



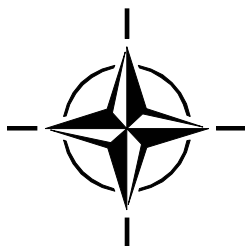
**RTO MEETING PROCEEDINGS**

**MP-HFM-109**

# **Combat Casualty Care in Ground-Based Tactical Situations: Trauma Technology and Emergency Medical Procedures**

(Soins aux blessés au combat dans des situations  
tactiques : technologies des traumatismes  
et procédures médicales d'urgence)

Papers prepared for the RTO Human Factors and Medicine Panel (HFM) Symposium  
which was held in St. Pete Beach, FL, United States, 16-18 August 2004,  
in co-operation with the US Department of Defense, Advanced Technology  
Applications for Combat Casualty Care (ATACCC) Conference.



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# The Research and Technology Organisation (RTO) of NATO

RTO is the single focus in NATO for Defence Research and Technology activities. Its mission is to conduct and promote co-operative research and information exchange. The objective is to support the development and effective use of national defence research and technology and to meet the military needs of the Alliance, to maintain a technological lead, and to provide advice to NATO and national decision makers. The RTO performs its mission with the support of an extensive network of national experts. It also ensures effective co-ordination with other NATO bodies involved in R&T activities.

RTO reports both to the Military Committee of NATO and to the Conference of National Armament Directors. It comprises a Research and Technology Board (RTB) as the highest level of national representation and the Research and Technology Agency (RTA), a dedicated staff with its headquarters in Neuilly, near Paris, France. In order to facilitate contacts with the military users and other NATO activities, a small part of the RTA staff is located in NATO Headquarters in Brussels. The Brussels staff also co-ordinates RTO's co-operation with nations in Middle and Eastern Europe, to which RTO attaches particular importance especially as working together in the field of research is one of the more promising areas of co-operation.

The total spectrum of R&T activities is covered by the following 7 bodies:

- AVT Applied Vehicle Technology Panel
- HFM Human Factors and Medicine Panel
- IST Information Systems Technology Panel
- NMSG NATO Modelling and Simulation Group
- SAS Studies, Analysis and Simulation Panel
- SCI Systems Concepts and Integration Panel
- SET Sensors and Electronics Technology Panel

These bodies are made up of national representatives as well as generally recognised 'world class' scientists. They also provide a communication link to military users and other NATO bodies. RTO's scientific and technological work is carried out by Technical Teams, created for specific activities and with a specific duration. Such Technical Teams can organise workshops, symposia, field trials, lecture series and training courses. An important function of these Technical Teams is to ensure the continuity of the expert networks.

RTO builds upon earlier co-operation in defence research and technology as set-up under the Advisory Group for Aerospace Research and Development (AGARD) and the Defence Research Group (DRG). AGARD and the DRG share common roots in that they were both established at the initiative of Dr Theodore von Kármán, a leading aerospace scientist, who early on recognised the importance of scientific support for the Allied Armed Forces. RTO is capitalising on these common roots in order to provide the Alliance and the NATO nations with a strong scientific and technological basis that will guarantee a solid base for the future.

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# **Combat Casualty Care in Ground-Based Tactical Situations: Trauma Technology and Emergency Medical Procedures**

## **(RTO-MP-HFM-109)**

### **Executive Summary**

The meeting was held jointly with the ATACCC 2004 (Advanced Technology Applications for Combat Casualty Care) meeting. This annual meeting is hosted by the Combat Casualty Care Research Program HQ, USAMRMC, Fort Detrick, Maryland. The remit of this technical evaluation report is confined to the NATO/OTAN component of the meeting.

#### **Theme and Objective**

In ground based tactical situations casualties can not be avoided. It is well documented that immediate haemostatic surgery can be life saving, and the most significant factor for survival is the time from injury to surgery. Late complications like septicemia and multi organ failure are in most cases sequelae of the initial hypo perfusion. In situations where evacuation will be delayed, the prehospital handling and management are of critical importance. In recent tactical situations with long distances to hospital, forward surgical teams have been deployed to reduce the time to surgery. Fast and correct decisions in questions of triage, evaluation and initial treatment are life saving and may reduce complications for the individual soldier. New technologies allow rapid location of casualties and advanced diagnostic aid and decision support in the field. The application of sensors to monitor vital signs and computers with embedded knowledge provide such support. Recent technology advances allow for non-invasive and remote monitoring of physiologic parameters and vital signs, thereby increasing the possibility for accurate treatment and management by ground personnel.

The main aim of casualty treatment is to secure oxygenation of critical tissues. Ventilation support, hemorrhage control and organ protection are thus crucial. Haemostatic devices such as improved bandages and tourniquets, haemostatic drugs, and agents such as platelet substitutes and oxygen carrier molecules based on per fluorocarbons or modified haemoglobin address the hemorrhagic challenge. Optimal fluid management, vasoactive drugs and resuscitation fluid additives to promote micro vascular perfusion may protect organ function and prevent organ failure and increase survival. During the last decades micro vascular sensitivity to inflammation has been identified as a major contributor to tissue hypo perfusion and various inhibitors of the inflammatory response have been tried to provide organ protection.

#### **Observations and Conclusions**

A substantial number of excellent scientific papers were presented many from world leaders in their domain and all of which had direct short or long-term bearing on combat casualty care. Outstanding science on haemostasis, shock research and resuscitation was dominant but important and cutting-edge presentations on technologies and monitoring with rationale solutions for existing problems were also offered. The Program Committee did an outstanding job in providing a meeting at which any person interested in this domain could obtain substantial information and value.

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**Recommendations:**

- More multi-national presentations at such joint meetings, particularly from research labs in Europe.
- Future focus on:
  - The scientific basis (evidence) for combat and expeditionary injury care.
  - Epidemiology and patterns of severity of injury and databases on the battlefield and post manoeuvre expeditionary force trauma systems.
  - Blast injury research to characterize the scope and nature of primary blast injury in a context of secondary, tertiary, and quaternary injury in contemporary tactics. This particular topic would have significant crosswalk value to civilian terrorist issues.

# Soins aux blessés au combat dans des situations tactiques : technologies des traumatismes et procédures médicales d'urgence

## (RTO-MP-HFM-109)

### Synthèse

La réunion était organisée conjointement avec la réunion ATACCC 2004 (Applications technologiques avancées pour soins aux blessés au combat). Cette réunion annuelle est organisée dans le cadre du Programme de recherche en soins aux blessés au combat du QG, USAMRMC, Fort Detrick (Maryland, Etats-Unis). Ce rapport d'évaluation technique est consacré uniquement au volet OTAN de la réunion.

#### Thème et objectif

Les situations tactiques terrestres engendrent toujours des blessés. La littérature indique clairement que des vies peuvent être sauvées si la chirurgie hémostatique est pratiquée immédiatement, et que le facteur le plus important du point de vue de la survie est le délai entre le moment de la blessure et celui de l'intervention chirurgicale. Les complications ultérieures telles que la septicémie et la défaillance multiple d'organes sont, pour la plupart, des séquelles de l'hypoperfusion initiale. Dans des situations où l'évacuation sanitaire est retardée, la gestion de la situation et les soins préhospitaliers sont d'une importance décisive. Dans de récentes situations tactiques, où l'hôpital le plus proche était très éloigné, des équipes chirurgicales de la zone avant étaient déployées afin de réduire les délais d'intervention. La prise de décision de façon rapide et juste en ce qui concerne le triage, l'évaluation et les soins initiaux peut sauver des vies et réduire les complications dans certains cas. Les nouvelles technologies permettent de localiser rapidement les blessés en fournissant aux combattants des aides avancées au diagnostic et à la prise de décision. La mise en œuvre de capteurs pour détecter des signes vitaux, ainsi que d'ordinateurs dotés d'information intégrée en sont des exemples. Les avancées technologiques récentes permettent la surveillance à distance et le contrôle non invasif de paramètres physiologiques et de signes vitaux, favorisant ainsi la dispensation de soins et la gestion de la situation appropriées par le personnel présent sur le champ de bataille.

Les principaux soins dispensés aux blessés ont pour objectif d'oxygéner les tissus vitaux. La ventilation, le contrôle des hémorragies et la protection des organes sont donc des éléments capitaux. Des dispositifs hémostatiques tels que des bandages et des tourniquets améliorés, des médicaments hémostatiques et des agents tels que des plaquettes de remplacement et des molécules transporteurs d'oxygène à base de chlorofluorocarbures et d'hémoglobine modifiée, offrent des solutions au problème des hémorragies. La gestion optimale des fluides, les médicaments vasoactifs et les additifs des fluides de réanimation qui favorisent la perfusion microvasculaire, peuvent contribuer à protéger le fonctionnement des organes, empêcher leur défaillance et améliorer les chances de survie. Au cours des dernières décennies, la sensibilité microvasculaire aux inflammations a été identifiée comme un facteur contributif majeur à l'hypoperfusion des tissus, et différents inhibiteurs de la réaction inflammatoire ont été testés pour la protection des organes.

#### Observations et conclusions

Un nombre considérable de communications scientifiques de haut niveau ont été présentées par des conférenciers leaders mondiaux dans leurs domaines respectifs. L'ensemble de ces communications

avaient des implications directes à court ou à long terme sur les soins dispensés aux blessés au combat. La réunion était caractérisée par des travaux scientifiques exceptionnels en hémostase, en traumatisme et en réanimation, mais d'importantes communications de pointe sur les technologies de contrôle, offrant des solutions sensées aux problèmes existants, ont également été présentées. Le comité responsable du programme est à féliciter pour avoir organisé une réunion où toute personne intéressée par ce domaine pouvait obtenir de nombreuses informations de grande valeur.

**Recommandations :**

- Présenter davantage de communications multinationales lors de telles réunions conjointes, en particulier des communications faites par des laboratoires de recherche en Europe.
- Mettre l'accent sur :
  - Les bases scientifiques (témoignages) des soins aux blessés au combat et des membres des corps expéditionnaires.
  - L'épidémiologie, la gravité des blessures, les bases de données sur le champ de bataille et les systèmes de traumatisme des corps expéditionnaires après la manœuvre.
  - La recherche dans le domaine des lésions provoquées par l'effet de souffle afin de caractériser la gravité et la nature des lésions dans le contexte de lésions secondaires, tertiaires et quaternaires dans des situations tactiques contemporaines. Cette question aurait des applications intéressantes dans le domaine du terrorisme civil.



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# Human Factors and Medicine Panel

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<b>14. Abstract</b>	Papers presented all had direct short or long-term bearing on combat casualty care and included outstanding science on haemostasis, shock research and resuscitation, as well as technologies and monitoring with rationale solutions for existing problems.																													





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