fears in some
- κ Encourage participation in disaster drills – this

builds capacity, confidence and reduce fears and panic.

CONCLUSION

It is good counsel that all practicing doctors should be aware of such a topical subject as bioterrorism. A working strategic plan and drills that will hone the responses of everyone including the primary care physicians may need to be organised as part of total defence of the nation, depending on the urgency and reality of world events.

TAKE HOME MESSAGES

On chem-bio incidents which is an euphemistic term for bioterrorism, the following are the key take home messages:

- κ Frontline healthcare providers need to be trained and be prepared.
- κ They have the following important roles to play: consider bioterrorism and raise alarm immediately; manage suspected cases appropriately; manage post exposure subjects and the environment to prevent infection or further contamination; reduce fear and panic amongst the public and healthcare workers
- κ Applying these roles in the context of the top biological agents of anthrax, botulinum toxin, plague and smallpox will be a useful mental exercise.

REFERENCES

1. Malecki J et al. Investigating of Bioterrorism-Related Anthrax, 2001. MMWR 2001; 50:1008-10.
2. English JF et al. APIC Bioterrorism Task Force, CDC Hospital Infections Program Bioterrorism Working Group Bioterrorism Readiness Plan: A Template for Healthcare Facilities, 1999. <http://www.cdc.gov/ncidod/hip/Bio/13apr99APIC-CDCBioterrorism.PDF>.
3. Henning KJ, Layton M. Bioterrorism. APIC Text of Infection Control and Epidemiology, 2000. Washington:APIC.