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Contemporary Issue

Bio-threat preparedness: Need for a paradigm shift

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ARTICLE INFO

Article history:

Received 13 January 2013

Accepted 27 May 2013

Available online 6 March 2014

Keywords:

Bio-threat

Policy

Mitigation center

ABSTRACT

India of late has been vulnerable to Chemical, Biological, Radiological and Nuclear (CBRN) threat, on account of its unique geographic position. Biological threat is an imminent threat in the hands of a terrorist. The public health system of our country is overburdened due to its present role and bio-attack response is not a priority area. This paper suggests that as the prime focus is on the CR and N threats in the integrated CBRN preparedness strategy and that specialized and technical forces are needed to deal with a bio-threat; hence there is a need for a paradigm shift in policy. The emerging field of bio-threat needs to be delinked from the joint family of 'CBRN', with consequent structural and functional changes. A separate specialized cadre needs to be formed for dealing with bio-threat, created from the pool of doctors and non-medical scientists from the AFMS and the DRDO. Structural changes are needed in the organization, to bring in the resources of NCDC, New Delhi for enhanced disease surveillance capacity and creation of a bio-threat mitigation node in the AFMC, Pune.

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Introduction

India, like most other countries in the world, has of late been vulnerable to Chemical, Biological, Radiological and Nuclear (CBRN) threat, on account of its unique geographic position.^{1,2} The scale of damage done by these weapons of mass destruction is undoubtedly huge. Nuclear weapons are likely to be the most catastrophic and regardless of our preparedness will wipe out a significant number of our economic assets and population within microseconds of its impact. However, the good part is that it is unlikely to be used in war due to widespread international repercussions thereafter. A terrorist can of course use it, but he needs a lot of preparation and sophisticated delivery mechanism to put it into practice.

Non-persistent chemical weapons do have the potential to be used in warfare because countries can easily deny it's use

and get away with it. The good part here is that our Armed Forces are geared up to handle this issue in both war and peace. A large number of exercises have taken place wherein the scenario of a "chemical attack" has been painted and our Quick Reaction Teams (QRTs), Quick Reaction Medical Teams (QRMTs) and hospitals have by their performance instilled confidence in us, that they can do the job during actual operations.

This takes us to the third dimension viz Biological threat mitigation. It is highly unlikely to be an option in war as the country using it will fear that its own troops might get affected. However, the risk of a terrorist organization using it is very real.³ His capability to acquire, cultivate and disseminate pathogens is widespread. Well documented bio-agent attacks are present in the recent past, like the salmonella released in salads in a restaurant of Oregon, USA, 1984⁴ and

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<http://dx.doi.org/10.1016/j.mjafi.2013.05.007>

anthrax spores filled letters of 2001, which resulted in the death of five persons in USA.⁵ Seth Carus has stated "pound for pound, biological weapons are potentially more lethal than thermonuclear warheads."⁶ WHO has estimated that "50 Kg of anthrax spores released over a city of half million people would kill 95,000 and incapacitate 125,000".⁷

These predictions are based on a non-contagious agent. With use of a contagious agent, like small pox, the disease could spread to several areas in a matter of hours and would become a worldwide pandemic within days, due to the mobility of our societies. The public health system of our country which is stretched due to diverse requirements and roles was slow to respond to bio-threat, during the plague outbreak in 1995.⁸

This is because there were multiple agencies with ill defined and generalized roles both in civil and the forces, resulting in lack of clarity and coordination. This paper suggests that the present integrated CBRN preparedness strategy being more focused on CR and N leaves us grossly unprepared to tackle a bio-threat. There is a need of a paradigm shift in policy to delink the now emerging Big 'B' from the joint family of 'CBRN', with consequent structural and functional changes, so that we are capable of taking on the bio-threat head on.

Rationale for paradigm shift

For managing any CBRN disaster, preparedness, prevention, mitigation and capacity building are the integral pillars of the response process. With the rise in the threat perception, progress has been made in leaps and bounds in the field of mitigation. But this is generally limited to the nuclear, chemical and the recently added radiological field. The place of 'B' in this integrated fit has been limited to classroom teaching.

There are policies and guidelines in place.^{9,10} However, priority is often allocated to nuclear and chemical threat perception and hence implementation of these guidelines takes a relative backseat. This could be due to the fact that unlike chemical and nuclear disasters that cause immediate casualties, bio-threat is essentially a slow developing emergency. The response operation against a bio-threat is heavily manpower intensive and requires extraordinary assistance from other agencies. A multi-dentate network involving diverse agencies of health along with a dedicated communication network is the need of the hour.

QRMTs have been identified, trained and positioned at the Corps level but the dual tasking of these personnel and insufficient equipment, defeats the very essence of the structure. Earmarked hospitals are authorized a crisis expansion ward but the trained manpower and specialized logistics is generally lacking.

Personal protection, early detection, vaccination and antidote administration are the special requirement for management of any biological casualty. But in the past few years, hardly any new product has been introduced to combat these bio-threats. To compound the problem, the production line for new drugs and equipment has also run dry.¹¹ Bio-threat mitigation equipments are still limited to the First Aid Kit Type A and B.

Let us take a few examples. The present bulky NBC suit worn by the first responder, is inadequate to manage any biological warfare casualty in the field, as the skilled operations are restricted and it also subjects the wearer to heat stress. Some improvement has been made by reducing the weight of the suits to less than 4 kg. This needs to be made available to the soldier on ground. Further, it is expected that epidemic investigation teams, launched on report of an unusual incidence of a disease will wear this suit, even when there is no nuclear or chemical threat envisaged. They need a lighter bio-suit for field conditions. Having said that, it is to be conceded that it is unlikely that the conventional Sartoga NBC suit will be worn in a bio-threat scenario, as bio-warfare casualties do not manifest in an emergency. However, the twenty one basic survival drills taught to the troops and first responders, are exhausted with the nuclear and chemical protection, but do not speak on bio-threat protection, as it is considered a specialized subject.

National Disaster Management Authority (NDMA) had earmarked the Armed Forces in 2008 as an important responder to any bio-threat in the country and had stated that by 2011 the Armed Forces will have a network of BSL 2 labs and a referral BSL 3 lab for detection of new bio-threat agents.¹⁰ We were also to have adequate personnel immunized with anthrax vaccine and develop a command wise stockpile of drugs for responding to a bio-threat. There are gaps to be plugged, as creation and maintenance of stockpiles of vaccines are major policy decisions at Ministry of Defence (MoD) level, in view of limited shelf life and financial constraints.

The integrated approach of the CBRN is scientifically flawed, as the strategy for bio-threat preparedness is totally at variance from that used for Chemical, Nuclear and Radiation preparedness. The component of 'B' has not been able to grow in the shadow of the 'N', 'R' and 'C'. It can no longer remain CbRN. With new genetic mutant strains emerging and widespread antimicrobial resistance being reported,¹² bio-threat preparedness is serious business, which needs a highly technical approach, coupled with ongoing research to match the wits of the virus/bacteria/toxin, to which a terrorist can have easy access. The cost per casualty with a nuclear and chemical weapon is estimated as \$2000 and \$600 respectively, while for bio-agents the cost is about \$1 per casualty.¹³

Case for a specialized focus

Considering the above reasons, it is deemed essential that a separate specialized cadre needs to be formed, for dealing with the bio-threat. It is high time that the field of 'B' is given a dedicated focus and mechanisms put in place, right from the time of early detection through regular surveillance till the final mitigation of the threat.

The requirement is even more evident as in the civil setup this task is handled by the NDMA, which in itself is overburdened with the ongoing natural disasters in the country. It had come up with a guidelines for the management of biological disaster, 2008¹⁴ but at present, most of the systems proposed need to be effective on ground. Whatever infrastructure exists, is not directly under its command and in case of actual scenario, valuable time would be wasted in inter-

sectoral coordination. This is because the NDMA does not have an executive role in its mandate.

Advantage should be taken of the esteemed NCDC (National Centre for Disease Control), New Delhi under Ministry of Health and Family Welfare Organisation which is modeled on the lines of the US Centre of Excellence i.e. Centre for Disease Control (CDC), Atlanta. In the US it is the CDC that handles bio-threat mitigation.¹⁵ Our NCDC has the capability to detect and rush teams for early detection of any epidemic which is the first sign of a possible bio-threat. Therefore, they need to be the nodal agency for bio-threat mitigation to optimize resources, avoid duplication and confusion. They are ably supported by a network of BSL-3 and 4 labs in civil sector. It is submitted that the NCDC is mandated to assist the Ministry of Health & Family Welfare which is the nodal agency for bio-threat preparedness.

The Corps of Engineers in the army is an excellent professional combat oriented organization with capabilities to mitigate nuclear and chemical threat, and they have demonstrated the same repeatedly. They have not yet been mandated for bio-threat mitigation. Bio-threat mitigation is a highly specialized job which can be best handled by a trained specialized cadre of medical doctors and non-medical scientists in the field of microbiology.¹⁶ This expertise exists with the AFMS and the DRDO exclusively.

Structural changes proposed in the civil and Armed Forces setup

Early warning of an outbreak or an epidemic is the core philosophy behind containment of a bio-threat. The NCDC has an extremely ambitious national level Integrated Disease Surveillance Project (IDSP) in place, in which real time data on occurrence of infectious diseases right from the sub-center level upwards is fed into a computer. This flow of this real time data from all four corners of the country (for any disease of public health importance) gives NCDC the edge.

This surveillance data is analyzed to find out any unusual occurrence of a disease in any geographical area of the country. In case any unusual pattern is noticed a team of an epidemiologist, microbiologist, physician and if required an entomologist is rushed to the area to further investigate the outbreak. They have the technical infrastructure to quickly pinpoint the cause of the epidemic and then advise the local health officials to initiate containment measures. These teams have investigated outbreaks of SARS, H1N1, Avian Flu, etc in quick time and helped in controlling the situation. This agency is thus the most appropriate agency in the civil setup to be nominated to take on the responsibility of bio-threat mitigation in the country from the NDMA, which can then concentrate on its other roles exclusively.

In the Armed Forces, the surveillance of infectious diseases is the responsibility of the Office of DGAFMS, which is the integrated medical HQ for all the three services. They are thus ideally placed to take over the responsibility of bio-threat mitigation, thus relieving the Corps of Engineers to take on Chemical and Nuclear mitigation roles, besides doing their conventional role as a vital combat arm of the army. They maintain close liaison with NCDC regarding IDSP. They are

also ideally suited to collaborate with the scientists in Life Sciences Division of DRDO for continuous technical research to keep ahead of the microbe. The DGAFMS is thus ideally placed to constitute a "think tank" for policy planning for bio-threat mitigation and preparedness having specialists from microbiology, medicine, epidemiology and non-medical scientists from DRDO, besides co-opted members of the RVC as the latter are ideally placed to advice on occurrence of zoonotic diseases in animals. The primary role of this organization would be framing policy, planning, conduct training and acquisition/stockpiling of specialized equipments, drugs and vaccines.

Formally, he would be then the technical adviser on bio-threat mitigation and preparedness to the Ministry of Defence as well as the Perspective Planning Dte of the Army and its equivalents in the other services.

AFMC, Pune is the cradle of medical knowledge and research in the Armed Forces and is recognized by one and all in the civil setup. This college is directly under the administrative control of the DGAFMS. It has got a host of diverse technically specialized manpower like the public health specialist, physician, epidemiologist and microbiologist along with quality equipments required to mitigate a bio-threat. It also houses the Armed Forces Central Epidemiological Surveillance Centre (AFCESC) which has the capability to move as an epidemic investigation and containment unit to any station should the need arise. It has recently been equipped with a portable State of the Art field laboratory, funded by the WHO. Since all the specialists are located in AFMC, AFCESC can move at an extremely short notice, as time would be at a premium in case of a bio-threat.

Therefore this bio-threat mitigation team should be self sufficient, in terms of mobility, logistics, protective equipments and be able to setup it's own accommodation, especially on reaching the far-flung and hostile areas of the country. The paramedical component should also be earmarked and well trained. Individually, they should be able to multitask for other members of the team.

WHO is the international agency that monitors bio-threats and infectious diseases epidemics. While WHO would be hesitant in dealing with a purely military setup, it has no issues in supporting training and research conducted in AFMC as this is a medical college. AFMC has regular collaborative ventures with WHO across all specialties. If an integrated formalized structure is put in place under the aegis of the DGAFMS then collaboration with not only WHO but also ICMR in the field of bio-threat preparedness is a real possibility. Gradually, AFMC could even become a designated WHO collaborative centre for South East Asia in the field of bio-threat mitigation and preparedness. The spinoffs in terms of technical up-gradation of own capability would be huge.

Similarly the life sciences wing of DRDO would give much needed impetus in the field of research. New drugs and vaccines can be developed in collaboration with AFMC as experiences in bio-technology and genetic engineering can be pooled. Likewise field detection equipments and personal safety equipments can be tailor made for the Indian scenario by the DRDO. Surveillance and early warning software can also be developed with collaboration of DRDO and AFMC. NCDC can collaborate with ICMR institutes like National

Institute of Virology, Pune for surveillance and research, and the same can also be done by AFMC due to its collocation. The proposed structure is given in Fig. 1.

The way forward

If effective defence against a bio-threat has to be established, then 'B' has to be divorced from the house of CBRN. It is a separate field altogether, with own requirement for technical expertise. The same glove for the CBRN, looked after by the Engineers does not fit the requirement of 'B'.

The proposed organization with DGAFMS acting as the nodal agency and AFMC, RVC and DRDO present on board, would solve the policy paralysis regarding this sector in the Armed Forces. This would also provide much needed impetus and leadership for the civil setup and ensure communication, coordination and cooperation at an unprecedented level. Intelligence sharing would be real time with the flow of information from the IDSP wing of NCDC. In the civil setup there is an urgent need for empowering the national task force on bio-warfare in collaboration of NCDC, which could have representatives from Armed Forces for laying down the road map for the country.

Much needed impetus can also be generated, if it is made a sub-specialization in itself. The defence against the bio-threat cannot be left solely in the hands of medical officers trained in the general concept of NBC, who are also very few in number. Specialists in the field of Medicine, microbiology and community medicine need to undergo further capsule courses to upgrade their skills, whether in India or abroad.

Creation of the Bio Safety Laboratories at different locations in the country is also a priority area. Case to construct modular BSL-3 labs at AH (R&R), New Delhi, INHS Kalyani, Visakhapatnam and AFMC, Pune is under consideration. They

would be the torch bearers in early detection of the bio-warfare organism and also give valuable insights for controlling the same. The BSL will also act as repository for the microbes and facilitate research and development in this area, as one has to be one step ahead of the microbe. DRDO is also creating a project for maintaining a repository of microbes and upgrading research facilities in addition to what exists at DRDE, Gwalior.

Field detection and air detection equipments need to be stockpiled at various locations in the country where they are accessible to the QRMT. Periodic exercises simulating different bio-threats are required at all levels especially for the AFCESC and QRMT. This would keep the team in operational preparedness. Similarly for the civil setup, the District RRT should be strengthened to remove time lag for the national response teams to arrive from NCDC and NDRF.

Drug policies regarding chemoprophylaxis and treatment in case of a biological attack is the need of the hour, as with the emerging drug resistance, the contemporary knowledge may not work. Similarly research work in the area of neutralizing novel microorganisms either by disinfection and drugs is desperately needed. Vaccine research for both novel and potential known bio-threat agents will also boost the defence capacity. This warrants pooling of huge resources, which can be generated if the research projects of AFMC and DRDO are done in collaboration with some financial and technical assistance from international agencies like WHO.

Stockpiling of the essential drugs like Doxycycline, Osteltamivir, Ciprofloxacin and Rifampicin is critical to mitigate a bio-threat. It acts as a deterrent against their use. Significant coordination and control is required over the vibrant pharmaceutical industry in the civil. History also brings out the importance of such a measure, as during the plague epidemic of Surat, most of the health care personnel had fled along with stores of tetracycline and doxycycline.

Fig. 1 – Proposed structure for bio-threat mitigation at civil and Armed Forces.

Conclusion

The small 'b' in CBRN has matured into a big 'B' due to changes in the environment. It now needs a separate house to accommodate its entire family as the present structure is inadequate to effectively mount a defence against a bio-warfare. The bio-threat has become larger than life and has grown beyond the realms of war. The case for a specialized specialty with a separate organization with DGAFMS as the nodal agency along with AFMC, RVC and DRDO on board is hence the answer for the future.

Conflicts of interest

All authors have none to declare.

Acknowledgements

Authors gratefully acknowledge the contribution of Medical Branch of HQ IDS in refining the article to its present form.

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