

Are Military Hospitals Prepared to Deal with CBRN Casualties in Urban Environment?*

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RESUME

Les hôpitaux militaires sont-ils préparés à prendre en charge des victimes d'événements NRBC en milieu urbain ?

En dépit du fait que, 14 ans après l'effroi causé par les lettres à l'anthrax aux Etats-Unis et 19 ans après l'attaque au sarin dans le métro de Tokyo, aucune autre attaque NRBC n'ait été observée en milieu urbain, il reste toujours probable qu'un tel incident survienne demain ! Dans une telle situation, ce seraient les hôpitaux qui auraient à faire face à un probable afflux massif de victimes. Les hôpitaux sont-ils prêts à faire face à un scénario aussi préoccupant ? A l'exception de quelques pays à travers le monde, la plupart ne sont pas prêts à faire face à ce problème spécifique. Cet article développe quelques idées mais la défense NRBC et l'entraînement des équipes hospitalières demande une approche multi-disciplinaire, du dévouement et de la continuité pour être applicable et durable.

KEYWORDS: Hospitals, Military, CBRN, Preparedness, Urban.

MOTS-CLÉS : Hôpitaux, Militaire, NRBC, Préparation, Plan.

The question posed in the title of this article is easy to answer in a generic way: "No! Hospitals are not prepared to deal with CBRN casualties". Both state and military hospitals are not prepared for such extreme

emergencies and it is interesting to investigate why and what can be done to fortify hospitals' defenses just in case a real asymmetric incident evolves in urban environment.

WHY WE ARE NOT PREPARED?

The easy answer might be cost and budget. We live into difficult financial times and money allocated to hospitals aim to cover functional needs and daily consumables and services. The hidden answer is the inherent belief that "it will never happen to us" or that "even terrorists will not use weapons of mass destruction against other human beings". This attitude is based on the fact that besides the 1995 Tokyo subway sarin incident, the 2001 anthrax letters' scare and three Olympiads' apart (2004-2008-2012) there was no relevant urban release of CBRN agents in the last 20 years worldwide. Putting the above two together one has a solid attitude against spending money for a situation that almost does not exist.

But is this a good excuse to claim in public if such an incidence happens one day somewhere in the world? Surely it is not! And this is the main reason why should all hospitals be prepared for the unexpected that unfortunately almost always happens.

WHAT COSTS MONEY AND WHAT DOES NOT?

This article will address these two categories in an effort to put down to earth the needs of what should be done and how to do it in order to achieve a baseline CBRN hospital defense:

1. Perimeter fencing

In modern hospital design the outdoor environment is usually composed by vast gardens and green spaces that soothe the sick and support their fast recovery. But how can the hospital control the incoming contaminated flow of victims rushing to the nearest hospital without a solid hard fence and a strong gate? Ground floor has tens of doors and windows that can provide entry to hospital if unguarded, unlock or easy to brake by frustrated incomers in need. Their uncontrolled entry will lead to overall hospital's contamination and make things worse. Conclusion: hard perimeter fence; main gate; secure/locked ground doors and windows are mandatory precautions to preserve hospital's integrity and working personnel's safety. Addition of a fence is costly and hardening of doors and windows with special films might be expensive as well. Most military hospitals are considered military camps and do have perimeter fence and main gate with a post.

2. Security personnel

All hospitals have them and they are very important for the daily function of the hospital (incoming vehicles and visitors, wards' security, following the visiting hours' program, etc.). But can the hospital count on them for controlling the incoming flow of contaminated victims without specialized training, specialized equipment and hands-on experience? Surely not! Most probably they will either lock themselves inside hospital or leave premises. Situation might be better in the military hospitals but even there training and equipment needs to be available and know how to use them. Specialized equipment and training cost money.

3. Planning

Plan is nothing; planning is everything! In that respect hospital needs to have a small, flexible, realistic, updated and anthropocentric plan readily available to all those involved. Planners' worldwide need to answer a very simple question: "What would be my reaction, if I was involved in a real CBRN incident?" Planners' should plan based on what people will actually do; not on ideal responses and academic expectations that usually have no place in actual mass emergency situations. Thus the anthropocentric (from Greek: *anthropos* [man] + *kentro* [center]) element should be prominent and the most important pylon in planning process. Plans do not cost a lot but require a lot of brain work and hands-on operational experience!

4. Exercises and drills

The best way to test plans and preparedness is by conducting exercises and drills. Although all know this is true we either do not do it or do it wrong! One big CBRN drill every two years equals nothing! One pre-scheduled drill is best for policy reasons but operationally equals nothing as well! Because in real life an incident will happen right here, right now! Usually bad things happen during off-working hours, vacations and holidays or weekends or during the night. In that respect exercises and drills within the hospital or with neighboring hospitals both at local and national levels should take these elements into account in order to generate drills that will stimulate personnel and simulate reality as close as possible. Exercises and drills do not stop at the entrance of the hospital or when casualties are safe inside ambulances. Ask your ambulance crews to proceed to the nearest hospital and deliver their casualties to the Emergency Department (ED) without a notice. This might change your preparedness mindset completely. Continuous acclimatization to personal protective equipment (PPE) is mandatory and should be included in each department's routine activities. Wearing PPE once or twice a year, it is like the first time!

5. Hospital's personnel

This is the key player in all response plans. Without them no plan is effective or applicable. All should be involved at various levels of engagement. All should be educated and trained depending on their speciality and duties assigned with special emphasis to ED's personnel but also to certain medical specialities closely related to CBRN agents. If they are not very enthusiastic about their involvement, speak with them to dig out why and improvise ways to motivate them. CBRN medicine is kind of a medical speciality requiring a lot of studying,

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training in difficult environments, performing duties while wearing uncomfortable PPE compromising senses and dexterities – and all that for what? Just for an incident once in a life time; if ever? At the same time, they have to face their daily emergencies, to take care of their patients, to improvise based on their deep medical knowledge and lots more. On top of these, we ask them to add another speciality as described above? These are only few of the questions and doubts posed to and by medical personnel. Think of intelligent approaches for intelligent people, fight their fears generated by ignorance and infuse interest through modern educational methodologies – you might be surprised by their reactions and change of overall attitude. If we ever manage to introduce "CBRNE Medicine" into the curricula of the medical and nursing university schools this would be the first step towards better educated future front-line health professionals that one day might confront with the real enemy. And this does not cost a lot!

6. Infrastructure

a. Decontamination facilities look expensive but are they? Depending on the hospital's budget and strategic mission there are many commercial solutions available in two forms: deployable and fixed. The first choice is usually a trailer containing deflated tents and related decontamination equipment. The later is a separate/adjacent infrastructure (usually one or two rooms) that serves the purpose. The ideal setting is to have an ED with two separate entrances: one is leading to "regular" ED for daily emergencies and the other (CBRN/HAZMAT) leading to a decontamination station first and then to regular ED. In case of an emergency – especially if the incident's scene is in close proximity to the hospital and response time is almost zero – hospital seals the one door, opens the CBRN/HAZMAT entrance and is ready for accepting contaminated casualties. All the above raise an important issue that usually is not taken into account. It is cheaper if we incorporate decontamination facilities

Figure 1: Olympic Hospital CBRNE Response Unit (Army General Hospital, Athens, Greece), Non-ambulatory victims' decontamination station, First Responder in Level B PPE.



Figure 2: Olympic Hospital CBRNE Response Unit (Army General Hospital, Athens, Greece), Decontamination station in a container.



and capabilities during the hospital's design phase instead of hardening premises later on under the pressure of change of threat estimate. A good solution for this is to put the civil engineers/architects' community into contact with medical/health community. Collaboration will surely provide clever and affordable solutions. In the bottom line, what is the difference of a fixed or deployable decontamination system with the showers we have at home? Improvisation will save money and will come up with custom-made solutions that fit specific needs. Imagine placing a big number of showers on the perimeter ground walls of your hospital; then connect them with the main water supply system, install a waste water collection tank underneath, add a number of privacy panels and you are set to go with a fraction of money. Use pipes, nuzzles and hoses and you can construct your own decontamination systems for your first responders!

If the above are still expensive for you then close collaboration with your local fire station is a one-way solution. Firemen are very good in providing "water curtains" (high volume/low pressure [60psi]) at no time. But you have to test this solution and solve the small problems that come with it by working together with them and let them know what you want them to do.

Other issues of concern are the isolation rooms (with positive/negative pressure) and radiation rooms (for inner contaminated casualties especially following a detonation of a radiological dispersion device [RDD]).

b. Existing laboratories pose a second problem. Are they at least of BSL-2 quality? Do they have any BSL-3 capabilities or do you have to transfer samples to an authorized bio-safety lab (BSL-3 or BSL-4)? Is the reference lab in the country or need to send samples abroad? Do you have proper protocols and means for transferring highly contagious samples? Do you have the equipment for fast verification of exposure to chemical warfare agents (i.e. organophosphates)?

c. Field hospitals: Hospitals can easily handle big numbers of "clean" chemical casualties. But can they equally

perform when confronting biological or radiological casualties? Do you have quarantine hospitals included in your plans? A field hospital (tents or containers) is a good solution and can be transported near to the infected area fulfilling the basic rule indicating that in biological attacks we do not transfer casualties to hospitals; instead we transfer hospitals to casualties. Armed Forces worldwide do have field hospitals for their own operational purposes – are these hospitals suitable to perform in a contaminated environment as well?

7. Equipment

Most of the equipment that hospital's personnel will need is already available and used on routine basis (e.g. IV fluids, intubation sets, suction pumps, haemostatic tourniquets, consumables etc.). In addition to these, specialized items need to be purchased.

8. Specialized equipment

a. PPEs: Best choice for ED's personnel is the powered air-purifying respirator (PAPR) ensemble that is comfortable and provides wide view helmet without restrictions on facial hair, glasses etc. In combination with a splash proof (water resistant) suit, makes an ideal ensemble serving all purposes including decontamination procedures.

Biological threats (e.g. Ebola virus) need different PPEs for the protection of personnel involved. So far the related technical document produced by the European Center for Disease Control (ECDC – October 2014) is highly recommended¹ and so is the new PPE prototype MKVI proposed by John Hopkins University². Same applies for another ECDC technical report addressing the issue of aerial medical transportation of bio-contaminated patients³. There are many related solutions in the market – choose one that can be folded (to save space) and can provide both positive and negative pressure inside the transportation capsule (it can be used for both biological and chemical/radiological agents' exposures).

Figure 3: Olympic Hospital CBRNE Response Unit, (Army General Hospital, Athens, Greece), Field CBRNE First Aid Station

Left: Cutter - Middle: Physician - Right: Nurse

Notice the field respirator with NBC filter (next to the physician).



Radiological casualties represent another category we should also focus on mainly because our medical knowledge on management issues is very limited. Even specialists in nuclear medicine and medical physics are not very familiar with triage and management protocols in case of mass casualties following a RDD's detonation in urban environment. An excellent source of related information is the REMM website⁴ that is highly recommended for further exploitation and study.

b. AMBU and respirators: Since the area outside the ED is considered a "warm zone" (contaminated) it is best to use equipment connected with gas filters (like those used in gas masks).

c. Field consumables: There are only three medical interventions that can be performed under PPE in a contaminated environment: provide auto-injectable antidotes (for nerve gases and cyanide); support respiration (chest seals would be beneficial in case of an explosion) and control hemorrhage (with modern haemostatic sponges or gauges). Remember: it is important to keep contaminated casualties alive until they are "clean" (decontaminated) and ready to undergo a proper triage at the ED where all means would be available to support their survival.

9. Interoperability

This is the term that the military love the most but civilian counterparts usually forget its importance. Imagine two hospitals having two different decontamination systems – one has it in deflated tents and the other in a container: what will actually happen when one hospital will be asked to support the other? Upon arrival, personnel of the first hospital will find themselves in an unfamiliar working environment and in the middle of havoc you do not ask questions or read the operational manual! Imagine now that these two hospitals had the same field equipment: upon arrival, the new crews will immediately start providing services by using their "own" systems. Sounds simple and logic but these are two qualities often forgotten or neglected during planning phases!

10. Morgues and contaminated corps' management

Hospitals are not equipped to handle big numbers of corps nor contaminated corps. In that respect you need to have solutions ready and applicable that will provide you time for further adequate management of this problem. Cemeteries might have big refrigerated rooms that can be used; commercial refrigerated trucks can be deployed provided that you remove the identification markings from outside surfaces; ice-skating halls might provide more space for storing the dead as well. The huge morgue facility deployed within 72 hours after the 7/7 London bombings (2005) represent a fine example of an holistic solution with excellent working environment and consideration of many ethical issues derived from the multiculturalism of the victims. Take also into consideration the burial processes to be used for the various types of CBRN contamination. This is one of the

major problems communities affected by the ongoing Ebola outbreak in certain African countries: superficial burial led to secondary infection of stray sarcobores (carnivores) digging into the shallow graves looking for food^{5, 6}.

CONCLUSIONS

The topic presented at the 41st World ICMM Congress on Military Medicine Congress, Bali, Indonesia (17-22 May, 2015) is complex and multi-dimensional and addressed only the headlines of hospitals' CBRN defense and preparedness. Deeper study and thorough evaluation is needed for a successful outcome. But even the summarized information provided herein should be enough to alert hospitals' military and civilian officials on their potential to deal with asymmetric threats producing mass casualties in urban environment while providing two alternatives: to pray nothing that horrible ever happens in their city or to do something to protect both their hospital and people working therein. It is their choice and so are the consequences of their decisions! Open source intelligence reveals that the Islamic State has chemical and radiological terrorist ambitions and their - so far – immoral behavioral *modus operandi* reveals that they are capable of releasing CBRN agents against «Western infidels».

In conclusion there are some key points that need to be taken into serious account in case authorized personnel decides to step up and take actions:

- a. Anthropocentric planning is mandatory;
- b. Save the savers to save the hospital;
- c. Continuous exercising and acclimatization to PPE is the antidote against fear and ignorance;
- d. HAZMAT/CBRNE treatment is mostly empirical and requires a lot of studying and field improvisation;
- e. All medical specialties will be involved;
- f. Medical decisions might contradict ordinary medical ethics and regulations;
- g. Introduce HAZMAT/CBRNE Medicine to medical schools' curricula – **invest in the future!**

ABSTRACT

Despite the fact that 14 years after the anthrax letters' scare in the United States and 19 years after the unique Tokyo subway sarin incident, no CBRN attacks has been recorded in urban environment there is always a chance that this might happen tomorrow! And if it happens it would be hospitals that would have to deal with the mass consequences expected. Are hospitals prepared enough for such a worrisome scenario? With some exceptions in certain countries around the globe, hospitals are not prepared to deal with this specific problem. Some insights are provided herein but hospital's CBRN defense and preparedness requires multi-level approach, dedication and continuity in order to be effective, applicable and long lasting.

Potential Conflict of Interest: None.

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