JMVH

Volume 16 Number 1 October 2007

Journal of Military and Veterans' Health

- Deployment Health Surveillance
- Australian Defence Force Personnel Rehabilitation
- Blast Lung Injury and Lung Assist Devices
- Shell Shock

The Journal of the Australian Military Medicine Association

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Australian Military Medicine Association

STATEMENT OF OBJECTIVES

The Australian Military Medicine Association is an independent professional scientific organisation of health professionals with the objectives of:

- Promoting the study of military medicine
- Bringing together those with an interest in military medicine
- Disseminating knowledge of military medicine
- Publishing and distributing a journal in military medicine
- Promoting research in military medicine

Membership of the Association is open to doctors, dentists, nurses, pharmacists, paramedics and anyone with a professional interest in any of the disciplines of military medicine. The Association is totally independent of the Australian Defence Force.

ISSN No. 1835-1271

Inside this edition

There are a number of themes that run through this edition.

Firstly, a paper outlining recent deployments undertaken by the Australian Defence Force to help with humanitarian assistance following the Earthquake on the Indonesian Island of Nias which sadly, during this later deployment, a helicopter crashed and nine of our people paid the ultimate sacrifice.

In another paper, colleagues from the Centre for Military and Veterans' Health outline how they are proposing to undertake surveillance of the health of those deployed on overseas deployments, using the example of East Timor. We can expect a great deal of important material from this group in the future. As Susan Treloar notes in a commentary on this work, the stakeholders involved in this program are extremely optimistic as to what will be achieved.

Neil Westphalen provides us with a comprehensive biography of one of Australia's leading naval surgeons, the late Surgeon Rear Admiral Lockwood. There are two features that you may wish to note. First, this brilliant naval surgeon suffered from mental illness – before most of his stellar career. Clearly, people with such diseases can be successfully rehabilitated, and go on to make important contributions to the Australian Defence Force. The other feature of the biography is the descriptions of blast injury provided by the late Admiral.

After reading Admiral Lockwood's description of blast injury, you will find Ben Mackie's important paper reviewing the world literature on lung assist devices in blast lung injury even more interesting. Sadly, we live in a world where military and civilian intensive care units will need to use this knowledge.

The legislative and administrative basis for successful rehabilitation of injured defence personnel is outlined in a paper by Jim Porteous. As outlined in the paper, there is a new focus on early identification of injury or illness.

Blast injury of another kind is identified in the paper that we have reprinted from *The Lancet* of 1915, in which Myers first described shell shock, with an attached commentary.

And this buffet of delights on military and veterans' health is rounded off by a toxicological essay on hemlock poisoning by Andy Robertson. As you can see from the article, the plant that gives rise to hemlock is common in Australia, and fatalities have occurred. Yet another concern for military health with units deployed in the field.

President's message

As you read this, you will probably be sitting at the 2007 Australian Military Medicine Association Annual Scientific Conference in Melbourne.

Over the last 12 months, and in the follow-on from the highly successful joint Defence Health Services/AMMA Conference in Brisbane last year, the Association through its Council has been working to improve the way we plan and manage our conferences.

As with the 2002 joint conference, the 2006 event has given us the opportunity to build on a huge level of interest in the Association and its professional and scientific activities.

This has been aptly demonstrated through the requirement at relatively short notice to change the venue of this year's conference to one that is significantly larger and better equipped for a conference of the scope that we are now able to produce.

There was an amazing level of interest in presenting papers this year, and the significant sponsorship that we have been able to attract demanded the change.

It is clear that the hard work of the Conference Organisers, Nader Abou-Seif, Peter Habersberger, Helen Kelsall and Bob Stacy, ably supported by our Secretariat, Leishman Associates, has well and truly paid off. On your behalf, I congratulate them on their success.

Nevertheless, there are some key areas of improvement that Council is determined to work on to ensure that future conferences are even better.

Foremost amongst these is the need for significant forward planning, and in this respect it has become clear that our conferences must be planned at least two years in advance.

I am pleased to report that the DHS has agreed to come on board for the 2009 Conference, and this is likely to be held in Brisbane. The determination of this location is largely brought about by the need for a large venue and one which facilitates the movement of DHS personnel to and from the Conference.

DHS has also agreed to work around a three-year rotation for joint conferences, which is an approach that Council considers best meets the needs of the Association. More frequently would dilute the Association's ability to grow as an independent body, whilst less frequently would risk the events becoming less embedded as a part of the overall military health and medical professional program.

Council has also decided that the 2008 Conference will be held in Hobart. Venues for future Conferences will be determined as a minimum two years out from the date.

In closing, I wish to personally acknowledge and thank the Head Defence Health Services, Air Vice Marshal Tony Austin RAAF, for his support and commitment to the Association and its activities, in particular both our Conferences and our new Journal. His determination to support the Association as an independent professional and scientific body is gratefully appreciated.

Russ Schedlich
President, AMMA

Editor's message

Welcome to the first edition of the *Journal of Military and Veterans' Health*.

JMVH is the successor to *Australian Military Medicine*, the original journal of the Australian Military Medicine Association.

AMM started as a fairly basic newsletter at the time of the Association's formation in 1991. Over the succeeding years, and under the tutelage of a number of editors, it had developed to the point of being a professionally prepared publication, with a variety of content. Publication largely depended upon the work of a sole editor, and its ability to grow and develop was thereby limited.

In 2005, representatives of the Association, the Defence Health Services and the Centre for Military and Veterans' Health met to discuss the future of professional and scientific publication in the area of military medicine and veterans' health. At this meeting, it was agreed that the Association should work, in conjunction with these organisations and others that have an interest in and commitment to research and publication in these fields, to develop its Journal into one of national and international standing.

To this end, the Association established an Editorial Board, consisting of representatives from the Association, the DHS, CMVH, and universities that are significantly involved in military and veterans' health research. Recently, the addition of a New Zealand Defence Force Health Services member was considered appropriate, and Brigadier Anne Campbell, the Director-General of the NZDFHS, kindly agreed.

Over the last nine months, the Board has been working with great dedication to develop and publish the Journal that you now hold in your hands.

Additionally, the Association through its Council has committed significant funds for the set up of the Journal and its associated website. I am also pleased to report that, through Senator Bruce Billson, the Minister for Veterans Affairs, the Commonwealth Government has provided a one-off grant of $5,000 to assist with these costs.

The Editorial Board has worked hard in identifying the framework within which the Journal should be published, including categories for papers, instructions for authors, reviewing processes, layouts and website design.

There remains a considerable body of work to be completed, including populating the website, bedding down electronic-based processes for managing the receipt, review and publication of papers, and setting out a variety of policies in relation to both these matters and other key issues such as editorial independence. The Board is also in the process of inviting a variety of appropriately experienced international researchers and authors to constitute an International Advisory Board.

The biggest challenge will be in the gathering together of appropriate high-quality work suitable for publication. I expect that this will be a bit of a grind in the initial stages, but the Association and the Board are determined to work as hard as possible to ensure that over the next couple of years *JMVH* becomes recognised as a national if not world leader in military medicine and veterans' health scientific publication, to the point where it will self-attract suitable copy.

Recognising that *JMVH* is the successor of our former Journal, the volume and issue number sequence has been continued from the last edition of *Australian Military Medicine*.

JMVH will be published four times a year. Initially this will be three issues of new copy, and one issue of conference abstracts. In the very near future, it is our determination that there will be four issues per year of new copy. The conference abstracts will then become a supplement to one of these issues.

In the very near future, you may anticipate being approached by one of the members of the Editorial Board asking you to consider putting pen to paper to contribute to this new Journal.

In closing, I would like to acknowledge the involvement and commitment of the members of the Editorial Board, whose names are listed at the front of this Journal. They have provided a wealth of experience and ideas that have laid the foundation for a Journal that I am sure in the not too distant future will be recognised around the world as one of the leaders in its field.

I trust you enjoy this first edition.

Russ Schedlich
Editor-in-Chief

Initiating an Australian Deployment Health Surveillance Program

Susan Treloar BSocStud (Hons), MSW, MSc, PhD, Alexander McFarlane MB BS (Hons), MD, Dip. Psychother, FRANZCP, Niki Ellis MB BS, DipOccHealth, FAFPHM

This first issue of the new *Journal of Military and Veterans' Health* publishes a significant paper in the history of deployment health surveillance. The paper by Associate Professor Scott Kitchener and colleagues from the Centre for Military and Veterans' Health describes a small but seminal Australian pilot project that has informed the foundation and development of the Centre's Deployment Health Surveillance Program (DHSP). The pilot project was designed on this scale to test various aspects of the proposed surveillance methodology and it was recognized from the outset that scientific outcomes would not be forthcoming. It included Australian Defence Force (ADF) personnel operationally deployed as part of Australia's commitment to the International Force East Timor (InterFET), a peace-keeping operation, and a sample of currently serving personnel who did not deploy on InterFET. The outcomes needed were information on the logistics, efficiency and feasibility of various data sources, including the testing of data collection from the multiple sources needed to effectively monitor health and well-being and identify predictors of future health outcomes for deployed personnel.

The InterFET pilot project was the first step towards implementing the vision for the DHSP which is to "provide a systematic, prospective and ongoing means of assessing and understanding the health effects of operational deployment on ADF personnel." The program has been commissioned by the Director General Defence Health Services (now Head, Defence Health Service) based on government policy espoused by the (then) Minister for Defence Personnel. With major commitments from both the Australian Department of Defence and the Department of Veterans' Affairs, the DHSP is now established.

The very nature of deployment health surveillance research means that it is intended to provide information for Defence policy-makers, not just within the boundaries of Defence health services, but more generally, for it is likely that many aspects of deployment outside the purview of health services may affect health and well-being. These factors may include operational tempo as well as factors specific to each deployment. We need to remember that effects of deployment may be positive as well as negative and allow for data collection that can embrace the possible benefits as well as the risk factors. On the topic of benefit, deployment health research needs to benefit serving personnel and veterans and in this sense our DHSP differs from other longitudinal epidemiological research conducted for purely scientific purposes. Substantial facilitative two-way interaction between the stakeholders and researchers is necessary for the research to be relevant and meet the needs of Defence and Veterans' Affairs policy-makers, managers, practitioners and the men and women who have served in the ADF. Particularly important is the need for empirical data from the DHSP to inform preventive interventions by the Australian Defence Force to avoid or minimize future illness and disability during service and post-discharge.

Conceptual and methodological challenges abound in this field. As in all longitudinal epidemiological research, the lead time to development and diagnosis of some adverse outcomes such as cancers and mortality is often long, and yet short-term answers are needed. Questions arise about how quickly one should respond to a short-term trend that may change over the longer-term, perhaps being a chance finding or a temporary effect of deployment. One of the basic difficulties all health researchers face is that clinical records are not kept with research in mind. Translating protocols for public health surveillance to a military health surveillance research program is not necessarily straightforward and we are fortunate to have the opportunity to learn from the experiences of other countries as well as our own pilot project.

Logistical problems can have scientific implications in terms of the ultimate power and impact of bias on the study being able to answer the research questions. The InterFET Pilot Project identified several important factors that are critical to the long-term success of a deployment health surveillance program but continue to pose challenges. In general

terms these factors are: the accessibility and utility of Defence health records; ability to successfully contact the relevant service personnel and locate them once they leave the Defence Force; ability to motivate participation from a population that is mobile, busy, and often actually deployed at the time of study in possibly remote and difficult physical and geographical settings, and also subjected to many other military demands for survey completion; and study access to chronologically accurate and complete data on exposures and interventions that may affect health and well-being.

The DHSP is now underway, with a current project investigating the health of service personnel deployed to the Solomon Islands. Projects are about to start based on deployments to Bougainville and other operations in East Timor, including some war-like operations, and a major study of deployments in the Middle East Area of Operations is under consideration for a possible start in 2008. While the program is being established on a deployment-by-deployment basis, we aim to develop a prospective, programmatic approach to data collection. The goal is to establish a database that will include health record data that proves to be valid and reliable, and clinical measurement and self-report data at particular time points. The database will span multiple deployments and exposures. This variety of exposures is important in cohort research. Stratification of the data according to deployments and combinations of deployment will allow important research questions to be answered. These questions essentially hinge on whether specific deployment factors or overall deployment experiences are predictors of aspects of short-term and longer-term health and well-being, and mortality. The InterFET pilot project identified some likely obstacles and cleared the course for Australian DHSP research to proceed. There will be further challenges but with commitment to the DHSP by all stakeholders we are extremely optimistic about what can be achieved.

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Myers – The dawn of a new era

Keith W A Horsley MB, BS M Pub Admin

In this edition of the Journal of Military and Veterans' Health is reprinted, with the permission of the Editors of ***The Lancet****, the classic paper by Charles Myers, which is believed to be the first written description of shell shock.*

For both military medicine and for psychiatry, this paper is very important and even today there are lessons that can be taken from this work.

There are interesting facets to all aspects of this article.

To begin with, the title of the article is important. Myers describes his paper as "a contribution to the study of shell shock"; this implies that there was already a broader debate underway of which the readers of *The Lancet* were aware. Note that there is no attempt to define shell shock or to describe the term. Myers writes in a manner that presumes that the term is known by his audience. Thus, although this is apparently the first written mention of shell shock in the journals, it seems that this was taking place within a wider debate that was presumably occurring in places like grand rounds and medical meetings at that time, of which no extant record can now be found.

The next important aspect is the date – February 13th 1915. While the First World War broke out in early August 1914, it took some time for the armies to join in battle, and the first major battles did not occur until September. Less than four months later, Myers was describing cases which he viewed as "a definite class among others arising from the effects of shell-shock." It is noteworthy that in such a small amount of time this new condition had been accepted as valid diagnostic entity, to the point that Myers could use it in *The Lancet* without explanation or caveat. While examining the date, it is interesting to note the last date on Case Three is February the 1st, and that under Case One he mentions that "now" is February 1st; 12 days later Myers was in print. This was at a time when the physical publication process would have consumed considerable time. They knew about accelerated publication in those days.

Even with this very tight publication timeline Myers obtained approval from his commanding officer to publish this article. Apparently, even for a condition as controversial and novel as shell shock, medical professionals in the British Army were given great freedom to publish as they saw fit.

It is also interesting to note how advanced was Myers in understanding the essential nature of the condition. While he does discuss the cases in terms of the physical effects of the explosion of the shell, he concludes that "the close relation of these cases to those of 'hysteria' appears fairly certain". Thus, he has grasped that the injury suffered by these soldiers is a wound to the mind, rather than an injury to the nervous system. It is apparent that Myers had this insight even earlier, as he records that he had attempted to use hypnosis to treat Case One as early November 10th 1914.

Also impressive is Myers' concern about memory. It is now accepted that disorders of memory are a central feature of post-traumatic mental illness. Myers measured and followed the memory disturbance in these patients.

Even more impressive is the clear description of the disruption to olfaction that occurred in these patients. Disruption to olfaction in patients with conditions such as PTSD is a subject of intense current research interest. It is perhaps a sad reflection of all of us who have worked in this field to learn that the first case-histories of post-combat malaise clearly and accurately record disruption to olfaction as a feature of the condition. One might ask what we have all been doing in the intervening ninety years. There are, of course, interesting reasons why Myers was able to make these insightful observations concerning olfaction. He worked at a time when modern psychiatry was still emerging, and although he is remembered for his contributions to psychiatry, he would have had a sound knowledge of neurology. The lack of separation between mind and body in those days allowed him to make observations that we are only now rediscovering.

There are some aspects of the paper that will sit uncomfortably with modern readership. The references to bowel motions, and the suggestion that a return to more regular defaecation was associated with a decrease in symptoms in Case Three, would be something that we would probably not fit in a case-history today.

The paper is almost as important for what it does not say as for what is said. There are no references; Myers seems to have thought that he was entering into a virgin field. There is no discussion of or reference to the work of da Costa in North America forty years previously, following the American Civil War. As Hyams and his co-workers have pointed out, post-deployment syndromes have been described after most wars. It is our repeated folly to forget the achievements of past generations, and to need to relearn what has been previously forgotten. Let us hope that we have at last learnt not to forget what has previously been discovered.

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The Australian Defence Deployment Health Surveillance Program – InterFET Pilot Project

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Introduction

In 1999, the then Minister for Defence Science and Personnel, Minister Bruce Scott, announced that health reviews would be conducted for all Australian Defence Force (ADF) personnel on future overseas deployments. Traditionally deployment health studies have been retrospective studies examining health issues that have arisen from veterans' concerns on return from deployment.

The Deployment Health Surveillance Program (DHSP) aims to replace this approach with a systematic, prospective collection of data on exposure and health outcomes. The DHSP is designed to provide longitudinal surveillance of health of ADF personnel including individual health measurements that are practical for large epidemiological studies.

The DHSP is being undertaken by the Centre for Military and Veterans' Health (CMVH). This began in 2004 when a Think Tank was conducted to review the various international perspectives of investigating the health and well-being consequences of military deployment.[1] The DHSP now includes four major projects involving The University of Queensland and The University of Adelaide nodes of the CMVH. The first project was a pilot study to establish methods for the wider program. It involved ADF personnel deployed as part of the International Force East Timor (InterFET) Operation compared to a control group of Defence personnel not deploying.

Research aims

Research aims of the InterFET pilot project were to:

1. Develop an assessment of hazards encountered during the operations;
2. Collect and test instruments to measure health and exposure for long-term surveillance of veteran health;
3. Develop a nominal roll of ADF personnel deployed on the InterFET operations;
4. Compare the mortality of those on the InterFET nominal roll with mortality in the comparable Australian national population;
5. Pilot test the collection of data for a sample of the InterFET population and a sample of other ADF personnel who did not deploy on these operations;
6. Establish data linkages across various sources of veteran health information; and
7. Establish an integrated data system and test it to a limited extent (but not to the stage of testing hypotheses).

Hazard assessment

The ADF personnel deployed to East Timor as part of Australia's commitment to the InterFET were exposed to a wide variety of operational, environmental and occupational health hazards. Overall, the principal health threat to the deployed force was environmental, with a large number of health care attendances for conditions related to the tropical environment of East Timor.

A feature of InterFET was the initial rapid force preparation and deployment into war-like conditions in a harsh tropical climate. There was limited opportunity to gather health information locally or for health intelligence to be incorporated extensively into force preparation at all levels. Consequently, there was a lack of detailed information on the health threat available to commanders once in theatre.

We found many existing sources of useful information for hazard assessment within the ADF. However, these were generally retrospective assessments of hazards rather than based on contemporary environmental measurement. This work highlights that adequate health risk assessment of an operational area is critical to military deployment. The timely identification of risk, communicated to the appropriate levels of command is essential to effectively mitigate health risks to personnel. A mechanism for rapidly identifying and quantifying

expected and unanticipated hazards and exposures is also essential to effective prevention and management of perceived risks.

Instruments for surveillance

Internationally, the body of research around post-conflict health outcomes lacks systematically collected data.[2] The broad approach we chose for the DHSP was to collect information from various sources which are then collated into an integrated database that can be used for signal detection of unusual patterns, and from which data may be extracted for specific research studies. Sustainable sources of information selected were: existing Defence-owned data, existing civilian registries and self-reported data from veterans and comparison sample groups. Such a multifaceted approach has not previously been attempted.

Extensive consultation was undertaken nationally and internationally in the development of a self-reported questionnaire. The Australian Vietnam Veterans' Health Study had obtained data using direct interview methods.[3] In contrast self-administered questionnaire were used by the Military Health Research Group at King's College London in their study of the health of veterans of the (1991) Persian Gulf War and more recent conflicts in that region.[4,5] The survey tools employed by this group were subsequently used by the Australian Gulf War Veterans' Study lending some relevance to the Australian circumstance, although the Australian study was limited to a smaller deployment of mostly Naval personnel.[6] Other considerations for the content of a self-reported questionnaires were the tools presently being employed in Australian research and particularly those being used by the ADF. Questionnaire items include the Traumatic Stress Exposure Scale,[7] 10 point Kessler scale (K10) of psychological distress,[8] the Alcohol Use Disorders Identification Test (AUDIT),[9] and the Post-traumatic Stress disorder checklist similar to that used in the Australian Gulf War Veterans' Health Study.[10]

A comprehensive analysis of oral health has not been a part of many previous veterans' health studies and was considered to be important for the purposes of the DHSP. The tool included for this purpose has been the Oral Health Impact Profile (OHIP-14).[11]

Additional information was requested regarding medications currently being used, hospitalizations, family history of selected psychological conditions and malignancies, reproductive and child health outcomes. General demographic information sought included confirmation of date of birth, gender, marital status and the highest educational qualification. A limited civilian occupational history was requested and a more extensive demographic and historic self-reported description of deployments undertaken with the ADF, including environmental or occupational hazards. There was provision for self-report of any other information not covered by the questionnaire, but deemed to be relevant by the respondent.

The survey included a list of 64 self-reported symptoms and 61 medical conditions. These lists were created by expanding the list from the UK Gulf War veterans' studies using information from the hazard assessment for the InterFET operations and also compensation claims from the Australian Department of Veterans' Affairs. The common pension claims from veterans of the earlier ADF East Timor deployments are summarized in Figure 1. This shows that the majority of claims by Australian veterans of the conflict in East Timor are for auditory damage, psychological conditions, musculoskeletal injuries, communicable and non-communicable tropical diseases.

Development of the InterFET nominal roll

In excess of 7000 Defence personnel were estimated to have deployed on InterFET, however, the nominal roll received from the Department of Defence included only 4124 veterans with a very small numbers of RAAF and RAN personnel. This nominal roll was essential for linkage to the National Death Index (NDI) and for selection of a random sample for the survey and assessment of Defence owned data.

A random sample was selected of 100 names from the InterFET nominal roll (veterans group) and a random sample of 100 ADF personnel who did not to deploy on these operations (comparison group). However two veterans were incorrectly placed in the comparison group and 23 of the comparison group were found to be ineligible since they were not in the ADF at the time specified for inclusion in the study (the onset of InterFET). This level of ineligibility is not sustainable for the scale of the larger studies and processes for the collation of the nominal rolls for further studies have been refined.

Mortality review

The mortality review was conducted as a comparison of the study nominal role (4124 veterans) and the National Death Index. The mortality statistics for the InterFET are based on total person-years of 25,375, an average of 6.2 years per person. Based on death rates for the Australian population of the same age and sex distribution the expected number of deaths by 2006 for the entire nominal roll was 32, compared to an observed number of just two.

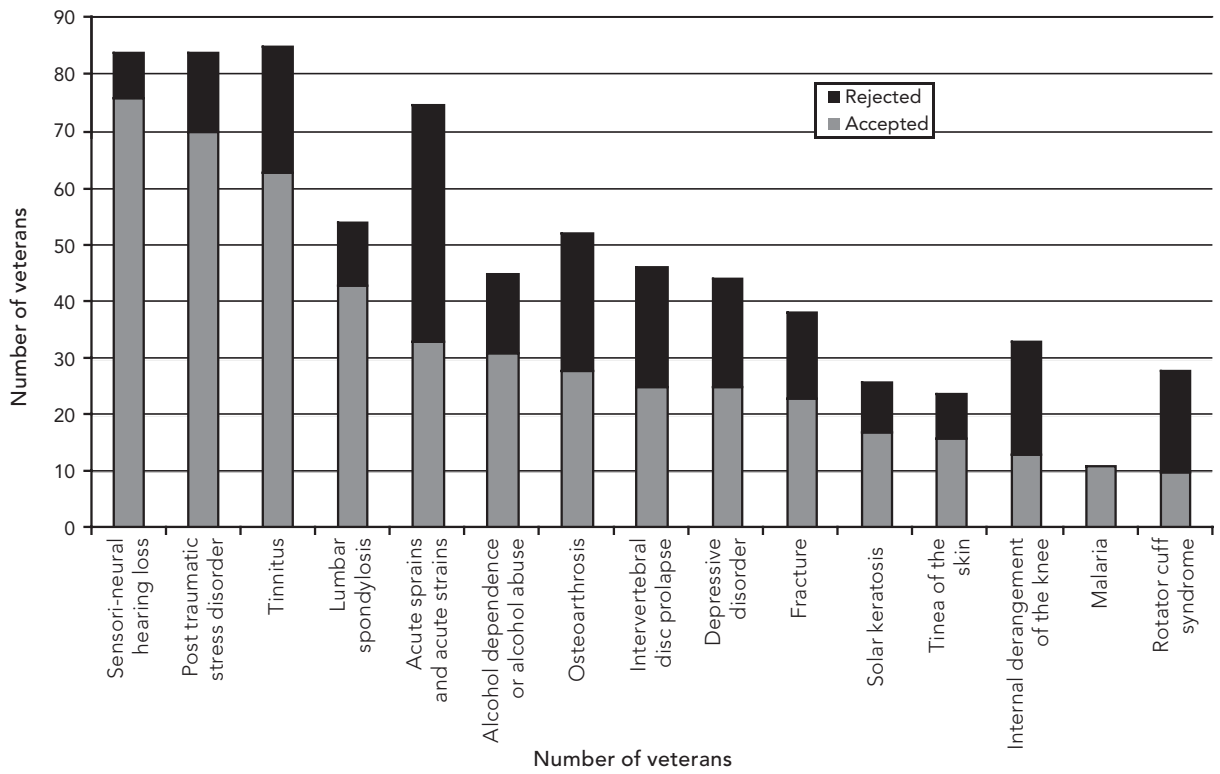

Figure 1. *Top 15 accepted and rejected disability claims in 2004/05 using Repatriation Medical Authority Statements of Principles – East Timor veterans only*

A number of possible reasons for this difference are:

- Personnel eligible for inclusion on the nominal roll, and who had died were not included on the nominal roll;
- ADF personnel are a group that is generally more mobile than the Australian population and hence may be more likely to have an unregistered death because, for example, they died overseas;
- The National Death Index failed to find real matches because of surname changes or misspellings on the project nominal roll or death register; or
- The healthy soldier effect - ADF personnel may well be healthier than the general population, and hence we might expect to see fewer deaths in the short term.

The largest differences between observed and expected numbers of deaths were in men aged 25 to 34. This difference could support the hypotheses of either a more mobile population or a healthy soldier effect.

Defence-owned health data

A significant part of the InterFET pilot project was to explore the use of Defence-owned routinely gathered health data to support longitudinal health surveillance of ADF personnel.

A search of archived routine health assessments produced 96% of the latest available records for the veterans sample and 93% for the comparison group. However, vaccine records were located for only 1% of the sample. Of those records obtained, almost 90% were from the two years immediately before the date of sampling (the end of 2005) and thus were reasonably recent (Figure 2). The Defence, health records are potentially a rich and contemporary source of data.

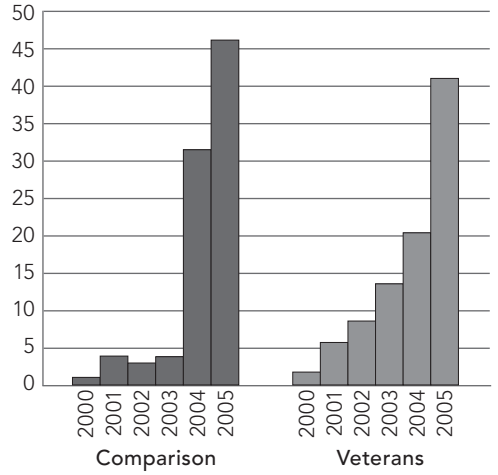

Figure 2. *Numbers of latest available Defence-owned health records for the comparison and veterans groups by year.*

Vaccine records will need to be sourced elsewhere for future projects. It is proposed to explore using HealthKeys (the electronic health database being implemented in Defence) directly for this information in addition to accessing the missing health records from the archives.

The self-reported questionnaire

Two hundred questionnaires were mailed out (100 each for the comparison and veteran groups) to addresses provided by Defence. Incorrect addresses were subsequently identified for 58 of the sample of 200 (35 from veterans group and 23 from the comparison group) among the ADF personnel still serving at the time of the study. One possible reason for these addresses to be incorrect was the posting cycle that occurred immediately after the nominal roll was provided to CMVH. It was not possible to determine how many addresses provided for civilians were also incorrect. Dead mail was received back for 11 packages including six identified as having incorrect addresses and five not previously known to be incorrect addresses. From the total of 137 (200-58-5) mail-outs not known to be sent to incorrect addresses, there were a total of 19 responses (14%); seven from each of veteran and comparison groups and five telephoned refusals.

The current British Op Telic study recently published initial findings indicating that even with media promotion, pre-notification, financial incentives, enclosed letters of support, within two years of the Operation and at the height of public debate regarding Gulf War Syndrome and British involvement in the war, only a 35% response rate was received from an equivalent first mail-out of questionnaires.

While the response rate for mail-out of the self-report questionnaire is very low, this aspect of the InterFET pilot project still achieved its desired aims in terms of:

- developing a foundation questionnaire,
- trialing the questionnaire,
- developing and trialing a recruitment strategy.

Factors considered to have contributed to the low response for the self-report questionnaire include no pre-recruitment media strategy; incorrect addresses for participants; no participant reimbursement; and size and structure of questionnaire.

Conclusions

The Deployment Health Surveillance Program has opened opportunities to link Defence-owned, routinely gathered health information and occupational-environmental hazard reports with self-reported and potentially other purposively collected information from veterans, and information contained in civilian registries regarding veterans and Defence personnel. The promise of this epidemiological opportunity has now been tempered by the reality of significant limitations identified in the InterFET pilot project.

The project was developed to act as a foundation for a prospective longitudinal surveillance program. The design is a significant innovation from previous retrospective veterans' health. All aspects of the design are capable of being repeated and used to obtain longitudinal information. Key elements have been designed to immediately permit longitudinal comparison with Defence data collected before and after operations and to articulate with tools presently employed by Defence for health assessments.

Finally, the design features not previously used in veterans' health studies and developed in this project have been tailored for ready use across operations beyond those of InterFET, for the differing nature of operational conditions from service-assisted evacuations and humanitarian assistance to war-like operations. In particular, they recognize the need to consider the health effects of multiple deployments which a common experience of ADF personnel presently.

We have successfully identified many strengths and limitations of accessing civilian registries, Defence-owned and self-reported data on recent veterans. The InterFET pilot project and the lessons learnt from this aspect of the program have being used to design subsequent studies of veterans of deployments of the Solomon Islands, Bougainville, East Timor and Middle East area of operations. The Defence Deployment Solomon Islands Health Study is already underway.

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Rehabilitation of injured or ill Australian Defence Force (ADF) Members

James S Porteous

The Director of the ADF Rehabilitation Services, Mr Jim Porteous, presented this article at the Defence Health Symposium in Brisbane on 21 October 2006.

This article explains the purpose of rehabilitation in the ADF; building a seamless rehabilitation management process; the essence of best practice rehabilitation programs; and the outcomes we expect to achieve.

Purpose

In October 2004, we began redeveloping the ADF's rehabilitation system to enhance the management of members being rehabilitated, as well as meet the new legislative requirements of the *Military Rehabilitation and Compensation Act 2004* (MRCA). A Steering Committee, with representatives from the ADF and the Department of Veterans' Affairs (DVA), was formed to oversee the redevelopment of the rehabilitation system.

Clinical rehabilitation and a formal return to work (RTW) on restricted duties program have been provided for some time as part of medical treatment through ADF health facilities for illnesses and injury. Specific ADF units provided rehabilitation programs based on unit requirements. The primary drivers of rehabilitation to date have been Army units, due to their inherently higher physical demands and injury rates.

The ADF Rehabilitation Program (ADFRP) is much more than clinical treatment or health care of military personnel. It is an holistic assessment and management system that combines the elements of health care, occupational health and safety, and personnel capability management (Figure 1). Unlike the civilian sector, rehabilitation is provided to our military personnel regardless of whether the injury or illness is work related and compensable.

Figure 1. *Alignment of purpose*

From a health care perspective, the ADF has a responsibility to provide health care to its members in order to maintain the required level of operational readiness. Rehabilitation focuses on the restoration of physical and mental functioning. It is a key component for facilitating the return of members to a state of readiness (for deployment on a military mission) as soon as is practicable after injury or illness.

The new program has also been developed to ensure the ADF meets its duty of care to members and its responsibilities under the Commonwealth occupational health and safety legislation and the Military Rehabilitation and Compensation Act. As an occupational health and safety initiative, it seeks to reduce the impact of occupational injury, illness and disease, and to minimise the members' need for compensation.

Most importantly, the new program is workplace or occupational-based as this provides the most realistic environment to assess fitness for work. It focuses on the restoration of productive work functioning. Through rehabilitation more members of the ADF will be employable and deployable, resulting in an increase in military capability. In addition, effective rehabilitation will reduce the number of medical discharges.

We use a case manager to provide continuity of care throughout a member's rehabilitation through the timely provision of identified services and the coordinated participation of the member, health staff, command elements and rehabilitation decision-makers in the development and delivery of rehabilitation plans.

Through effective rehabilitation the ADF maximizes the personnel dimension of capability with the intent to return an injured or ill member to maximum effectiveness within the ADF environment, or if this is not possible, the civilian environment.

The purpose is to maximise the ADF's ability to fight and win by reducing the impact of occupational injury and illness.

Process overview

The new program involves early identification, treatment and management of injury or illness, through a coordinated response involving all relevant parties.

Triggers - Members, health staff and commanders at all levels have a responsibility to ensure that intervention through assessment occurs as soon as practicable after injury or illness. The requirement for a Rehabilitation Assessment is triggered when:

- A treating Medical Officer considers it necessary.
- A member is to be on sick leave/restricted duties/convalescence > 28 days.
- A member requests an assessment.
- A member's Commanding Officer requests an assessment.
- A needs assessment by the Military Rehabilitation and Compensation Commission recommends that rehabilitation may be beneficial.

Assessment – Rehabilitation must occur at the earliest possible time in order to optimise the outcomes. Wherever possible, rehabilitation will be workplace-based as this provides the most realistic environment to assess fitness for work.

Rehabilitation Plan – An important element of the Program is an individual's Rehabilitation Plan. It is aimed at returning injured or ill members to suitable ADF employment, or if appropriate, providing a seamless transition to the civilian environment. All Rehabilitation Plans commence with a thorough assessment of a member's suitability and capacity to undertake rehabilitation.

Outcome – The three goals of the ADFRP (in priority order) are:

Goal 1 – Fit for duty in the pre injury/illness work environment.

Goal 2 – Fit for duty in a different position and/or environment.

Goal 3 – Transition out of the ADF with the optimal level of function.

Building a seamless rehabilitation process

Rehabilitation is a multi-disciplinary strategy to maximise an individual's potential for restoration to their pre-injury physical, vocational, social, psychological and educational status (Figure 2). It is much more than clinical management.

Figure 2. *Multi-disciplinary seamless rehabilitation strategy*

Member – When examining the various elements of the ADFRP, we start with the military member as the central element. They have a responsibility to maintain their fitness and ability to deploy on overseas operations, and we want to support, rehabilitate and retain them.

Health Care – Is focused on the achievement of optimal physical and mental recovery.

Compensation and the Transition Management Service (TMS) – Through compensation eligible ADF members may be provided with financial compensation, payment of travel to attend medical appointments, home and car modifications, household services and attendant care at home. In addition, DVA provides transition management services that prepare all members being discharged on medical grounds for civilian life.

Command – The focus of this element is on return to suitable work at the earliest possible time. Service Chiefs are responsible for the prevention and management of work-related injury and illness. Commanders and supervisors are responsible for the health and welfare of members under their command. This includes the provision of a safe workplace and

the maintenance of personnel fitness, occupational and military skills, and career management.

Psychosocial - Restoring the individual's ability to function in the community and their confidence to participate and take control of their rehabilitation.

Case management and coordination - The ADF Rehabilitation Coordinators are responsible for the contracting and coordination of contracted rehabilitation case managers. They support commanders and supervisors in coordinating the rehabilitation of their people, together with Health and Personnel agencies.

Examining the essence of best practice Rehabilitation Programs

One of the many studies that provided the essence of best practice was the 2004 "Workplace-based Return to Work Interventions: A Systematic Review of Quantitative and Qualitative Literature" study by the Canadian Institute for Work and Health. They made a number of recommendations in relation to successful injury management and rehabilitation interventions. These are:

- All workplace-based return to work (RTW) strategies include early contact with the worker by the workplace, a work modification offer, and contact between the workplace and healthcare providers;
- Workplace-based RTW strategies include a strong ergonomic component, as facilitated by ergonomic workplace visits;
- Education for supervisors and managers as part of the interventions;
- Building the confidence in the rehabilitation process and a shared understanding among all parties (injured person, supervisor, physicians and insurance providers), and gaining their commitment;
- Providing adequate and consistent information (including rights and obligations) when communicating with the injured person about return to work;
- Creativity and sensitivity to the needs of all parties be considered an integral part of modified work planning;
- There is careful coordination and consideration of the needs of all parties, and that the feasibility of rehabilitation plans and the ability of the person to successfully negotiate the process is addressed;
- Supervisors are important to the process and are included in RTW planning and offered related training; and
- Rehabilitation and occupational healthcare experts are involved in the process as they are a bridge between the workplace and healthcare providers.

From our experience, these were essential to the development and the successful implementation of our program.

The ADF Rehabilitation Program involves early identification, treatment and management of injury or illness, through a coordinated response involving all relevant parties, in order to reduce the likelihood of an injury or disease becoming a long-term injury or illness. Wherever possible, rehabilitation should be workplace-based as this provides the most realistic environment to assess fitness for work.

An important element of the program is an individual's Rehabilitation Plan. This is a managed process involving early intervention with appropriate, adequate and timely services based on assessed needs. It is aimed at returning injured or ill members to suitable ADF employment, or if appropriate, providing a transition to the civilian environment.

The principles of the ADFRP are:

a. Early intervention to reduce the impact of injury, illness and disease and contribute to enhanced capability.

b. Utilisation of evidence based process to establish clear and accurate expectations of the outcome of rehabilitation and reduce psychosocial complications.

c. Rehabilitation assessments and plans based on an individual's needs and the inherent requirements of service.

d. Coordinated participation of the member, health staff, command elements and rehabilitation decision-makers in the development and execution of rehabilitation plans.

e. Maximising the potential for a positive rehabilitation outcome for the individual, ADF and the community.

f. Clear roles and responsibilities reflected in organisational performance agreements combined with accountability as measured against the performance indicators of the Services and Groups.

The principles of the ADF Rehabilitation Program have been developed to suit our Defence Force. And they are based on best practice programs.

Outcomes

We have developed our new program as a strategic initiative that will contribute to the following outcomes:

Increased Capability – Increase the ADF's capability by reducing Workdays Lost Through Injury, as well as support the retention of experience through reduced separations. The aim of the Program is to return all members to duty, either in their pre-injury role or in a new role identified as part of their rehabilitation.

Support Retention – Reduce the number of separations through fewer medical discharges, thereby saving the ADF many millions of dollars a year in separation costs.

An Employer of Choice – Support the ADF in meeting its duty of care thereby enhancing its reputation in the community as an employer of choice where 'people matter'.

Continuity of Care – Dedicated case management for members requiring rehabilitation will coordinate the support of the Chain-of-Command, Health and Personnel services and if required, Department of Veterans' Affairs. Case management will also provide continuous support for members requiring transition to civilian life.

OHS Strategic Plan – Priority 3 is to "Reduce the impact of occupational injury, illness and disease".

Early Intervention – Provide rehabilitation programs based on early intervention and focusing on the physical, mental and occupational rehabilitation of members.

Legal Compliance – Support the ADF in meeting its legal obligations under the Defence Act 1903, OH&S Act 1991, the Safety, Rehabilitation and Compensation Act 1988, and the Military Rehabilitation and Compensation Act, 2004.

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What is the effectiveness of lung assist devices in blast lung injury: A literature review

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Abstract

Blast lung injury (BLI) is a direct consequence of a blast wave from high explosive detonations upon the body. The physics of a blast wave are nonlinear and complex. The primary blast effects are most significant at air-fluid interfaces such as the ear, lung and gastrointestinal tract. Of these air-fluid containing organs, the lung is most susceptible to the primary blast effects and the extent of lung injury is considered a decisive parameter in defining morbidity and mortality for blast victims both at the scene and among initial survivors. The clinical sequel of BLI is a rapid respiratory deterioration and progressive hypoxia with resultant ventilation perfusion mismatch and subsequent acute respiratory distress syndrome (ARDS). All patients with significant BLI require mechanical ventilation and admission to ICU. The rationale for using the LAD in BLI is not primarily to improve oxygenation, but more to minimise ventilator associated lung injury, and to ameliorate and eliminate the inflammatory process that is enhanced by mechanical ventilation. The notion of a lung assist device (LAD) was first raised in 1967 by Rashkind who proposed a pumpless oxygenator for temporary lung assist in cystic fibrosis, ARDS and congenital heart disease. The aim of this paper is to identify through an extensive literature review: (1) the effectiveness of LAD in BLI; and (2) the recommended treatment modalities for BLI. This paper will also provide current information ensuring that medical and nursing staff within the Australian critical care setting become familiar with the management of BLI.

Introduction

Blast lung injury (BLI) presents a unique triage, diagnostic and management challenge for health professionals working in critical care. BLI is a condition that is seen most frequently in a combat or military environment, however, urban terrorist activities such as the recent Bali, Madrid and London train bombings, plus industrial and domestic explosions can occur at any moment in the civilian setting. BLI is a direct consequence of a blast wave from high explosive detonations upon the body. The physics of blast waves is nonlinear and complex.[1] The blast wave consists of two parts, a shock wave of high pressure followed closely by a blast wind, or air in motion.[2] The effects of blasts fall into the following four categories: primary (direct effects of pressure), secondary (effects of projectiles), tertiary (effects due to wind), and quaternary (burns, asphyxia, and exposure to toxic inhalants).[1] Primary blast injuries are estimated to contribute to 47-57% of the injuries in survivors and 86% of fatal injuries.[3] The primary blast effects are most significant at air-fluid interfaces such as the ear, lung and gastrointestinal tract. Of these air-fluid containing organs, the lung is most susceptible to the primary blast effects and the extent of lung injury is considered a decisive parameter in defining morbidity and mortality for blast victims both at the scene and among initial survivors.[4, 5]

BLI is characterised by the clinical triad of (1) apnea, (2) bradycardia, and (3) hypotension and may occur without obvious external injury to the chest.[5] Additionally, the blast waves' impact upon the lung results in tearing, haemorrhage, contusion, and oedema. The clinical sequel of BLI is a rapid respiratory deterioration and progressive hypoxia with resultant ventilation perfusion mismatch and subsequent acute respiratory distress syndrome (ARDS).[3,6,7] The rapid ARDS picture that develops in BLI patients is a direct result of the high pressure wave front passing through the interfaces between air, alveolar, tissue and blood vessels. This pressure front causes chest wall displacement toward the spinal column, leading to transient high intrathoracic pressure. The elevated intrathoracic pressure leads to tearing of the alveolar septa, stripping of airway epithelium, and rupture of alveolar spaces with consequent alveolar hemorrhage, edema, and alveolovenous fistulae.[7,8] Currently, there is no standardised assessment criteria for the diagnosis of BLI, however, is typically confirmed by clinicians from the following: chest radiographs showing a butterfly appearance (with or without pneumothorax) on admission and increased haziness in serial chest radiographs; the presence of burn injuries; and smoke inhalation of the upper airways as seen at bronchoscopy.

Interventional Lung Assist Devices

The notion of a lung assist device (LAD) was first raised in 1967 by Rashkind *et al*[9] who proposed a pumpless oxygenator for temporary lung assist in cystic fibrosis, ARDS and congenital heart disease. This vision could not be realised with the technologies available at the time; however, over the past decades critical care medicine has made tremendous contributions to improve outcomes in patients suffering from acute lung injury (ALI).[10] Key technologies for LAD include diffusion membranes to avoid plasma leakage in prolonged applications, long-term coating technologies and homogeneous distribution of blood flow. Currently, three concepts for LAD are being explored: (1) Interventional LAD for percutaneous attachment to the systemic circulation creating an arteriovenous shunt. This device is for single use and does not require a blood pump due to its insertion into the femoral artery and vein; (2) Intravascular gas exchange devices for single-needle venous access have been designed for implantation in the vena cava or the pulmonary artery. A pulsating balloon in the membrane bundle or an impeller blood pump can be employed to optimise blood flow around the gas exchange fibers or across the device; and (3) Total artificial lungs to completely replace pulmonary gas exchange function.[11] LAD are viewed as an adjunct to mechanical ventilation that allow for optimised lung protective ventilation, thus giving the lungs time to heal and provide a bridge to recovery, or a bridge to transplantation after acute lung injury. Dembinski *et al*[12] tested the safety and efficacy of a LAD (Delta Stream Rotary Blood Pump) in a controlled trial on animals with experimental ALI. The results from this study showed that in animals (N = six pigs) with ALI, hoemodynamics remained stable and gas transfer across the LAD was optimal with two animals showing a marked increase in PaO_2 and carbon dioxide (CO_2) removal was effective in all animals. Although the results from this study cannot be generalised to all ALI they give an insight into the potential benefits that LAD pose in treating ALI and BLI.

Impetus for the literature review

During the period March till July 2005 at the 332nd Expeditionary Medical Group (EMDG), a United States Air Force Hospital (USAF) based in Iraq, several patients suffering severe BLI due to improvised explosive devices (IED) were treated. The management of these patients within the intensive

care unit (ICU) became extremely difficult as they developed permissive hypercapnia, severe acidosis and ARDS. To prevent further deterioration and minimise ventilator induced lung injury these patients were trialed on an interventional LAD called the NovaLung.® This device showed promising results with significant improvements seen in patients' acidosis, oxygenation and reduced ventilator support. Consequently, these improvements enabled the patients to be aeromedical evacuated to a level four military hospital in Germany. The trials conducted at the 332nd EMDG have not been formally reported in the literature; however it is suggested that timely diagnosis and correct treatment of BLI will result in improved outcomes.[13]

Aims

The aim of this paper is to identify through an extensive literature review: (1) the effectiveness of lung assist devices in blast lung injury; (2) the recommended treatment modalities for BLI; and (3) that this paper will provide current information ensuring medical and nursing staff within the Australian critical care setting become familiar with the management of BLI.

Review process

Literature on lung assist devices and treatment modalities for BLI in the critical care setting from January 1995 until March 2006 was reviewed using the CINAHL, MEDLINE, Cochrane Library, Blackwell Synergy, and ProQuest databases. Key words utilised were: blast lung injury, acute lung injury, blast lung, barotrauma, lung assist devices, trauma management, treatment modalities, acute respiratory distress syndrome and extracorporeal membrane oxygenation. Combinations of these words were also used (e.g. lung assist devices – blast lung, acute respiratory distress syndrome – lung assist device, extracorporeal membrane oxygenation – blast lung, treatment modalities – blast lung). The lack of research conducted in this area was demonstrated by the fact that the review produced no primary source articles reporting the use of lung assist devices in blast injured patients. Consequently, the review process was broadened to incorporated all research conducted on subjects with injuries that would reflect a blast lung type injury (e.g. ALI, ARDS, and barotrauma). This broadening of the review process identified only three relevant primary source articles reporting the use of LAD for ALI/ARDS in clinical trials and three retrospective case studies of BLI patients. This paper reviews these articles and Table 1 displays the authors, design, sample and main findings of the reviewed articles.

Literature review

What is the effectiveness of lung assist devices in blast injured patients?

The articles reviewed indicated that lung injury developing within 24 hours after an explosion is typically classified as ARDS or ALI, depending on the severity of injury.[13] The three retrospective BLI case studies reviewed indicate that despite the severe hypoxemia caused by explosions, timely diagnosis and correct treatment will result in improved outcomes.[8,13] Furthermore, Avidan *et al*[8] was the only retrospective study to follow up the long term outcome of his cohort. Of the 28 survivors (one patient died 24 hrs after admission from sepsis and multiorgan failure), 75% responded to their telephone interview (median time of follow up was three years). This follow up reported that sixteen patients (76%) were free of respiratory symptoms and only five patients (24%) reported some degree of respiratory dysfunction leading them to conclude that BLI will have good outcomes if treated promptly and correctly.[8]

Clinical classification of BLI

Initiating the appropriate treatment for patients with BLI is dependent upon the severity of the blast injury and correct diagnosis. In assessing the presenting symptoms of BLI, Pizov *et al*[14] attempted to develop a BLI severity score and suggests that stratification of the severity of lung injury produced by blasts may be useful in the treatment and prediction of patient outcomes. The proposed BLI severity score is based on three objective signs: hypoxemia (PaO_2/FiO_2 ratio), chest radiograph findings, and the presence of bronchopleural fistula. The score defined three levels of injury: (1) Mild: PaO_2/FiO_2 ratio >200 mmHg, localised lung infiltrates and no pneumothorax; (2) Moderate: PaO_2/FiO_2 ratio of 60 to 200 mmHg and diffuse (bilateral/unilateral) lung infiltrates with or without pneumothorax; and (3) Severe BLI: PaO_2/FiO_2 ratio < 60 mmHg, bilateral lung infiltrates and bronchopleural fistula. Hypoxia exists in all patients with BLI and both Pizov *et al*[14] and Sorkine *et al*[13] have incorporated this objective measure into their lung injury scores. In Sorkine *et al*[13] retrospective analysis patients were assigned lung injury scores (LIS) according to the criteria of Murray *et al.*[15] The Murray score is a scale of 0 to 4 for four parameters: (1) evaluation of chest radiographs, (2) PaO_2/FiO_2 ratio, (3) level of positive end expiratory pressure (PEEP), and (4) lung compliance. The LIS was obtained through modification of the Murray score by adding individual criteria scores and dividing the sum by the number of variables used: no injury = 0, mild to moderate = 0.1 to 2.5, severe > 2.5, and maximal

Table 1. *Lung assist devices in ARDS and ALI, BLI case studies*

Author(s)	Year	Design	Sample	Main Findings
Ruettiman *et al*[20]	2006	Case study	N=1 (15 year old girl with MODS, ARDS) N=29 patients with BLI and required ICU admission.	* An arteriovenous pumpless extracorporeal LAD assisted in decreasing $PaCO_2$ and reduced mechanical stress by applying minimal MV; * LAD was simple to operate and has potential for routine use in treatment of ARDS.
Avidan *et al*[8]	2005	Retrospective study	N=1 (male fire eater, aspirated on paraffin oil – ARDS)	* 76% of patients required MV (mean 11.4 days); * Aids/special modes of MV included HFJV, NO; * Long term outcomes of 28 survivors (75% responded to interview) 76% nil symptoms, 24% with respiratory dysfunction; * PCV failed to improve oxygenation, hypercapnia and severe acidosis developed.
David *et al*[19]	2004	Case study	N=20 (41+/- 16 yrs) with ARDS and failing conventional therapy (i.e. surfactant replacement, prone positioning)	* HFJV improved PaO_2 but not acidosis; * NovaLung™ enabled less aggressive ventilation, $PaCO_2$ normalised after initiation; * After six days, patient transferred to conventional MV, and ILA ceased at day 13.
Liebold *et al*[18]	2000	Prospective, controlled study	N=15 patients (median ages 29 years) with primary BLI resulting from explosions on two civilian buses in 1996	* After 24 hours of being connected to MO (Quadrox Special™, Jostra Inc) significant improvement in oxygenation ($p < 0.05$); * 15 patients weaned off MO, five patients died on system, 60% (12 of 20) survived procedure and discharged; * Simple system facilitating easier nursing care and fewer risks of technical complications.
Pizov *et al*[14]	1999	Retrospective study (BLI score developed retrospectively - modified Murray Score)	N=17 (11 male, 6 female) with severe pulmonary blast injury.	* Stratification of BLI severity may be used in future studies of BLI patients and guide appropriate management (use in triage) and serve to predict the final outcome; * severity of primary blast had dominant effect on development of ARDS; * all three patients with severe BLI who survived the first 24 hr developed ARDS as did 33% of moderate BLI, no mild BLI patients developed lung injury.
Sorkine *et al*[13]	1998	Retrospective study	three major bomb incidents in Tel Aviv from 1994 to 1996	* four patients developed increasing $PaCO_2$ levels (to 93+/- 12 mmHg) associated with a reduction in arterial pH that was corrected by increasing MV RR; * Evidence of ventilator induced pulmonary barotraumas; * 88% survived, 12% died from severe penetrating head injuries; * limited PIP in VCV is a useful and safe mode of MV in BLI patients

Key: MODS- multi-organ dysfunction, MV- mechanical ventilation, ARDS- acute respiratory distress syndrome, LAD – lung assist device, BLI – blast lung injury, ILA- interventional lung assist device, HFJV- high frequency jet ventilation, MV – mechanical ventilation, PCV – pressure controlled ventilation, MO- membrane oxygenator, VCV- volume controlled ventilation, RR – respiratory rate.

score = 4.0. On admission, the LIS for Sorkine *et al*[13] patient group was 3.2 +/- 0.3 indicating major lung injury while Pizov et al14 group showed 33% with mild BLI, 40% had moderate, and 27% had severe BLI. Pizov *et al*[14] criticises this modified Murray score or LIS because when applied to his patient group at 6 and 24 hours as it did not differentiate between patients with moderate BLI and those with severe BLI. Moreover, Pizov *et al*[14] argues that the most critical and dynamic period in which primary blast lung injury develops is during the first 24 hours. However, 24 hours post blast injury Pizov *et al*[14] study demonstrated good correlation between the proposed BLI score and the modified Murray score. The reliability and validity of both the BLI severity scoring system and LIS has not been established and its application in Pizov *et al*[14] and Sorkine *et al*[13] studies are limited due to the small sample size and retrospective analysis. Regrettably, Avidan *et al*[8] was not able to retrospectively apply the Murray score or any other measure of injury severity due to the failure of the hospital to hold a trauma registry and the lack of relevant data in patient charts. Therefore, the comparability of this study is questionable despite that it represents the largest reported series of blast lung injuries in the literature to date.

BLI patient management and treatment modalities

In the retrospective study conducted by Pizov *et al*[14] following primary resuscitation or surgery all patients with primary BLI (N=15) were admitted to the ICU. Similarly, in the Avidan *et al*[8] study of BLI patients (N=29) all required ICU admission. Although all the patients included in the Avidan *et al*[8] study were admitted to ICU, the authors acknowledge that a BLI patient may have been admitted to a ward bed and they were unable to retrospectively identify patients in this category. Additionally, even though the Sorkine *et al*[13] study group of blast lung injured patients (N=17) were all admitted to ICU, they represented only 5.6% of the total number of casualties injured during three bomb blasts in Tel Aviv. All three of the retrospective studies had similar distributions in the mechanism of lung injury with N=24 (83%) patients reviewed in Avidan *et al*[8] study injured in a closed space (defined as a bus or café); N=10 (59%) of patients in Sorkine *et al*[13] study were victims of an explosion in a bus; and all of the patients within the Pizov *et al*[14] study were in two civilian bus explosions.

Analysis of BLI patient records across all three retrospective studies revealed that to correct hypoxaemia and respiratory distress endotracheal intubation and mechanical ventilation was initiated either at the scene, during initial resuscitation in the emergency department, in the operating theatre, or in the ICU. In the Avidan *et al*[8] study, 22 patients (76%) required intubation and mechanical ventilation, 14 patients (93%) in the Pizov *et al*[14] study and 17 patients (100%) in the Sorkine *et al*[13] retrospective study. Sorkine *et al*[13] notes that in ARDS cases caused by other means, the large area of ruptured lung in BLI patients makes them prone to develop unique complications from mechanical ventilation. Furthermore, positive pressure ventilation and PEEP should be avoided whenever possible because of the risk of pulmonary alveolar rupture and subsequent arterial air embolism.[14] Air embolisms were clinically suspected in two patients (7%) in the Avidan *et al*[8] study, however, the mode of ventilation, level of PEEP, and outcomes of these patients is not documented in the results. In the Pizov *et al*[14] study of the five patients with mild BLI, one received oxygen through a face mask whereas the others received volume-controlled (VCV) or pressure support ventilation (PSV) with PEEP that did not exceed 5 cm H_2O. Of the six patients with moderate BLI two were ventilated with VCV and four with pressure controlled inverse-ratio ventilation (PCIRV) and received PEEP levels up to 15 cm H_2O.[14] Similarly, the levels of PEEP in the Avidan et al[8] cohort ranged from 0 to 15 cm H_2O (median 7.5 cm H_2O). It is impossible to compare this with the Sorkine *et al*[13] study as the results makes no reference to the PEEP levels used in the mechanical ventilation of its patients.

A possible explanation for this lack of data in the Sorkine *et al*[13] study is that he used a respiratory management strategy based on volume controlled synchronised intermittent mandatory ventilation (VC-SIMV) with small tidal volumes (V_T) and low peak inspiratory pressures (PIP) together with permissive hypercapnia. In limiting PIP through reduced V_T, the authors argue that ventilator induced lung damage is reduce. Furthermore, permissive hypercapnia which results in alveolar hypoventilation, respiratory acidosis, and lower ventilatory pressures may limit pulmonary over distension in severe lung injury.[13] The initial mechanical ventilation variables for the 17 patients in this study were a V_T of 6.4 +/- 0.6 ml/kg and a mandatory ventilator respiratory rate of 17 +/- 5 bpm, resulting in PIP of 35 +/- 0.3 cm H_2O.[13] Shortly after instituting mechanical ventilation with limited V_T, four patients developed elevated $PaCO_2$ (93 +/- 12.4 mmHg) which resulted in an associated reduction in arterial pH (7.13 +/- 0.08). Until this time Sorkine *et al*[13] made no attempt to control $PaCO_2$ levels until the arterial pH fell below 7.20, at which time the mandatory respiratory rate was increased in increments of two breaths per minute until the pH rose to greater than 7.50. These low pH values

responded to the increased respiratory rate and Sorkine *et al*[13] state that the patients experienced no adverse metabolic or haemodynamic effects as measured by changes in mean arterial pressure (MAP), cardiac index (CI), central venous pressure (CVP), or peripheral vascular resistance (PVR). Of the 17 patients, two patients (12%) died while in ICU from severe penetrating head injuries. Despite the authors' assurances that there was no organ system dysfunction related to the respiratory acidosis they have not outlined which statistical tool was used to measure the significance level in these baseline physiological measures. Therefore, due to the lack of controlled studies utilising this ventilatory strategy the conclusions made by Sorkine *et al*[13] should be viewed cautiously.

Special modes of ventilation or unconventional therapies were applied in both Pizov *et al*[14] and Avidan *et al*[8] more severely lung injured patients. In the Pizov *et al*[14] study four severe BLI patients developed extreme hypoxia (PaO_2/FiO_2 < 60 mmHg) together with bronchopleural fistulae resulting in the following management: independent lung ventilation (one patient), extracorporeal membrane oxygenation (ECMO) (one patient), and a combination of nitric oxide (NO) inhalation and high frequency jet ventilation (HFJV) (two patients). Similarly, three patients in the Avidan *et al*[8] study were trialed on HFJV (two patients), NO inhalation (one patient) and excluding the patient trialed on ECMO, both studies patients' oxygenation improved, flow reduced through the bronchopleural fistula and lower ventilation pressures were required. Although NO has become increasing popular for the treatment of severe ARDS, it is not the first choice for treatment of hypoxaemia in lung injury.[16] Moreover, only three BLI patients were treated with NO making it impossible to draw any conclusions from the results of these studies. Pizov *et al*[14] states that HFJV is recommended for ventilation of patients with bronchopleural fistula, however, most clinicians would argue that they can be ventilated adequately with conventional mechanical ventilation.[17] Despite this argument, the results from these studies demonstrated that four patients with severe BLI (two with a bronchopleural fistula) were successfully ventilated with HFJV. As with patients treated with NO, no direct correlation can be made in regards to the effectiveness of HFJV and improved outcomes of severely lung injured patients due to the small sample size of the studies and the significance of its combination with NO in the Pizov *et al*[14] study. The patient in the Avidan *et al*[8] study trialed on ECMO two hours after the explosion experienced severe refractory hypoxaemia, shock, massive haemoptysis, and intrapulmonary bleeding increased upon heparin administration. Ultimately this patient died and the use of ECMO as a last resort in a severely BLI patient was stated by Avidan *et al.*[8] Regrettably, the authors did not detail the type of ECMO device used or how it was managed in combination with mechanical ventilation.

Effectiveness of LAD in ARDS and ALI

The prospective study conducted by Liebold *et al*[18] was the first clinical report on the use of LAD applied to patients suffering from severe ARDS. Patients were selected for this study based on the consensus that if pulmonary injury could not be reversed the patient would die. Consequently, 20 patients (aged 41 +/- 16 years) with ARDS and failing conventional respiratory therapy (HFJV, surfactant replacement, prone positioning) were recruited through referral to either a cardiothoracic, surgical or medical ICU. The minimum heamodynamic requirements for inclusion in this study were a cardiac output (CO) > 6 L/min, and MAP > 70 mmHg which resulted in septic and cardiac failure patients being excluded from the study group. The authors aim was to test the feasibility and effectiveness of a pumpless extracorporeal LAD in patients with ARDS.[18] Liebold *et al*[18] justified the use of the pumpless membrane oxygenator (MO) (Quadrox Spezial™, Jostra Inc., Hirrlingen, Germany) because it is based on heparin coated hollow fibre technology thereby reducing the requirements for systemic anticoagulation, the risk of thrombus formation, and haemolysis of blood through a mechanical pump.

Similarly, the studies conducted by David and Heinrichs[19] and Reuttimann *et al*[20] are both a case report of a patient with severe ARDS who are trialed on the same pumpless interventional LAD (NovaLung™, GmbH, Hechingen, Germany). The similarities between these studies ceases there as David *et al*[19] utilises the LAD in combination with high frequency oscillatory ventilation (or HFJV), Reuttimann *et al*[20] aimed for apneic ventilation, while Liebold *et al*[18] reduced mechanical ventilation to achieve a more normal inspiratory: expiratory (I:E) ratio, reduced PEEP, and a reduced maximum airway pressure (Pmax). The mechanism of injury for each patient which resulted in the development of ARDS in these studies also varies dramatically. All Liebold *et al*[18] patients' developed ARDS from differing causes (e.g. pneumonia, lung contusion) while Reuttimann *et al*[20] case report details the treatment a 15 year old girl who fell 15 metres down a rock face and developed severe ARDS two weeks into her admission following a bacterial pneumonia. In contrast, David *et al*[19] reports on a 30 year old male who aspirated paraffin oil whilst fire eating, and rapidly developed hypoxaemia and ARDS (within eight hours). Initially, David *et al*[19] trialed pressure controlled ventilation (PCV), with PEEP levels increased to 20 cm H_2O, mean airway pressures of 27 cm H_2O, and despite repeated recruitment maneuvres, oxygenation did not improve

(PaO_2/FiO_2= 72 mmHg). Following this deterioration, the David *et al*[19] patient was commenced on HFJV to allow the application of a constant high mean airway pressure, avoid high cyclic inspiratory pressures, and end-expiratory lung collapse with reopening on inspiration. Within 24 hours, the $PaCO_2$ did not increase with concomitant respiratory acidosis (arterial pH 7.14) and neither lower oscillatory frequencies nor maximum amplitudes lowered the $PaCO_2$. Consequently, the authors decided to initiate the LAD to remove the carbon dioxide, correct the acidosis and offer less aggressive ventilation with HFJV. Similarly, Reuttimann *et al*[20] trialed PCV, with a high respiratory rate and low V_T, prone positioning, inhaled bronchodilators, high levels of PEEP, and inhaled NO but the patient remained critically hypoxaemic (PaO_2/FiO_2= 60 mmHg) and the $PaCO_2$ reached 145 mmHg. At this point the authors believed all conventional therapeutic efforts were exhausted; hence they initiated the pumpless LAD.

The David *et al*[19] results indicate that there was no further improvement in oxygenation after the LAD was started, however, CO_2 removal was effective and the arterial pH rose to 7.22 (from 7.14). Subsequently, to ensure sufficient blood flow through the membrane, the patients' CI was supported with inotropes (norepinephrine: max dose 1.5 mcg/kg/min) to achieve a flow of 2.5 L/min/m2. Once this flow was achieved the FiO_2 was reduced stepwise and at day 13 the LAD was removed. In a similar time frame, the LAD in the Reuttimann *et al*[20] case study remained in situ for 10 days, with the FiO_2 progressively weaned from 1.0 to 7.0 (day 5), then to 0.4 (day 10). Following 24 hours on the pumpless MO, Liebold *et al* reported significant improvement in oxygenation ($p < 0.05$), with MO therapy discontinued as soon as patients were stable for 24 hours (PaO_2 > 80 mmHg, FiO_2 < 0.5). A total of 15 patients were successfully weaned off the MO (median assist time being 12 +/- 8 days), while five patients died on the system (four from sepsis, one from VF arrest). A further three patients died after successful weaning on day 8, 30, and 50, respectively resulting in a overall survival rate of 60%.[18] Throughout this study, Liebold *et al*[18] experienced several technical problems including: thrombosis of the venous cannula (n = 5), thrombus formation within the MO (n = 2), MO plasma leakage (n = 2), and MO contaminated with Candida albicans. Due to these complications, the authors were forced to replace four MO (three MO had been running continuously for 22, 27, and 32 days) and no interruption in therapy was observed. Despite the drastically reduced sample size, both Reuttimann *et al*[20] and the David *et al*[19] results showed a survival rate of 100% plus they experienced no adverse effects during treatment with the LAD despite the David *et al*[19] patient having a reduced systemic anticoagulation for a percutaneous tracheostomy on day 12.

Conclusion

The paucity of controlled trials investigating the effectiveness of LAD in BLI patients is of great concern as the current global war on terror places both military and civilian personnel at an increased risk of exposure to a terrorist bombing event. Moreover, in the Australian critical care setting very few clinicians employed in trauma centres have any experience in both triaging and managing a severely BLI patient. The current assessment instruments for diagnosing the severity of BLI require further validation, however, are based on sound objective data and may assist in early management and triage. Treatment modalities of BLI should focus on correcting the effects of barotruama and supporting gas exchange. All patients with significant BLI require mechanical ventilation and admission to the ICU. Respiratory management of patients with severe BLI is challenging not only because of the lung injury (contusion, bronchopleural fistula), but also because it is often accompanied by shock and unconsciousness. Despite the risks associated with mechanical ventilation it remains the primary treatment modality for BLI patients. The literature indicates that current strategy for mechanical ventilation in BLI is to prevent further lung injury through a volume controlled synchronised intermittent mandatory ventilation with small tidal volumes (< 6ml/kg) and low PIP (< 40 cm H_2O) together with permissive hypercapnia (maintain pH > 7.2, $PaCO_2$ 56mmHg +/- 3.0). Complications of positive pressure mechanical ventilation and of higher PEEP levels in BLI patients are air emboli through the alveolovenous fistulae and pneumothorax. The rationale for using the LAD in BLI is not primarily to improve oxygenation, but more to minimise ventilator associated lung injury, and to ameliorate and eliminate the inflammatory process that is enhanced by mechanical ventilation. Regrettably, all the authors who have reported initiating the LAD have done so as a last resort (i.e. patient will die) when all other conventional and unconventional treatments have failed. Therefore, it is recommended that future research focuses on the following: (1) developing a valid and reliable BLI scoring system; (2) initiating an interventional lung assist device during the ALI phase (i.e. before ARDS develops); and (3) educating clinicians within the Australian critical care setting of the clinical sequel of BLI and the management of a mass casualty situation involving a terrorist bomb event.

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Unusual Poisons: Socrates' Curse

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Introduction

This is the first in a series of articles looking at some unusual poisons that may not be familiar to most military health personnel. This is of particular relevance, as soldiers deployed on exercises or operations in rural and remote areas may consider using local vegetation as part of their food supply to supplement normal rations.

Hypothetical case study

The paper is in the form of a hypothetical case history, but is based on symptomatology reported in other case histories.[1-3] The subject was a 25 year old Reserve soldier, who had been exercising in a semi-rural area on the outskirts of Perth in Western Australia. He told a fellow soldier that he was going to make a brew from some leaves from a plant growing nearby. He prided himself on his bush food knowledge. The plant looked like parsley or the tops of carrots. He made about 200 grams of the plant into a tea, which he consumed, but complained of a somewhat unpleasant taste. He complained of feeling sick and went to lie down, where he promptly went off to sleep. He awoke about an hour later, was noted to be unable to raise himself from the bed and was breathing slowly. He quickly went back to sleep. An hour later when he was checked, he was unable to be roused, not breathing and pulseless. Attempts at resuscitation were unsuccessful.

Discussion

The unfortunate subject in this hypothetical case has died from coniine poisoning. Coniine, a plant piperidine alkaloid, comes from Spotted or Poison Hemlock (Conium maculatum). Coniine is believed to have been the poison given to Socrates in 399 BC[4] and was the poison used to kill Amyas Crale in Five Little Pigs, one of Agatha Christie's Hercule Poirot mysteries.[5]

This ferny leafed weed grows up to 2-3 metres in height, has purple spots on leaves and stem, a small white flower and a mouse-like smell.[1] All parts of the plant are poisonous and the plant is widespread in Australia, particularly in southern moister areas; Asia and North America. Poisoning is rare in Australia, but Drummer et al outlined three fatal cases in Victoria in the early 1990's.[2] Coniine is highly stable to heat and poisonings have been associated with tea made from the leaves.[2,6]

Coniine has its principal effects on neuromuscular transmission, acting as a non-depolarising blocker. While structurally related to nicotine, its pharmacodynamic effect is similar to curare. The alkaloid initially stimulates and then paralyses the nicotinic receptors and may produce complete neuromuscular block.[1,2] It also has a narcotic-like effect, with the victim falling off to sleep before becoming unconscious and unrouseble.[2] Rhabdomyolysis and acute tubular necrosis have also been described.[3]

Symptoms usually appear within 10 to 60 minutes and include nausea, vomiting, salivation, lethargy, narcosis, muscle pains and weakness.[1,7] Signs may include tachycardia followed by bradycardia, mydriasis, hypotension, flaccid paralysis, fasciculations and shock.[1,7] Death is usually caused by respiratory failure. Supportive laboratory data may include myoglobinuria, elevated muscle enzymes and raised liver function tests.[3] Generally, there is no long-term renal or liver damage in survivors.[8]

Medical management is supportive. In cases of known ingestion, the treatment is oral activated charcoal, usually after airways protection.[7] In rare cases, gastric lavage may be considered, although prior airways protection is essential. As there is no specific antidote, respiratory and renal support should be initiated rapidly.[1] This should include adequate hydration and management of renal failure and rhabdomyolysis as required.

Diagnosis would generally be clinical and dependent on the described history, signs and symptoms. The differential diagnosis should include Nicotine poisoning, Golden Chain Tree (Laburnum anagyroides) poisoning; Poison Hemlock (Conium maculatum) poisoning or Curare poisoning. The generalised weakness also raises the possibility of snake envenomation and possibly organophosphate poisoning.

Nicotine poisoning would need to be excluded; however, tobacco plants are an unusual bush plant,

there was no history of ingestion of cigarettes, the nausea and vomiting would be more pronounced and muscular paralysis is generally associated with very large doses.[9] The Golden Chain Tree (Laburnum anagyroides), which contains the alkaloid cystisine, is principally seen in Europe and North America but is occasionally seen in Perth gardens, although it is also unlikely to be in the bush. Poisoning is usually associated with the consumption of the seed, but all parts of the plant are toxic. Gastrointestinal symptoms are likely to be more pronounced. Curare is very rapid in its effect, is harmless if swallowed and its source, the Strychnos toxifera plant, would be highly unusual in the bush around Perth.[9] A history of contact with snakes or organophosphates has not been elicited in this example and would be expected if either were playing a significant role.

So are most poisonings accidental or intentional? Despite the references to hemlock in history, mystery novels and some homeopathic texts, most cases are accidental ingestions of a plant that is sometimes mistaken for parsley, carrots, parsnip (the roots) or anise.[2]

For the military health practitioner deployed with troops to rural areas, consideration should be given to warning personnel about using local vegetation in preparing meals, even when it may look like a food they know, and being aware that this could be a possible diagnosis when someone presents with symptoms of acute poisoning. Rapid gastric decontamination may prevent death but concurrent rhabdomyolysis and acute tubular necrosis may need to be managed.

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*Reprinted from **The Lancet**, Volume 185, Issue 4772, 13 Feb 1915, pp 316-330*
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A CONTRIBUTION TO THE STUDY OF SHELL SHOCK.

BEING AN ACCOUNT OF THREE CASES OF LOSS OF MEMORY, VISION, SMELL, AND TASTE, ADMITTED INTO THE DUCHESS OF WESTMINSTER'S WAR HOSPITAL, LE TOUQUET.

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THE remarkably close similarity of the three cases which are described in this paper is shown in the following synopsis:—

—	Case 1.	Case 2.	Case 3.
Cause	Shells bursting about him when hooked by barbed wire.	Shell blowing trench in.	Shell blew him off a wall.
	Preceding period of sleeplessness.	As in Case 1.	?
Vision ...	Amblyopia. Reduced visual fields.	,,	As in Case 1.
Hearing ...	Slightly affected for a brief time.	Not affected.	As in Case 2.
Smell	Reduced acuity.	Total anosmia	Unilateral anosmia and parosmia.
Taste	Almost absent.	Reduced acuity	As in Case 2.
Other sensations ...	Not affected.	As in Case 1.	As in Case 1.
Voluntary movements	,,	,,	,,
Defaecation	Bowels not opened for five days following shock.	,,	,,
Micturition	Urine not passed for 48 hours.	Not affected	As in Case 2.
Memory ...	Apparently slightly affected	Very distinct amnesia	,,
Source of treatment	Gradual improvement by rest and suggestion.	As in Case 1, supplemented by hypnosis	As in Case 1.

CASE 1. Private, aged 20. Admitted on Nov. 5th, 1914. On the nights of Oct. 28th and 29th he slept in the booking hall of X station; "not much sleep there." On the 30th he motored in a bus from X to Y, arriving there at 7.30 P.M.; billeted found at 8 P.M.; on guard from 10-11.30 P.M., and from 1.45-3.45 A.M. At 11 A.M. on the 31st for the first time he went to the firing line. His platoon advanced to one set of trenches and then crossed the road to another, only to find it filled with cavalry and to be told that there was no room for them. During the retirement from this trench, at 1.30 P.M., they were "found" by the German artillery. Up to that time he had not been feeling afraid; he had "rather been enjoying it," and was in the best of spirits until the shells burst about him.

He was now retiring over open ground, kneeling on both knees and trying to creep under wire entanglements, when two or three shells burst near him. As he was struggling to disentangle himself from the wire three more shells burst behind and one in front of him. (An eye-witness in this hospital says that his escape was a sheer miracle.) After the shells had burst he succeeded in getting back under the wire entanglements; all his comrades had retired already. He managed to get into a trench, and as the firing slackened he rejoined his company. Immediately after the shell had burst in front of him his sight became blurred. It hurt him to open his eyes, and they "burned" when closed. The right eye seemed to have "caught it" more than the left. At the same moment he was seized with shivering, and cold sweat broke out especially round the loins. He thinks the shell behind him gave him the greater shock—"like a punch on the head, without any pain after it." The shell in front cut his haversack clean away and bruised his side, and apparently it burned his little finger. It was this shell, he says, which "caused his blindness."

Falling in with two comrades, he was led by them, one on either side, to the dressing station. He opened his eyes occasionally to see where he was going, but everything

appeared blurred except at the first moment of opening. There was no doubling of objects; they seemed to "dissolve." He was crying the whole time and worrying as to whether he was going blind. He kept turning over in his mind the succession of events from the beginning of the advance to the bursting of the shells. At the dressing station he was still crying and shivering; he was taken thence to a hospital by horse ambulance, where he was given brandy, and then sent on by horse ambulance to another hospital, and thence by motor ambulance at night to X, where he arrived early on Nov. 1st. He thinks he must have slept on the ambulances, as he *remembers nothing*.

From Nov. 1st to 4th at X; his eyes were bandaged and drops were instilled which "burnt terribly." No numbness or anæsthesia observed. *Slight deafness*, which soon passed off. On Nov. 1st he shivered in bed almost incessantly; his thoughts were still running on events between the advance and the bursting of the shells. No shivering after Nov. 3rd. He says he *did not micturate* from Oct. 30th P.M. until Nov. 2nd P.M., and *did not defecate* from Oct. 30th until Nov. 5th (after aperient here). No involuntary passage of urine or fæces.

Past history.—He had been for two months in the Aisne district on the lines of communication, sleeping badly all that time owing to lumbar pains (and toothache during the first three weeks). He had failed to pass a medical examination some time previously because of renal trouble (abnormal amount of albumin in water) until after a long period of treatment. He had had lumbar pains a few nights before coming to France.

Present condition. Nov. 9th. A well-nourished man of nervous temperament, clubbed complexion, and dark eyes. Movements normal; skin sensations normal. Eyes, fundi normal. *Fields distinctly contracted*, especially on temporal sides. Right eye can read at normal distance, but "things have a slight haze round them." Left eye the haze is much greater; is unable to see letters until they are quite near.

Nov. 13. Says he has lost his sense of taste and smell since the shells burst round him. Gets up now.

Nov. 24. Woke up last night and found himself crying, "not thinking of anything in particular"; he at once "pulled himself together."

Nov. 26.—Tested for *taste* (tongue protruded) and *smell* in order mentioned:

(1) Very strong sol. of sugar ...	Slightly sweet (only tasted after the tongue had been moved about).
(2) " " " salt ...	No taste.
(4) " " " acid ...	No taste, but "a peculiar feeling as if it dried the tongue."
(7) " " " quinine...	No taste (later, "a peculiar feeling of biting on the tongue").
(5) Carbolic acid (1 : 40)	No smell.
(6) Ether	Faint smell, like collodion.
(8) Peppermint (strong)	Faint smell of peppermint.
(3) Tincture of iodine	No smell.

Hypnotised; patient explains later "I insisted on resisting." *Suggestion* offers during concentration. *Nov. 28th.* Says his taste and smell are returning. Fields of vision still restricted, perhaps slightly less so. *Nov. 29th.* He was transferred to England for further treatment.

On Nov. 29th the patient was admitted to the Middlesex Hospital, London, under the care of Mr. Arnold Lawson, who has kindly allowed me to append his note of the condition of the patient's eyes:

Nov. 25th: R. E. $\frac{+1.75}{+2.25}$ L. E. $\frac{-1}{+3}$

Visual acuity, each eye 6/36; when under correction 6/18. Just below and to the outer of the left disc is a small clear buff patch in the choroid. The upper inner margins of the discs are somewhat blurred and more densely white than elsewhere. These features are probably not pathological. The fields are definitely restricted, especially on the nasal side of the retina, being limited here to 40° in the right eye and to 70° on the left. No central scotoma. Taste and smell were found affected on admission, but these recovered earlier.

Nov. 27th. General condition improved. Not so "nervy." Visual acuity under correction, R. E. 6/24, L. E. 6/18. The patient is now (Feb. 1st) attending the hospital as an out-patient.

CASE 2. Corporal, aged 25. Admitted on Dec. 11th, 1914. The patient says that he was buried for 18 hours on Dec. 8th owing to a shell bursting and "blowing in" the trench in which he lay. Can remember nothing until he found himself in a dressing station at a barn lying on straw. He says that then he could not see and that for this reason he fell over something when he got up and walked about there. As to his past history, he came out to the war on August 13th, and was in the last two days' retreat at Mons and after at La Bassée. Has slept very badly since the start, often when bullied taking large doses of whisky to procure sleep. Has led a "fast" life and has had recent domestic worry.

Present condition. Dec. 17th. A healthy-looking man with flushed face and large dark eyes with wide pupils. His general manner does not inspire one with confidence in his reliability. Complains of pains in abdomen, back and limbs, and of difficulty in seeing. The pains are chiefly in the knees and ankles. His *right has been very indistinct* since he was "blown." Says that if he looks at an electric light it takes him "five minutes" before he can see anything again. His vision has much improved since Dec. 6th, but he can only read when the type is close to his eyes and not for long; "it all becomes blurred." Heart, lungs, and joints appear normal. Abdomen distended and tender in lower part. *Bowels not opened for past days.* Aperient is effective. Vision: R.E. 5/60, L.E. 2/60. Media clear. Fundi normal. Pupils and eye movements normal. Hearing normal.

Dec. 17th. Smell: Fails to smell peppermint, ether, iodine (tincture, and carbolic acid (1 : 40). *Taste* (tongue protruded): Very strong solution of sugar tasted only after movements of tongue are allowed. Very strong solution of salt—"feels like pieces of ice on the hand," tasted only after movements of the tongue are allowed. Solution of acid—"salty, like alum."

Dec. 19th. Complains that he does not sleep, but the sister in charge of his ward says that he sleeps well. *Treatment by suggestion* (during and without hypnosis) was begun, and continued daily until patient's transfer to England. On the second trial and afterwards a state of light hypnosis was easily induced. The deeper stages, involving hallucinations, anæsthesia, and post-hypnotic amnesia, could not be reached on any occasion. But the lighter stages (in which the patient responded to suggestions that he could not open his eyes, close his hand, stop laughing, and the like) sufficed to bring about assurance of a good night's sleep, gradual restoration of memory, and (later) improvement in visual and olfactory acuity, in near vision, in visual fields, and in colour sensibility. The improvement in visual acuity and near vision is shown in the following table:—

		Visual acuity. Both eyes.	Near vision. Right eye.	Near vision. Left eye.
Dec. 15th.	Before hypnosis.	5/60	No. 15 Jaeger	Less than No. 19 Jaeger.
" 23rd.	After "	5/36	No. 12 Jaeger	No. 15 Jaeger (nearly).
" 24th.	Before "	1/6	No. 8 "	No. 12 Jaeger
	After "	—	No. 4 "	No. 10 "
" 27th.	" "	2/6	No. 2 "	No. 10 "
" 29th.	No "	3/6	No. 1 "	No. 4 "

Colonel W. T. Lister, A.M.S., reports (Dec. 30th) that under homatropine and cycloplegic the refraction of the patient's eyes is as follows:

R.E. $\frac{-2.5}{+2.5}$ L.E. $\frac{-1.7}{0 \text{ or } -0.5}$

He makes at the same time the following note on the fundi: "Right eye: Region below the disc is deficient in retinal pigment, so that the choroidal vessels are abnormally visible, but there is no pathological pigmentation and these are not pressed aside. Left eye: Internal crescent; vessels drawn to nasal side; and lack of retinal pigment on nasal side (nasal staphyloma). The atrophic appearance is more marked in this eye, even the choroidal pigment is deficient, giving a pale area. Macula normal. Both discs are pale, and there is compression by the sides of the vessels. The whole condition, to my opinion, might be congenital."

The improvement in visual fields is shown on the annexed Chart 1.[1] The "functional" character of this restriction of fields is shown by the fact that the patient was never observed to collide with objects when walking, and that he was able to box here when convalescent.

The improvement in *colour sensibility* was as follows: Dec. 14th: Half-inch square of colour recognised at 22 cm. R.E., 7·5 cm. L.E. Dec. 27th: 35·0 cm. R.E., 50 cm. L.E. The sensibility of the eyes to red appeared to be keener than that to any other colour. Thus the red square was recognised at 100 cm. by the left eye on Dec. 27th, while other colours (yellow, blue, and green) could only be recognised at 50 cm. So, too, on Dec. 14th the visual field for the recognition of coloured squares was limited in both eyes to the fovea save in the case of red, the field for which in the right eye extended definitely, though slightly, beyond the fovea towards the nasal side of the retina.

The improvement in *olfactory acuity* is shown by the fact that on Dec. 27th he was able to smell and to recognise ether, peppermint, camphor, and turpentine, although still unable to smell carbolic acid (1:10), tincture of iodine, or methylated spirit.

The gradual restoration of *memory* occurred as follows:—*Dec. 22nd.—During hypnosis* suggestions made evoked a description of how the ground fell in on him at the trenches. He says that he was buried up to the neck and that Sergeant L. dug him out. Men of the N. Regiment (not of his own regiment) took him to their dressing station, but the medical officer there "packed him off" to the dressing station of the M. (his own) Regiment. He can now remember Captain S. (attached to his regiment from the) speaking to him and giving him a drink. He spoke to him when he reached the barn (the M.'s dressing station). While under hypnosis the patient is told that he will remember this when he awakes. He does so, but cannot explain why he had not been able to recall it before.

Dec. 23rd.—To-day, *before hypnosis*, he remembers another "big hospital" to which he was taken on leaving the barn—a "big square room with a stove in the centre"—opposite which he was placed. But he cannot recall how he got there, or how he left to come here by train. He cannot remember being carried on a stretcher until they took him out of the train at Etaples (the railway station for this hospital). He says that there was "no light" in the barn all the time he was there (24 hours). He remembers struggling in the trench "for hours" after he was buried. Finally he gave it up. "I went to sleep, and was enjoying myself at home when they started 'messing me about.' Someone fell on me and woke me up. I tumbled to things a bit" when they got me out. I got up and then fell down, and it was all a "wash out."

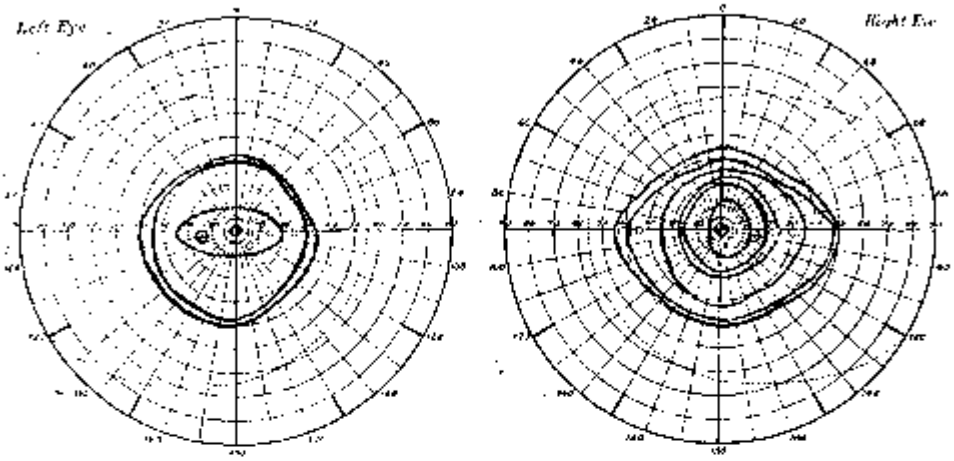
Under hypnosis he continues the above, adding that in his struggles in the trench he "said a prayer or two," and that when he fell asleep he thought himself in the B. Hotel at S., where he had lived for years and is well known. "I was listening to a young lady I know [not intimately] playing the piano. I saw Mr. S. [the landlord] and Mrs. S. The sleep and dreams kept coming and going. It was dark when they dug me out. After I got out a chap said 'the fellow's mad,' and I said 'You're a liar!' . . . Now, I remember a place between the barn and the hospital, rather a small building, a long, low place. I was on a stretcher there. I must have got there by a horse ambulance, but I cannot remember this."

Dec. 24th.—Before hypnosis he recalls going to the clearing hospital (just mentioned) from the barn in a horse ambulance on a stretcher at midnight. He says: "I can remember talking to a major the next morning and having a sleeping draught at night. Then I went to another hospital at B. I had a ride in a motor ambulance on a stretcher, but whether this was from or to that hospital I cannot remember. I remember the journey in the train here distinctly. There were continual offers of tea, cocoa, sweets, and cigarettes. They wouldn't let us sleep for these things. I had a bad headache all the way down from the trenches. I did not bother much about my sight, as I thought it was imaginary. It wasn't until I got rid of the pain in my stomach which I came in with that I began to find my sight wouldn't let me read."

Dec. 27th.—While in hypnosis he gives the name of the man in the same trench with him as K. He "sees" very clearly the position of the trenches, their shallowness and covering. He remembers that he had been two days in the reserve trenches before he was sent on Dec. 7th to the firing line. He says, "The explosion lifted us up and dropped us again. It seemed as if the ground underneath had been taken away. I was lying on my side, resting on my hand, when the shell came. I got my right hand loose, but my left was fixed behind a piece of fallen timber. At last I dropped off to sleep and had funny dreams of things at home. One dream in particular I have thought over many times since. I haven't been able to make out why I should dream of the young lady playing the piano. I don't know her name and don't think I have seen her above twice."

Dec. 29th.—Before hypnosis he says that he can now "see" the N.'s dressing station, a one-storeyed house with two non-communicating rooms. He was taken first into the left-hand room, and later into the other in which the medical officer sat. No further information obtainable *under hypnosis*. He cannot recall how he got to the N. dressing station from the trenches.

CHART 1.



Perimeter charts from Case 2. A, Dec. 14th, at start, by after testing other eye; B, Dec. 22nd; C, Dec. 26th, D, before hypnosis, under hypnotic suggestion; E, Dec. 27th; F, Dec. 29th.

[1] My thanks are due to Colonel Elster, A.M.S., who, by presenting the hospital with a portable perimeter and test types, made these observations possible.

To recover the memory of this period other methods, in addition to hypnosis, were vainly tried. His dreams were generally of incidents belonging to earlier periods of the war, never of the trench-shelling. Attempts to obtain revival of the lost memories by getting him (*a*) to concentrate his attention on the scene of the shell bursting or of the N. dressing station, or (*b*) to record his thoughts when in a state of reverie, were fruitless.

How far the patient's memory, so far as it returned, can be trusted is not altogether certain. A man of the same regiment happened to be warded here at the time. He believes that the patient could not have remained in the trench for longer than an hour after the shell had burst. He declares that he saw him get out of the trench and report himself sick to Corporal R., and that he heard Corporal R. tell the patient to go off on foot to the M. dressing station. Until the day after the patient's arrival at the barn he never saw the patient again, when he was brought in himself there. He says that the doctors at the barn considered the patient "off his head." He does not believe that the N. Regiment was anywhere in the neighbourhood. He says that the man K. had been mortally hit some days before.

On further examination the patient says he has no recollection of reporting himself to Corporal R. or of meeting his fellow patient while at the barn, and he is quite certain that *somehow* he reached the N.'s dressing station before he got to his own.

On the other hand, another fellow patient here happened to belong to the N. Regiment and was able to confirm the patient's account by stating that the trenches of the N. Regiment were on that day immediately next to those of the M. Regiment, and that the N. and M. dressing stations were situated in the same village, the former in a cottage about three-quarters of a mile beyond the latter, so that one would have to pass the M. dressing station on the way from the trenches to the N. dressing station.

There is hence a possibility that the patient wandered in a state of somnambulism from the trench past his own dressing station to that of the N.'s or that he wandered first into the N. trenches and was then brought, as he avers, to the dressing station by men of the N. Regiment. But of this last point the patient is not now so certain. He still insists that a man stepped into his fallen trench on top of him.

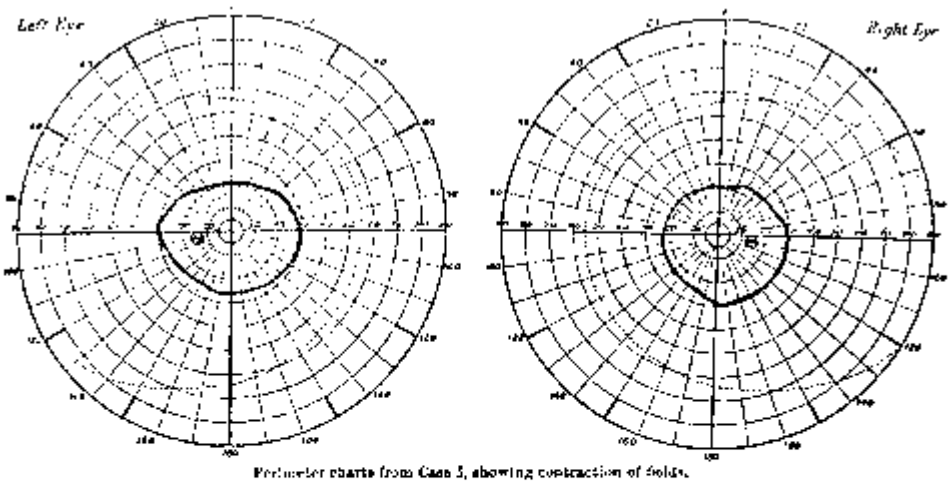
On Dec. 30th the patient was transferred to England for further treatment, and on the 31st he was admitted to the London Temperance Hospital under the care of Mr. J. S. Hosford, whence he has, I understand, now been discharged.

CASE 3.—Private, aged 23. Admitted on Jan. 26th, 1915. The patient says that he was blown off a heap of bricks 15 feet high owing to a shell bursting close to him. Thinks he must have fallen into a pool of water, as he next remembers finding himself, about 3 P.M. the same afternoon, in a cellar near a church with his clothes drenched. He does not know how he got there or how he left the cellar, but he remembers being in another hospital before he was admitted here. He cannot say if anyone was in the cellar with him. He remembers someone in the train talking to him and reminding him of being in the cellar.

Present condition.—Jan. 27th.—A healthy-looking man, well-nourished, but obviously in an extremely nervous condition. He complains that the slightest noise makes him start. His legs feel weak, and he has pain in the precordial region. His *sight has been very much impaired* since the shock. Distant vision, he says, is affected, and objects and type become blurred when long looked at. He has slept very little the last two nights. Heart, lungs, and joints appear normal. Abdomen, general spasm of muscles of wall on being touched. Hands tremulous. Knee-jerks normal, but the first attempts to evoke them provoked a spasm of the calf muscles and a few general convulsive movements as the patient lay in bed. His hands became very tremulous and his forehead sweated profusely. He appeared as if about to faint, and says that he felt cold and dizzy, and experienced "round and round movements of the stomach." The slightest touch on the legs provoked well-marked spasm of the quadriceps muscles of the same thigh. Plantar reflexes not obtainable. Extensor muscles of the toes appeared to be in a state of tonic contraction.

Jan. 30th. Slept well last night for the first time. *Bowels not opened for five days* since the shock. Took an aperient last night and this morning; bowels open to-day. *Eyes:* Fundi normal. *Fields, distinctly contracted*, as in Chart 2. Near vision, either eye, No. 14 Jaeger; less for short words. Visual acuity (investigated by Colonel Lister, A.M.S.) at first 6/24, but improved by encouragement and the indiscriminate use of weak + or − lenses to nearly 6/6.

CHART 3.



Perimeter charts from Case 3, showing contraction of fields.

Smell: Has complained until to-day of a *subjective sensation* of the odour of cordite. This has left him "since the bowels were open." *Left nostril fails to detect* smell of ether, peppermint, eucalyptus, ammonia, carbolic acid, or iodine tincture, all of which, save the last, are at once recognised when placed beneath the right nostril. No signs of nasal obstruction. *Taste. Only tastes very strong* solutions of sugar, salt, and acid, and then only when the tongue has been withdrawn and moved about the mouth; the taste is described as "*false*."

Feb. 1st. He complains that he gets very excited when anyone addresses him. He still fails to remember how he got to the cellar, but he now remembers someone there asking him his name and regiment. He says: "When I got into the hospital before I came to this one I can now remember being put against a wall and then being taken into a small room to see the doctor, who gave me a ticket and told me I was suffering from concussion. I think I must have gone to sleep after this, as I don't remember anything else until I was in the train. There a Royal Army Medical Corps bearer brought me a German prisoner to talk to. He was in the Bavarian Guard and had just seen his first action.

[Patient is still under treatment.]

Comment on these cases seems superfluous. They appear to constitute a definite class among others arising from the effects of shell-shock. The shells in question appear to have burst with considerable noise, scattering much dust, but this was not attended by the production of odour. It is therefore difficult to understand why hearing should be (practically) unaffected, and the dissociated "complex" be confined to the senses of sight, smell, and taste (and memory). The close relation of these cases to those of "hysteria" appears fairly certain.

I have to thank Captain W. P. S. Branson and Captain H. Pritchard, R.A.M.C., in whose wards these patients were placed, for permission to make these investigations, and Major Gordon Watson, R.A.M.C., Commandant, for permission to publish them.

Operation Sumatra Assist Two

CMDR Fabian Purcell

Originally published by the RANR Professional Studies Program, Office of the Director General Reserves (Navy) in ***Goorangai****, Volume 2, Number 1, April 2006*

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ADF operations are planned and executed in line with the government's and the Operational Commander's requirements. War fighting operations focus on winning the battle while health support is tailored to fit into this essential primary need. Recent ADF operations, however, have included tasks other than war (OOTW) such as OPERATION SUMATRA ASSIST ONE and TWO.

OPERATION SUMATRA ASSIST TWO was unusual because the primary aim of the operation was the provision via amphibious over the shore methods, of public health, engineering and acute medical services to the Indonesian communities affected by the Nias Island earthquake of March 2005. Rather than being support elements, these capabilities became the core business of the operation.

On Tuesday 29 March at 0210 AEST an earthquake measuring 8.7 on the Richter-Scale struck the Island of Nias off the west coast of Sumatra. Subsequently the Government of Indonesia estimated that there were 676 deaths and 25,335 people injured as a result of the earthquake and aftershocks. HMAS KANIMBLA, alongside in Singapore, was immediately 'crash sailed' and ordered to return to the designated Area of Sumatra following Operation Sumatra Assist 1. A Tri-Service team of full-time and Reserve health professionals was deployed to augment elements of the RAN Primary Casualty Reception Facility (PCRF) still on board KANIMBLA. In light of concerns over sea bed changes and available safe anchorages following the earthquake, the Deployable Geospatial Survey Team of the Hydrographic Meteorological and Oceanographic Force Element Group was also deployed. In addition, a cadre of interpreters was embedded in the PCRF complement.

The initial Concept of Operations was to position KANIMBLA tactically near areas of population damage on the island and via an RAN liaison and medical triage officer ashore, airlift patients to the PCRF for initial surgery via the embarked Sea King helicopters of 817 SQN. This triage role, performed by CMDR Geoff Day, RANR, ensured the finite resources of the PCRF could be best applied to those patients whose initial care was feasible and sustainable, prior to transfer back to civilian authorities ashore. While all forms of acute life saving surgery were incorporated into the scope of surgical operations, other injuries requiring prolonged convalescence and rehabilitation were referred to Non Government Organisation (NGO) health facilities. It was also recognised that to facilitate the patients' care and their understanding of what was happening, family members should accompany the injured onboard KANIMBLA, thus incurring the additional duty of care to these individuals. Pivotal to this process were the presence of interpreters deployed with the PCRF personnel. The importance of this capability cannot be overstated. These personnel dramatically improved the safety, quality and efficiency of PCRF activities.

Upon KANIMBLA's arrival in the AO late on Friday 01 April 2005, NGO aid agencies were in place and were providing experienced and professional disaster relief services. The initial liaison between the Commanding Officer of HMAS KANIMBLA and local authorities indicated multiple population areas affected with continuing reports of severely injured people isolated from acute medical care due to the destruction of roads. By early Saturday morning several patients had been transferred to the PCRF, where life saving surgery commenced immediately. Until the arrival of the United States Navy Hospital Ship, USNS COMFORT on 08 April, HMAS KANIMBLA provided the most advanced health capability in the Area of Operations. Prior to KANIMBLA's arrival serious cases were flown to Sibolga after stabilisation at the Singaporean Field Hospital.

In response to reports of multiple severely injured people at the town of Amandraya, the aero medical evacuation (AME) component of the PCRF was dispatched to investigate on the afternoon of 2 April. The subsequent crash of the Sea King Shark 02 is now the subject of a Board of Inquiry.

The loss of the AME team and the requisite cessation of flight operations by the other embarked Sea King altered the tempo of operations. KANIMBLA's difficulty finding a safe anchorage and local conditions that limited the use of the embarked LCM8s, required all subsequent patient transfers to be undertaken by boat. This reduced the rate of transfer from island to ship and increased the complexity of embarkation for injured patients. Despite these constraints an evolution was devised that combined the skills of sailors at the helm of the ship's RHIB, the ship's medical contingent and PCFR personnel whereby the boat was lifted into its cradle and the casualties carried on stretchers to the resuscitation bays in the hanger. The unbroken and ongoing provision of care

to the Indonesian population was a reflection of the dedication, ingenuity and increased intensity of effort by the entire ship's company in the face of adversity.

Figure 1. *Ship's company lifting injured from a RHIB (photo provided by CMDR F. Purcell)*

Over the following days the number of acute casualties progressively declined. The caseload was distributed between the Singaporean field hospital ashore, NGO health facilities and the USNS COMFORT. After this time the focus shifted from acute health services to primary care and public health activities.

The Deployable Geospatial Survey Team continued its work assessing the sea bed and likely anchorage points while engineering elements from KANIMBLA began repairing infrastructure damaged by the earthquake. The embarked LCM8s were utilised in many ways, including delivering rice to subsistence populations who, isolated by the damaged transport infrastructure, were often running very short of food. The diverse, immediate and critical needs of the affected populations required a whole-of-ship response. This was demonstrated by the deployment of PCRF personnel ashore, while elements of KANIMBLA's crew toiled in demanding conditions elsewhere, shifting 133 tonnes of rice by hand, and repairing the water supply to isolated towns. This all took place whilst the ground still moved from earthquake aftershocks! The combined nature of these efforts by service personnel remains the great story of OPERATION SUMATRA ASSIST TWO.

For the PCRF personnel, operations were now restructured around teams of five to 10 personnel including doctors, nurses and medics, going ashore, aided by Indonesian Army (TNI) liaison officers. With the support of local Catholic nuns, small temporary clinics were established that treated a variety of chronic health ailments. Tragically, they were also confronted with some severe chronic illnesses including heart failure and terminal neurological disease. For these individuals only limited care could be provided and local health services alerted. The clinics, however, were so popular, with hundreds of people attending, that extra support was required from the ship's company. One such response was the delivery of OPERATION KINDERGARTEN COPS. This activity provided personnel to play with and entertain the children thus allowing the health personnel to systematically attend to as many people as possible. These clinics continued over several days culminating in the ship's company returning to Amandraya.

Over a two-day visit to Amandraya, more clinics were conducted and a memorial was built to honour our fallen comrades. Approximately 70 metres from the crash site, a Sea King rotor tail blade was set in the ground and the PCRF badge with its motto 'Care Afloat' affixed to the blade. Soft Rank Insignia of the RAN Medical branch and RAAF Health Wing were also attached. This final act finished OPERATION SUMATRA ASSIST TWO and KANIMBLA departed the next day for Singapore.

The efforts of the crew of HMAS KANIMBLA included the following:

Humanitarian Aid Stores Delivered

133 tonnes of rice and 5000 litres of water

Medical

980 patients treated ashore within Primary Health Care Team clinics; 13 surgical and further treatments conducted in KANIMBLA; Seven patients evacuated from ashore by SK50 to other medical facilities; and 83 X-Rays/Ultrasounds conducted in the first 48 hours on station.

Other

Lahewa town water pumps repaired;
Lahewa town generator repaired;
Four beach and anchorage surveys completed and significant geodetic data collected on the geospatial consequences of the earthquake;
Eight family members of patients cared for in KANIMBLA while patients underwent procedures; and
Hundreds of smiling faces – Operation KINDERGARTEN COPS entertained hundreds of children in Lahewa with various activities including attempts at teaching them to play cricket and Aussie Rules Football.

HMAS KANIMBLA proved herself to be a highly potent and resourceful platform providing mobile amphibious health and engineering support to disaster-affected communities. It reinforced the maritime operational concept of sustained and effective 'poise' with a minimal infrastructure impact on foreign territory.

This operation was a typical example of 'capability bricks' building Joint operations. HMAS KANIMBLA and its organic logistic and engineering elements provided the platform, which in turn allowed the PCRF to deliver health care. This care was improved significantly by the embedded cadre of interpreters. The Deployable Geospatial Survey Team conducted surveys and were able to provide data on the scarce anchorage points available while also contributing to the knowledge of geospatial sea bed effects following the earthquake. The combined operational effect of all elements added to the positive strategic effects of Australia's Humanitarian involvement in South East Asia.

Sadly it came at the cost of nine of our colleagues. Their lives, loves, aspirations and service will forever represent our nation's integrity in times of need. They remain always…our shipmates.

Figure 2. *The Amandraya Memorial (photo provided by CMDR F. Purcell)*

Surgeon Rear Admiral Lionel Lockwood (1902-1987) CBE MVO DSC MD (Melb) BS FRACP FACMA RAN

CMDR Neil Westphalen, RAN

Lionel Lockwood was born in Natimuk, near Horsham in Victoria, on 13 January 1902. He was the eldest of four siblings and son of Alfred Wright Lockwood (1867-1956), journalist and proprietor of the West Wimmera Mail newspaper, and Alice Ellen, nee Francis (1873-1913), of Melbourne's Presbyterian Ladies College and a musician, temperance campaigner, and school teacher. His father had entered the newspaper industry at the age of thirteen and completed a six-year apprenticeship before going on the road in rural Victoria. He was a proud craftsman and retired at the age of eighty-three with more than 3000 newspaper issues under his belt.[1]

Alice's death from cancer was followed by domestic and financial chaos, until March 1916 when Alfred married Ida Dorothea Klowss, a member of the local German-Australian Lutheran community. Despite Alfred's civic-mindedness the union initially attracted anti-German hostility, but it restored domestic order, sound financial management, and added three more children to the family. Despite his father being Anglican; his mother Church of Christ and his step-mother Lutheran, religion in the Lockwood household "was intense. Perhaps fervent would be a better word".[2]

By the age of ten the Lockwood children could set type, and operate their father's printing machine. Lionel's half-brother Douglas (1918-1980) remained in the industry as a national award winning journalist and distinguished author of thirteen books, while Frank (born 1919) and Allan (born 1922) took over the Mail following Alfred's retirement and turned it into the Wimmera Mail Times, the largest circulation tri-weekly newspaper in Australia.[3]

The best-known of the literary Lockwoods however was Lionel's brother Rupert Ernest (1908-1997), journalist and prominent member of the Australian Communist Party, who became involved in the 1954 Petrov spy case. By coincidence the story of Mrs Petrov's defection was broken to the public by Rupert's half-brother Douglas in Darwin.[4] The Royal Commission into the Petrov defection found Rupert to be the author of 'Exhibit J', which named three staff members of the Leader of the Opposition (Dr H.V. 'Doc' Evatt) as Russian spies. Although this allegation was not proved, 'Exhibit J' was pivotal to the Royal Commission's influence on the 1954 Federal election, and the subsequent destruction of Evatt's political career.[5] Family lore has it that Rupert's actions precluded Lionel's subsequent appointment as Governor of Tasmania, if not Governor-General of Australia.[6]

The iconic image of Mrs. Petrov and her MVD (Soviet secret police) escorts at Mascot Airport Sydney, 19 April 1954. She was later removed from their aircraft at Darwin Airport by ASIO personnel. (National Archives of Australia, A6201:62)

Lionel Lockwood's brother Rupert in the Domain, Sydney, 1963.[7]

Lionel was educated in Natimuk (where his father reported him becoming dux in 1914)[8] and at Ballarat High School.[9] He studied medicine while living at Queen's College at Melbourne University from 1919 to 1923. His results in his university entry exam won him a Hague Entry Scholarship worth £35 in 1919, as well as Hansford Bursaries worth £25 for his exam performance every year thereafter.[10] Besides being a member of the cricket team, he was awarded a blue for football in 1919,[11] was Captain of the Queen's College football team in 1920 and 1921, and Vice-Captain in 1923.[12]

Family lore has it that he was the youngest-ever captain of a VFL football team,[13] however 'University' was a full VFL member only from 1907 to 1915 and was only in the VFL Reserve competition in the 1919 and 1920 seasons, before joining the Melbourne Amateur Football Association in 1921.[14]

Queen's College Football Team, 1921 Premiers. Lionel Lockwood is holding the ball.[15]

Lionel Lockwood, 1921 Cricket Team[16]

Dr Lockwood entered the Royal Australian Navy as a Surgeon Lieutenant (on probation) on 12 November 1924, and served initially at HMAS *Cerberus*, in Westernport VIC.[17]

RAN Hospital HMAS Cerberus, 1940s.

Most buildings were used in the roles described until the new Health Centre was built in the 1990s, after which most were demolished.

Key as follows:[18]

1. Administration Block (now a wardroom accommodation block)
2. Main Surgical Ward
3. Surgical Ward
4. M Ward (WRANS Ward)
5. B Ward
6. D Ward (post war Outpatients Department)
7. C Ward
8. Main Medical Ward (post war Medical Training School)
9. Physiotherapy
10. Galley
11. Hospital Switchboard
12. Store
13. Covered Ways
14. X-ray
15. Laboratory
16. Operating Theatre

Surgeon Lieutenant Lockwood was then posted to the hydrographic survey vessel HMAS *Moresby* on 18 September 1925 and spent the next 18 months on the Great Barrier Reef.[19]

HMAS Moresby at Bowen QLD, 1928.[20]

He remained posted to *Moresby* 'temporary additional' from 7 March 1927 whilst aboard the depot ship HMAS *Penguin* at Garden Island in Sydney, before returning to *Cerberus* from 4 September 1928 until 10 January 1933. During this time he completed a doctorate of medicine (pathology) at the Alfred Hospital, and was promoted to Surgeon Lieutenant Commander on 12 May 1930. He then joined the Flagship of the Australian Squadron, the heavy cruiser HMAS *Australia*, on 11 March 1933.[21]

Surgeon Lieutenant Commander Lockwood was appointed a Member of the Victorian Order (Fourth Class) on 2 April 1935 by His Majesty King George V.[22] The Royal Victorian Order was established by Queen Victoria in 1896 as a personal gift from the Sovereign, as a mean of rewarding personal service.[23] Lockwood received the award for his services as a physician to HRH the Duke of Gloucester during the latter's visit to Australia for the Victorian centenary celebrations. Lockwood accompanied the Duke on the return journey to England in Australia, and was later honorary physician to the Duke whilst he was governor general of Australia in 1945-47.[24]

HMAS Australia, c1932-3[25]

Surgeon Lieutenant Commander Lockwood left Australia on 18 January 1936 for a promotion course at the Royal Navy College at Greenwich, achieving first place with a score of 84% for which, had he been a Royal Navy medical officer, he would

have been awarded the Gilbert Blane Medal.[26] First awarded in 1830, the Blane medal is still awarded to Royal Navy medical officers "who, to a degree which is considered worthy of recognition, have brought about advances in any branch of medicine in its application to Naval service, or who have contributed to an improvement in any matters affecting the health or living conditions of Naval personnel."[27]

Royal Navy Gilbert Blane Medal (obverse and reverse)

Lieutenant Commander Lockwood was specially promoted (12 months early) to Surgeon Commander on 12 May 1936,[28] but sustained a nervous breakdown in February 1937, three days after commencing surgical fellowship training at Edinburgh. He returned to London, was medically surveyed and given six weeks sick leave, before undertaking a brief postgraduate course in medicine and surgery at the London Hospital. He returned to Australia aboard the Royal Mail Ship Ormonde in March 1937.[29]

On returning home he served as a surgical specialist at the RAN Naval Wing, Prince of Wales Hospital in Sydney, until he joined the light cruiser HMAS Hobart on 21 February 1941 as Squadron Medical Officer.[30]

Surgeon Commander Lockwood discusses a chest x-ray with Surgeon Lieutenant Trevor McLean RANR* c1940.[31]

At that time *Hobart* was engaged in escort duties on the Australia Station, including convoys in January and April from New Zealand. Following exercises in Port Philip Bay she returned to Sydney for a short refit, before sailing for the Mediterranean on 20 June to replace her sister *Perth*, after the latter had been damaged off Crete the previous month.[32]

HMAS Hobart (then HMS Apollo) at Miami Florida, February 1938 (NH # 58633)

En route through the Gulf of Suez, *Hobart* went to the aid of the 27,000 ton transport *Georgic*, after she was dive-bombed on the night of 13-14 July with 800 Italian internees aboard while anchored off Port Tewfik.[33] *Georgic* had been hit aft twice, resulting in a fire and exploding ammunition, and numerous casualties including 63 fatalities.[34]

Postcard RMS Georgic, 1930s[35]

Accompanied by Sick Berth Attendant Bruce Phillips,† Surgeon Commander Lockwood took *Hobart's* pinnace, into which was loaded a field valise, first-aid bag, morphine, burns dressings, several straight splints and two Neil Robertson stretchers. He later wrote:

> The merchant ship was already burning fiercely and was an awe-inspiring sight. The pinnace came up under the forecastle of the ship, where a number of lascars [Indian sailors] were sliding

* Trevor Alexander McLean. Born 02 Jan 11 Traralgon VIC. Joined RAN Reserve as Surgeon Lieutenant 15 Sep 37; appointed Cerberus 07 Sep 39; joined 'Scrap Iron' destroyer HMAS Stuart 13 Sep 40, shore to Cerberus 01 Oct 41. Transferred to PNF 07 Sep 44; promoted Acting Surgeon Lieutenant Commander 01 Nov 44, appointed to staff Naval Officer-In Charge New Guinea at Madang 29 Nov 44. Rank made substantive 07 Mar 45, joined Hobart as Squadron MO 21 Aug 45. Transferred back to reserve as acting Surgeon Commander 08 Jan 46, paid off Lonsdale 21 Jun 46, resigned 28 Oct 49. (NAA item A6769 5225547 Officers Record of Service Card).

† S2777 Bruce Glenton Phillips. Born 10 Nov 14 Dubbo NSW. Entered RAN Reserve as Sick Berth Attendant (SBA) and joined HMAS Penguin II (now Kuttabul) 05 Sep 39, HMAS Rushcutter 01 Aug 40, Penguin II 01 Oct 40. Joined Hobart 03 May 41, Acting Leading Sick Berth Attendant (LSBA) 01 Jul 41, made substantive 01 Jul 42, Acting Sick Bay Petty Officer (SBPO) 01 Jan 44. Shore to Penguin (BNH) 08 Feb 44, Hobart 15 Feb 44, Fleet Auxiliary Merkur 17 Jun 45, shore to Penguin 10 Jul 45, Rushcutter 23 Apr 46. Demobilised 21 May 46. (NAA item A6770 4514513 RANR Record of Mobilised Service Card).

down ropes, too frightened to take the final plunge into the water, and stubbornly holding on the ends of the ropes. Some of these lascars were treated for rope burns with 'Tannafax'[petroleum jelly containing tannic acid].

At about 0330 a tender came alongside and activities were transferred to her. The saloon was used as a medical station; the ship's surgeon had been injured [and] treatment of the casualties began at once. A number of these appeared in the saloon and a brief glance showed that most of the cases were severe burns. Most of the burns were caused instantaneously by the flash of the bomb; but others were due to people escaping through the flames of the burning decks to safety. Those who escaped informed me that the smoke caused choking and made escape difficult.

The first thing done was to administer a hypodermic injection of morphine sulphate grains one third [21.6mg]. The effect was dramatic, and the look of gratitude on the faces of those severely burned will never be forgotten.

It is worthy of mention that in all cases it was only the exposed portions of the body which were affected by the bomb flash; in other words, those areas of the skin which were covered, even if only by very thin clothing, were not affected by the flash and showed no evidence of burning.

Some of the cases, who at the time of the raid were wearing shorts only, suffered very extensive burns. After the morphia injection had eased the pain and mental anxiety, orders were given for the administration of hot sweetened tea, and this was relished by all burned patients.

The first-aid treatment of burns has been for long a very vexed question, and there are many opinions existing as to the best treatment under the stress of emergency. The large blisters were opened and raised-up skin removed. Much of the skin was charred and blackened, the char being driven into the deeper layers of the skin. It was impossible to deal with this problem. After removal of the blistered skin, some of the burns were dressed with 'Tannafax' ointment applied to the smooth side of lint, while in other cases lint soaked in a solution of tannic acid 2.5% and acriflavine 1:1000 was used. A large quantity of tannic acid and lint was necessary, and it was fortunate that a large supply was already available in the field valise and first-aid bags.

About 0430 Surgeon Lieutenant Milroy‡ and Sick-Berth Attendant Kain§ O.N. 22629 arrived to assist with the treatment and their appearance was very welcome, as there was much work to be done. The bravery of the wounded was very impressive, particularly of the engine-room personnel.

Two of the cases were brought back to HMAS *Hobart* when the medical party returned at 0600, exhausted but happy to be of some use. One case, the ship's barman, a fat man of 64, was suffering from multiple burns of the face, arms and chest. He was very shocked, with a pulse of 100. Morphine sulphate grains one third was given, together with fluids and he was kept warm in bed. All dirt, loose skin and blisters were removed, and the affected areas sprayed with acriflavine and tannic acid solution (no triple dye was then available). A very good tan soon developed, and the patient's condition soon improved. The other case, a lascar, had his right hand removed at the wrist due to a high explosive fragment. Arterial haemorrhage was arrested with a tourniquet and morphine sulphate grains one third given. Both these cases were discharged to the local military hospital later in the day.[36]

Hobart's subsequent Mediterranean service included escorting convoys to Malta and Cyprus, supporting the Tobruk Ferry Run, shore bombardments of Bardia and 'Hellfire Pass' in North Africa, and operations against the Vichy French in Syria. During this time she was subject to frequent air attacks both at sea and at her base at Alexandria, but remained unscathed. At one point during this time her wardroom held no less than five future flag officers, including the future Rear Admiral Lockwood.[37]

‡ William Hugh Milroy. Born 26 Jan 12 Melbourne VIC. Appointed to RAN Reserve as Surgeon Lieutenant 15 May 37, joined sloop HMAS Swan 08 Sep 39. Shore to Penguin II 24 Feb 40, Rushcutter 01 Aug 40, Penguin 01 Oct 40. Joined Hobart 21 Feb 41, shore to Penguin 11 Jan 43. Promoted Surgeon Lieutenant Commander 15 May 43, joined Landing Ship Infantry HMAS Manoora 19 Jul 44, awarded Mention in Despatches 09 Oct 45 "For skilful organisation and for courage and devotion to duty during the assault landing at Tarakan" on 01 May 45. Shore to Penguin 20 Aug 45; demobilised 27 Aug 48, retired list 30 Jun 58. (NAA item A6769 5332176 Officers Record of Service Card).

§ R22629 Gordon Clarence Kain. Born 31 Aug 17 Oaklands NSW. Entered RAN as Sick Berth Attendant at Cerberus 05 Dec 38. Joined Hobart 16 Oct 40. Shore to Lonsdale 29 Nov 41, Cerberus 04 Jun 42. Promoted LSBA 01 Jul 44, overseas to Madang (New Guinea) 26 Jan 45, Cerberus 27 Jul 45, and Kuttabul 31 Jul 45. Extensive post war career as X-ray sub rate medic at Cerberus, Penguin Albatross Watson and Tarangau (New Guinea); ships included Australia and Melbourne. Promoted SBPO 01 Feb 47 and to Sick Bay Chief Petty Officer (SBCPO) 01 May 50, discharged 11 Oct 66. (NAA item A6770 4425851 Ratings Record of Service Card).

At the end of 1941 Surgeon Commander Lockwood listed a number of infectious diseases treated in the Fleet at this time, including amoebic and bacillary dysentery, cerebrospinal meningitis, malaria, hepatitis, typhoid and paratyphoid, pulmonary tuberculosis, brucellosis, diphtheria, pneumonia, erysipelas, rubella, scarlet fever, smallpox, poliomyelitis, mumps and measles.[38] He also described cases of solar photoretinitis among anti-aircraft lookouts, with and without scotoma formation from looking up-sun despite the protective equipment in use (screens and welder's goggles).[39]

With the entry of Japan into the war in December 1941, *Hobart* proceeded to Singapore, where she encountered more air raids on arrival on 1 February. With Singapore about to fall, Surgeon Commander Lockwood recalled the discovery of 500 electric sewing machines in a nearby store. So many were taken aboard that *Hobart's* Commanding Officer (Captain Harry Howden RAN) cleared lower deck to tell his ship's company "I will not tolerate looting so don't bring anything over the gangway. Return those machines immediately".[40]

Three hours after sailing from Singapore on 3 February, *Hobart* met the *Norah Moller* (built Harland and Wolff 1915, 4,434 tons), which had been bombed and set on fire by three Japanese aircraft the previous night en route to Calcutta. The fire could not be controlled and she was abandoned off West Nanka Point with the loss of 17 lives.[41]

Hobart beat off further air attacks and picked up 57 survivors including 28 wounded, while another six died on passage before they were landed the following day at Tanjong Priok (Batavia, now Jakarta).

Surgeon Commander Lockwood later wrote:

> Another type of injury dealt with was due to the effect of blast at the time of bombing. Two cases received the blast injury while in the bombed ship; the third was stated to have been injured by the compression wave in the water after having jumped overboard, due to a bomb bursting in the water not very far away. At first sight this type of the injured does not appear to be very ill. The patient complains of some pain and discomfort in the abdomen; one had a moderate degree of haematemesis. A characteristic feature of all three was their inability to micturate; all had to be catheterised. Abdominal rigidity did not develop until some hours after admission to hospital the next day, that is until at least twenty-four hours after receipt of the injury. What made things more difficult was the fact that all three cases were Chinese and could not speak any English.
>
> When abdominal rigidity developed, Professor Reddinhuis (of the Central Civic Hospital, Batavia) at once operated. Two cases were found each to have a rupture of the ileum; in the third the sigmoid colon was ruptured. In the latter case a left-sided ileostomy was performed. The first two cases were found to have large tears of the ileum; owing to their shocked condition resection and anastomosis was inadvisable, and exteriorisation of the affected loop of ileum was performed in each case; that is, the ruptured segment of bowel was brought outside the abdominal wall and sutured to the peritoneum. After the patients had recovered from the initial shock and their general condition had improved, it was proposed to resect an appropriate amount of small intestine. In the case of the sigmoid colon lesion, it was hoped that this would heal and that later the colostomy could be closed. However all three cases died, and autopsy showed that in each general peritonitis had developed.
>
> The combination of severe burns with blast injuries undoubtedly increases the hazard very greatly.[42]

Surgeon Commander Lockwood and SBA Phillips attend casualties being transferred from Norah Moller to Hobart, Banka Strait, 03 February 1942.[43] The lack of personal protective equipment despite Japanese air attacks appears particularly noteworthy.

Norah Moller casualties being landed from Hobart, 4 February 1942.[44]

Further patrols were made from Batavia despite heavy air raids, with *Hobart* enduring 13 attacks by 109 aircraft in one day; once being straddled by no less than 24 bombs. However she was not hit and there was only one casualty. Lack of fuel meant *Hobart* missed the Battle of the Java Sea when the

Allies lost half their force, and she left Tanjong Priok on 27 February to pick up refugees at Pedang. En route Surgeon Commander Lockwood operated on a sailor from the accompanying destroyer HMS *Tenedos*, removing the largest appendix he had ever seen. *Hobart* departed Pedang at 29.7 knots and arrived safely at Columbo on 4 March, thereby avoiding *Perth's* fate (sunk in Sunda Strait 1 March) and that of the sloop HMAS *Yarra* (sunk south of Java on 4 March).[45] Surgeon Commander Lockwood was later awarded the Distinguished Service Cross 'for bravery and endurance when HMAS *Hobart* was taking convoys across the China and Java seas in the face of sustained enemy attacks'.[46]

Hobart returned home via Fremantle and Adelaide, arriving at Sydney on 4 April for a refit before sailing on 1 May. She participated in the Battle of the Coral Sea as part of Task Force (TF) 17.3, which was detached from the main Allied force to intercept the Port Moresby Invasion Force, however the latter withdrew before contact was made. Further patrols were made in the area until the US-led landings at Tulagi and Guadalcanal in the Solomon Islands on 7 August. *Hobart* was on patrol to the east of the landing force and therefore missed the Battle of Savo Island two days later, where four Allied cruisers including HMAS *Canberra* were sunk while patrolling to the west. *Hobart* returned to Brisbane with TF 44 on 3 September, and spent the next few months patrolling the Coral Sea with TF 44 (later renumbered TF 74).[47]

Surgeon Commander Lockwood left *Hobart* on 17 April 1943, shortly before she was torpedoed by a Japanese submarine off Espiritu Santo on 22 July, with 13 killed and seven wounded.

Hobart torpedo hit, 22 Jul 1943 (NH #80535)

Surgeon Commander Lockwood spent the rest of the war at *Cerberus* as a specialist in pathology and bacteriology.[48] He was promoted to acting Surgeon Captain on 14 January 1946 and was Medical Officer-In-Charge (MOIC) at Cerberus from December 1946 to January 1950. He was then posted to the new Balmoral Naval Hospital at HMAS *Penguin* as MOIC and Command Medical Officer to the Flag Officer East Australia Area.[49]

Surgeon Captain Lockwood and SBPO C. Mckenzie [||] ***with two patients in A Ward BNH, 1954.***[50]

On 12 March 1955 Surgeon Captain Lockwood was promoted to Surgeon Rear Admiral and appointed to Navy Office (then in Melbourne) as Director of Naval Medical Services (later re-designated Director-General Naval Medical Services, thence Director General Naval Health Services), following the death of his predecessor (Surgeon Rear Admiral Denis Pritchard CBE RAN).[¶] Whilst DGNMS he also

|| B2106 /R30828 Colin Ross Mckenzie. Born 14 Feb 12 Brisbane QLD. Entered RAN Reserve as SBA second class 02 Sep 39 at Penguin, promoted SBA 01 Oct 39. Brisbane 01 Aug 40, Cerberus 30 Dec 41, Brisbane 13 May 42, loaned to corvette HMAS Broome 29 Jul 42. Shore to Penguin 17 Aug 43; overseas to HMAS Ladava (Milne Bay New Guinea) 11 Sep 43. To HMAS Moreton (Brisbane) 18 Dec 44, Penguin (Birchgrove Park NSW) 17 Apr 45, then sea aboard Manoora 7 Jun 45. Shore to Penguin 01 Sep 45, loaned destroyer HMAS Arunta 01 Jan 46. Transferred to PNF 08 May 46 and had a long post war career, with service at Penguin, Harman, Kuttabul, Nirimba and Cerberus; ships included Sydney, Swan, Warramunga and Barcoo. Promoted LSBA 01 Jul 47, SBPO 01 Oct 51, transferred to RAN Reserve 13 Feb 62, retired 14 Feb 69. (NAA item A6770 4528835 Ratings Record of Service Card).

¶ Denis Adrian Pritchard. Born 26 Apr 1895 Petersham NSW. Joined Penguin 05 Mar 23, to sea aboard destroyer Anzac 01 Jun 24, Penguin 26 Nov 26. To sea aboard cruiser Melbourne 22 Dec 26, Penguin 14 Feb 27. To sea aboard Moresby 01 Mar 27, shore to Penguin 05 Sep 28, promoted Surgeon Lieutenant Commander 03 Aug 29, RAN College (later known as Creswell) 06 Jan 30, then Penguin from 01 Jul 30. To UK for training 09 Dec 33, promoted Surgeon Commander 03 Aug 34, then Cerberus 14 May 35. To sea aboard Sydney 06 Nov 36, Canberra 09 Jul 37, Perth 10 Jun 40. Shore to Penguin from 13 Dec 40, then to sea aboard Australia 29 Apr 42. Shore to Penguin 11 Jul 44; Cerberus 14 Nov 45, promoted Surgeon Captain 31 Dec 45. Lonsdale (Navy Office) from 01 Oct 51, awarded CBE 01 Jan 52, promoted Surgeon Rear Admiral 20 Mar 52 (first two-star medical officer in the RAN); died 11 Mar 55. (NAA item A6769 5221310 Officers Record of Service Card).

became Chairman of the Defence Medical Services Committee from 1958, which included chairing the Defence Medical Services Rationalisation Committee in 1962-1964.[51]

Rear Admiral Lockwood proceeded on final leave on 17 December 1963 before retiring from the RAN on 12 January 1964. His successor as DGNMS was Surgeon Captain Robert Coplans RAN.[**]

Rear Admiral Lockwood strongly encouraged a vibrant reserve medical branch, such that at least eight of his reserve protégés were subsequently promoted to Surgeon Captain.[52] The late Surgeon Rear Admiral John Cotsell RAN (DGNHS 1970-76)[††] wrote that during Rear Admiral Lockwood's tenure, the recruitment of consultants to the RANR was widened and that *"the hospitals were thriving with panels of top rate civilian consultants, the medical reserve was full of good up and coming specialists"*. He also credits Rear Admiral Lockwood with progressing the re-creation of the RAN Nursing Service following the disbandment of the wartime service in 1948, and establishing the undergraduate medical scheme used to this day. Rear Admiral Cotsell also described his predecessor and mentor as *"shrewd as a wagon load of monkeys"*.[53]

Rear Admiral Lockwood was also instrumental in establishing the RAN School of Underwater Medicine (later the Submarine and Underwater Medicine Unit or SUMU). Following the establishment of the RAN Diving Branch at HMAS *Rushcutter* in 1951, underwater medicine support was initially provided by Surgeon Lieutenant Commander Shane Watson DSC RANVR.[‡‡] Notwithstanding Lieutenant Commander Watson's interest in sharks and rays, it became apparent that deficiencies in understanding the physiological diving hazards also had to be addressed. Rear Admiral Lockwood therefore invited Surgeon Lieutenant Commander Rex Gray RANR[***] to consider full time service in underwater medicine, it being considered his skills as a civilian consultant anaesthetist would be of great value. Lieutenant Commander Gray resigned his practice and commenced a four-year short service commission at *Rushcutter* on 20 February 1961. The need for his services was highlighted the same day by a diving fatality during free ascent training at Garden Island.[54]

Rear Admiral Lockwood also fought hard for a visible presence of navy medicine in postgraduate activities in both Melbourne and Sydney. In the late 1940s he was a frequent attender at ward rounds and clinical meetings of the Clinical Research Unit under the direction of Dr (later Sir) Ian Wood at the Royal Melbourne Hospital, and was later a frequent presence in his admiral's uniform at postgraduate teaching sessions in Melbourne. He was immensely proud of his affiliations with the Royal Melbourne, the Alfred (The Baker Institute) and St Vincent's Hospitals and the Peter MacCallum Clinic in Melbourne as well as the Royal Prince Alfred Hospital in Sydney.[55]

** Robert Michael Coplans. Born 22 Apr 11 Headingley, Leeds, Yorkshire UK. Appointed to RAN 15 Nov 48 as Surgeon Lieutenant Commander, following wartime RN service from 15 Oct 39 to 28 Nov 46. Joined Albatross 14 Mar 49, to sea aboard carrier Vengeance 31 Mar 55, promoted to Surgeon Commander 31 Dec 55, to sea aboard Melbourne 22 Mar 56, Cerberus 17 Jul 58, promoted Surgeon Captain 30 Jun 59, Penguin 02 Aug 62, Lonsdale (Navy Office) 13 Jan 64. Promoted to Surgeon Rear Admiral 20 May 65. No further information available after 01 Feb 70. (NAA item A6769 5399497 Officers Record of Service Card).

†† John Arthur Basil Cotsell. Born 19 May 16 Lee-On-Sea, Essex UK. Appointed to RAN 17 Mar 51 as Surgeon Lieutenant following wartime RN service (including Atlantic convoys 1942-3 and British Pacific Fleet 1944-5). Joined Rushcutter 04 May 51 and promoted to Surgeon Lieutenant Commander 07 Jun 51. To sea aboard destroyer Tobruk 23 Jun 51, Rushcutter 02 Aug 51, then back to sea aboard Australia 20 Sep 51, Rushcutter 05 Oct 51, and then Australia again from 06 Jan 54 until Penguin 24 Jul 54. To Lonsdale (Navy Office) 03 Jan 55, to sea aboard Melbourne 31 Dec 56 and promoted to Surgeon Commander 30 Jun 57. Posted ashore to Penguin 03 Mar 59 and promoted Surgeon Captain 31 Dec 62. Cerberus from 14 Jan 63 and Penguin from 27 Nov 67. No further information available after 01 Feb 70. (NAA item A6769 5217168 Officers Record of Service Card).

‡‡ Shane Andrew Clarke Watson. Born Broughsham, Antrim, Ulster 21 Jul 15. Joined RAN as Surgeon Lieutenant 04 Nov 40, to UK to join destroyer HMAS Nestor 03 Feb 41, and awarded the DSC for gallantry and devotion to duty when she was lost 15/16 Jun 42. Posted ashore to Penguin until Manoora 05 Feb 43, then Arunta 06 Dec 43. Posted ashore to Rushcutter 05 Oct 44, Kuttabul 05 Feb 45. Promoted Surgeon Lieutenant Commander 15 Jun 46 and demobilised 07 Jul 46. Continued reserve days at Rushcutter, Penguin and Kuttabul, awarded VRD 18 Nov 57. Resigned 08 Apr 62. (NAA item A6769 5220178 Officers Record of Service Card).

*** O1997 Rex Justice John Gray. Born 03 Jun 26 Kensington NSW. Joined RAN Reserve 02 May 51 as Surgeon Lieutenant, promoted Surgeon Lieutenant Commander 02 May 57. Transferred to permanent RAN 20 Feb 61 and loaned to RN for long underwater medicine course until 12 Aug 62, posted Watson for School of Underwater Medicine duties. Promoted acting Surgeon Commander 13 Jan 65; visited I Aust Field Hospital and USN hospital, Vietnam 1968. No further information available after 01 Feb 70. (NAA item A6769 5233281 Officers Record of Service Card).

Rear Admiral Lockwood's non-naval professional organisations included membership of the National Council and the National Blood Transfusion Committee of the Australian Red Cross from 1955, Chairman of the Central Citizen's Appeal Committee of the Victorian Red Cross in 1961-2, Member of the St John Ambulance Executive Committee since 1954, and member of the British Medical Association (Victorian Branch) in 1961 (the Australian Medical Association from 1962). He also chaired the Naval, Military and Air Force Sections of the BMA Congresses in Brisbane (1950) and Hobart (1958), and was vice-Chairman of the Australian BMA Congresses in 1950, 1955, 1958, and 1962.[56]

Besides his appointment as Honorary Surgeon to the Governor-General in 1945-6, Rear Admiral Lockwood was also Honorary Surgeon to His Majesty King George VI in 1946-52, and to Her Majesty Queen Elizabeth II from 1952. He was appointed Commander of the British Empire on 1 January 1957 in recognition of his distinguished service to the RAN,[57] admitted to Fellowship of the Royal Australasian College of Physicians in 1958,[58] and to Fellowship of the (then) Australian College of Medical Administrators in 1967.[59]

In 1970 Rear Admiral Lockwood chaired a committee to conduct a feasibility study on raising the Victorian colonial naval vessel *Cerberus*, which had been sunk as a breakwater at Black Rock in Port Phillip Bay in 1926. This committee later formed the basis of the Maritime Trust of Australia, and it was during his tenure as vice-chairman in 1970-74 that it was gifted the WW II corvette *Castlemaine*, now a museum ship at Williamstown VIC.[60]

Ex-HMAS Castlemaine at Cerberus, c1973[61]

In 1974 Rear Admiral Lockwood was appointed a Knight of Magisterial Grace of the Sovereign Military Order of Malta, a lay Catholic order that operates as a neutral, independent and non-political religious, charitable and hospitaller organisation.

Dating back to 1050, the Order is based in Rome, but claims sovereignty under international law and has permanent observer status at the United Nations.[62]

From 1976 to 1982 Rear Admiral Lockwood led fundraising campaigns as Chairman of the Queen's College Foundation. He worked tirelessly in this role, and was successful in raising large capital sums. In an early fundraising letter he wrote:

> Having been a resident scholar at Queen's for five years many years ago, the passing of the years has impressed upon me the great benefits which my time in Queen's has given me. I am certain that such success as I have achieved in life is largely due to Queen's, with its accent on learning and character development. It is out of gratitude that I recently accepted the arduous office of Chairman of Queen's College Foundation.[63]

Rear Admiral Lockwood as Chairman, Queen's College Foundation, 1976-82[64]

Rear Admiral Lockwood was also a member of the Committee of the Naval & Military Club from 1959, the Melbourne Cricket Club, and the Lawn Tennis Association of Victoria, the Beaumaris RSL, and the Australian Club (Sydney). Recreations are listed as included gardening,[65] however his grandson Rodney Calhaem did not recall him as having any special leisure activities. Rodney does however recall as a child being taken by his grandfather to the member's stand of the Melbourne Cricket Ground every year for the VFL Grand Final "just like any other kid"! Perhaps understandably given his age at the time, he remembers a rather formal man, referred to within the family as "the Admiral".[66]

Lionel Lockwood had converted to Catholicism when he married Evelyn Loretto Shelton on 29 August 1925 at St Patrick's Cathedral, Melbourne.[67] They had one son (Geoffrey Shelton) and three daughters (Judith Mary McGingle, Margaret Evelyn Plunkett, and Rosemary Alice Calhaem), all of whom survived both parents. He also married Daisy Margaret Paterson on 12 July 1980 following Evelyn's death in 1977.[68]

Rear Admiral Lockwood died on 19 September 1987 at Diamond Creek in Melbourne, and was buried at the Boroodara Cemetery in Kew.[69] Speakers at his funeral included RSL president Bruce Ruxton.[70]

Lionel Lockwood came a long way from a small country town in Victoria; his naval career spanning 40 years full-time service, and a world war. He was immensely proud to be a naval officer, a naval medical officer and a fellow of the Royal Australasian College of Physicians.[71] His initial service coincided with a modest naval expansion after significant cutbacks following WWI. This expansion was curtailed by the Great Depression and it is interesting to speculate what Lockwood might have done with his career had the world economy (and Australia's in particular) been in better shape.

Lockwood's wartime sea service coincided with the heaviest casualties sustained by the RAN during WWII. All of HMAS *Sydney's* crew were lost in November 1941 off Geraldton WA, including Surgeon Commander John Hasker RAN (joined 1928),[72] Surgeon Lieutenant Commander Francis Genge RAN (joined 1936),[73] and Surgeon Lieutenant (Dental) Mervyn Townsend RAN (joined 1940).[74] A week later Surgeon Lieutenant Charles Harrington RANR (joined 1939)[75] was missing presumed killed when HMAS *Parramatta* was torpedoed in the Mediterranean. Surgeon Lieutenant Commander Eric Tymms DSC RANR (joined 1935)[76] and Surgeon Lieutenant Commander (Dental) Alleyne Tregear RAN (joined 1927)[77] were lost when HMAS *Perth* was sunk in the Battle of the Sunda Strait in March 1942, and Surgeon Lieutenant William McLaren-Robinson RAN (joined 1938)[78] were lost when *Yarra* was sunk three days later. Although there were no casualties among *Canberra's* health staff when she was sunk in August 1942, Surgeon Lieutenant John Gaskell RANR (joined 1941)[79] was killed when *Hobart* was torpedoed only three months after Lockwood posted off. Given his rank and seniority Lockwood was perhaps fortunate to have survived his wartime sea service, when many of his wartime seagoing contemporaries, many of whom he had served with in the small pre-war Navy, did not.

With five years as MOIC Cerberus, another five as MOIC BNH followed by eight as DGNMS, Lionel Lockwood was pivotal to the evolution of the Navy's post-war health services. It is worth noting that no less than five of his PNF protégés achieved two star rank before the 1989 Sanderson report reduced it to a one-star billet.[80] His post war career also included commissioning the new hospital at HMAS *Penguin*, and instigating the first permanent peacetime nursing service, the School of Underwater Medicine, and the undergraduate medical training scheme.

The end of his service coincided with the Indonesian Confrontation, the first stirrings of Australian involvement in the Vietnam conflict, and the impending Melbourne-Voyager collision and its aftermath. His legacy therefore underwent considerable testing in the years following his retirement. Arguably, this remains the case even today.

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WOMEDL Ronald Keith Josey 20 March 1927 – 28 August 2007

Ronald Keith Josey joined the RAN February 1946 having transferred from the Army. On entry to HMAS *Cerberus* he was one of the first 30 Sick Berth Attendants to be recruited following WWII. Ron was privileged to achieve another first in 1972 by being in the first group of Chief Petty Officers to be promoted to the newly appointed Warrant Officer this made Ron the first WOMED in the RAN since WWII.

Having discharged from the RAN in 1974 Ron remained actively involved with all things Navy through his association with the NSW Naval Association (Life Member) as Vice President 1984 – 1987 and President 1987 – 1990. In 1990 Ron was elected as the first Vice President of the Federal Council of the Naval Association of Australia, a position which he held until 1996. He was instrumental in the formation of the Sick Berth Association now known as Health Services Association. As if this was not enough he was also the inaugural Secretary of the White Ensign Magazine Management Committee from 1991 until 2006.

Ron is survived by his wife June and children Keith, Gregg and Karen and grandchildren.

May you have smooth seas and the wind forever at your back.

David Moss

Author's Instructions

1. Purpose and scope

The Journal of Military and Veterans' Health is a peer reviewed journal published by the Australian Military Medicine Association. The aim of the journal is to promote excellence in the discipline of military and veterans' health, to promote research and to inform and educate all those practicing as health professionals or who have an ongoing interest in this area. The scope of the journal covers all aspects of health of service personnel from enlistment and service within a military organisation to post service health care as a veteran. Environmental and related aspects of employment are included in this scope so that the journal provides a unique forum for discussion and research related to a wide range of health issues arising from exposure to military environments. This scope is very broad including, for example, mental health, trauma, health training and effects of environment on health.

Editorial Office

Please address all non-electronic correspondence to:

Journal of Military and Veterans' Health
113 Harrington Street
Hobart TAS 7000

Email: editorial@jmvh.org
Tel: 6234 7844
Fax: 6234 5958
URL: http//:www.jmvh.org

Submission of manuscripts

Electronic submission of manuscripts is mandatory.

Manuscript requirements

Manuscripts submitted to the Journal of Military and Veterans' Health must conform with the *Uniform requirements for manuscripts submitted to biomedical journals* (www.icmje.org/).

2. Categories of manuscripts

The Journal of Military and Veterans' Health publishes articles related to health of military personnel and veterans within two broad areas of interest:

Research and practice related

Informative and commentary

Research and practice related	Informative and commentary
Original Research/ Original Articles	Editorials
Short Communication	Letters to the editor
Review articles	Biographies
Reprinted Articles	History
Case Studies	Obituaries
Abstracts from the Literature	Book reviews
	Commentary
	View from the Front

Each issue may not contain all categories of articles. The word limit does not include text in the abstract, references, figures and tables. The requirements for submission categories, which are peer reviewed, are summarised below:

Category	Maximum word count	Maximum number of	
		Tables and/or figures	References
Editorials	1000	1	3
Original research	3500	6	30
Short communication	1500	3	10
Review article	5000	8	60
Case studies	1000	3	10
Letters to the editor	800	2	10
History	3000	6	20
Commentary	1500	3	10
View from the Front	2000	5	20
Obituaries	200	1	4

Original research

This category is the primary mode in the journal for communication of findings from original research studies.

Short communications

This category is for communicating the findings from small-scale research studies however other subject material will be considered.

Review articles

Authors who wish to submit a review should first contact the editors to determine its suitability for publication in the journal. The editors encourage authors to submit systematic reviews for publication.

Reprinted articles

This section will include full length copies of articles reprinted with permission from other journals. These articles must be keynote and valuable contributions to health issues in the military and veterans' areas. Readers are invited to email details of papers that should be considered for this category. Any proposal should be accompanied by a short commentary (maximum 200 words) outlining why this historical paper was important in shaping some aspect of military or veteran health practice. The commentary will be published with the keynote article.

Case studies

This category is primarily designed to present details of interesting or unusual clinical cases and a summary is required with a limit of 100 words. The text should be presented using the following headings; background, history, examination findings, special investigations, discussion including differential diagnosis. The article should succinctly illustrate important points.

Abstracts from the literature

This category will include abstracts of seminal work published in other journals which is related to the scope of the Journal of Military and Veterans' Health. Readers are invited to email references to papers that are considered to be valuable to healthcare professionals and others in the military and veterans domains. The editors acknowledge that many of our readers may not have facilitated access to comprehensive reference libraries.

Letters to the Editor

Letters may comment on material that has recently been published in the journal or may address new topics, such as use of new equipment or instrumentation in the field or a new technique applicable to preventive medicine. Where the subject matter is directed towards a previous publication the editors will usually send the letter first to the authors of the original paper so that their comments may be published at the same time as the letter.

Editorials

Submissions are encouraged for publication in this category and these will be subjected to the peer review process. Topics of interest must fall within the scope of the Journal of Military and Veterans' Health. Guest editorials may be invited from time to time by the editor; suggestions for topics for editorials should be directed to the editor.

Biographies

Biographical accounts of the work of individuals who have made outstanding contributions to the health and care of military personnel and veterans will be considered for publication. If you wish to submit a biographical article the editor should be consulted prior to preparation of the article. The editorial board may solicit such articles directly.

History

Articles describing notable themes related to health and care of military personnel and veterans are invited for publication. The scope is broad and could include, for example, the conduct and outcome of military operations, effect of climate, improvements in trauma care, surgical techniques and mental health. The article should focus on health care delivery and practice as the main theme and may compare changes from earlier practice to those in use today. The editorial board may invite such articles directly however if you wish to submit a manuscript the editor should be consulted in advance. The style of this category will be the same as that applied to a review article.

Obituaries

The editorial board will accept obituaries for individuals who have served as health professionals within the Australian Defence Force. These have been very successful in the British Medical Journal (BMJ) to provide information to the wider health readership. Guidance for preparing an obituary can be found on the BMJ web site, www.bmj.com (e.g. *BMJ 1995;311:680-681* (9 September) and *BMJ*

1995;311:143-144 (15 July)). Obituaries should be submitted within one month of death and will be subject to editing if required.

Book reviews

Reviews of publications which have a direct focus on military and veterans' health for educational, informative, reference or other reasons will be invited. The author/s would be expected to be independent, have considerable experience and/or a track record and a direct involvement in the field which is addressed by the publication.

Commentary

Commentaries will be short articles which provide incisive, informative and balanced comment on current health issues. The editors may invite commentary on a research paper published in the same edition of the journal. All commentary articles will be peer reviewed and the article style will be that of an editorial.

A view from the front

This category will consider submissions from health individuals at the front line of health care and health delivery to serving personnel and veterans. These articles should be topical, recent, may contain an individual's personal view of a health delivery system and will be subject to peer review.

3. Editorial policy

Original material

The Journal of Military and Veterans' Health publishes original work describing health related research studies. Submitted manuscripts must not have been published or submitted for publication elsewhere, either in whole or in part. This applies to both paper and electronic methods of publication but not to abstracts presented to scientific meetings. Authors planning to submit review articles should first contact the Editorial Office to ensure the appropriateness of the subject material.

Disclaimer

While the Editorial Board makes every effort to ensure that no inaccurate or misleading data, opinions or statements are published in the journal, all data, results and opinions appearing in articles and advertisements are the responsibility of the contributor/s and/or the advertiser concerned. Accordingly the Editorial Board and their respective employees, officers and agents accept no liability whatsoever for the consequences of any such inaccurate or misleading data, results, opinions or statements. While every effort is made to ensure that all data are accurately presented, new methods and techniques should only be considered in conjunction with published literature from manufacturers.

Ethics approvals

All studies that involve participation of humans, information on participants or which would otherwise be considered to require ethical approval related to the principles set forth in the Helsinki Declaration should be conducted in accordance with such principles. Studies of this nature must contain a statement indicating that approval has been granted by a properly established Human Research Ethics Committee.

All studies involving experiments with animals must contain a statement indicating that the protocol *was approved by an appropriately constituted ethics committee or institutional review board in compliance with guidelines* established by that country's government. A statement must be included that indicates that all animals received humane care in compliance with these guidelines.

Confidentiality

Confidentiality must be maintained in relation to all participants. All presented data must be de-identified. If a participant is able to be identified from illustrations, photographs, case studies or other study data then release forms or copies of permission for publication must be submitted with the manuscript.

All potentially identifying information (including patient likenesses, identification numbers, names and initials) must be removed from images, tables, graphs, charts and text before the manuscript is submitted.

If a reference is made in the text to personal communication (oral or written) as a source of information, a signed statement of permission is required from each source. The year of receipt of these statements should be provided in the text. Use of personal communication as a reference will only be accepted in special instances.

Informed consent

A statement must be included indicating that informed consent was obtained from all participants if data were obtained from or were related to human participants.

Author's Process form

Each author must complete this form and forward the original signed copy to the editorial office. A faxed or scanned image may be submitted electronically to maintain the editorial process however the original completed form must be received by the editorial office before publication.

Copyright assignment

Copyright for each submission is to be assigned to the Journal of Military and Veterans' Health or provision for a licensing arrangement must be completed (*Author's Process* form).

Conflict of interest and funding

Authors are responsible for recognising and disclosing financial and other conflicts of interest that may bias or could be perceived to bias their work. They should acknowledge in the manuscript all financial support for the work and other financial or personal connections to the work. Each author must complete the conflict of interest and funding section of the *Author's Process* form.

Authorship and acknowledgments

Each author must indicate their contribution to preparation of the manuscript (*Author's Process* form). The corresponding author is responsible for ensuring that all individuals who do not satisfy the criteria for authorship are noted in the acknowledgements section together with a brief description of their contribution.

Sole submission

Authors must indicate that the work is original and has not been published or submitted for publication in another journal (*Author's Process* form) as the same or similar material. This includes submission by the authors and their colleagues in the interval before this work is published. Submission by authors of similar material to advertising, news media or other forms of publication must be indicated when the Journal of Military and Veterans' Health receives your manuscript and a copy of that material should be provided with your manuscript.

Peer review

Two or more referees are assigned to review each submission (except for Book Reviews and Reprinted Articles). Acceptance of original articles is based on significance, originality, scientific quality and interest to the Journal of Military and Veterans' Health readership. If the submission is accepted for publication, editorial revisions may be made to aid clarity and understanding without altering the meaning. Authors are given the opportunity to nominate reviewers whom they believe are expert and impartial in their area of interest.

Offprints

A copy of the final paper will be provided to the corresponding author in pdf format. A copy will be available from the journal website (www.jmvh.org) for interested individuals to download. These copies are made available for single, personal use only and are not available for commercial or other use.

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Written permission to reproduce any previously published tables or figures must be obtained from the copyright holder (and authors as applicable) and a copy of this permission provided with your submission. Any reproduced material must be clearly identified and its source and permission noted in the manuscript.

Clinical trial registration

We define a clinical trial as "Any project that prospectively assigns human subjects to intervention and comparison groups to study the cause-and-effect relationship between a medical intervention and a health outcome (ICMJE definition). These should be registered, including early phase uncontrolled trials (phase I) in patients or healthy volunteers (WHO Recommendation)".

The Journal of Military and Veterans' Health requires all clinical trials to be registered with a registry that is accessible to the public (at no charge); is searchable using standard, electronic (internet) means; is open to all prospective registrants at minimal or no cost; validates registered information; identifies trials with a unique number; and includes basic information related to the researchers and the trial.

If you are submitting a randomised controlled trial, add the registration number of the trial and the name of the trial registry in the acknowledgements section of your manuscript. Other trial registers that currently meet all of the International Committee of Medical Journal Editors (ICMJE) and World Health Organization (WHO) requirements can be found at http://www.icmje.org/faq.pdf.

Registries that meet these criteria include:

- Australian Clinical Trials Registry (www.actr.org.au/)

- US National Library of Medicine (sponsor) (www.clinicaltrials.gov)
- The International Standard Randomised Controlled Trial Number registry (www.controlled-trials.com)
- The National (UK) Research Register (www.update-software.com/national/)
- European Clinical Trials Database (http://eudract.emea.europa.eu/)

Language

All manuscripts must be written in English. Spelling and phraseology should be to either standard English or standard American usage and should be consistent throughout the manuscript. Contributors with a non-English native language are encouraged to seek the help of a competent linguist who is familiar with medical terminology prior to submission. It is the author's responsibility to have the language revised before submitting the work for publication. Only minor language revisions are provided after submission.

Review process

Receipt of all submitted papers is acknowledged by email. Manuscripts are initially assessed by the editors and then sent for external review to experts in the field. The corresponding author will be notified by email when a decision is reached. To aid in the peer review process we invite authors to suggest potential reviewers, with their contact details, in the cover letter.

Reproduction of articles, figures and tables

If you would like permission to reproduce an item from material published by the Journal of Military and Veterans' Health, contact the editorial office by email editorial@jmvh.org.

Software and format

The manuscript must be supplied in Microsoft Word in .doc format (Word 2007 file format not accepted at this point in time) or in rich text format. Files prepared in other packages will only be accepted and considered provided they are compatible with Microsoft Word and that *any reformatting is minor.* Files prepared in various desktop publishing proprietary formats will not be accepted.

4. Organisation of manuscripts

Papers will differ in structure depending on category. These instructions refer to sections of manuscripts independent of category where these sections are included. For original research articles the structure should follow the order below with each section beginning on a new page. Reviews should commence with an abstract and then be organised such that the information is presented in a logical sequence with informative headings and sub-headings related to the content.

Title page

The manuscript should be preceded by a title page which includes the following information:

- Concise title of manuscript
- Name, address, title, highest qualification, affiliation and contact details (email, postal address, telephone and fax) for each author
- Identify corresponding author
- Identify (email) address for correspondence (corresponding author)
- Short running title (maximum 50 characters including spaces)
- Word count (text of paper only – excludes abstract, references, figures and tables)

Abstract

The abstract for original articles should be structured under the following headings: Background, Purpose, Material and Methods, Results, Conclusion. The Background must be a maximum of two sentences. Maximum length of the summary should be 250 words with three to five key words or phrases included below the abstract or summary.

Conflict of Interest

All conflicts of interest must be disclosed in full in this section of the manuscript. These may include, but not be limited to, specific or "in kind" interests, incentives and relationships in respect of the manuscript (e.g. grants, funding, honoraria, stock ownerships, royalties, payment of expenses). This section applies to all authors.

Introduction

It should be assumed that the reader does not have a comprehensive knowledge in the field and you should therefore provide a concise account of the background (including relevant literature references) and reasons for this study.

Materials and methods

Descriptions of any techniques and methods must provide sufficient detail such that a reader can replicate the procedures. Methods that have been published elsewhere should not be described in detail and should be referenced to the original work

Statistics. A full description of the statistical methods used should be provided.

Results

Description of results, while concise, should permit repetition of the procedures and direct comparison with similar data by others. Data should not be repeated unnecessarily in the text, figures and tables and appropriate selection of significant figures for numerical data presentation should be applied. Significance should be expressed as values of probability. Where appropriate, results should be presented as figures rather than tables of data.

Discussion

The discussion should not simply reiterate the results presented; the authors should present their analysis and conclusions with reference to the current knowledge base related to this work. Any assumptions on which conclusions may be based should be stated and there should be some discussion of strengths and weaknesses of the research.

Acknowledgements

These should be brief and should include references to sources of support including financial, logistical and access to material not commercially available. Any individuals named must be given the opportunity to read the paper and approve their inclusion in the acknowledgements before the paper is submitted.

References

A list of references should be provided starting on a new page. Only published references or those genuinely in press should be included.

Tables (including legends to tables)

Tables are to be placed at the end of the manuscript in order of appearance in the text with one table per page. Captions to tables should be short and concise, not exceed one sentence and be on the same page as the table.

Illustrations

These are to be submitted as a separate electronic file for each image.

5. Preparation of manuscripts

Style

References. A standard English dictionary should be used (e.g. Oxford English Dictionary 2007) for spelling or hyphenation of non-medical terms and Dorland's Illustrated Medical Dictionary (WB Saunders, Philadelphia) is recommended for medical terms. A source for general style including grammar, punctuation and capitalisation is the Style manual for authors, editors and printers, Sixth edition 2002 (John Wiley and Sons, Australia).

Numbers. Use numerals for all units of measure and time and for all sets of numbers (e.g. 1 m, 2 hours, 5 years, 4%, 2 of 6 observations). Spell out the numbers one through nine only for general usage (e.g. "we had two opportunities"). Spell out numbers beginning a sentence.

Abbreviations. Abbreviations should be kept to a minimum to avoid confusion with readers who may not be familiar with the subject material. Only standard abbreviations, as listed in a style manual or accepted internationally for use within a subject area, may be used without definition. Terms used frequently within a manuscript may be abbreviated however these should be spelled out at first citation with the abbreviation in parenthesis. Abbreviations in speciality areas must conform to accepted use in that area.

Layout. Headings and sub-headings should be consistent throughout the article and conform to the style used in articles previously published in the journal. No text should be underlined. Prepare the manuscript with double-spacing and allow margins of 2.5 cm.

Tables

Tables should be on separate pages at the end of the paper (following the References section) and be capable of interpretation without reference to the text. They should be numbered consecutively with Arabic numerals (e.g. Table 1). A concise, descriptive caption must be provided for each table. Units in which results are expressed should be given in brackets at the top of each column and not repeated on each line of the table. Ditto signs are not acceptable. An indication should be provided in the manuscript as a guide to indicate where the table should be inserted.

Image files

All images must be submitted as separate files. Images embedded in word processing files are not

acceptable. Each image must be referred to in the text and an indication should be provided in the text as to the preferred position of the image. Lettering and lines should be of uniform density and the lines unbroken. Image size and layout should be constructed so that each can be placed within a single column or page width.

At submission all files must satisfy the following criteria for resolution, file format and file size and be submitted in the actual size to be used. Image width should be constructed to be either one or two column width.

- Halftone images 600 dpi
- Colour images 400 dpi (saved as CMYK)
- Images containing text 600 dpi
- Black and white line art 1200 dpi
- File types TIF, EPS (JPG and GIF are not suitable)
- Figure width (single column) -- mm
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- Font type Times, Times New Roman, Helvetica, Arial
- Line width Between 0.5 and 1.0 point

Illustrations. These should be referred to in the text as figures (e.g. Figure 1) and numbered consecutively with Arabic numerals. Photographs and illustrations will only be accepted as digital images and should be either composed or cropped before submission to ensure there is no unwanted material in the frame. Digital files judged to be unacceptable in the review process must be resubmitted by the authors.

Graphs, charts and figures. All graphs, charts and figures must be submitted in electronic format (.EPS or .TIF files) and should be prepared by a suitable software package. These should be referred to in the text as figures (e.g. Figure 1). Images of hand drawn material will generally not be accepted. Symbols which are to appear in the figure (and not in the caption) should be chosen from the following available types:

● ❍ ■ ❑ ▼ ▲ ♦ ◊ + ∆

Footnotes

The following symbols should be used in the order given to reference footnotes:

*, †, ‡, §, ||, ¶, **, ††, ‡‡

References

The list of references should appear at the end of the manuscript. References should be numbered consecutively in the order in which they are first mentioned in the text. References in text, tables and legends should be identified by Arabic numbers and appear in the text in superscript, for example text 1 or text 2-4 or text 5,6-7. Where punctuation (e.g. comma, period) follows a reference number then the punctuation should appear after the reference.

The format of references should follow the "Vancouver" style as described in the *Uniform requirements for manuscripts submitted to biomedical journals* (www.icmje.org/). The Journal of Military and Veterans' Health varies in two respects from these guidelines: Surnames and initials of no more than the first three authors [*et al.*] are cited and the first and last page numbers of a reference are cited in full. Journal names should be abbreviated as accepted in Index Medicus http://www.nlm.nih.gov/tsd/serials/lji.html) and a period is not used after journal name abbreviations (e.g. J Mil Vet Health). A list providing detailed examples of references for many types of publication is available at http://www.nlm.nih.gov/bsd/uniform_requirements.html. Where appropriate, cite the type of reference (e.g. letter, editorial, abstract or supplement).

Authors should verify references against the original documents and are responsible for checking that none of the references cite retracted articles except in the context of referring to the retraction. For articles published in journals indexed in MEDLINE, the International Committee of Medical Journal Editors considers PubMed (http://www.ncbi.nlm.nih.gov/sites/entrez/) the authoritative source for information about retractions. Authors can identify retracted articles in MEDLINE by using the following search term, where pt in square brackets stands for publication type: Retracted publication [pt] in pubmed.

An example of the reference system is as follows:

1. Quail G. Asthma in the military. *Aust Mil Med* 2000; 9(3):129-137.

Units of measurement

The International System of Units (SI) must be used. For values less than zero enter a zero before the decimal point e.g. 0.123. The style should include a solidus e.g. mg/L.

Abbreviations

Use of abbreviations should be minimised. Spell out non-standard abbreviations at their first mention in the text followed by the abbreviation in parentheses. Avoid uncommon abbreviations and jargon.

6. Checklist

Check the following items before submitting your manuscript.

- ☐ Covering letter
- ☐ Author's Process Form completed by all authors
- ☐ Copy of permission to publish material from other sources (copyright holders)
- ☐ All individuals named in Acknowledgements have read the paper and approved their inclusion.
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- ☐ Copies of any part of the manuscript that may have been published previously
- ☐ Copies of any advertising or other material that includes any of the submitted material or data
- ☐ Statement on ethics approval/s included

7. Submission of manuscripts

Covering letter

Your covering letter should be submitted electronically with the manuscript as a separate file. It can contain author identifying information as it will not be shown to peer reviewers. It should include:

- Why the paper should be published in the Journal of Military and Veterans' Health
- Details of suggested reviewers

Proofs

Proofs will be sent in electronic form as a PDF to the corresponding author who should read them carefully. Major alterations to the text cannot be accepted at this stage. The proofs should be corrected and returned to the Editorial Office by fax or email (image) within 48 hours of receipt.

Software file requirements

The software files must be named so that each is uniquely identified and attributable to your submission. All files submitted should be named to include the following information in the order below:

- Corresponding author surname
- Corresponding author initials
- Title of paper (may be abbreviated)
- Supplementary identifier to indicate contents of file (e.g. for a figure, include *figure* and unique identifier which can be related to that figure).

Examples:

Quail G Asthma in the military Text of paper.doc
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