Of pruritus and terrorism...

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The response to any disaster is always local first: the local community will be the first to be affected and the first responders will be members of that community. Although no community will always have the adequate amount of resources and expertise to respond to a significant chemical-biological terrorist attack, inadequate preparation will only magnify the consequences of the catastrophe.[1,2] Effective preparedness requires knowledge of the likely events, identification and mitigation of potential threats and risks, an initial assessment and subsequent enhancement of system capabilities and capacities, and a programme of planning, training, exercising and incorporation of lessons learnt into continuous systems improvement.

Timely recognition of an event is crucial to prevent or contain the spread of disease and hazards as well as reduce mortality and morbidity. This will require a pre-existing awareness of what constitutes normal and thus, the ability to identify the aberrancy. Information sharing between law enforcers and the medical community is valuable especially in the early warning of a potential chemical-biological terrorist attack. Information may come from the environment, population characteristics and individual patients. Surveillance systems must be in continuous operation to be effective.

ENVIRONMENTAL SURVEILLANCE

This would theoretically be the best method of discovery, allowing time, albeit minimal, for action to reduce the impact. Unfortunately, the detection of some of these agents may be difficult. Some organisations are developing air, water and soil analysis technologies to improve the speed, accuracy and sensitivity of detection. Many of these will be of restricted use, perhaps only to the military and law enforcers. Trained and experienced operators will be required to handle these detectors and monitors.[2-5]

EPIDEMIOLOGICAL SURVEILLANCE

This is currently in use but requires improved capabilities. Some of the difficulties with the current systems include:

a. reliance on confirmed diagnoses,

b. enforcement of mandatory reporting, and

c. inadequacies in the timeliness of submission and analysis.

Two of the epidemiological surveillance tools currently in use are syndromic surveillance and data mining.[2,3,5]

Syndromic surveillance. A syndrome is a set of signs, symptoms or a series of events that often points to a single disease or condition as a cause. Syndromes may be pathognomonic or focus on several possible conditions. Syndromic surveillance is an enhancement of standard epidemiologic data collection and analysis in which a clinical syndrome is the target of the surveillance system. Continuous monitoring of the prevalence of syndromes associated with potential chemical or agents of terrorism may identify those that should trigger further investigations to ascertain the cause. The data collection and reporting is labour-intensive. The intensity and effort of the investigations is dependent on the severity of the disease, the number of people affected, the potential to spread and the effectiveness of available countermeasures. Patient privacy must be maintained at all times.

Surveillance systems are also susceptible to false positives: detecting an event which is not there. These false alarms can be a concern as they cost money – resources are needed to respond to phantom events – and may desensitise responders to real events. Collecting more or better data or analysing the data longer can help to reduce false positives but this would mean either sacrificing timeliness or reducing the system's sensitivity to attacks.[6]

Data mining. This is directed at other potential markers of disease. Behaviour of symptomatic individuals may be tracked, such as increased school or work absenteeism, increased use of certain over-the-counter medications, utilisation of emergency medical services, emergency departments or other care facilities. Large numbers of rapidly fatal cases, clusters of patients from a single locale, rapidly-increasing disease incidence and an epidemic curve that rises and falls over a short period of time should all ring the alarm bell. Analysis of this disparate information may hallmark early phases of a terrorist epidemic.[3,6]

This issue of the Singapore Medical Journal carries an interesting article from Iran that studies the effect of phenol with menthol on pruritus induced by mustard gas exposure.[7] As sulphur mustard is relatively easy and cheap to manufacture, and still rather widely available, this paper is an appropriate and timely one to help enhance our awareness and understanding.

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MUSTARD GAS

Mustard gas, also known as the "king of war gases", is a vesicating agent (causes blistering) and is a liquid at typical environmental temperatures. It is oily, yellow brown, heavier than water, and smells like mustard, onion or horseradish. Mustard gas accounted for 77% of World War I casualties. Although several warring nations stockpiled sulphur mustard during World War II, there is little evidence it was used in combat. More recently, Iraqi forces used it during the Iran-Iraq conflict (1980-1989) causing over 3,000 Kurdish deaths.[8,9]

About 20% of mustard gas is absorbed through the skin, and due to its fat solubility, it penetrates down hair follicles and sweat glands. Once it diffuses across the cell membranes, cell injury and death occurs. There are some proposed theories for this cell death:[10,11]

a. alkylation of DNA,
b. oxidative stress upon cell components,
c. depletion of gluthatione, and
d. severe inflammatory response.

The skin is an important target for mustard gas as it has frequently dividing cells. There will be cutaneous blisters and erythema on areas directly exposed to the agent. Burns may develop in response to the vapour or the liquid. The skin effects are dependent on the ambient temperature and concentration. The concentration time needed to produce erythema is 100–400 mg-min/m^3, while for burns, it is 200–1,000 mg-min/m^3.

In the immediate phase of contact, there will be injury to the endothelium of capillaries and venules. Vascular leakage and basophile infiltration will take place. In the delayed phase, there will be death of basal epidermal cells secondary to DNA damage, vascular leak, neutrophilic immigration and ulceration. Interestingly, there is racial variation in the severity of vesicant burns. Increased melanin appears to have some protection. Long term sequelae to the skin include pigmentary abnormalities (hypo- and hyperpigmentation), chronic skin ulceration, scar formation and skin cancer. Pruritus is a very significant symptom as it affects the quality of life of patients.[8,10,11]

MEDICAL MANAGEMENT FOR CUTANEOUS SYMPTOMS

Decontamination within two minutes of exposure is the most pressing and necessary intervention after dermal exposure. Mustard gas rapidly fixes to tissue after which its effects are irreversible. There are no antidotes available currently. Several agents under investigation include antioxidants (vitamin E), anti-inflammatory drugs (steroids), mustard scavengers (gluthathione, N-acetylcysteine) and nitric oxide synthase inhibitors (L-nitroarginine methyl esters). The use of IV sodium thiosulphate and vitamin C has also been tried with variable results, while amifostine, a drug used to prevent effects of cancer chemotherapy, shows some promise.[8,11] Soldiers with skin burns in the Iran-Iraq war were treated with saline baths twice daily and dressings with silver sulphadiazine cream and paraffin gauze. Initial burns management must be aggressive.[12]

Surgical debridement of blisters and necrotic tissue may be warranted after severe exposure. Some novel techniques are under study to facilitate healing of deep partial thickness burns such as the use of enzymatic active dressings, CO_2 laser debridement, and dermabrasion. These have been effective in animal studies.[13,14] In fact, bioengineering methods indicated that laser debridement followed by autologous split thickness skin grafting was efficacious in healing deep sulphur mustard burns in swine models. Topical antibiotics have limited use. Analgesia, such as opiates, is usually required.[15,16]

Intense itching is a problem. This is usually at the erythematous stage or in the chronic phase. The drugs which are used for this include benzodiazepine or chlorpromazine. Any other symptomatic treatment may be used based on individual cases. These would include anti-histamines, local applications and treatment for dry skin (which often accompanies the pruritus).[17,18] This study which tests the use of phenol with menthol for pruritus, shows potential, with relatively minor side effects. It may offer another option for the medical community to treat the patient.

CONCLUSION

The assessment and triage of patients presenting to acute care facilities, must be done with high vigilance. Together with prehospital care, it has become high priority in this day and age. Hospitals and institutions must have a terrorism response plan, which must include the:

a. activation and notification plans,
b. facility and staff protection plans,
c. decontamination,
d. supplies and logistics acquisition and management,
e. expansion of services and alternative care sites,
f. staff education and training,
g. command, control, coordination and communications, as well as,
h. the recovery issues and debrief.

A comprehensive and well-rehearsed plan cannot be over-emphasised. An "all hazards approach" to disaster planning and management form the basis for a solid terrorism response plan. Education and training are imperative. Clinicians must maintain a high index of suspicion at all times. Other staff from administration, pharmacy, laboratory, communications and human resources, security and facilities management must be

familiar with the plan and understand their roles in the response. Hospital leadership too must be aware and take a pro-active hands-on approach.

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