Selected Environmental Factors of Czech Contingent Soldiers during their Deployment in Afghanistan and Health Status Markers after their Homecoming

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ABSTRACT

In the frame of ISAF operation, the Field Hospitals of the Czech Armed Forces were deployed in Afghanistan near Kabul. Their operation period was since May 2002 till February 2003. Physically and psychically demanding work in adverse and variable climatic conditions and bacteriologically contaminated dusty environment required enhanced medical surveillance to maintain soldiers´ good health status during their activities. 1448 samples of clinical material, food products, water and environmental materials were examined in a mobile laboratory. The highest morbidity ratio was observed in guard duty members, it was three-times higher than morbidity of other soldiers.

262 staff members of the Field Hospitals were medically examined after their homecoming. Physical examinations were in physiological range almost in all soldiers. Less significant signs of leukocytosis, the slight increase of liver transaminases, and the moderate increase of erythrocyte sedimentation, moderate haematuria and proteinuria were most common laboratory disturbances. In some soldiers, increased levels of antibodies against Rickettsias, M. Dengue and Chlamydias were detected. Parasitological findings in faeces were inconsiderable. Still after quarantine period no signs of serious disease were observed and most of labor findings were normalized.

1.0 INTRODUCTION

In the frame of ISAF operation, the 6th Field Hospital and later the 11th Field Hospital of the Czech Armed Forces were deployed in Afghanistan near Kabul in order to provide medical care for our and allied troops´ soldiers as well as humanitarian care for local inhabitants. Their operation period was since May 2002 till February 2003.

There were a lot of real and potential adverse environmental and internal factors, that could influence the health status of the soldiers on duty to beginning with physically and psychically demanding workload in adverse and variable climatic conditions, bacteriologically contaminated dusty environment, high energy expenditure, shortage of sleep, psychological factors, potential chemical, biological or conventional weapons jeopardy. In the territory, where the military basis was placed, there was an unpleasant environmental average daily temperature at the range of 45-55 °C, with very low relative humidity at about 5–20 % only. The altitude of Kabul is approximately 1800 m above the sea level among the

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mountain peaks, and there is very potent and permanent wind in this area, especially in summer time. These conditions are completely different from those our soldiers are accustomed to in central Europe. The complexity of mentioned factors required enhanced surveillance in the area of hygiene and epidemiology. From this point of view the workplace of experienced epidemiologist was an inevitable condition in order to maintain good health status and working abilities of soldiers.

1.1 Epidemiological situation in the country

Afghanistan is a country with the occurrence of etiological agents of many significant infectious diseases, such as cholera, typhus, brucellosis, malaria, leishmaniosis, anthrax, pestis or some types of hemorrhagic fevers. However, the medical care in Afghanistan is badly developed and even the overview about the epidemiological situation in the country, about local epidemiological conditions and distribution of diseases and their resources was poor.

1.2 Local conditions

The base of the 6th and later the 11th Field Hospitals were established in the flat area near Kabul. In the past cattle was grassed there and some animals died there too. This piece of land was characterized by a high level of subsoil water, which was heavily contaminated by various kinds of microorganisms. The area was very windy and the contaminated soil dust was spread out into far-away surroundings. The whole situation was even more complicated because no epidemiological studies were carried out in the territory, and there was no information available from other epidemiological laboratories or health offices in the Afghanistan territory on the distribution of etiological agents of infectious diseases in the mentioned area. Medical services of other countries troops participating in the ISAF operation were in a similar situation and they did not have more information about the epidemiological situation in the region either.

2.0 METHODS

2.1 Medical examinations, pre- and post deployment

The most important role of the military medical service representatives in the Czech territory was to arrange the preventive medical criteria, which should ensure, that any soldier with even minimal health impairment would not be allowed to take part in a humanitarian mission in Afghanistan. Candidates underwent series of medical tests in order to determine their health status before the deployment and to exclude people with health disturbances. These medical examinations were organized and evaluated by the Department of Occupational Medicine of the Central Military Hospital in Prague. The outline of these examinations is listed in Table 1. All soldiers chosen to fulfill the tasks of the ISAF missions were in good health status, they didn't report any subjective complains and all the medical tests and examinations performed in the whole group were in the physiological range.

Similar medical examinations were carried out after the soldiers returned home from the deployment. After arriving at the airport in Prague they were transported to the military base. They followed necessary administrative and personal procedures and during the second and third day after their homecoming they underwent similar medical examination as they absolved before deployment.

Table 1: Content of medical examinations

Internal examination	*Physical examination of the body* *ECG* *Chest x-ray*
Blood examination	*Blood elements, differ., FW,*
Biochemistry	*AST, ALT, GMT, bilirubin, glycaemia, CRP*
Serology	*Chlamydias, tularemia, brucellosis, leishmaniosis, echinococcosis, rickettsiosis, amoebosis, M. Dengue, VHA, VHB, VHC, VHE, VDRL, HIV*
Urine examination	*Chem.+ sediment*
Parasitology	*Faeces* *Malaria in blood - microscopy*
Microbiology	*Sputum – TBC* *Throat swab* *Rectal swab*

2.2 Preventive medical care during deployment

The local conditions were very favorable for spreading food, water and air borne diseases. According to previous military experience from last conflicts, in which most soldiers were killed by infectious diseases out of the battlefield, a specialist in the field of hygiene and epidemiology was an important member of the medical team deployed in Afghanistan. His task was to monitor incidence of epidemiological diseases among the troop soldiers and if possible among patients and local inhabitants as well. According to the knowledge of epidemiological situation he had to arrange the preventive medical measures in order to maintain the good health status of troops and to minimize the environmental health hazard.

The basic equipment for clinical laboratory samples examinations as well as for hygienic and epidemiological tests was a Mobile hygienic and epidemiological laboratory II (Figure 1). It enables some basic and special examinations of delivered samples in the field of hematology, biochemistry, microbiology, parasitology, hygiene, epidemiology and veterinarian medicine. In spite of almost all food products were imported from the Czech Republic, the check of water and food products from all sources was carried out regularly. From epidemiological point of view, the most important workplaces on the base – i.e. kitchen and cutlery washing room, restrooms, bathrooms – were regularly checked out and microbiologic samples from these places were taken and examined (Figure 2). Increased attention was devoted to the base gate and the outpatient clinic, where local visitors and patients were contacted. Potential hosts of animal-transmitted diseases were checked there – mosquitoes, rodents - and insect and rodent control were regularly carried out. The mosquitoes as potential leishmaniosis transmitters were regularly inspected.

Figure 1: Mobile hygienic and epidemiological laboratory II

Figure 2: Processing of microbiology samples

The quantity as well as quality of microbiological agents was monitored regularly three times a day in various places of the base. At 9.00, 12.00 and 18.00 o'clock dust fall-out swabs were collected for 5 minutes at the Petri tray with blood agar. After cultivation, the colony forming units (CFU) were counted and species of microorganisms were determined.

3.0 RESULTS AND DISCUSSION

In this laboratory, in total 1448 samples were examined including 1086 samples of clinical materials, 362 samples of food products, water and environmental materials.

3.1 Local food products examinations

When fresh fruit and vegetables imported from Europe were consumed, it was necessary to use fresh fruit and vegetables from local sources or from Pakistan. Before it was released for the kitchen processing and utilization, the samples had been delivered to the laboratory and microbiology examination had been performed. According to the results of these food products examinations the authorities made decisions about the possibility of kitchen utilization.

The examination of apples, mangos and grapes revealed no microbiological contamination but inside the peach there was heavy microbiological contamination proved repeatedly. These fruits were contaminated during watering and fertilization through tree leaves. Onions and watermelons were heavily contaminated as well.

During the inspection of Afghan bread and flour a large amount of microorganisms and moulds were confirmed. The surface water as well as deep well water in the town was highly contaminated. The lamb and sheep meat from local sources showed no evidence of bacteriological contamination. All contaminated food products weren't allowed for kitchen processing.

Table 2: Bacteriological contamination of local food products

Food product	Bacteriological finding
Bread	*Bacillus cereus, Klebsiella sp., Aspergillus sp., Mucor sp., Serratia marcescens*
Flour	*Klebsiella sp., Bacillus cereus, Penicilium sp., Mucor sp.*
Watermelon	*Aeromonas sp., Flavobacter sp., Escherichia coli, Streptococcus haemolyticus*
Eggs	*Enterobacter cloacae*
Onion	*Klebsiella sp., Enterobacter sp., Pseudomonas sp.*
Peach	*Interior: Klebsiella sp., surface: Klebsiella sp.*
Apricot	*Interior: negative, surface: Bacillus cereus, fungi*
Surface water	*Klebsiella sp., Aeromonas sp., Vibrio sp., Pseudomonas sp., Enterobacter sp., Streptococcus faec.*
Drill hole water	*Aeromonas sp., Pseudomonas sp.*

3.2 Another environmental examinations

Three times a day the qualitative and quantitative examinations of dust fall-out samples were performed. The results of 6 casual days of monitoring are shown in Table 3.

Table 3: Microbiological examination of dust fall-out

Day	9.00 (container)	9.00 (gate)	12.00 (container)	12.00 (gate)	18.00 (container)	18.00 (gate)	Microbiological determination
	CFU/5 min						
1.	8	350	16	36	86	250	*Bacillus cereus, Aeromonas sp., Escherichia coli, Flavobacter sp.*
2.	10	66	12	46	170	360	*Bacillus cereus, Aeromonas sp., Escherichia coli, Mucor sp.*
3.	56	120	26	130	130	270	*Bacillus cereus, Aeromonas sp., Escherichia coli, Aspergillus .*
4.	18	56	42	75	105	290	*Bacillus cereus, Klebsiella sp., Aspergillus, Mucor sp.*
5.	46	130	35	105	205	320	*Bacillus cereus, Klebsiella sp., Escherichia coli, Aspergillus, Mucor sp.*
6.	36	106	26	65	130	300	*Aeromonas sp., Bacillus cereus, Klebsiella sp., Flavobacter sp.*
Avg	**29**	**138**	**26**	**76**	**137**	**298**	
sd	**20**	**108**	**11**	**36**	**43**	**39**	

The results of dust fall-out samples on the surface of Petri tray (average 90 mm) showed, that the heaviest microbiological contamination in the air was in the evening and especially at the base gate. Two-times lower amounts of microorganisms in the dust fall-out were measured in the morning and the least amount was measured at noon, when the air was almost calm. It was four-times lower than in the evening, but nevertheless the movement of microorganisms in the air was significant. Using this method, it was determined that during 5 minutes the amount of microorganisms, bacteria and fungi, impinging at 1 m^2 of human body could reach 50 000 - 70 000 of units. All of them could be a potential source of respiratory, skin, eye or other infectious diseases.

The subsoil water was under the ground surface and arose mostly from melted snow from the mountains in the neighborhood, at the perimeter of the fold. This moist subsurface of soil was continually contaminated with organic disposals coming from the two-million town including fecal contamination because there is no sewage system built. The area was surrounded with mountains and a huge "bacteriologic test-tube" with hot air got there, and at the temperatures of about 45-55 ^{o}C a multiplication of microorganisms was in a continual process. During the day a surface layers of the ground became dry, dust was spread out by wind and became a source of heavy microbiological contamination of the air. This microbiologically contaminated dust remained inside the fold and was circulating all the time.

3.3 Soldiers morbidity

During the deployment the highest morbidity ratio was observed among the soldiers on the guard duty. These soldiers were at the most exposed to a windy and dusty environment and to sand storms for the longest period of time. The morbidity of these soldiers was three times higher than in the other soldiers and medical staff working inside the tents or containers. The clinical symptoms appeared mostly within 24 hours after the guard duty. The prevailing diagnoses were diarrhoeal diseases and conjunctivitis.

Similar health problems with gastrointestinal disturbances were diagnosed after the ball games. The source of these problems was the river sand placed on the playground. The river had been used as a sewage pipe

in the town before it dried up and that is why sand contained a great variety of various microorganisms. When the epidemiological causes of these health difficulties were known, the epidemiologist recommended to sprinkle the playground with a disinfecting solution.

3.4 Post deployment medical examinations

262 staff members of the both Field Hospitals were medically examined on the second and the third day after their homecoming. The examination consisted of internal procedures including hematological and biochemical examinations of blood and urine, bacteriological examination of throat and rectum swabs, parasitological and serological examinations (Table 1).

Subjective annoyances reported to the doctor were inconsiderable; some soldiers reported common cold, one soldier complained of slight back pain after physical workload. Physical examinations were in physiological range almost in all soldiers; only in solitary cases the signs of laryngeal catarrh and skin efflorescence were observed.

In more than three quarters of examined soldiers minimally one of the group of laboratory markers was observed out of physiological range. These findings were detected in 93 soldiers of 6th Field Hospital; this represents 76% of total amount, and in 108 soldiers of the 11th Field Hospital, i.e. 77% of total contingent soldiers. Most common determinations were non-physiological findings in blood examination (9-11% of soldiers). The most often findings were less significant signs of leucocytosis (25 soldiers), in some cases signs of moderate leucopoenia or misbalanced blood cells differentiation count were present. In 29 soldiers (11% of total) the moderate increase of erythrocyte sedimentation (FW) was observed, but in 60% of these soldiers the borderline elevation of FW lower than 25 mm/h was observed. Next pathological finding concerned the slight increase of liver transaminases. In 46 soldiers, i.e. 17% of total amount moderate increase of ALT and/or AST was found. As in the other parameters, most of the transaminases were elevated only moderately. Just in three soldiers the ALT/AST level exceeded 2 mmol/l. In 2 soldiers light glycaemia was found, in 14 soldiers levels of bilirubin elevated and in 17 soldiers CRP levels was found.

The biochemical examinations of urine were in physiological levels in most of the soldiers, only in some cases pathological determination was found. Sporadic moderate hematuria (13 cases) and proteinuria (8 soldiers) were the most common urine laboratory disturbances.

In spite of all the soldiers were vaccinated against viral hepatitis type B before deployment, 15% of soldiers showed out negative anti-Hbs antibodies.

In some soldiers, elevated antibody titres against Rickettsias (37 soldiers, i.e. 14%) were detected. Enhanced titres were found against Rickettsia prowazeki (16 cases) and Rickettsia conorii (27 cases). Antibodies against M. Dengue were found in 28 soldiers, i.e. 11% of total amount. 19 soldiers reported the presence of IgM, 9 soldiers IgG levels. None of these soldiers had clinical signs of active disease. The titre levels were in the range of 16-32. They were controlled repeatedly and no progress in the antibody levels was observed. The conclusion for these titres was that there are either remnant antibodies after long lasting infection (but there were no anamnestic or clinic confirmation), or the tests showed non-specific cross-reacting antibodies.

Enhanced titres of antibodies against Chlamydias (107 soldiers, i.e. 40% of total) were found also in most cases without clinical signs of disease. Most of these findings were boundary levels, and in repeated examination they were normalized. In 36 soldiers (13%) active chlamydeous infection was diagnosed (elevated IgA, IgM levels). In most cases antibodies against chlamydia pneumoniae were observed, 2 of the cases showed out antibodies against chlamydia trachomatis. Subjective and objective symptoms of disease were reported in 5 people, the other cases showed out only slightly elevated IgA that were

normalized in next control examination. Other soldiers' examinations reported elevated IgG levels. The explanation could be, that there is an anamnestic sign of an infection underwent in the past.

The prevalence of antibody titres in examined group of soldiers is in relation with literary findings and we couldn't make any conclusions about the elevated incidence of these diseases in the association with the stay in Afghan environment. The interpretation of the serology results is very complicated, even when clinical signs of disease do not accompany them. The clinical signs of disease were relatively poor in all our cases and so the assessment of an exact diagnosis was difficult. Also the long lasting persistence of the antibodies could embarrass the diagnostics of an acute disorder.

Parasitological findings in faeces were inconsiderable and weren't accompanied by clinical signs of disease (Giardia lamblia 9 cases, Endolimax nana 8 cases, Chilomastix mesnili 2 cases, Entamoeba histolytica varietas minuta 2 cases).

Still after quarantine period no signs of serious disease were observed and most of laboratory findings were normalized.

4.0 CONCLUSIONS

The adverse environmental conditions, heavy workload, risks of water, soil and local food products contamination during the ISAF operation in Afghanistan could influence the working abilities and the health status of deployed soldiers. However these deployment conditions lasted almost half a year in each hospital's staff, they impacted the health status of the people relatively insignificantly. The morbidity of the soldiers didn't deviate from common range during the deployment. The health status of the staff members of the Czech Field Hospitals after their homecoming was good. They didn't report any serious subjective complains. Most of the soldiers showed out minimally one of the set of medical laboratory findings out of physiological range, the findings were without clinical sign of serious disease. Most of the laboratory findings were normalized in short time period after their homecoming. This maintaining of a good health status of the soldiers was possible due to high quality of preventive as well as therapeutic medical care about the Czech Armed Forces contingent soldiers deployed in the ISAF operation in Afghanistan.

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