MEDICAL PROTECTION FOR THE EXPEDITIONARY FORCE IN THE EVENT OF USING BIOLOGICAL AGENTS

Colonel (ret.) Viorel ORDEANUL, Phd*
Biologist doctoral candidate Simona BICHERU**
Biologist doctoral candidate Gabriela DUMITRESCU***

Abstract: The ADM/CBRN military or terrorist attack *is most likely to be enforced on the Force deployed in the theaters of operations (TO), as peace making troops, peace keeping troops, etc. For the medical protection of the expeditionary forces deployed in external theaters of operations (T.O.), when using biological agents, we conducted a* ***documentary study*** *on the prophylaxis and specific treatment for the medical force protection, when using biological agents, by updating and improving the medical protection countermeasures against BWA, by* ***anti-infective prophylaxis*** *(antibacterial and antiviral) pre-exposure, post-exposure and* ***anti-infective etiology*** *and support of the vital functions* ***treatment****. The aim is to develop a set of* ***national military-medical procedures*** *for the medical protection against biological agents, in conformity with the policy of the Romanian Army, NATO and the recommendations of the Ministry of Public Health (MSP), the European Union (UE), the World Health Organization (OMS) etc.*

Keywords: *force protection; biological agents; CBRN medical protection; prophylaxis; treatment; sanitary damage.*

The danger of **biochemical attacks** poses a threat to the national security of the countries around the world. The national security concept expresses the actions taken by the state to permanently maintain the operation throughout its entire existence. Romania's national security, calls for achieving a stable steady state of the social system in

* Medical-Military Research Center, Bucharest.
** Specialist biologist, doctoral candidate, Scientific Researcher Rank III (CCSMM)
*** Medical-Military Research Center, Bucharest.

which individuals, social groups organized by different criteria and the Romanian State can develop and promote their interests.

Bioterrorism is a component of terrorism and can be defined as "the use or threat of use of biological agents (aetiological/causative) of infectious diseases (viruses, bacteria, parasites and fungi, of their toxins, plant toxins, bioregulators – natural organic compounds of the cells of living organisms that regulate various natural processes), which can induce and spread anxiety, fear, anguish, terror in the population of a country, aiming for religious, political, ideological, financial or personal interests ".

The various **anthrax attacks** in the world reinforce the statements on the reality of biological hazard, and the consequence was the amplification of the measures meant to improve the preparedness and the response to biological attacks that may be recorded in the future. Biological and toxin weapons, although formally prohibited by international law (BTWC 1972) represent a real danger not only from the perspective of a biological warfare, but especially in regards to the "biochemical" terrorist attacks. Each state must effectively protect its population, now and in the future, against the consequences of bioterrorism. All states, starting with the great powers began to work on development, equipping, training and have intensified the financial effort to obtain the necessary endowments for the fight against CBRN terrorism. However, the proper use of medical countermeasures already, developed or in the course of developement, can prevent or minimize many of the damages.

Biological agents are live microorganisms and microbial toxins, animals or plants, used as specific ammunition to biological weapons, or used by terrorists in „biochemical" attacks. In recent years, around the world appeared diseases and epidemics such as HIV, Ebola, Hantavirus or different strains of staphylococci, tuberculosis mycobacterium resistant to antibiotics, which caused panic on all continents. In order to develop on a global level a detection, identification and monitoring system as a response to the insidious evolution of infectious diseases, the US Senate passed a decree on "Global Pathogen Surveillance" that preceded the establishment of the Centers for Disease Control – CDC, and in the EU was established the European Centre for Disease Prevention and Control (ECDC).

The detection, identification and confirmation of biological agents. For rapid identification using modern molecular techniques (Polymerase Chain Reaction – PCR) and Real Time Polymerase Chain Reaction – Real Time PCR)

applied to infectious products derived from cell culture or animals. In contrast to the classical PCR, the Real Time PCR allows the rapid detection of amplicons from the time of the reaction. The measurement of the kinetics from its early stage is one of the advantages of Real Time PCR. The classical PCR allows the detection and analysis of the amplicons until the end of the reaction. The Real Time PCR technique is used to simultaneausly amplify and quantify the DNA molecules. This allows the detection and quantification of specific sequences from a DNA sample. The data analyzed by the computer calculates the relative expression of a gene or number of ARNm copies. Regarding the serological diagnosis, conventional assays are being used, ELISA (Enzyme - linked immuno – sorbent – Asay) and IF (immunofluorescence). The problem is that of the immune responses and therefore, in the serological diagnosis, it is recommended to use 2-3 types of tests to confirm the results. The serum neutralization reaction is considered to be the most specific identification method, but can also be used for the serological diagnosis of the disease. The confirmation of the microbologic diagnosis can be done with mass spectrometry (MS). To implement several requirements of the capability target, scientific researches are required for the achievement of medical countermeasures.

The **treatment** of infectious contagious diseases caused by living or non- living biological agents may differ significantly from the treatment of corresponding diseases, in clinical practice. This is because the biological agents used for biological weapons are enhanced or modified to be more pathogenic, more virulent and more resistant both to the environment and to anti-infective treatments. As a result, medical countermeasures must be more severe and the treatment shall differ, being performed with the most effective anti-infective drugs in higher doses and for a longer period of time.

The risk of the CBRN attack (chemical, biological, radiological and nuclear) remains a current issue in today's multipolar world, despite international laws that prevent proliferation and CBRN agents and that formally ban mass destruction weapons (ADM/CBRNE), biological weapons (Geneva 1972) and chemical weapons (Geneva 1993).

The ADM/CBRN military or terrorist attack is most likely to be enforced on the Force deployed in the theaters of operations (TO), as peace making troops, peace keeping troops, etc. From the defense counsel’s point of view, the action may seem as justified, and the Geneva Convention recognizes the right to self-defense, if the attacker threatens the national security, the state is entitled to use "any means". But using ADM violates the laws and customs of

war, being considered as a "criminal". As a result, all enemy actions that the violate laws and customs of war are considered criminal offenses and the offenders are considered terrorists and suffer legal consequences.

The characteristics of biological agents (BWA) rank these as first on the list of the **vulnerability, threat and risk** analysis. Bioagents are relatively easy to procure (from the environment), to duplicate, to condition and to disseminate, discreetly and with the lowest costs per effect.

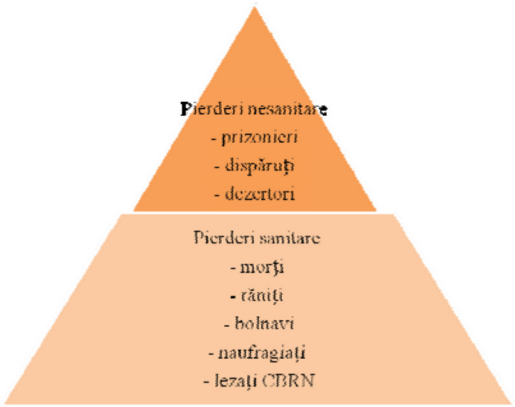
The **biological attack** may be masked by the endemic pre-existence of the disease in the area and the bioagents represent the only way to fight, being capable of naturally **autoreplicate**, causing new remote outbreaks of diseases, epidemics, epizootics, pandemic, panzootic etc. Precisely this unique and remarkable quality of biological weapons (BW) led to the fear that caused outbreaks **may totally escape control**, bringing sickness not only amongst enemy troops but also the state's own troops, the enemy's civilian population, the state's own and neutral population, domestic and wild animals, and so on. As a result, BW (bacteria, viruses, fungi, parasites, toxins, etc.) were the first **formally prohibited** ADM (BTWC 1972), and Romania joined in 1979. This delay is not due to an alleged evil intention to use such weapons (the Romanian Army never used ADM/CBRN against the enemy), but to the attempt of maintaining a **deterrent** via a possible defensive CBRN threat versus external pressures mainly by the threat represented by the USSR at that time. In 1968, in the political and military context created by the invasion of Czechoslovakia by some armies from the Warsaw Pact, the Romanian Army was restructured, enlarged, sanitised, modernized and new structures have emerged. One of them is the Center of Military Medical Scientific Research, Bucharest, dealing mainly with medical protection against ADM/CBRN for troops and civilians.

For the **medical protection** of the expeditionary Forces deployed in external theaters of operations (T.O.), when using biological agents, we conducted a **documentary study** on the prophylaxis and specific treatment for the medical force protection, when using biological agents, by updating and improving the medical protection countermeasures against BWA, by **anti-infective prophylaxis** (antibacterial and antiviral) pre-exposure, post-exposure and anti-**infective etiology** and support of the vital functions treatment. The aim is to develop a set of **national military-medical procedures** for the medical protection against biological agents, in conformity with the policiy of the Romanian Army (35), NATO policy (for example USAMRIID 7, STANAG 2242, STANAG 4632, AEP 10 etc.) and also taking into

account the recommendations of the Ministry of Public Health (MSP), the European Union (UE), the World Health Organization (OMS) etc.

The **hygiene and epidemiology** rules must be fully respected, including their adaptation for the campaign. In addition, we present the anti-infective therapeutic procedures for prevention and treatment, updated and adapted to current therapies, in compliance with the drug Regulation, which allows only approved drugs by the Medicines Agency (EMA/ANMDM), without providing exceptions for cases of force majeure or for the military (as in the USA) and its violation represents a criminal offense. Currently, out of more than a thousand pathogenic microorganisms for the human, over a hundred are considered to have a potential for the biological, military, bioterrorist or biocriminal attack. Of the many bioagents and anti-infective drugs, we chose the most representative entities, which present the maximum likelihood of use. But if in the T.O. the specialized medical support is provided by another NATO army and they provide treatement for our military, it is good for them to apply their own therapeutic procedures.

The sanitary damages. The history of the armed forces shows that during peacetime, crisis or war (declared or undeclared), within the **total damages** array structure of the vital forces prevail over **sanitary damages**. The unsanitary damages (prisoners, missing, deserters etc.), recoverable or irrecoverable, appear only in certain circumstances and are typically reduced in number (Figure 1).

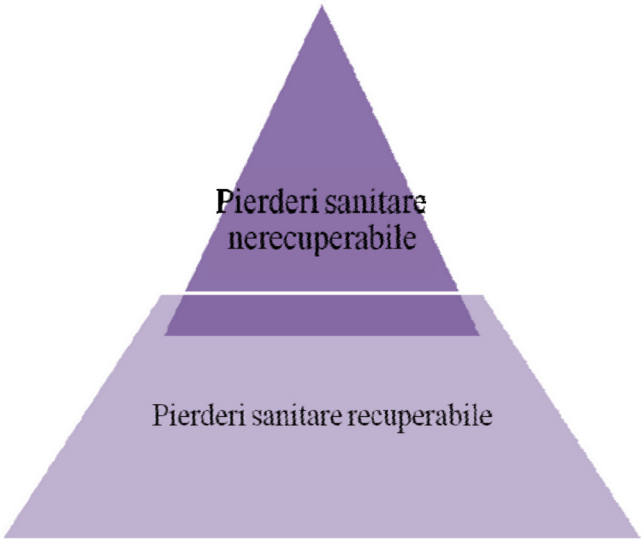


Unsanitary damages (prisoners, missing persons, deserters);
Sanitary damages (dead, wounded, sick, shipwrecked, CBRN impaired)

Fig. 1. *The structure for the vital force damages in the campaign*

Recoverable sanitary damages health prevail in the total human losses. Most are caused by mental or physical illnesses, shipwrecks, unusual environmental conditions, frostbite, sunstroke, dehydration etc.). Here we may include patients resulting from certain uses of ADM/CBRN as a military, terrorist or criminal attack: infectious patients, poisoned with STL or smoke, burned, irradiated etc. Far fewer damages are caused by traumatic injuries or as a direct result of warfare (blasts, shrapnel, bullets, knives/stabbing weapons, etc.) or as a result of various accidents.

Irrecoverable sanitary damages represent a part of the sick and wounded, or either death due to the seriousness of their injuries or their combination or because of the medical treatment's inefficiency. This may be given by the insufficiency of the forces and adequate sanitary means or due to the absence of a preventive or curative treatment for the disease (Fig. 2).



Irrecoverable sanitary damages / Recoverable sanitary damages

Fig. 2. *The structure and ratio of sanitary damages in the campaign*

All organized armies have had and will have a **medical service**. The ancient Greeks had at their subunits what today we call "sanitary soldiers" who fought alongside their comrades, and cared for the wounded after the battle, also having an appropriate "health kit" for the retrieval of counterpoints

belonging to arrows and spears from the bodies of the wounded. From them, we were left with the term "surgeon", that is to say "retriever of arrows by hand". All commanders, meaning the officers, also had medical training. An old painting has been kept for over 3,000 years, which depicts Achilles bandaging the wound of Patroclus with a perfect two-rolled bandage. Alexander of Macedon had Greek physicians in the campaign (like a campaign hospital attached to the military staff), one of which was his personal physician. This did not prevent him from dieing of cholera in Persia, along with many of his soldiers. The military genius of the Romans added to the sanitary soldiers from subunits (decuries and centurions) the campaign hospital of the legion, and each Roman camp had a hospital in the center built based on a kind of project type. This model has also been preserved in the Middle Ages, such as the hospital in Rhodes Citadel which respects this view. Moreover, the Romans observed the link between the lack of hygiene and disease, so they built latrines, they cooked centralized in subunits etc. In the fight, they acted **ergonomically**: the forefront fought only seven minutes (intense effort limits leading to the "lack of oxygen"), and then was replaced by the second front and so on, reaching the end of the battle formation in 40-45 min., where they received medical care, were drinking water, eating and resting, then rejoined the fight from the first to the last line. In this way, a Roman unit was able to fight with the same efficiency from morning till night, while the enemy was becoming weaker and had to abandon the fight.

This health insurance system has been successfully used, until **firearms** were generalized, when the number of wounded in battle grew more and the armies have become very large. In the XV century, the Ottoman Turks used the troops of "mercenaries" even after the battle, to liquidate the seriously injured, to relieve the suffering. In the XIX century, Napoleon had surgical campaign hospitals and had created sanatoriums for recovery. Some military surgeons, as was Larey, invented new surgical techniques and the disinfection of wounds. But at the invasion of Russia, "La Grande Armee" was weakened by camp fever typhus from the lice in Poland and did not have the expected efficiency.

Gradually, the **troops equipped with modern technology** were becoming even more aggressive and the number of sick and wounded were beyond the medical service. In the Franco-Prussian War the large number of military and civilian victims called for the establishment of a neutral civil organization, the

"Red Cross" to deal with the sick and wounded. In the Russian-Turkish-Romanian War from 1877, the "Red Crescent" station was constituted because Mohammedan soldiers refused to be cared for under the sign of the cross. Unbelievable, but things were repeated at the beginning of the XX century, when the "Red lion and sun" appeared and in the mid-twentieth century the "Red Star of David" and the message of neutrality has been emptied of content. As a result, the UN proposed a new universal symbol, the "Red Crystal" (a red diamond on a white background), but until now it has not been adopted by anyone. For these reasons and because of the abuse of use, these signs are no longer considered as protective, but only indicative.

To illustrate the **sanitary damages in modern wars**, we recall that in the Balkan Wars were more victims of illnesses, especially cholera, than wounded and many more dead of cholera than because of warfare, for both the troops and the civilian population . During World War I, most of the recoverable and irrecoverable sanitary damages were due to influenza. At the same time, in Romania were epidemics of camp fever typhus, typhoid fever and cholera which caused more casualties than all warfare. Let us not forget that the Romanian Army fought with the Hungarians, Austrians, Germans, Bulgarians and finally with Russian allies who wanted to get us out of the war. Only the heroic intervention of M.D. phd. Ioan Cantacuzino, with the Institute that bears his name, managed to stop the epidemics that had hit troops and the civilians. The Second World War was better prepared for all armies, being a continuation of the first. Based on previous experience and medical advances in microbiology, epidemiology and pharmacology (disinfectants, vaccines, therapeutic serums, sulfa drugs and penicillin) has been avoided the scourge of infectious and contagious diseases and the over infection of the wounded. Except for the **biological weapons** used, for example, by the Japanese army against the Chinese, it seems that the most contagious diseases, as reported by British veterans, were in the group of sexually transmitted diseases (STDs) (?!).

In **contemporary wars**, medical countermeasures prevented the spread of epidemics among troops and civilians. We are more prepared, including with countermeasures in case of a biological attack and medical procedures exist for the prophylactic, healing and recovery treatment. But, the case of the current epidemic of Ebola in West Africa, which was

officially declared "totally out of control" clearly shows that not all infectious diseases can be mastered.

We must not forget that war is, in medical terms, an epidemic (or pandemic) of multiple epidemics, including a specific epidemic polytrauma. The main role of prophylaxis, for reducing the number of victims, is carried by commanders at all levels, through the planning and management of the battle. Only secondly, the prophylaxis of sanitary damages is due to medical countermeasures, by which the medical service helps reduce the "unnecessary over mortality" of the troops and the civilian population. Medical countermeasures are provided in the Doctrine and CBRN regulations and medicals.

Therapy of diseases caused by biological agents (BWA)

Biological agents can be living pathogens that are selected or genetically modified to be more pathogenic, more virulent, more resistant in the environment and resistant to antimicrobial treatment. By way of dissemination, they may have unusual ways of entry into the body and cause atypical severe disease, such as lung anthrax, pulmonary plague or pneumonias with enteric pathogens. The contamination huge amounts of germs, for example, 1 ng (i.e., one billionth of a gram), meaning 1 million spores of anthrax, thus hundreds of minimum infectious doses (DMI) for humans. This may contaminate both people or animals, including those who were vaccinated or treated preventively and the environment can remain contaminated for a long period of time, showing long-term residual risk.

As a result, treatment should be more complex, more aggressive, with effective and personalized medication. The requirement is difficult to achieve in terms of **a mass influx of patients** with the same diagnosis, therefore with the same therapeutic requirements, and the medical logistics can be exceeded. This means that the conventional methods of treatment are no longer effective and specific therapeutic protocols should be developed between these diseases, grouped by types of microorganisms (bacteria, viruses, fungi, toxins etc.) and divided into subchapters: pre-exposure prophylaxis (vaccination), protection to exposure (individual and collective equipment), postexposure prophylaxis (to contaminants and contacts), curative treatment according to clinical form (the sick, suspects, the contaminated and healthy carriers), rehabilitation treatment (the convalescent, relapses, aggravating or disabling complications that reduce

the fighting ability, work or the quality of life) and final disinfection of carcasses and contaminated objects.

Comment. If we have sufficient and adequate forces and means and use them correctly, it increases the percentage of the healed. As an example, in the untreated pulmonary anthrax the mortality was 99% and it can be reduced by half with the appropriate treatment. It is necessary to compare different therapeutic recommendations, such as those used in clinical infectious diseases recommended by NATO (but where some drugs are not approved by the FDA, their use being possible by presidential decree US, which has no legal status in other countries) and by the EU / EMEA which are mandatory for Romania as a member country. Based on these and our experience, we have developed specific therapeutic protocols for BWA applicable to the Romanian army and the civilian population. But with some exceptions for troops in the T.O. and NATO headquarters under the US command, which can be applied by medical staff of the headquarter and **NATO therapeutic protocols**, even if not fully approved by EU regulations.

Conclusions

The expeditionary force in the T.O. may be exposed to biological attacks with living biological agents or their toxins. The medical service must be able to manage the situation through appropriate countermeasures, prophylaxis, microbiological diagnosis, treatment etc.

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