

Abstracts of Scientific and Invited Papers NATO Medical Conference 2009 and 8th NATO Blood Conference

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Epidemiological Surveillance

Wound Infection Surveillance of War Wounds in British Forces Personnel

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Introduction: Deployed British military personnel sustaining battlefield wounds enter a single aeromedical evacuation pathway with rapid repatriation to a sole UK civilian hospital in Birmingham. A prospective wound infection surveillance system was established to identify true clinical wound infection in these patients.

Methods: All military patients admitted to the UK civilian hospital with battlefield wounds were included and followed-up on until hospital discharge. Wounds were clinically and objectively assessed for infection using Surgical Site Infection Surveillance (UK definitions). Variables possibly affecting outcome such as type of injury and surgical interventions also were recorded.

Results: In the 12-month period (April 2008–April 2009) 162 patients were captured by WISS. Thirty-six distinct wound infection episodes occurred in 27 individuals—a wound infection rate of 16%. A total of 75% of these were classified as “deep” infections. All were contaminated at time of injury, most often blast injury (88%). No deaths resulted from wound infection. Microbiology varied, but *Acinetobacter species* caused no clinical infections despite significant rates (37%) of colonization.

Conclusions: The low clinical wound infection rate reflects the quality of primary surgical care. The results are a critical performance indicator of surgical and post-trauma care, forming an integral part of patient management. The wound infection surveillance system now will be extended to include long-term follow-up.

Keywords: British forces; infection; military personnel; wound; wound infection; war

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Impact of Medical Intelligence for Non-Medical Users

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The NATO-accepted definition of *Medical Intelligence (Renseignement Médical)* is “intelligence derived from medical, bio-scientific, epidemiological, environmental and other information related to human or animal health. This intelligence, being of a specific technical nature, requires medical expertise throughout its direction and processing within the intelligence cycle.” (AJMedP-3)

By combining inputs from several collecting methods and processing medical intelligence predict intentions, threats, risks, and future developments.

Medical intelligence contributes to an integral intelligence picture that highlights threats and risks. For example:

1. Two countries are in a state of dispute that seems to be escalating. Suddenly, the border between the two countries is closed and all communication by road is ceased.
2. As medical intelligence signaled one of the countries has an outbreak of foot-and-mouth disease, and closed its border per OIE regulations.
3. The information confirmed that there was no escalation of foot-and-mouth disease, some of the bureaucratic systems functioned, and the country demonstrated commitment to international obligations.

Keywords: impact; medical; medical intelligence; non-medical

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Medical Evacuation

A Pilot Study of Performance of LTV1000 and TbirdVSO2 Ventilators Stimulated at Altitude: Study of Tidal Volume

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Introduction: Military air evacuations require a great amount of flexibility in terms of ventilator options, without alteration of tidal volume across a wide range of hypo-barometric conditions. The performance of two ventilators was studied using an advanced turbine delivery system: (1) a LTV1000; and (2) a TbirdVSO2. The ventilators' abilities to deliver a set tidal volume (V_t set) in the face of cabin altitude change and variable compliance and resistance were compared.

Methods: A decompression chamber was used to mimic the hypo-barometric environment at a range of cabin simulated

altitudes of 1,500 and 3,000 meters (4,000 and 8,000 ft). Ventilators were tested against models simulating a normal lung, a low compliance (ARDS) lung and a high-resistance (asthma) lung, with various FiO₂. The volumes delivered were measured with dedicated instrument of the French Air Force physiological laboratory.

Results:

	Normal Lung	Asthma	ARDS
LTV 1000: % maximum variation V delivered/V _t set	+16	+18	-16
T BIRD VSO2: % maximum variation V delivered/V _t set	-17	-18	-22

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Conclusions: Both ventilators performed well. In hypo-barometric conditions, the LTV1000 showed mostly a moderate increase in volume delivered for normal lung and asthma and moderate decrease and increase for ARDS, whereas the TBIRD VSO2 showed a moderate decrease in all cases (more marked with FiO₂ = 21%).

Keywords: air evacuation; altitude; ventilator

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A Pilot Study of Performance of LTV1000 and TbirdVSO2 Ventilators at Simulated Altitude: Study of Fraction of Inspired Oxygen

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Introduction: The performance of two ventilators built with an advanced turbine delivery system (LTV1000 and TbirdVSO₂) was studied. The ventilators' abilities to deliver a set fraction of inspired oxygen (FiO₂) in the face of cabin altitude change and compliance and resistance variation were compared.

Methods: A decompression chamber was used to simulate the hypo-barometric environment from 1,500 to 3,000 meters (4,000 to 8,000 ft). A model of normal lung was used. Ventilators were tested with V_t = 700 ml and various FiO₂ set (21%, 50%, 90%). Each FiO₂ set was noted, the effective FiO₂ assessed by the ventilators (paramagnetic analysis) and the FiO₂ delivered (dedicated instrument of the French physiological laboratory of aviation) was measured.

Results: The maximum variation of FiO₂ really delivered compared to FiO₂ set and FiO₂ assessed is shown in the Table.

Ventilator	LTV 1000	LTV 1000	T BIRD VSO2	T BIRD VSO2
FiO2 set (%)	50	90	50	90
% variation FiO2 delivered/set	-3	+10	+20	+10
% variation FiO2 delivered/assessed	+28	+30	+29	+14

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Conclusions: Both ventilators showed a moderate variation between FiO₂ set and delivered. On the other hand, variations between FiO₂ delivered and assessed are high, suggesting the inefficiency of ventilators hypo-barometric conditions.

Keywords: air-evacuation; altitude; ventilator

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Medical Air Transportation with Tbird Ventilator: Cabin Altitude Must be Input!

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Introduction: Mechanical ventilators suffer from variations in the environmental pressure. For a Tbird ventilator, the cabin altitude value should be input manually, which might be tedious. The ability of the Tbird VSO2 to deliver a set tidal volume at high altitude was assessed in two cases: with and without the input of cabin altitude.

Methods: A decompression chamber was used to mimic the hypo-barometric environment at a range of cabin simulated altitudes of 1,500 and 3,000 meters (4,000 and 8,000 ft). A model of a normal lung was used. The ventilator was tested with V_t set = 400 ml and various FiO₂ (21%, 50%, 90%), with and without inputting cabin altitude. The volume delivered was measured using the dedicated instrument of the French Physiological Laboratory of Aviation and Space Medicine of the Air Force.

Results:

	1,500 m	3,000 m
V _t set (ml)	400	400
Volume delivered without input of cabin altitude	280 ±5	125 ±10
Volume delivered with input of cabin altitude	385 ±5	350 ±10

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Conclusions: Performance of the Tbird VSO₂ are reduced dramatically regarding V_t if the value of cabin altitude is not input manually. Concomitantly to the development of highly specialized machines, there is the need to train personnel to optimize the performance of the ventilators.

Keywords: air-evacuation; altitude; ventilator

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An Intensive Care Unit Taking Off!

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Introduction: Aeromedical evacuation (MEDEVAC) is a dimensioning component of French Armed Forces foreign deployment. Considering the technical limitations of the previous collective MEDEVAC system (conversion of an Airbus A 310), the Ministry of Defense asked for a new one, designed for MEDEVAC of multiple critically injured patients.

Methods: A non-dedicated vector among existing French Air Force aircraft with cargo capacity, high range, and permanent availability was selected. A platform meeting medical and aeronautical standards was created, based on a combination of specifically designed, modifiable modules.

Results: Eleven C135FR have been modified to accommodate the medical solution. The technical platform includes patient care modules (intensive care modules accommodating one mechanically ventilated patient; light care modifiable modules) and logistical modules (two racks, one preparation table, one centralized monitoring area). The medical team includes two anesthesiologists, three anesthesiology nurses, two emergency physicians, two nurses, two MEDEVAC nurses, and one medical specialist or liaison officer.

Conclusions: The MORPHEE system and its successful operational missions emphasize the versatility and efficiency of a solution based on mission-tailored “plug and play” modules easily and quickly installable aboard a non-dedicated aircraft.

Keywords: aero-evacuation; intensive care unit; military

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“Doctor on Board”: What is the Optimal Skill-Mix in Military Helicopter CASEVAC?

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Introduction: Military prehospital times may be extended due to geographical or operational issues. The skill-mix of the prehospital team may vary. The aim of this study was to quantify the contribution of a physician to military prehospital care.

Methods: Joint Force Medical Command Afghanistan Medical Emergency Response Team (MERT) missions were entered into a prospective log. Patient nationality, mechanism of injury, and whether the doctor was required to perform a medical intervention during the mission were recorded.

Results: A total of 324 recent MERT missions retrieved 429 patients. The median number of patients was 1 (range 1–13). Of the troops, 56% were local nationals and 44% were coalition troops. Twenty-two percent were T1, 52% were T2, 21.5% were T3, and 4% were dead. A total of 48% patients had blast injuries, 25% had gunshot wound/s (GSWs), six patients had blast and GSWs. A total of 41 patients (9.5%) were medical, 23 (5%) received injuries in road traffic collisions, and 42 patients had other diagnoses. Median time from take-off to delivery of the casualty was 44 minutes (range 10–183 minutes). A doctor flew on 88% missions; the doctor was thought unnecessary in 77%. Of the missions where a doctor was useful, the commonest intervention was rapid sequence induction (45%), other interventions included provision of analgesia, sedation or blood products, chest drain or thoracostomy and pronouncing life extinct.

Conclusions: The MERT is a high-value asset that makes an important contribution to patient care. A relatively small proportion of missions require interventions beyond the capability of well-trained military paramedics.

Keywords: helicopter; military; physician; prehospital

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2008 Air Base 4 Clinic “Tenente Coronel Médico Viriato Garrett” Aerial Evacuations/Search and Rescue and in Flight Emergency Response

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Introduction: Air Base 4 clinic, a NATO “role 1” health unit, “Tenente Coronel Médico Viriato Garrett” scrambles medical teams for patients or injured people in need of air-medical evacuation, search-and-rescue, and/or in-flight emergencies.

Objective: The objective of this study was to characterize patients, diagnosis, and drug therapy involved in air-medical evacuations/search-and-rescue and in-flight emergencies in 2008.

Methods: This was an objective, cross-sectional, and descriptive study.

Results: Twenty passengers were evaluated following 19 in-flight emergencies (interruptions in commercial airliners). There was a predominance of males and acute cardiovascular pathology was most common. There were 13 patient air-medical evacuations from ships, with traumatic injuries and gastroenterology issues prevailing (analgesics and antiemetics were most widely administered). Eight search-and-rescue missions were accomplished, but in only one situation was a medical intervention needed to assist seven crew members with 1st degree burns, who were hoisted from a fishing vessel, then flown to a hospital.

Conclusions: Due to its central geostrategic location at the crossroads of transatlantic shipping and air lanes, Lajes Air Base plays an essential role in the stabilization and transportation of ill persons from vessels and also provide medical care to emergencies developing in commercial and military flights.

Keywords: air evacuation; in-flight emergencies; military medicine; search and rescue

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Role of Local-Regional Analgesia during Medical Evacuation

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Today, local-regional analgesia represents a simple and effective alternative to deep sedation or general anesthesia during medical transport of patients with severe traumatic injuries. Particularly for patients with fractures and/or penetrating injuries of the extremities, shoulder and/or thorax, local-regional analgesia could be performed using safe and simple methods, thus, avoiding or reducing the need for administering central nervous system depressants. Moreover, the use of long-lasting local anesthetics (e.g., L-bupivacaine) mixed with short acting local anesthetics (e.g., lidocaine) induce a rapid analgesic block. The use of an electrical nerve stimulator has no contraindications in the severely injured trauma patient, and permits a quick and precise localization of the nerves and plexus even by relatively unskilled attendants.

Using the tool facilitates the reception of data and creates a snapshot, which enables a global vision of the functioning

of the hospital in the different treatment sites. This overview facilitates focusing on the weak points of the hospital. Hence, the results assist in drawing conclusions that enable improvement in future exercises and responses to real events.

Keywords: analgesia; medical evacuation; prehospital
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Main Importance of Training in Air-Medical Evacuation

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Introduction: Air-medical evacuations are performed by military and civilian organizations, often in cooperation with each other or in a conjugated way. Evacuations are an important resource for out-of-hospital medicine. It is required in the most diverse situations, from the simple transport between health units to the aid of victims of catastrophes.

Methods: The aim of this study was to characterize the type and quality of medical assistance provided in-flight by the Portuguese Air Force, and analyze the healthcare provided.

Results: Medical assistance, in the aeronautical context, does not constitute a concrete professional area in Portugal. However, although, great progress has been achieved. As a consequence of the high deficit of training observed, there still is a dissonance between the theoretical ideologies and the practice, which compromises the quality of the assistance provided.

Conclusions: Medical assistance in air-medical evacuation missions always should be performed by medical crew members with strong knowledge and abilities. This only is possible by eradicating the lack of training, and by establishing training models and requirements that will overcome the existent deficits.

Keywords: air-medical evacuations; medical assistance; Portuguese Air Force; training.
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Aero-Space Medical Challenges

Military-Technical Cooperation—Portugal-Mozambique in Aeronautic Medicine

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In the scope of the Military-Technical Cooperation with the Republic of Mozambique, the Portuguese Air Force has participated in the Project 3—“Support to the Organization and Functioning of Marshal Samora Machel Military Academy”. The Air Force has responsibilities for advising the implementation of the aeronautic pilot degree.

In the search to guarantee the sustainability of the project, the advice given extended beyond the academic dimension and also included the areas of selection and medical support.

Through an initial assessment of the needs, and awareness that aeronautic medicine constitutes one of the necessary foundations to a safe practice in all aviation activities, the creation of an Aeronautic Medicine Department was considered.

The essential conditions, and the process for candidate selection for the aeronautic pilot course were determined. In addition, regular medical updates were provided to those already enlisted.

The procedures/norms must be adjusted to the Mozambican reality, considering the socio-cultural differences and the inherent particularities to the influence of the specific diseases of this African region.

Participation in the aeronautic medicine training allowed for a wide and mutual experience.

Keywords: aeronautic medicine; cooperation; Mozambique; Portuguese Air Force
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Civil-Military Relationships

Evolution of Civil-Military Relationship Concept in NATO: Requirements for Medical Cooperation in the Field of Reconstruction and Development

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This presentation highlights the evolution of requirements, capabilities, and the role of NATO in contributing to reconstruction and development (R&D) efforts in theaters of operation. The audience will learn about the three levels of civil-military medical cooperation (tactical, operational, and strategic).

The aim of this presentation is to identify, on a demand-driven basis, how NATO military medical actors in synergy with national and international civilian actors, can help to meet the needs for R&D support in operations.

Specific objectives:

1. To provide an overview of the needs for military engagement in R&D support in operations;
2. To deepen and broaden the knowledge of the relevant R&D support provided by the civilian international community in the theaters of operation; and
3. To identify key NATO military medical capabilities that can help meet the needs of operational commanders as well as of the authorities of the host nation in their R&D efforts.

The participants will receive guidance in outlining the definition and scope of civil-military medical cooperation; receive insight on the area of interest and responsibility for NATO; and a common understanding on where Alliance medical forces can add value in civil-military relationships and specifically in R&D efforts.

Keywords: civil-military relationship; scope of cooperation; medical cooperation; reconstruction and development efforts
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Migrants' Health—New Challenges

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At the beginning of the 21st Century, the world is witnessing an unprecedented movement across geopolitical, cultural, and epidemiological borders. Each year, approximately 200 million people, 8% of the world population, cross the borders of his/her country of origin. Approximately one million registered persons permanently cross the EU external borders each year.

Migrants reflect the conditions and medical background (including health beliefs and health behavior) of their

country of origin. These may be significantly different from that of the host country. Rare, re-emerging, and vaccine-preventable diseases may appear. During transit and while settling in the host countries, migrants will encounter the health risks specific for that epidemiological area.

Migration health received special attention in 2007. Though the EU still has no harmonized migration health policy, the Schengen protocol has no human public health part, and the training of law-enforcement bodies have no detailed warnings on occupational health hazards and ways of prevention in relation to the first contact with migrants.

Military corps on peacekeeping or humanitarian missions may meet people with significantly different health backgrounds and morbidity profiles than those of the country of operation. Both military medical service providers and other participants should be trained and prepared on how to cope with this new, rapidly growing phenomenon.

Keywords: health; humanitarian; migrant; migration; military

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CIMIR or CIMIC, Time to End the Humanitarian Confusion?

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Military forces are measured by their ability to hurt, not by their ability to help. Their historical rationale has been either for protection (defence) or aggression (annexation). Concomitantly, modern military forces comprise all systems to sustain their operations, and therefore, also to assist in humanitarian needs and health action in crisis. Consequently, Civilian-Military Relations (CIMIR) covers a wide range of contact and interphasing, some positive and some negative. The support for the tsunami victims of 26 December 2004 and earthquake victims in Pakistan in 2005 exemplifies the positive contribution. The oppression, as seen in many states under military rules, signals the opposite. Further, the significant difference between a drafted military army and a professional army must be understood.

The term Civilian-Military Cooperation (CIMIC), currently widely used in NATO, is, in this context, confusing. It was originally defined as a “non-lethal combat support weapon”, serving the objective of the troops through activities for “winning hearts and minds”. As such, humanitarian needs are not first priority. In other settings, e.g., peace-keeping operations, parts of military forces are involved in collaborative, well-conceived, and sustainable projects, purely addressing the defined needs of the population. The anesthesia capacity building project in Afghanistan and the MEDCAPS (one day healthcare support to random villages) are both healthcare support, but based on very different philosophies. The anesthesia project is done in collaboration with the World Health Organization and the Ministry of Public Health. MEDCAPS seem more like CIMIC.

Consequently, CIMIR is not purely “black or white”. It also covers all shades of “gray”. As such, CIMIC is but one part of CIMIR and should not be understood as humanitarian assistance *per se*, but should be conceptualized as only one activity

under the larger umbrella of CIMIR. Civilian-Military Relations fathoms cooperation = sharing goals, coordination = sharing processes, and collaboration = sharing resources.

All military forces, including NATO Allies, must elaborate and fine tune its terminology, e.g., CIMIC must not be allowed a stand-alone position, as it will jeopardize otherwise fruitful collaboration both with civilian operational entities as well as recipients and/or supported countries.

Keywords: civilian-military; cooperation; humanitarian; terminology

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Health Systems for Peace and Security

US Navy Asthma Care Practices as Reported by Primary Care and Acute Care Providers

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Introduction: Healthcare system implementation of asthma clinical practice guidelines (CPG) has been challenging.

Methods: To understand the current status of asthma care in the US Navy, medical providers completed an anonymous questionnaire. Questions explored compliance with guideline recommendations including inhaled steroid use, asthma action plans, and spirometry.

Results: A total of 337 providers completed the questionnaire (67% were physicians). For newly diagnosed, mild, persistent asthma, 70% of primary care providers (PCPs) prescribed an inhaled steroid as recommended by guidelines; 70% of acute care physicians would start an inhaled steroid in the acute care setting. The asthma action plan use varied significantly by patient age: 68% of PCPs reported use in the majority of children; only 38% used plans regularly for adults. Action plan use varied by location (medical center > hospital > free-standing clinic) and support staff availability (PCPs with <1.5 support staff were less likely to use action plans). Only 40% of PCPs used spirometry to monitor at least half their asthmatics. Facility type (medical center = hospital > free-standing clinic) and spirometer availability were factors. More support staff trained in patient education tasks was the #1 improvement deemed most likely to enhance asthma care.

Conclusions: Asthma CPG compliance remains low. Identifying barriers to optimal asthma care will be important to managing this chronic disease.

Keywords: action plan; asthma; care; guidelines; US Navy

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CBRN—Managing the Threat

CBRN Medical Support of the French Groupe D'Intervention De La Gendarmerie Nationale

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Introduction: The French Groupe d'Intervention de la Gendarmerie Nationale (GIGN) is a police special force unit from the military. Its main missions are counter-terrorism, fight organized crime, and also protection and security of vital keypoints of the nation and state, in France and overseas as well. The GIGN is trained to work under chemical, biological, radiological, or nuclear (CBRN) conditions. The aim of this study is to improve CBRN medical support.

Methods: An in-depth literature analysis was conducted to the great expertise of the GIGN medical unit and of the French Service de Santé des Armées.

Results: Before a mission, the physicians of the military are key actors to train soldiers to face CBRN conditions. They define medical counter-measures including personal protective equipment (PPE) and antidote kits including Ineupe® auto-injecting syringes that contain atropine, pralidoxim, and diazepam.

During the mission, the medical units, including the GIGN, are able to move and work in contaminated areas. They can initiate the medical care of classic soldier wounds and CBRN contaminated wounds as well. The impact of the pharmaceutical and antidote kits and specific training are of great importance to accomplish the medical mission while wearing PPE. They can also strengthen CBRN decontamination modules of the Gendarmerie.

Conclusions: The CBRN risk must be considered for Special Force medical unit: training, constantly adapting the protective equipment and specific therapeutics to the risk is a major challenge.

Keywords: chemical, biological, radiological, or nuclear; decontamination; French Groupe d'Intervention; military

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Training of French Hospital Personnel in CBRN Decontamination

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In France, the hospital health plan known as the white plan contains specific sections to deal with chemical, biological, radiological, or nuclear (CBRN) risks. The training of personnel and the organization of exercises are mandatory within the plan. This training began in 2002 after the conception of a civil-military doctrine by a national steering committee. Four-day training seminars occurred at a national then zonal level, and then, were divided into two-day seminars for additional teachers. Since 2002, these additional teachers trained >30,000 people from emergency services in one-day seminars. Since 2006, additional

efforts have been made under the responsibility of CESU (emergency teaching centre). First, voluntary health professionals who also are medically fit are chosen to run a decontamination area at the entrance to their hospitals. These people are trained for nine hours and receive a diploma that is valid for two years. Second, anybody working in hospitals has to be trained in emergency procedures every four years including general information on CBRN risks. These subjects must be taught in a hands-on manner with the objective of changing traditional health professionals' perceptions. Finally, training is a continuing learning and adapting process.

Keywords: chemical, biological, radiological, or nuclear; decontamination; hospital personnel; training

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Human Factors and Medicine Panel Activities—Human Protection Against CBRN

John Frazier Glenn

NATO Human Factors and Medicine Panel

Introduction: NATO nations continue to be concerned regarding the impact of chemical, biological, radiological, or nuclear (CBRN) attacks, both in terms of conventional force deployments, as well as the ever-increasing threat of terrorist attacks using CBRN materials against civilian populations. The Human Protection Area recently has examined, or is currently examining, Radiation Bio-effects, Risk management of exposure to chemicals under operational conditions, Chemical Agent Protection (Non-Medical), Application of Emerging Nano- and Bio-Technology to Deployable Laboratories, the State-of-the-Art in Research on Medical Countermeasures Against Biological Agents, and Integration of CBRN physical protective measures to lessen the burden on personnel.

Methods: This presentation will describe recent Human Factors and Medicine (HFM). Panel technical activities related to medical CBRN defense, with emphasis on human protection, will summarize some of the main findings from those activities.

Results: In preparation.

Conclusions: The NATO HFM Panel Technical Activities provide an opportunity for other NATO organizations to benefit from the efforts conducted with the support of the Research and Technology Agency of the Research and Technology Organization.

Keywords: chemical, biological, radiological, or nuclear; defense; Human Factors and Medicine Panel; protection

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Prediction of the Severity of Acute Radiation Syndrome Severity

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Recent decades have been characterized by a steady growth in the number of contingents exposed to various ionizing radiation sources. Compliance with all safety procedures and regulations does not exclude a possibility of radiation

accidents with overexposure of both workers and the population. The threat of nuclear terrorism with possible negative consequences for the population is real. Medical triage of exposed individuals by the extent of required medical aid is critical in large-scale radiation emergencies. Medical triage is based on the prediction of acute radiation consequences by estimated exposure dose. Whereas physical dosimetry, which provides more accurate dose estimates, often is not feasible in the event of large-scale radiation accidents, especially within the first hours and even days after exposure, biological dosimetry is of special value. Thus, a scale of Radiation Injury Severity Classification (RISC) has been developed based on the recently available medical data on 59 workers in Russia and two in the US, who were exposed due to the short-term acute irradiation.

The RISC scale includes clinical and hematological parameters for triage of acute radiation injuries into three prognostic categories: (1) survival probable; (2) survival possible; and (3) survival improbable. For *in-situ* testing of the RISC scale, 24 workers with the full clinical information for the first days after acute exposure have been selected. Eight physicians with limited training in assessment of radiation injuries have been recruited to test the scale. They have used the RISC scale to assign a numerical score to each of the 24 cases. Physicians have been able to classify appropriately 84% of cases. More importantly, they have correctly classified 96.8% of cases into a category of possible survival, i.e., those who would benefit of medical care. A more extensive *in-situ* testing is planned to validate these findings.

Keywords: prediction; Radiation Injury Severity Classification; severity

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8th NATO Blood Conference

The Blood Supply of Foreign Missions Army of the Czech Republic

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The residence of the Czech Armed Blood Transfusion Service is the Department of Hematology, Biochemistry and Blood Transfusion (DHBBT) in the Central Military Hospital in Prague. This facility is the blood collection, processing, and storage base for the military health service, and in special circumstances (frozen blood) also for civilians. The DHBBT is responsible for the blood supply of the foreign army missions as well as for blood transfusions in field hospitals.

The blood supply is based on regular delivery by aircraft every 4–5 weeks, one pack usually consists of 20 TU RBC and 20 TU FFP. The field military blood bank is part and parcel of laboratory of field hospital in container ISO-1C.

The Czech Army operated in numerous field foreign missions with field hospitals: 1994–1996 Croatia (Knin UNPROFOR), 1996–1998 Croatia (Klisa UNTAES), 1999 Albania (Kavaje AFOR), 1999 Turkey (earthquake, Gölcük), 2002 Afghanistan (Kabul, ISAF), 2007 Iraq (Basra, Enduring Freedom), 2007–2008 Afghanistan

(Kabul, ISAF). During missions, more than 1,600 TU red cells and 500 TU FFP was delivered these from DHBBT. Some situations were solved by blood collection in place of the operation.

The problems with aircraft delivery led to the decision to build-up the special blood bank container for field hospitals with frozen blood storage and to have the blood supply ensured in 3 components: (1) frozen blood components; (2) delivery of fresh blood (if available); (3) and blood collection in place of operation.

Keywords: blood supply; Czech Armed Blood Transfusion Service; field hospitals

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Allergy Symptom Response Following Conversion from Injection Immunotherapy to Sublingual Immunotherapy

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Background: The objective of this research was to determine the clinical response to sublingual immunotherapy (SLIT) among patients with allergic rhinitis previously managed with injection immunotherapy (SCIT). Because deployed, active-duty military personnel often are prevented from using SCIT due to logistic and safety concerns, a secondary aim was to consider the appropriateness of SLIT in this group.

Methods: Questionnaires were offered to a sample of patients using SLIT during the period November 2009 to February 2009. The questionnaire assessed changes in nasal, eye, sleep, and constitutional symptoms following conversion to SLIT. Allergy-related quality of life was quantified using a validated instrument.

Results: Thirty patients (100%) agreed to participate. The average age was 48.6 years and 27.5% were military personnel. 100% with nasal symptoms reported improvement or no change following conversion to SLIT. Of those with eye symptoms, 97% were improved or unchanged. Sleep and constitutional symptoms were reported in 26 patients each. Improvement or no change was reported in 25 (96%; $p < 0.001$) and 24 (93%; $p < 0.006$). No adverse reactions were reported.

Conclusions: Allergy patients receiving SCIT can be converted to SLIT without loss of allergy symptom control. Because military personnel in this study were able to use SLIT in conjunction with their duties, larger studies are indicated to fully assess the potential role of SLIT in deployed military personnel.

Keywords: allergy; response; sublingual immunotherapy; symptom

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The Use of Anthrax and Orthopox Therapeutic Antibodies from Human Origin in Biodefense

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Introduction: It is impossible to protect whole nations from the effects of bioterrorism by preventive vaccination. There are too many possible agents, costs would be exorbitantly high, and the health risks associated with complex mass vaccination programs would be unacceptable. Adequate protection, however, could be provided via a combination of rapid

detection and diagnosis and the treatment of those exposed with drugs that would be beneficial in all stages of disease. Monoclonal antibodies, preferably from human origin to prevent severe complications, which neutralize or block the pathological effects of biological agents, are the optimal candidates to be deployed in case of biological warfare or a bioterrorist event. Recent research has shown that a combination of monoclonal human antibodies against the protective antigen (PA) and lethal factor (LF) of the anthrax toxin even after application 48 hours after the infection is therapeutically effective. This new development offers a safe therapy that can start several days after bioterrorist victims are possibly infected with anthrax spores.

Study Design & Production Process: The human body is one of the better and most suitably equipped places for the generation of monoclonal antibodies that can be used effectively in humans for treatment. Such antibodies will be of optimal physiological specificity, affinity, and pharmacological properties. In addition, the chances of severe adverse effects and cross-reactivity with human tissues will be slim. Therefore, the human immune response has been used by the Dutch company IQ Therapeutics, a spin-off of the Groningen University and financially supported by the Dutch Armed Forces, as a basis for selecting the antibodies. People, immunized against or infected with the agent in question, donate blood cells voluntarily, which are used to generate fully human monoclonal antibodies.

The antibody-based part of the human immune response, which, by selection, is found in the blood of the donors is preserved by processing the antibody producing B lymphocytes according to a novel human adaptation of Köhler and Millstein's mouse hybridoma technology. The antibody producing genes are transferred to the human PER.C6 cell line (licence from Crucell), which produces up to 3.5 g/l therapeutic antibody; but the culture of this human cell line also can be done in an XD™ (eXtreme Density) process to get higher yields.

In this way, effective therapeutic class IgG1 antibodies, with an affinity typically better than 10¹⁰ against the protective antigen (PA) and lethal factor (LF) toxin components of *Bacillus anthracis* are developed. Currently antibodies against orthopox viruses are generated as well from donors, which have been immunized with vaccinia. Other projects are the development of therapeutic antibodies for antibiotic-resistant *Staphylococcus aureus*, and *Enterococcus spp.*

Results: Both human antibodies against the anthrax toxin components are efficacious in vitro and in pre- and post-exposure settings in mice and rabbits (inhalation). The anti-LF IgG1 (k-light chain) antibody against domain 1 of the anthrax lethal antigen has been tested in a phase I clinical trial in Q3 of 2009. GMP-testing material already is available. The anti-PA antibody is in a pre-clinical stage, as are the other antibodies mentioned.

A remarkable result is that we have seen a strong synergistic effect in the treatment of anthrax infections when both anti-LF and anti-PA are used simultaneously. Studies have shown that a sub-optimal concentration of anti-PA can be supplemented with anti-LF to obtain 100% survival of the rabbits infected with a lethal dose of anthrax by inhalation.

The animal experiments indicated that with the use of dual (anti-LF and Anti-PA) antibodies, the window of treatment can be extended as well. While the onset of disease in the rabbit anthrax inhalation studies is in 25–29 hours, the lifesaving treatment of the animals with a normal dose has proven to be still effective when the treatment starts 32 hours after the lethal dose is given.

Conclusions: The Dutch company IQ Therapeutics has successfully generated and developed a fully human monoclonal antibody against the lethal factor of *Bacillus anthracis*. The same technology can be used to generate antibodies for passive immunization after (suspected) exposure to other biological threat agents. As such, antibodies are effective immediately after application, the scientists have termed them Instant Immunity™ antibodies. There is a strong synergistic effect of human antibodies directed against LF and PA epitopes of anthrax, which leads to higher therapy rate, lower dose, and wider window of treatment.

Keywords: anthrax; bioterrorism threat; monkey pox; MRSA; orthopox; smallpox; toxin
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Feasibility of Use of ROTEM to Manage the Coagulopathy of Military Trauma in a Deployed Setting

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Introduction: Hemostatic resuscitation; the rapid, proactive treatment of the coagulopathy associated with major trauma, is an accepted part of combat casualty care. Thromboelastography offers timely and convenient monitoring of the coagulation state when compared to standard laboratory tests; ROTEM® is one method to do this. This paper describes the evaluation of use of the ROTEM into a deployed setting, and how it has been used to optimize management of trauma patients.

Methods: Over a seven-week period from January to March 2009, ROTEM was used prospectively to gain information on trauma patients who underwent immediate transfusion when admitted to the Role2E facility. Analysis also was undertaken of admission physiology, injuries, blood product use, and outcome. In patients who underwent massive transfusion, further ROTEM were performed to monitor product use.

Results: Thirty-one patients were tested with ROTEM; 20 were enrolled onto the massive transfusion protocol (MTP). 15% of the MTP group (3/20) had an abnormal PT/APTT on arrival, whereas 60% (12/20) had an abnormal initial ROTEM trace. In these patients, the initial average results were; temp = 34.8°C; pH = 7.24; Base excess = 6.42; and total blood product (units) use was 168 P RBC; 121 FFP; 13CRYO; 16PLT. Specific cases clearly demonstrated the machine's benefit in guiding management.

Conclusions: ROTEM can be used successfully in a deployed setting, and has shown its value in both monitoring and guiding patients who have a massive transfusion situation.

Keywords: coagulopathy; deployed setting; massive transfusion; ROTEM®; trauma
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French Army 2009 Update of Transfusion in Military Overseas Operations

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Introduction: The French military service recently has updated its transfusion policy for overseas operations according to its previous experience and recent medical literature.

Methods: A structured search of Medline and the database of United States Army Institute of Surgical Research was performed using a combination of MeSH terms.

Results: A total of 2,131 articles were identified, of which 71 relevant articles were abstracted, thus facilitating an update of transfusion policy during overseas operations. Briefly, for hemorrhagic shock (HS), it was decided to transfuse red blood cells (RBC) and plasma in a 1/1 ratio, 0.2 gr of fibrinogen (Fi) for every RBC unit, and increase the early use of platelets. Accordingly, it was decided to increase the availability of Secured Freeze-Dried Plasma (FDP) and Fi for forward surgical teams, and to promote the use of fresh whole blood (FWB). Predefined protocols for FWB use for both individual (HS) and collective (blood bank shortage) indications were implemented. A protocol for FWB collection was implemented separately aiming at the anticipation of emergent needs.

Conclusions: The French army's medical service has updated its transfusion policy in order to increase the availability of clotting factors for overseas medical operations through the improvement of FDP and FWB use.

Keywords: military; overseas operations; policy; transfusion; update
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Incidence of Autoantibodies in Servicemen

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Introduction: The incidence of irregular allo-antibodies (IAA) against red blood cells (RBC) in the general population is unknown. The question is relevant during overseas military operations, since RBC are transfused without awareness of the presence of such antibodies. Thus, one asks if an IAA screening should be conducted for servicemen before overseas operations.

Methods: A research of IAA was performed in all blood donations in the French army's national blood bank during the year 2007. The prevalence of irregular antibodies was analyzed according to age and gender of donors.

Results: A total of 17,784 donations were analyzed. In 44 cases, an IAA was identified. Thirty-three of 44 were not transfused. Eleven IAA in 11 donors (eight women/three

men, mean age 32 (21–47 years)) were considered clinically relevant. The IAA identified were: anti-RHD (anti-RH1) (4/11), anti-E (anti-RH3) (7/11), anti-c (anti-RH4) (2/11), and anti-S (anti-MNS3) (1/11). Three women had two different antibodies for each: anti-D+E or anti-E+c or anti-c+S.

In a selected population fit for blood donation (young, healthy, and without any previous transfusion), the prevalence of IAA associated with an unsafe transfusion is 6.2/10,000 (CI 95% = 3.1–11/10,000), 2.4/10,000 for men and 14.5/10,000 for women ($p = 0.0001$). Anti-E antibodies identified in men are natural antibodies without risk of adverse reaction. IAA identified in women are probably of obstetrical origin and may cause hemolytic transfusion reactions. According to these data (rarity of relevant antibodies and low benefit/risk ratio) the French army medical service has chosen to not perform mandatory IAA screening for servicemen.

Keywords: blood, irregular antibody; military operations; transfusion
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French Project for the Traceability of Products and Blood Transfusion in OPEX

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Introduction: The French military Joint Health Service (SSA) provides its operation theaters (OPEX) with blood products (BP) prepared in France. Additionally, fresh whole blood collection is used to face shortages or needs for platelets or clotting factors. Transfused patients are French and allied soldiers or civilians in the context of medical assistance (AMP). The Military Blood Transfusion Center (CTSA) has worked with the 2007 data and has found that only 61% of BP and 51% of transfusions were tracked.

Objectives: This project aims at improving the traceability of BP sent and transfused in OPEX.

Methods: Computerized traceability was considered, but the use of paper records was preferred due to technical and logistical issues. At the CTSA level, the data will be entered into dedicated software, enabling centralization, archiving, and accessibility. Two documents are used to track BP sent in OPEX (transfused or destroyed). All BP used by the nations of NATO are listed and all documents are written in French and English.

Results: In 2007, 2,539 CGR were sent in OPEX, 1,445 (56.9%) destructions were tracked. For the 1,094 (43.1%) remaining, 105 transfusions (4.1%) were recorded. The tracking of 989 (36.3%) was lost. Forty-five patients were transfused, (42 AMP/3 soldiers). A total of 23 transfused patients were tracked (48% AMP/100% soldiers). This new procedure has been validated by the technical authorities of the SSA and will be implemented during H2-2009.

Conclusions: The SSA is implementing a new procedure for BP traceability with a target for tracking >95% for 2010.

Keywords: blood products; blood transfusions; traceability
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Ethics Committees Have a Role in Expeditionary Military Medicine

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Introduction: The benefits of ethics committees (ECs) are well-established in civilian medicine. Military medicine is not immune from ethical dilemmas. Formalized ECs are present in the military, but their role in forward deployed, small medical units is not well-established. Potential benefits: serve as a resource for healthcare providers, patients, and local families; facilitate discussion and communication; and develop recommendations based on the values of medical ethics. Arguments against such an EC may include: unnecessary bureaucracy, time constraints in high operational tempo, and the need for approval from higher authority.

Methods: The formation of an EC at a Level-2 Surgical Shock-Trauma Platoon (SSTP) during Operation Iraqi Freedom (OIF) 06-08.2 is reviewed. Two specific cases are evaluated. Determination was made regarding the effect of the EC's recommendation on the practice at the time and the overall benefit to the unit.

Results: The involvement of the EC had an effect on clinical practice. Discussion of the events in an open, but formalized way, allowed for lent greater credibility to the decisions and improved unit morale. The ability for anyone to request a consult appeared to have particular appeal.

Conclusions: A committee-type decision on issues of medical ethics does not conflict with good military order and discipline. EC decisions are superior to informal discussions and improve unit cohesiveness. On-site ECs may have advantages over distant authority. Pre-deployment training and designation of an EC may be helpful.

Keywords: ethics committee; military medicine; role

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Development of a Near-Real-Time Disease Surveillance Capability for NATO

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At the 2002 NATO Summit of the Heads of State and Government, held in Prague, decisive capability gaps were shown to exist within NATO. Among other issues, warnings were raised about the lack in capability for the near-real-time determination of whether an outbreak of disease is to be attributed to the use of biological weaponry or to natural causes.

Since 2003, under the lead of NATO Allied Command Transformation (ACT), existing capabilities/systems of NATO partners have been identified and examined as to their suitability for NATO. The NATO ACT designated the Bundeswehr Medical Office as a "Central Analysis Center" for a surveillance experiment in the spring of 2006. Following the successful completion of the multinational experiment, COMEDS Force Health Protection Expert Panel (FHP EP) planned to conduct a multinational surveillance exercise at KFOR as a second developmental step.

This exercise at KFOR was planned, prepared, and conducted under German lead during 2008. Participants at

KFOR and at the Bundeswehr Medical Office in Munich included: Germany, France, the US, Poland, and NATO's C3 Agency. Therefore, exercise participants recommended to NATO COMEDS that a multi-nationally staffed near-real-time disease surveillance capability be established on a continuing basis at the Bundeswehr Medical Office in Munich.

Keywords: disease; near-real-time; out break; surveillance

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Programs on Health Promotion and Preventive Health Care in Bundeswehr

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In accordance with the trend toward a passive, physically inactive lifestyle observed in society as a whole, the Bundeswehr should expect an increase in obesity and reduced physical performance ability, as well as associated diseases (such as high blood pressure, diabetes, and malfunctions of the locomotor system) among its personnel. On the other hand, the requirements of missions performed within the "extended task spectrum" have made significantly greater demands on personnel regarding their physical and mental performance abilities and resistance to stress.

Apart from a descriptive approach to assess the physical and mental performance abilities of Bundeswehr soldiers, concrete measures targeted toward restoring, maintaining, and improving the performance abilities and fitness for duty of servicemen and women.

The presentation discusses both the initial results obtained through evaluation of the "Bundeswehr Adipositas Intervention Program" and the contents of programs, training courses, and seminars.

Keywords: fitness; health promotion; preventative health care; training

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TERCEIRA 2008 Study—2008 Characterization of the Military and Civilian Workforce at the Air Base 4 Clinic "Tenente-Coronel Médico Viriato Garrett"

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Introduction: Air Base 4 "Tenente-Coronel Médico Viriato Garrett" clinic, is a NATO "role 1" health unit, serving a 1,500 patient population, seen as ambulatory or in a 24-hour emergency room.

Objective: The objective of this study was to characterize the military and civilian workforce at Air Base 4 by gender, age group, military rank, body mass index, pathology, drug therapy, and convalescence or sick leave.

Methods: A cross-sectional and descriptive study was carried out.

Results: All active duty, reserve, and retired military personnel and active civilian workforce population (508 patients) were studied. A total of 81.9% were male, 390 military, and 118 civilian. Patient referral was mostly through administrative and follow-up appointments. A prevalence of over-

weight/obesity of 56% was concluded and a raised prevalence, >20% of dyslipidemia and hypertension, was determined. Most prevalent morbidities appeared through the endocrine system, psychological, and musculoskeletal diseases. Up to 2,528 registered days of medical-related conditions waiver, 1,483 days of convalescence or sick leave, and 104 days of family-related issues waiver were identified.

Conclusions: In order to improve medical programs, awareness of a population featuring an evaluated prevalence of overweight/obesity, dyslipidemia, and hypertension will foster the development of prospective, preventive strategies, with an impact in budgetary planning at decision levels.

Keywords: dyslipidemia, hypertension, military personnel
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Quality Management of the Blood Component Production Process Using Boeing Statistical Process Control Methods Adapted Excel-based Applications

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Introduction: Records from 2005 indicated a great variability in the use of performance indicators at different blood component production process control points.

Failure mode analysis of the production process showed that human and material resources are the main risk factors for nonconformity of blood components, and that adequate, in-time, corrective and preventive measures are the key success factors for process quality management.

Methods: A statistical process control (SPC) system was built based on the Boeing methods, considering each blood donation as a different production lot, and using the conditional color-formatting functions of Excel tables. These allowed for an immediate visual signal, which points to the corrective measure to be taken. Systematically followed parameters, such as measurements validity indicators, initial, intermediate and final process control points performance indicators, and process efficiency indicators recorded since 2000 were used to validate the SPC system.

Results: After six months of use, a statistically significant reduction in variability of different quality parameters such as component weights, cell counts, and active substances contents was identified.

Conclusions: Such a SPC system indicates that 100%, and certainly not 1%, blood component conformity control should be mandatory. Random human mistakes and material dysfunctions are the most frequently encountered process failure modes.

Keywords: blood component production; human error; performance indicators; statistical process control
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Transfusion—Transmissible Viral Infections Among US Military Emergency Transfusion Recipients

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Introduction: US military doctrine permits the use of non-Food and Drug Administration-regulated freshly collected blood products to save the lives of patients. The risks of transfusion-transmitted infections (TTI) related to battlefield transfusion of unscreened blood products are not well characterized.

Methods: US service members who received emergency transfusion products in Iraq and Afghanistan (01 March 2002–30 September 2007), were evaluated for hepatitis C (HCV), hepatitis B (HBV), and HIV-1 infections using reposed pre- and post-transfusion sera. Selected regions of viral genomes from epidemiologically linked infected donors and their recipients were sequenced and compared.

Results: Of 761 US emergency transfusion recipients, 475 had sera available for testing: 475 were tested for HCV, 472 for HIV-1, and 469 for HBV. One transfusion-transmitted HCV infection (incidence rate: 2.1 per 1,000 person-years, 95% CI = 0.1–11.7) was identified. The number of pre-transfusion infections was: HCV-4 (0.8%, 95% CI = 0.2–2.1%); HBV-11 (2.4%, 95% CI = 1.2–4.3%); HIV-1-0 (0.0%, 95% CI = 0.0–0.8%).

Conclusions: One TTI (HCV) was associated with the use of emergency blood products. The pre-transfusion HCV and HBV prevalence in transfusion recipients, for an eligible donor population, indicate further studies are warranted to characterize the actual deployed force donor population and these donors' TTI prevalence. These data will inform countermeasure development and clinical decision-making.

Keywords: blood donors; transfusion-transmissible; viral infections
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Hemotherapy in the Norwegian Armed Forces

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For decades, standards for blood transfusion in the field have shifted due to logistical constraints combined with identified problems regarding the transmission of infections, immunizations, and depletion coagulopathy. A directive for hemotherapy in the Norwegian Armed Forces was issued in 2008 to ensure that military transfusion standards are comparable to civilian standards.

Blood products, supplied from Norway, only are given at surgical installations. Solvent-detergent-treated fresh frozen plasma (Octaplas®) blood group AB, kept at -20°C, is used to secure concentrations of coagulation factors. Thawing takes 20 minutes. Freeze-dried fibrinogen is optional. Recombinant coagulation factor VIIa (NovoSeven) is available.

Leukocyte filtered erythrocyte concentrates of blood group O in SAGMAN solution, transported and kept at 4–8°C, are used to secure adequate oxygen supply. Fresh whole blood (FWB), donated *ad hoc* by blood grouped personnel and pretested for transmissible diseases, is the only source of thrombocytes. Two units of blood group O can be given regardless of the recipient's ABO group. If more are required, cross-matched units of the recipients own ABO are preferred.

Hemostasis-promoting products start early, administering SAGMAN and Octaplas® as close to a ratio of 1:1 as possible. Octaplas® is thawed immediately when the arrival of an acutely bleeding patient is announced. If bleeding remains out of control after 4 units of SAGMAN, NovoSeven is given (90 microgram/kg/body weight, single dose), simultaneous FWB donations should be initiated.

Fresh whole blood contains leukocytes, which may induce transfusion-associated lung injury (TRALI), transmit viral genomes, and induce immunization against HLA antigens. As all European nations comply with the European Blood Directive, European allies might supply blood products to each other when needed, taking advantage of, for example, the Dutch and the British system for the supply of active thrombocytes.

Keywords: fresh whole blood, hemotherapy; transfusion standards
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Lessons Learned from Terrorist Attacks

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The Disaster Medicine Center, "Zaschita", is a chief coordinating center of the Health Ministry with the general goal of management and medical relief delivery in response to emergencies. The objective of this study is an analysis of all Disaster Medicine Center activities in complex emergencies and in medical relief delivery in terrorist attacks.

Medical staff of the Russian Disaster Medicine Service has responded to emergencies complicated by local military conflicts and by terrorist attacks. The absence of sufficient information, time necessary for deployment of a hospital, and decision-making on the upper level of management complicated the delivery of emergency medical care to the affected, injured victims during the emergency events and their aftermath.

One of the specificities of major terrorist attacks is a total or partial destruction or insufficiency of local medical facilities (Chechen Republic, Budennovsc, Beslan, and Tschinvali). The mobilization and air transportation of medical products, medical staff, and mobile multi-profile hospitals are detailed during a limited period of time. The collaboration of Emercom is accentuated on-site. The field hospital deployment is prepared on-site by local facilities. The security procedures are accomplished by special teams of the Internal Affairs Ministry. The majority of the injured are evacuated to the nearest regional hospitals after being primary treated on-site. The mechanisms, schemes, and procedures of air evacuation are analyzed.

A probable scenario of the situation in progress is to be the base of the response plan for immediate medical care delivery. The disaster response plan is to be prepared for any potential conflict or terrorist attack.

Keywords: lessons learned; Russia; terrorist attack
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Psycho-Physiological Approach in Health Evaluation and Certification

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Introduction: The selection and training of medical staff preparedness for the accomplishment field activities in emergencies requires a set of quantitative methods. The complex psycho-physiological approach requires the application of tools for the selection and preparedness at the psychological and professional levels. The goal of this study is to introduce into the original system of the computer instruments for the staff selection procedure, a battery of new methods for staff mental preparedness.

Methods: A battery of instrumented, quantitative evaluation methods is proposed for the study and use in laboratory and field conditions for emergency medical staff preparedness and psychological support. The methods are underlined by complicated, bilateral, sensorial reactions in modeled conditions of ipsi- and contra-lateral visual deprivation and conditioned environment on a computer screen. In the conditions of the experiment, the mechanisms of integrative factors regulating the characteristics of hemispheres asymmetry are evaluated and managed as a result of the specific procedures of influence. The conditions of selection and ultimate correction, if necessary, are determined as a result of preliminary professional preparedness and initial mental status. The methods battery is completely objective based on the quantitative criteria. The selection procedure does not include any subjective evaluation step or any questionnaire.

Conclusions: The method battery is registered in the National Register of Patents and Inventions. The results

could have implications for search-and-rescue teams, medical emergency teams, and other hazard profession staff.

Keywords: certification; medical staff; psycho-physiological; training

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Seven Day Storage at 4°C of Previously -80°C Frozen AB Plasma

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Background: The Netherlands military mainly uses deep frozen (-80°C) blood products to support operational medical care. Thawed red cells can be stored for 14 days at 4°C, and are directly available for transfusion, whereas -80°C (refrozen from thawed -30°C) AB FFP must be thawed first for 30–40 min. The possibility of extending the shelf life of this thawed plasma to make both products directly available for damage control resuscitation in trauma patients with (massive) blood loss was studied.

Methods: Apheresis leukodepleted AB plasma (n = 42) were frozen at -30°C, quarantined, and released after repeated donor testing. On average, units contain 296 ±14 ml of plasma and have been stored at -30°C for 316 ±20 days. The units were thawed in a water bath at 37°C (Type 2032, Forma Scientific) repacked, frozen, and stored as deep frozen plasma (DFP) at -80°C for 20–40 days, before the final thawing procedure. Each day, before sampling, the units were inspected visually. Samples were drawn into sample pouches using sterile techniques, after thawing from -30°C (Day minus 1), from -80°C (Day 0), and after storage for 5, 7, and 14 days at 4°C respectively. Samples were immediately processed and APTT, PT, INR, fibrinogen, FV, FVII and FVIII were measured within 4 hours, using an automated coagulation analyzer (Destiny Amelung plus, Trinity Biotech).

Results: Apart from a slight prolongation of the APTT, no significant changes were observed when plasma was refrozen and thawed from -80°C. During subsequent storage at 4°C, only the activity of FVII remained stable. Fibrinogen decreased after 14 days of storage, whereas Factor V and VIII decreased after only 5 days of storage. There was no significant difference between 5 or 7 days 4°C stored units. The appearance of the majority of the thawed DFP units changed after 7–14 days storage at 4°C from clear into more turbid solutions, and sometimes even with clots.

Conclusions: All units contained more than 50 IU/dL FV, FVII, FVIII on Day 7 and had a normal APTT, PT, INR and fibrinogen concentration. In May 2009, a maximum storage time of seven days at 4°C of -80°C refrozen AB plasma was implemented, making this thawed plasma readily available together with thawed red cells for damage control resuscitation in combat casualties.

Keywords: blood products; frozen AB plasma; storage; thawed plasma

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-80°C Red Cells Plasma and Platelets in Combat Casualty Care

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Background: Since 2004, the Netherlands military mainly uses -80°C frozen blood products to cover operational needs. The experiences with these products based on data collected from two NLD blood bank facilities in Afghanistan during the past 33 months are described in this study.

Methods: Apheresis leukodepleted group O platelets in 5% DMSO/plasma are frozen as a concentrate (±15ml) at -80°C. After thawing, the platelets are resuspended in thawed AB plasma, to be used within six hours. Apheresis leukodepleted AB plasma is thawed from -30°C, repacked and frozen to -80°C before the final thawing procedure. Red cells from leukodepleted group O whole blood are frozen at -80°C in 40% (w/v) glycerol. After thawing and deglycerolization, the red cells are stored for no longer than 14 days at 4°C in AS3, before use. All thawed (and washed) products are in compliance with international regulations and guidelines.

All frozen products are produced in the Netherlands, shipped at -80°C (dry ice), stored in theater at -80°C, thawed on demand (all products) or for liquid storage (red cells). Occasionally, standard liquid red cells are sent from the Netherlands as a supplement, to cover periods of (expected) higher usage.

Results: During the past 33 months, 533 patients (85% Afghan) were transfused with 533 units of standard liquid red cells and 3,380 frozen blood products (1,360 red cell units, 1,425 plasma units and 595 apheresis platelet units). On one location, where all blood products were provided by the Netherlands Military Blood Bank, blood usage and survival were further analyzed. It showed that >90% of the transfused patients were trauma victims, of which, 14% (30 out of 209) required >10 red cell units within 24 hours. In these massively transfused patients, survival improved from 44% (n = 16) to 85% (n =14) after the introduction of a new transfusion policy in November 2007 (1:1 red cell to plasma ratio, with or without platelets). No shortages or transfusion reactions were reported.

Conclusions: Fully tested, frozen blood products, readily available after thawing, proved to be an effective and safe blood support for combat casualty care. A 1:1 red cell to plasma ratio appeared to increase survival in MT patients, also when only -80°C frozen blood products were used.

Keywords: combat casualty care; frozen blood products; storage; thawing

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Establishment of NATO Trauma Registry—A Joint Project within the NAT Framework

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In 2004, the Human Factors and Medicine (HFM) panel of the NATO research and technology organization (RTO) arranged a symposium on combat casualty care in order to address the problem of combat injuries in joint operations. The symposium was held together with the American yearly

ATACCC conference in Florida, and the referee of the meeting, Howard S. Champion emphasized the need for a common registry. The HFM then established an exploratory team to look at the possibilities to establish a trauma registry. The team had one meeting in 2005, where it was decided to start working on a trauma registry. In the fall 2005, the HFM established a Research Task Group (RTG) to identify the structure of a registry, and also the possibilities and challenges in establishing a registry. The RTG finalized its report in 2007, suggesting the establishment of a registry. The plan to establish a trauma registry was endorsed by COMEDS in November 2007, and the Military Medical Committee was given the responsibility to lead the work. Both the MedCis working group and the healthcare working group were tasked to work with the registry. To facilitate and speed up the process, the HFM established a lecture series (RTC) to address the COMEDS working groups. Lectures were given at core NATO meetings on five occasions in 2008.

The purpose of the proposed NATO database as suggested by the HFM RTG was:

1. Collect, process, and analyze summary data in any role 2 facility;
2. Contribute to the reduction of injuries and related deaths in the field by identifying, describing, and quantifying trauma;
3. Increase awareness of combat injury;
4. Assist injury prevention and improve treatment programs; and
5. Support injury-related approved analysis and research within NATO.

Possible outcome to the NATO nations were:

1. Define risk situations for different casualties;
2. Quality assessment of primary treatment;
3. Assessment of evacuation;
4. Assessment of secondary and tertiary treatment;
5. Compare different modes of management;
6. Establish common practice within NATO;
7. Perform multinational clinical trials; and
8. Create an evidence-based practice within NATO in the treatment of trauma.

In October 2008, the Netherlands and Norway agreed to establish a trial database, and test communication of data between the nations first in a sham situation. Once the two nations have established a working solution, this will be made available to the other NATO nations.

The NATO Database system consist of several elements:

1. Develop a registry on agreed standardized elements;
2. Develop a system for communication between nations;
3. Develop a system for acquiring data at the role 2;
 - a. Electronic, paper format;
 - b. Appoint dedicated registrars at the role 2 facility; and
4. Develop a system for communication from the field to the central national registry.

The present project aims at developing the database structure, the element structure and the mode of communication of data between the two nations.

Keywords: combat casualty care; communication; database; trauma registry

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The Human Factors and Medicine Panel of the NATO Research and Technology Organization

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The NATO Research and Technology Organization (RTO) promotes and conducts co-operative scientific research and exchange of technical information amongst 28 NATO nations and 38 NATO partners. The largest such collaborative body in the world, the RTO encompasses more than 3,000 scientists and engineers addressing the complete scope of defense technologies and operational domains. This effort is supported by an executive agency, the Research and Technology Agency (RTA), that facilitates the collaboration by organizing a wide range of studies, workshops, symposia, and other forums in which researchers can meet and exchange knowledge.

The RTO was established in 1998 by combing several NATO institutions within research and science. The RTO has divided its activities between six panels: (1) Applied Vehicle Technology (AVT); (2) Human Factors and Medicine (HFM); (3) Information Systems Technology (IST); (4) System Analysis and Studies (SAS); (5) Systems Concepts and Integration (SCI); and (6) Sensors & Electronics Technology (SET).

The mission of the Human Factors and Medicine Panel is to provide the science and technology base for optimizing health, human protection, well being, and performance of the human in operational environments with consideration of affordability. This involves understanding and ensuring the physical, physiological, psychological, and cognitive compatibility among military personnel, technological systems, missions, and environments. This is accomplished by exchange of information, collaborative experiments and shared field trials.

Since the scope of the HFM panel is broad, comprising all aspects of medical and human factors research, the work is divided between four areas:

1. Human Effectiveness focusing on psycho-social, organizational, cultural, and cognitive aspects in military action;
2. Human System Integration focusing on human-in-the-system analysis, design, and evaluation and experimentation;
3. Operational Medicine focusing on aerospace, hyper/hypobaric, and military medicine necessary to ensure sustenance, health, safety, and survival of military personnel; and
4. Human Protection focusing on human-centered research for optimizing physiological tolerance, protection, and survivability in adverse mission environments.

The human factors and medicine panel organizes two major symposia every year, organizes task groups to explore specific topics, and conducts lecture series to promote scientific knowledge.

A number of activities also are central in civilian medicine and personnel selection.

Keywords: Human Factors and Medicine Panel; NATO Research and Technology Organization; research

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The Portuguese Blood Transfusion System

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The Portuguese Territory is composed of a continental part (mainland) and two archipelagos (Azores and Madeira). The estimated population was 10.6 million, with <0.5 million living in the islands (INE—Estimativas Provisórias PR 2008).

The national blood system is anchored in three Regional Blood Centres (CRS) of the Portuguese Blood Institute (IPS) that collects 66.8% of all donations made in the mainland. The system is regulated by the Competent Authority for Blood and Organ Transplantation and complies with the European Directives, Regulations, and Guidelines on blood and transfusion medicine practice.

Portugal is self-sufficient in blood components (40 blood units per 1,000 inhabitants), and all donations are from voluntary, non-remunerated donors. The system is fully certified, highly automated, and transparent to the public.

Almost all of the hospitals are connected to the IPS through a Web-based network system. Orders for blood components are posted online. By using innovative software created in-house, an immediate view of the stock of blood in any hospital, among other relevant information, is immediately available at any time. The access to this software is made through the Internet and the login is restricted to the top managers of each CRS. This tool, very useful for the daily management of blood stocks, also proved to be of great utility in a catastrophe simulation scenario. As it increases readiness, this is a most valuable tool for the management of blood supply in emergencies and natural catastrophic situations in the country. A demonstration will be made during the presentation.

Keywords: blood supply; blood transfusion system; Portugal
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Underwater and Hyperbaric Naval Medicine (Historical Perspective and Actual Situation)

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Introduction: In this communication, we emphasize the contribution of the Centre of Underwater and Hyperbaric Medicine (CUHM) for the development of this medical area.

Methods: In order to evaluate the performance of the CUHM, its evolution was reviewed and an analysis was conducted of the statistical data related to its activity, from 1989 until December 2008.

Results: The maximum capacity of actuation attained by the CUHM, together with the increase of the Navy's dive activities and with the new definition of its health service politics, implies a structural change of the CUHM in order to expand its activities to allow it to provide the adequate support to the operational underwater activities, to better benefit to the civilian patients, and to increase its investigational activity.

Conclusions: The CUHM activity contributes to the individualization of the Naval Medicine and for the maintenance of the Navy in the leadership of the Underwater and Hyperbaric Medicine (UHM) practice in our country, which does not surprise, since the medical aspects related

with the dive and with the exposure to changes of the ambient pressure are specificities of the Naval Medicine, and that the CUHM's main mission is to ensure the maintenance of the efficacy of the forces involved in the practice of such operational activities.

Keywords: hyperbaric; medicine; naval; underwater
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Psychological Resilience

Psychological Support for Mental Health in Times of Crisis within a Strategy for Lifelong Learning

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Introduction: Special emphasis is placed on crisis preparedness procedures for psychological support for mental health. The frame is taken from social-psycho-pedagogical approaches. The support procedures must be focused on training to ensure the professionals as well as the volunteers are fully ready to "decontaminate stress" in time of crisis interventions.

Methods: Training using a simulation model is very important in the framework of preparedness, and fits-in-well with the systematic approaches adopted in the framework as EU documents and National Lifelong Learning programs. The concepts of Lifelong Education and Lifelong Counseling (EU) emphasize long-term preparation. These approaches take into account pedagogical psychology (philosophy and psychology of learning), demographic, and social considerations, as well as "psychology of stress". The concept of Lifelong Learning developed by international organizations (EC, UNESCO, OECD, etc.) concentrated on social and cultural development through "new ways of humanism", while work approaches only were touched on.

Harmonious international collaboration is essential in the sphere, and all major stakeholders should be involved: representatives of employees, employers, educationists, state and local authorities, all working together with professionals in each phase. The program is based on the ideas expressed in Education and Training 2010—the Success of the Lisbon Strategy. Psychological Support for Mental Health is a detail, but essentially important as a pillar of the program.

Results Expected: The best effects always are started by good and effective educational approaches, and they are improved by "best practices".

Conclusions: NATO can be a good source of expert advice on education for the sphere of crisis preparedness for the EU nations (source of international "good practices"). The NATO document, as non-binding recommendation, could be a good base. Such an international document is expected by crisis preparedness professionals to be a real support for educational approaches with training.

Keywords: crisis; preparedness; learning; mental health; preparedness; psychosocial; stress
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Stress, Burnout, and Psychosocial Support for Staff of the Emergency Medical Services

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Introduction: The objectives of study on stress of EMS professionals were to analyze the average and individual rates of burnout syndrome symptoms, sources of stress associated with the profession, and the degree of exposition to critical incidents. Two years later, burnout and experience with any psychological intervention technique were analyzed again. Meanwhile, Critical Incident Stress Management (CISM) techniques after critical incidents, according to Mitchell's model, were performed in some organizations' lectures on prevention, communication trainings, consultations concerning professional stress, supervision meetings and debriefings also are offered to professionals within crisis preparedness.

Methods: The questionnaire study used a screening test of symptoms of burnout syndrome. Burnout scores of groups from the year 2003 (286 respondents) and from 2005 (597) were compared. Analysis of variance (ANOVA) was used for basic comparison. The General Linear Model (GLM) was used for testing individual factors' influence on burnout symptoms and for comparison for each of four professional groups: physicians, medical nurses, paramedics, and dispatchers. Exposition to critical incidents, and stressful and positive factors associated with profession were analyzed using descriptive statistics.

Results: A highly significant difference in burnout score was found between the group of dispatchers when compared to any other professional group. The other factor significantly influencing symptoms of burnout was the length of practice in EMS. No other factor (sex, matrimonial status, any professional position other than dispatcher, age) has had influence on the degree of burnout. Surprisingly, high (85.5%) experience with assault and/or an ambulance vehicle accident during duty was found. Experience with any psychological intervention technique was also analyzed. No statistically significant difference ($p = 0.771$) was found between the two groups: A (372; any type of intervention) and B (225; no intervention). Satisfaction with the named techniques ranged from 79–92%. Another pilot study with psychological peer support took place in Prague in 2008. This pilot testing identified the most stressful events and the need of support (15 contacts/month, on average). Effectiveness of both models—CISM and peer—currently is being evaluated

Conclusions: A large-scale study on stress of EMS professionals had proved the need for psychological support. Analysis of stress helped to implement supporting psychological techniques adapted to specific needs of rescuers. Based on the results and on experience from pilot programs the Ministry of Health has constituted a working group to develop national guidelines for psychological crisis intervention for rescuers. The Ministry's draft of the Law about Emergency Medical Services also declared the obligation

to provide psychological support both for rescuers and victims of disasters. The aim of psychological interventions and targeted education is to increase well-being of the professionals, their effectiveness, and, as a result, to improve the patient care.

Keywords: burnout; critical incidents; emergency medical services (EMS); stress; psychological support
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Psychological Support for EMS Professionals in the Czech Republic

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Introduction: A study on stress of emergency medical services (EMS) professionals proved the need for psychological support. Based on results of the study and on experience from pilot programs, the Ministry constituted a working group to prepare national guidelines. The Ministry's draft of the Law about EMS also declared the obligation to provide psychological support both for rescuers and victims.

Methods: Prevention, education, supervision meetings and debriefings after critical incidents according to Mitchell's model have been performed in Central Bohemia and Northern Moravia since 2004. A pilot study with crisis intervention by peers occurred in Prague in 2008. Effectiveness of both models currently are evaluated

Results: This study on stress analyzed experiences with any psychological intervention technique. No statistically significant difference ($p = 0.771$) was found between the two groups: A (372; with any intervention) and B (225; with no intervention). Satisfaction with different techniques ranged from 79–92%. Pilot testing of psychological peer support in the Prague's EMS identified the most stressful events and also the need of support. Based on these preliminary results, the working group of the Ministry started to develop national guidelines for psychological crisis intervention for rescuers.

Conclusions: The aim of psychological interventions and targeted education is to increase well-being of the professionals, their effectiveness and, as a result, improvements in the patient care.

Keywords: critical incidents; emergency medical services (EMS); psychological support
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Human Factors and Medicine Panel Activities in Psychological Health and Mild TBI/Concussion

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NATO Human Factors and Medicine Panel

Introduction: As in previous eras, military members and civilians involved in current operations are reporting increased incidence of psychological and mental health problems during and after exposure to the physical and mental stresses that are part of armed conflict. The blast effects of Improvised Explosive Devices (IEDs) also have been associated with an increased incidence of mild traumatic brain injury (mTBI), or post-concussive disorder. The causal factors, incidence rates, and options

for diagnosis, prevention, and treatment are a target of research in many NATO countries.

Methods: This presentation describes recent HFM Panel technical activities related to psychological/mental health and mTBI and summarizes some of the main findings from those activities.

Results: In preparation.

Conclusions: NATO HFM Panel Technical Activities provide an opportunity for other NATO organizations to benefit from the efforts conducted with the support of the Research and Technology Agency of the Research and Technology Organization.

Keywords: armed conflict; blast effects; mild traumatic brain injury
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Psychological Team Organization following a Disaster

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Introduction: Following an abnormally stressful event, such as a disaster, people can experience a wide range of psychological and physiological acute reactions, which can be extended to first responders. Psychological first aid for disaster-induced stress and trauma may be a precious resource to facilitate a resilience response. Given the disaster's dimension, the technicians may have to intervene in different places with different objectives.

Methods: This study results from documented research based on the past experience and on the best practices describes in the literature. A search was completed using terms “disaster”, “prehospital”, and “psychological intervention” using the EBSCO database, MEDLINE and PSYCHARTICLES.

Results: The Centre for Psychological Support and Crises Intervention (CAPIC) of the National Institute of Medical Emergency created a description of six role tasks that can be assumed in a disaster scenario: (1) Psychosocial Coordinator; (2) primary triage; (3) intervention with people in need of medical assistance and intervention with people in no need of medical assistance; (4) support in the area of bodies recognition; (5) intervention with first responders; and (6) support for relatives through the Information Centers. In addition, a triage protocol was produced.

Conclusions: This study suggests that following the proposed role, tasks in a disaster scenario that is, by nature, chaotic, may enhance the psychological intervention, producing a more resilient behavior.

Keywords: disaster; prehospital; psychological intervention; team organization
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Psychosocial Resilience as a Cross-Cultural Concept: Understanding and Measuring Psychosocial Resilience

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Introduction: Resilience refers to the process of coping with stressors, adversity, change, or opportunity in a man-

ner that results in the identification, fortification, and enrichment of protective factors (Richardson, 2002). Resilience has proved to be quantifiable by scales such as the Connor-Davidson Resilience Scale (CD-RISC) (Vaishnavi, Connor, Davidson, 2007). This study examines the psychometric properties of the Portuguese version of the CD-RISC.

Methods: The Portuguese version of the Connor-Davidson Resilience Scale was used. The CD-RISC items were translated with a process of translation and back-translation by persons fluent in both Portuguese and English. The participants were Portuguese adults from the general population, and of both sexes. The Scale consists of 25 items with an alpha value of 0.89 and test-re-test correlation of 0.87 in the studies with American participants.

Results: Preliminary results of the adaptation study will be presented, including factor structure and psychometric properties of the Portuguese version of the CD-RISC.

Conclusions: It is concluded that the construct of resilience and its measurement used on the American population can be helpful and applicable in understanding Portuguese people ability to thrive despite adversity.

Keywords: Connor-Davidson's Resilience Scale; cross-cultural; factor structure; protective factors; resilience; psychometric properties; trauma

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Trauma in Deployment

Comparison of Four Hemostatic Agents versus Standard Gauze Dressing in Control of Extremity Hemorrhage in a Model of Penetrating Combat Trauma

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Introduction: A randomized, prospective, unblinded trial was conducted to investigate hemostatic agents in a model of severe vascular injury in a small, linear tract wound designed to replicate a penetrating combat injury.

Methods: A complex groin injury with transection of the femoral vessels through a 3 cm entrance wound and 45 seconds of uncontrolled hemorrhage was created in 80 swine prior to randomization to five groups. The groups included: (1) standard gauze (SD); (2) Celox (CX); (3) Chitoflex (CF); (4) Combat Gauze (CG); and (5) WoundStat (WS). Each agent was applied with five minutes of manual pressure prior to resuscitation. Hemodynamic parameters were recorded >180 minutes. Primary endpoints included incidence and the amount of rebleeding.

Results: Composite adverse events consisting of mortality, post-treatment hemorrhage, and failure of initial hemostasis were compared between treatment groups using a single degree of freedom chi-squares. Chi-squares were Yates corrected to obtain conservative tests of statistical significance. Four of 16 (25%) CX, 10 of 16 (62.5%) CF, 6 of 16 (37.5%) CG, 11 of 16 (68.8%) WS, and 7 of 16 (43.8%) SD subjects suffered from adverse events. A significant difference was found between the agents CELOX-A and WoundStat with respect to composite adverse events ($p = 0.0335$).

Conclusions: Celox was superior to Woundstat with respect to composite endpoints in control of hemorrhage in limited access combat trauma wounds

Keywords: combat; hemorrhage; hemostatic agent; swine; trauma
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Does the Time to Administer Lidocaine-Propofol Admixtures Affect Induction Times?

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Purpose: Propofol is a commonly used induction agent for rapidly securing the airway for emergency surgery and is routinely combined with lidocaine to reduce pain upon injection. The purpose of this study was to determine if a difference exists between groups of patients administered a lidocaine-propofol admixture prepared immediately before induction (control group) as compared to one prepared 60–180 minutes prior to induction (experimental group).

Methods: This prospective, randomized investigation enrolled 125 patients scheduled to undergo a procedure requiring general anesthesia. They were randomized into either the control or experimental group. All subjects underwent induction of general anesthesia with a 2 mg/kg propofol and 0.2 mg/kg lidocaine admixture. Time to induction was measured from the time of bolus injection to the time subjects dropped a syringe held between their thumb and forefinger during administration of the admixture.

Results: A total of 116 subjects were included in the final results. No significant differences in demographic variables or other measured variables between groups except in time to syringe drop. Time to syringe drop was noted as 29.7 ±11.9 seconds in the control group and 43.8 ±22.1 seconds in the experimental group. ($p < 0.001$).

Conclusions: Lidocaine-propofol admixtures should be mixed immediately before use in order to reduce the risk of awareness under anesthesia during rapid sequence induction for emergency surgery.

Keywords: anesthesia; induction time; lidocaine; propofol
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Detection of Intracranial Hypertension: Utilization of a Portable Ultrasound System

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Introduction: Traumatic brain injury (TBI) is one of the first causes of death in overseas operations. Management of TBI requires intracranial pressure (ICP) monitoring, but that is not always available. A protocol for detection of intracranial hypertension was developed using the ultrasound system dedicated to cardiac or abdominal examination in forward surgical units.

Methods: Transcranial echodoppler (TCED) measurements were performed with the SonoSite TITAN® and a 2 MHz probe dedicated to cardiac examination.

The first step consisted of 2D-echographic identification of the turcica sella through the trans-temporal window

at a depth of 60–70 mm. Secondly, color Doppler was used to detect the middle cerebral artery (MCA). Then, a pulsed-wave Doppler acquisition was realized on the MCA.

Results: Mean, systolic, and diastolic values of blood flow velocities (Vm, Vs, Vd, respectively, in cm/s) and the pulsatility index (PI) [(Vs-Vd)/Vm] were calculated. Measurements were repeated twice.

Transcranial echodoppler was considered pathological when two out of three measured values were outside the following limits: Vm <30 cm/s, Vd <20 cm/s, PI >1.4.

These easily reproducible measurements could be used to detect on admission patients at risk for secondary neurological deterioration and to guide their neurologic treatment.

Conclusions: This method will be taught to all military physicians able to use SonoSite TITAN® ultrasound devices.

Keywords: intercranial hypertension; traumatic brain injury; ultrasound

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Comparison of Two Granular Hemostatic Agents in a New Lethal Model of Extremity Arterial Hemorrhage in Swine

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Introduction: Exsanguinating extremity wounds remains the primary source of battlefield mortality. Significant research recently has been undertaken in developing new hemostatic dressings that can stop severe compressible bleeding rapidly. The new granular/powders hemostatic Celox™ (CX) and Woundstat™ (WS) were studied in a new severe hemorrhagic model in the groin area of anesthetized pigs.

Methods: Twenty-one animals were utilized, with seven in each group. After 15 seconds of free bleeding, WS, CX, or standard gauze (SD) were placed on the wound. Continual calibrated pressure was applied upon the dressings starting at 200 mmHg, and was decreased slowly by 5 mmHg every 5 minutes. If bleeding occurred, the external pressure was increased by 5 mmHg. The total pressure quantity (KNS) to obtain definitive hemostasis was expressed in KNewton/Seconds. Blood loss (BL), heart rate (HR) and arterial blood pressure (ASP) were recorded continuously.

Results: There were no differences between the SD, CX, and WS group for the average hemodynamic parameters (ASP, FC). Time when bleeding stopped (BT) was 15.5 min for WS, 16.5 min for CX, 29 min ($p < 0.05$) for SD. Blood loss (ml/Kg) was 6 for WS, 5.9 for CX and 13.1 ($p < 0.05$) for SD. Total pressure quantity was 3.1 for WS, 3.5 for CX and 5.1 ($p < 0.05$) for SD.

Conclusions: Woundstat™ and CX obtained better results than SD in decreasing the BL and the compression task to obtain a definitive hemostasis in a lethal hemorrhagic wound.

Keywords: hemostatic dressing; uncontrolled hemorrhage

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Understanding Trauma: An Intervention Model for Treating Resistant Cases of Post-Traumatic Stress Disorder

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Psychological trauma is a significant portion of all medical casualties in combat and peacekeeping operations. Significant resources are dedicated to its prevention and treatment, and yet, rates for incidence and recovery basically have remained unchanged over the years. This is particularly evident in chronic, treatment-resistant patients. One of the major difficulties in managing post-traumatic stress disorder (PTSD) is the failure to grasp the meaning of “trauma” for the patient.

Practitioners have assumed that the trauma the wounded experiences is the direct effect of the “traumatic event” and no further inquiry is necessary or warranted. Evidence however, points to the contrary, as not all individuals exposed to a traumatic event develop PTSD, and the majority of those who develop symptoms will recover within a relatively short period of time.

But what about those who do not respond to treatment? There is no clear understanding of the reasons or conditions that adequately explain this outcome. However, it is the author’s experience, that individual factors in the context of a specific socio-cultural context set the stage from where the trauma is experienced and lived. Efforts at treatment focusing in targeting symptom relief only will have limited impact. The author will present a review of the literature, his experience treating chronic PTSD patients from various countries including Colombia, Argentina, and the US, and will argue for the need to develop a comprehensive model for its understanding and treatment.

Keywords: factors; post-traumatic stress disorder; trauma

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Hypertonic Saline to Treat Intracranial Hypertension after Traumatic Brain Injury: Why Not?

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Primary lesions after traumatic brain injury (TBI) (i.e., epidural, subdural, or intra-parenchymal hematoma) evolve through parenchymal edema then intracranial hypertension (ICHT), which is particularly deleterious (death or neurological sequelae).

Before neurosurgical evacuation, osmotherapy should be used in case of clinical signs of ICHT (e.g., uni- or bilateral pupillary dilation). Even though mannitol is effective, it induces hyperdiuresis, then hypovolemia and hypotension. It requires compensation of urinary losses to avoid hemodynamics side effects. One alternative is hypertonic saline (HS) (alone or associated to hydroxyethylamidon (HEA) to prolong its effect).

An experimental study in rats indicated superiority of HS compared to mannitol on neuronal apoptosis and secondary brain damages. Clinically, efficacy of HS on ICHT is longer than mannitol. A review by the Cochrane database showed a tendency to a decreased mortality when using HS compared to mannitol in TBI. In the field, HS is

used for hemorrhagic shock (Small volume resuscitation). So, HS associated to HEA appears interesting for prehospital treatment of ICHT after TBI. It is effective and easy to transport. A study to compare effects of HS compared to mannitol on cerebral biochemical markers of ischemia and metabolic crisis in TBI will be conducted. The aim is to prove non-inferiority of HS compared to mannitol on lactate/pyruvate ratio (a marker of ischemia), and then, to promote the utilization of HS not only for hemorrhagic shock, but also for combat TBI.

Keywords: hypertonic saline; intercranial hypertension; mannitol
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Mass Accident Victims—Disaster Medicine

The Method of Blood Crisis Policy in the Czech Republic

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In the Czech Republic (10,000,000 inhabitants) 450,000 Red Blood Cell (RBC) units/year are collected and transfused. The blood collection and processing are performed on 65 small blood centers.

In 2008, the Ministry of Health and Ministry of Defense was entrusted with the enforcement of the blood crisis policy. This was to guarantee sufficient and efficient blood supply during any crisis situation.

The system ensures seven state “blood crisis centers” (BCC) (one military and six civilian). The central role was designated to the military blood bank in the Central Military Hospital Prague (CMH), which houses the Central Information and Logistic Center (CILC). Each BCC is responsible for supplying blood to a defined territory. In case of the transport troubles, BCCs can ask for help from the Ministry of Health. The BCC must keep at least 200 RBCs and 200 plasma units and 2,000 g of albumin. The CILC collects daily updated information from each BCC about available blood and plasma units. Each BCC must have the emergency disposable and tests stock for 2,000–2,500 blood collection units.

A crisis may be proclaimed by central or local health care authority or government. Any crisis status is coordinated by CILC.

The first experience with the real functionality of the policy was in September 2008, when humanitarian blood was supplied to Georgia.

The method represents the unique system of joint cooperation between civilian and military health services.

Keywords: albumin; blood; plasma; policy; supply

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Some Educational Strategies for Disaster Medical Preparedness and Response

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Introduction: In the world of multiple threats, including disasters due to natural or technological hazards, preparedness is an essential premise of a successful disaster response.

This paper addresses education and training as the effective modalities that tangibly enhance disaster medical preparedness and response.

Methods: A disaster preparedness educational program designed to provide opportunities for education and training and that will increase preparedness and resilience to all types of hazards will be described in this study. This program, aimed at all students irrespective of their specialization, is presented to more than hundreds of thousands students every year throughout the country. Well-trained students are encouraged to register into organized teams prior to an emergency event.

Results: The experience shows that students involved in disaster preparedness educational program have an advantage over the others in facing disasters. They are capable of initiating immediate assistance, and providing simple but life-sustaining care until the attendance of professional healthcare personnel.

Conclusions: The presenters conclude that early involvement of well-trained students, registered through organized teams into national disaster plans, could enhance a nation's capacity to handle mass-casualty events and mitigate potential losses. This approach might be particularly useful in a future pandemic event.

Keywords: disaster medical preparedness and response; education and training

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Comparison of Two Non-Invasive HbCO Portable Measurement Devices

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Introduction: Treatment of carbon monoxide (CO) poisoning is guided by clinical signs and by carboxyhemoglobin (HbCO) level. A "classical," non-invasive portable device for HbCO measurement, using exhaled air analysis was compared to a new device based on infra-red spectrophotometry technique Masimo Rad-57, which seems to be more ergonomic. This new device was tested to see if it better answered the user's expectations.

Methods: The two non-invasive devices were used simultaneously with suspected CO poisoned patients and managed by prehospital medical teams. Fifteen users, doctors, and nurses, answered a questionnaire evaluating the new device compared to the older device, considering ergonomic, setup, handling, response time, measurement reliability, and general feeling. Proposed answers were: much lower; lower; identical; greater; and much greater.

Results: The new device (Masimo Rad-57) has been judged greater or much greater by 47% of the users for the children, by 60% for the non-cooperative patients, and by 53% for the unconscious victims. Of those surveyed, 87% consider the response time faster or much faster. All together, one-third of the responders evaluated the new device identical as the older, one-third superior, and one third much superior.

Conclusions: The new Masimo Rad-57 non-invasive HbCO measurement device based on spectrophotometric technique allows faster measurement compared to exhaled-air analysis, and give a chance to perform measurement on

non-cooperative patients, which are inaccessible to the conventional method.

Keywords: carboxyhemoglobin; detection; device

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Measurable Performance Indicators for Management in Civilian Disaster Medicine and Military Medicine

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Introduction: Measurable performance indicators have proven to be a useful tool for evaluation and quality control of management in major incidents and disasters. It also is possible to apply indicators in military medicine training. The aim of this study is to demonstrate the possibilities when using a method of a structured and defined process in which the same evidence-based indicators could be used throughout the whole process.

Methods: Indicators have been developed for: (1) prehospital command and control; (2) hospital management; (3) strategic management; (4) staff procedure skills; (5) full-scale exercises; (6) pedagogic skills; and (7) military training. The same indicators were measured and studied throughout the entire process from first the pilot study via education and implementation, to the application in real incidents.

Results: Five years passed before results from real incidents could be obtained from the first pilot study. This method shows that evidence based indicators can be used throughout the entire process of education, implementation, and into real-world situations. The method is a tool for creating new knowledge which can be used for evaluation and quality control of real incidents.

Conclusions: Measurable performance indicators provide one way to systematically implement knowledge from evidence through education and training into evaluation and quality control of real incidents. This method also can be applied in military medicine.

Keywords: disaster medicine; education; implementation; performance indicators

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Assessment of the Regional Capabilities in Mass-Casualty Incidents

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Introduction: The preparation for mass-casualty incidents is one of the major tasks of a healthcare system. A methodology based on the utilization of GIS modeling methods to fuse infrastructure, demographic, and risk sources data with a logistic simulation based on standard operation procedures and tactics of emergency services is recommended for mass-casualty incidents.

Methods: Synthesized maps provide visualization of regional medical capabilities to cope with a mass-casualty incident with a high number of casualties. As an input, the simulation utilizes data from GIS (classified road and street network, locations of the medical facilities), and estimated types and number of casualties and available medical

resources according to a given scenario to calculate the time needed to cope with a major incident in a specified point in the territory. The procedure is repeated for all of the defined points—risk locations in the area of interest.

Results: The result is a capability map—a map layer covering the territory and containing color-coded information on the capability of the territory to absorb the estimated number of casualties in a given time period.

Conclusions: The methodology allows for identifying which gaps must be solved, e.g., by improving management of resources or creating new resources within the territory. The statistical analysis enables an evaluation of changes in the system settings.

Keywords: GIS; mass-casualty incident; simulation
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