Medical Chemical Defense in Operations Desert Shield and Desert Storm

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The authors give a brief overview of how the Chemical Institute prepared for Desert Shield/Storm. Numerous refresher courses dealing with chemical warfare were held, and 800 deploying health professionals graduated from these courses. The center assisted medical facilities in assessing their clinical efficacy and safety of medical countermeasures and provided consultation to the USCENTCOM Surgeon in medical-casualty care and other related issues.

Introduction

The Army Medical Department (AMEDD) has historically played a crucial role in any successful combat operation. The advent of highly sophisticated and automated weapons systems has in no way lessened the significance of our most critical asset —the soldier. Operation Desert Storm's execution required US forces to operate in a potential chemical threat environment for the first time since World War II, not having actually experienced chemical warfare (CW) agent use since World War I. Chemical warfare poses problems for the soldier which are uniquely medical in nature. Whereas most weapons systems are hardware oriented, and thus somewhat foreign to many AMEDD personnel, CW agent effects are based on fundamental principles of physiology and pharmacology. To some degree we should all be CW subject matter experts.

As soldiers, it is imperative that we also remain focused on the ultimate goal of the AMEDD, which is to "conserve the fighting strength." Our research and clinical efforts must therefore provide the soldier in the field with knowledge or products which improve his combat effectiveness and enhance his ability to fight and win. Our responsiveness to all aspects of this mission was tested during Operations Desert Shield and Desert Storm, as we faced an adversary who possessed a modern, offensive CW capability. We weren't as ready as we could have been, but we rose to the challenge admirably.

Before the Crisis

All AMEDD personnel receive individual skill training in the detection, decontamination, signs, symptoms and treatment of CW agent exposure. We have all practiced donning our masks and chemical protective overgarments. Many have experienced life at MOPP 4 (chemical gear) for extended periods of time. Yet, all too often, we have failed to fully appreciate the difficulties inherent in accomplishing our mission in a chemical environment. This is borne out in numerous after action reviews from the National Training Center, which clearly demonstrate a lack of training with realistically integrated CW agent employment for medical and non-medical units alike. This issue, which has been the subject of two Department of the Army IG readiness assessments and periodic General Officer Medical Chemical Defense Reviews, was briefed to the Army Surgeon General in July 1990. This timing was fortuitous in that it set the stage for a series of events which culminated in the highest degree of medical-chemical readiness the Army has ever seen.

The US Army Medical Research Institute of Chemical Defense (USAMRICD), Aberdeen Proving Ground, Maryland, is the lead laboratory conducting research on medical defense measures against CW agents. Its mission includes elucidating the mechanism of action of threat CW agents, identifying promising candidate pretreatment, therapeutic and decontamination compounds, testing their efficacy, and supporting those organizations tasked with their development, testing and evaluation. It also has responsibility for the postgraduate education of medical personnel in the management of chemical casualties, through the Medical Management of Chemical Casualties Course (M2C3), a professional short-course under the co-sponsorship of the Office of the Army Surgeon General and the US Army Academy of Health Sciences.

Training and Readiness in Desert Shield

With the Iraqi invasion of Kuwait on Aug 2, 1990, it became clear that our research efforts over the past several decades might be put to the test under fire. It was also apparent that the greatest contribution that USAMRICD could make to Operation Desert Shield was to rapidly share our experience in medical-chemical defense with the largest number of people possible. Teams gave pre-deployment familiarization lectures to health professionals of all services at US locations in August and September. In September, at the request of US Central Command (USCENTCOM), an initial cell of three officers from USAMRICD arrived in Saudi Arabia to provide staff support and training in chemical casualty care during Operation Desert Shield. The mission of the USAMRICD Forward Detachment and the USCENTCOM Chemical Casualty Officer was threefold:

(1) To conduct refresher and supplementary training of US and coalition forces medical personnel in chem-

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ical casualty care, initially as formal M2C3, and subsequently on an as-needed/as-available basis.

(2) To assess the clinical efficacy and safety of medical countermeasures and treatments directed against chemical agent exposure, formulate needed treatment modifications and disseminate new information in the theater as rapidly as possible to ensure optimal chemical casualty care.

(3) To provide consultation to the USCENTCOM Surgeon in medical-chemical defense, chemical casualty care and other related issues.

From September through December 1990, this team conducted 16 three-day M2C3s in theater, training over 1,450 medical personnel from all four services and seven allied nations in CW agent detection, in the recognition of signs and symptoms, the decontamination and treatment. These sessions included an intensive field training exercise with triage, decontamination and treatment of mock chemical and mixed chemical/conventional casualties. Other USAMRICD teams conducted M2C3 courses in Europe and the United States that graduated another 800 deploying health professionals. In spite of the challenging "classroom" conditions, attentiveness to course material and performance on the final examinations were exceptional. Many M2C3 graduates provided further instruction to their entire unit, assisted by a series of USAMRICD Technical Memoranda. These publications, which were developed to provide up-to-date information on selected medical issues relevant to CW agents, were provided during or soon after the M2C3. All in all, medical personnel took optimal advantage of the five months before the start of the war by enhancing their knowledge of CW agent effects and preparing for possible CW agent use.

Operation Desert Storm: Continued Training and Clinical Assessment

The CW threat and chemical casualty potential were assessed as greatest for Army (ARCENT) and Marine Corps (MARCENT) units within the range of tube artillery and short-range multiple launch rocket systems. The possible use of SCUD missiles carrying chemical warheads, while extensively covered in the press and of great concern to the civilian population, was determined to be a much lower risk. Although medical personnel had been well-trained in the medical management of chemical casualties, the relevant doctrine and its clinical concepts were largely based on historical data, laboratory research and medical intelligence derived from the chemical casualty care experience of non-allied forces. While our doctrine and concepts were soundly based, they could likely have been improved upon with first-hand experience in chemical casualty management. The nature of the anticipated ground combat and the challenge posed by timely dissemination of information in theater required an agile and expert capability to capture, evaluate and disseminate clinical lessons learned. Thus, upon the initiation of hostilities, with the threat of actual US and allied chemical casualties, USCINCCENT requested deployment of a detachment of clinical experts in chemical casualty care and the continued support of a dedicated Chemical Casualty Officer. USAMRICD's total in-theater end-strength of eight soldiers was deployed from January to March 1991. It included four physicians, three clinical scientists (AN, VC, MS), and one noncommissioned officer (91T).

Additional mini-courses and refresher/updates were provided to over 40 field hospitals and medical units during the initial phases of Operation Desert Storm, the target audience being approximately 3,000 physicians, physician assistants (PAs), nurses and medics. By the onset of ground operations, over 90% of the physicians and PAs assigned to divisional units were M2C3 graduates. For corps-level units and echelons above corps, the figure was about 50%.

The process of designating selected M2C3 graduates as "Medical Chemical Casualty Officers," begun in December, and was completed prior to the initiation of ground operations. For the first time since World War I, Army units designated medical-chemical casualty officers for each hospital. The other services participated on an informal basis. This network was used extensively in January to communicate the perceived medical-chemical threat, to disseminate the US Food and Drug Administration's recommended soldier information on Nerve Agent Pyridostigmine Pretreatment (NAPP), to collect data on the use and acceptance of NAPP in the field and to clarify the doctrinal use of the Convulsant Antidote Nerve Agent (CANA) upon introduction to the theater.

A specific message format, the Medical Chemical Update (MCU), was initiated to allow rapid dissemination of relevant information to Medical Chemical Casualty Officers. MCUs were used to recommend initiation and cessation of NAPP to the component services. A subsequent review of how these messages were received in the field suggests that this was a worthwhile endeavor, and would have been extremely beneficial in the face of actual chemical agent use.

Medical-chemical related staff actions and policies were proposed and managed at USCENTCOM and subordinate unit levels. These included, for example, restriction of insecticide use that would potentially impair cholinesterase reserve; consideration of chemical casualty recovery times and the impact on theater evacuation plans and policy; implementation of plans to load all medical evacuation vehicles with decontamination solution to permit far-forward decontamination of patients whenever possible; distribution and accountability for CANA, the diazepam autoinjector; and guidance on chemical decontamination of human remains. Requirements for public information presentations to the American and allied civilian communities and to the press were recurring actions.

Clinical Assessment During Desert Storm

Soon after initiation of hostilities in January 1991, three chemical assessment cells, each composed of two experts in chemical casualty management, were placed under operational control of the Corps Surgeons of the VII Corps and XVIII Airborne Corps of ARCENT, and of the MARCENT Surgeon. The Army Corps and MARCENT Surgeons' sections were tasked and staffed to perform medical threat estimates, battle tracking and information gathering on the occurrence of conventional and chemical casualties. USCENTCOM also had a strong NBC threat assessment capability. Upon anticipation of CW use, or identification of actual chemical casualties, the chemical assessment cells were to deploy forward to the most appropriate medical element, depending on the predominant threat agent. For example, nerve agent vapor exposures would be best evaluated at a forward support or clearing company, while mustard casualties would be best evaluated at a Corps-level evacuation hospital. This was put to the test on the second day of the ground war when a cavalry scout of the 3d Armored Division was treated for blister lesions on his arm which were presumptively identified as clinically similar to those produced by sulfur mustard (HD). This individual was seen at his battalion aid station by one of the assessment teams, the lesions were examined and photographed, and the soldier was treated symptomatically after which he returned to duty. Definitive identification of vesicant agent exposure was not confirmed. Relevant data was to be captured on a standardized form with subsequent entry into an automated database on a portable computer. In addition, targeted data needs or opportunities which arose from special circumstances (eg, the use of pyridostigmine by a large unit before the onset of major ground combat) were exploited.

The USCENTCOM Surgeon's Chemical Casualty Officer was to serve as the hub for data evaluation. He was best positioned to communicate as needed with the scientific experts in all three cells and with resources at USAMRICD and other laboratories. Also, depending on the nature of the clinical lessons learned, he could rapidly disseminate this information to all component services and allied forces as appropriate. As a hypothetical example, an evaluation of our initial experience with severe nerve agent casualties treated with CANA might have indicated that some hallmark findings could guide further therapy: ie, convulsions breaking through the first CANA may be a reliable sign that atropine requirement over the first day would likely exceed 50mg. The officer at USCENTCOM was well positioned to sound out this inference quickly with the neuroscience community and immediately formulate new management guidelines. The Commander, USAMRICD, has DoD teaching authority to promulgate such guidelines as part of his chemical casualty professional education mission. The Medical Chemical Casualty Officer network was to be used for rapid dissemination of evaluated information and new management concepts and guidelines. The cells at each Corps level assisted, as time permitted, with reinforcement and explanation of information regarding the management of chemical casualties.

Specific Medical-Chemical Countermeasures

Over 41,000 soldiers from the XVIII Airborne Corps took NAPP for one to seven days in January 1991 under a nerve agent threat. Clinical information of the physiologic changes attributable to NAPP that resulted in need for medical attention, discontinuation, hospitalization and/or evacuation from theater were captured (Keeler et al: *JAMA*, vol 266, Aug 1991). In summary, the NAPP regimen as practiced by soldiers under wartime conditions caused more frequently noticed physiologic responses than reported in earlier peacetime evaluations; however, these non-incapacitating symptoms did not impair military mission performance. The known effects of pyridostigmine on postsynaptic acetylcholine receptors and cholinergic transmission suggest that special attention to muscle relaxant management may be important during anesthesia. This information was reviewed with the anesthesia staffs of theater medical units, and the appropriate data capture management approaches were widely disseminated.

CONCLUSION

The Army Medical Department made a strong response to the chemical threat in the Persian Gulf. Guided by the Surgeon General's staff, it provided doctrine and training packages from the Academy of Health Sciences that supported new products such as NAPP and CANA. The US Army Medical Materiel Development Activity and Medical Materiel Agency both worked closely with the US Food and Drug Administration to ensure delivery and appropriate safety and efficacy monitoring of medical chemical countermeasures. Scientists at USAMRICD and other laboratories supported the effort with critical confirming and monitoring studies. Collectively, US forces achieved an unprecedented level of readiness to cope with the potential for enemy CW agent use. Timely M2C3 training, prior to deployment or in theater, allowed medical personnel to focus their attention on the mission at hand—treatment and conservation of the fighting strength—with less concern about the uncertainties of CW agent use. The competence and confidence that medical personnel acquired as a result of these efforts cannot be overestimated. The immediate presence of medical-chemical experts in the theater allowed for rapid dissemination of information, prompt answers to the questions of field commanders and continued reassurance that we were the best equipped and prepared medical force in the world. ●