Editorial

Changing the Guard

As we approach the year 2000, we are seeing some fundamental changes in the composition and, I expect, direction of the Defence Health Service. Brigadier Paul Buckley is retiring after a long and distinguished career in the Royal Australiain Army Medical Corps and the Defence Health Service Branch. AMMA is grateful for his support over the years and we wish him well on his future endeavours. His place will be taken by Brigadier Wayne Ramsey, who comes to the position of Director General of the Defence Health Service after a challenging two years as the inaugural Director of the Joint Health Support Agency. As the new DGDHS, BRIG Ramsey will be taking Defence Health Service into a challenging period as Defence Health come to terms with providing support to deployments in East Timor and Bougainville. Future evolutions, like the Olympics, and the ever present unexpected should ensure a frenetic start to the new millennium. I will be talking to BRIG. Ramsey to get his vision for the future, hopefully for next issue.

On the AMMA front, we are seeing the stepping down of Captain Russ Schedlich as both the Fleet Medical Officer and the Editor of the Australian Military Medicine. Fortunately, Russ is remaining on as Vice President. Russ has taken the journal from its early newsletter days to the premiere Australian Military Medicine journal it is today. For that, and his other tireless efforts in the AMMA Council, we owe him a debt of gratitude. I am only just realizing now the amount of effort that Russ had to put in to get the journal out.

Well, who am I?? Many of you will already know me, but for those who don't, I'll give you a brief summary. I joined the Navy as a medical undergraduate in 1979 and started with the Navy full time in 1984, after completing two years of residency at Royal Prince Alfred Hospital. I have served on various ships and bases, in Australia and overseas, with the particular emphasis on those in Western Australia. I initially trained as an Underwater Medicine doctor but have branched out into Public Health Medicine and Medical Administration, both areas in which I hold medical specialist qualifications. More recently, I sub-specialized in Nuclear, Biological and Chemical Defence Medicine and many of you will have met me through the Medical Officers NBC course. I am currently the Medical NBC Adviser to Defence. I have been on the AMMA Council, with one slight break whilst overseas, since its inception and have been assistant editor for the past few years. I am keen to see the journal grow even further and I appreciate any assistance people can give me in this endeavour. I have already been fortunate in recruiting a very capable assistant editor, SQNLDR Karen Gisler. So if you have something to contribute, please feel free to e-mail either Karen (kgisler@cyberone.com.au) or me (agrobert@excite.com).

What is my vision? My vision is to publish the journal at least 4 times a year, to increase the size of the journal and to tap into that deep wellspring of military medicine knowledge in our community. I believe that this journal should and can become one of the premiere military medicine journals in our field. To achieve this, I will need you help and will endeavour to speak with many of you over the next twelve months to seek your contributions. I am also interested in novel ideas so send me an e-mail if there is anything that you think could contribute to these aims.

Andy Robertson

Coming next issue:

- Developing injury prevention strategies for the Australian Defence Force
- The price of prevention: Drugs, vaccines and medications used to prevent disease in the ADF
- Emergency medicine in the military: A new untapped specialty
- Hypothermia: A review
- Landmines

President's Message

Time marches on and here we are facing the end of another year. Once again, the need for military medical services and humanitarian aid has been on the front pages of our national newspapers. The Nobel Peace Prize has been won by an organization, Medecins Sans Frontieres, which clearly practices the disciplines of Military Medicine. This year has followed the pattern of the 1990's, and, indeed, of the 1900's as being a year in which health support to the community in times of great distress is required and crucial to the survival and well being of those communities.

At our recent National Meeting, there was a very positive feeling about our direction and the quality of achievement by our members and those actively practicing military medicine. The recent demands placed on military health practitioners in Bougainville, East Timor and in recent military and emergency response scenarios has, briefly, captured the interest of the media. A number of speakers were approached by members of the media during our recent meeting, a sign of the recognition of our association as being an important resource and provider of collective knowledge in the fields of Military Medicine.

In the past year, I have both written and spoken of the period of consolidation which AMMA has passed through as we have strived to establish ourselves as a broad based and relevant association. Much of the last two years have been spent streamlining our procedures and ensuring that our database is accurate. Now, I think we have reached a point where we need to expand further and build on our firm foundations. Council, with the support of our Patron, Major-General John Pearn, is planning a membership drive that will have the benefit of both increasing our knowledge base and improving our financial footing.

I ask for your help in encouraging colleagues and acquaintances with an interest in Military Medicine in joining, or re-joining AMMA. The strength of our association relies on the depth of the shared expertise and interest of our membership. Because military medicine has such breadth, the scope of an organization such as AMMA to act as a forum wherein all the different branches and disciplines that are involved in the provision of health care may be both heard and recognized for their contributions is enormous.

Once again, I encourage you all to consider just how much we can achieve if our membership base maintained an active role in helping the society to expand and share our collective knowledge.

This journal is the first issue under the editorship of Andy Robertson who takes over from Russ Schedlich. While thanking Russ for his role in taking our journal from a newsletter to a journal, I wish Andy the very best in the next stage of our journal's development. I hope that all of you may consider sharing your experiences, expertise and practical concerns through the pages of Australian Military Medicine. As I have said many times, the quality of the presentations given at our National Meeting reflects on the degree of knowledge in the association. By contributing to the journal, the interest and discussion generated will add further value to both the journal and the association as a whole.

Finally, as we reach the end of another year, on behalf of the council, I wish you all a happy and safe festive season and look forward to the year 2000. The 1990's have seen the birth and early days of AMMA. As we leave them we hope that the next few years allow us continued growth and development.

Nader Abou-Seif

Original Article

Japanese Encephalitis – "The Plague Of The Orient"[1]

A. Lewis[2]

"Japanese encephalitis (JE), the "Plague of the Orient", is the most important mosquito-borne viral encephalitis in Asia."[1]

INTRODUCTION

Japanese encephalitis is one of a number of **ar**thropod **bo**rne **viruses** (arboviruses) known to cause human disease. It is a zoonoses of water birds and large mammals, such as pigs. It is usually transmitted by the bites of *Culex spp*. mosquitoes, mainly *Cx. Tritaeniorhynchus* and *Cx. Gelidus*. Human disease is associated with proximity to normal host populations, in particular pigs. Those at most risk of developing encephalitis are the young, due to not have been previously exposed, and the elderly, because of their reduced ability to 'fight' the disease. Other groups at risk include displaced persons such as refugees and long term expatriates living and working in rural settings.

JE is found throughout the Far East and SE Asia. It was until recently considered a disease of the Orient. Recently, however, there have been reports of JE cases in the Australasian region. Several vaccines are available. In Japan, use of Japanese Encephalitis vaccine has greatly reduced the transmission of JE.

DISCUSSION

Arboviruses

Arbovirus infection refers to those illnesses caused by **ar**thropod **bo**rne **viruses**. These are commonly zoonoses maintained in a wild animal reservoir, often rodents and birds. Man is usually an incidental host and transmission occurs with proximity to infected animal reservoirs. There are some arboviruses, such as Dengue, that do not seem to rely on an animal reservoir. For others such as Japanese encephalitis, animal reservoirs are amplifying hosts for the illness. Arboviral infection can be present in a population without outward signs of infection as a result of a build up of immunity in the population. Epidemics occur when the immunity level drops, thus effecting the young and elderly most often, or those coming from non infected areas, such as peacekeeping forces. [2,3]

There are four common clinical syndromes caused by arboviruses:

- Acute undifferentiated fever.
- Fever with a morbilliform rash.
- Fever with hepatitis and haemorrhagic features.
- Fever with encephalitis.

Japanese Encephalitis

Japanese encephalitis is caused by a flavivirus,[4] transmitted by the bite of mosquitoes usually of the *Culex spp*. Initial symptoms include sudden onset with fever, headache and vomiting. For some, fits and/or disturbances in level of consciousness may follow. For every person with clinical JE there are likely to be from 25 to 1000 persons with subclinical infection. For those that develop encephalitis, there are three outcomes. For 25% of the cases, the outcome will be fatal. Of the survivors, 50% will develop permanent neurological damage. The rest will have a full recovery. Children are the main victims in epidemics as they have no immunity due to previous exposure. The same applies for large groups of people coming from areas where JE is not a risk. Thus, refugees and armies are susceptible during periods of epidemic transmission. For instance, the ratio of encephalitis cases to infection in American servicemen in Korea is 1:25. This compares to a ratio of 1:1000 children in Japan during times of epidemic transmission.[2]

Distribution of JE

Wallace's and Weber's Lines [5,6]

Alfred Russel Wallace, a nineteenth century naturalist, proposed a hypothetical boundary between the faunal regions of the Orient and Australasia. Wallace' Line was a regional

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1 Lewis A. Japanese encephalitis: The plague of the Orient. *Aust Mil Med* 1999; 8(3), 3-6.

2 Capt. Tony Lewis is a Nursing Officer and is currently posted as the Health Intelligence Officer for the New Zealand Defence Force.

boundary or line extending from the Indian Ocean through the Lombok Strait (between the islands of Bali and Lombok), northward through the Makasar Strait (between Borneo and the Celebes), and eastward, south of Mindanao, into the Philippine Sea. This line presents an abrupt limit to the distribution of many fish, bird and mammal groups.

Figure 1: Crossing the Line

In 1902, a replacement was proposed. Weber's Line extends from the Indian Ocean through the Timor Sea east of Timor, northward through the Molucca Sea (between the Celebes and the Moluccas), and into the Philippine Sea north of the Moluccas. Until recently Wallace's Line was considered the usual eastward limit to the geographic distribution of JE. This may be changing, as there has now been JE spread to islands of the Torres Strait and reports of JE in Irian Jaya and Western Province of Papua New Guinea.[6] Is it possible that JE could spread to NZ? Potential vectors certainly exist.[7]

Figure 2: Distribution of Japanese Encephalitis

Vectors

Figure 3: Culex quinquefasciatus

Culex tritaeniorhynchus and *Cx gelidus* are the primary vectors of JE. These mosquitoes rarely enter houses. The adult mosquitoes feed throughout the night with peak biting activity at dawn and dusk, preferring wading birds and domestic animals. They feed on man during times of high vector population density. Larvae are found in a variety of sites including temporary ground pools, rice paddies, irrigation canals, bodies of polluted water and occasionally, artificial containers. Secondary vectors include *Culex vishnui*, *Cx. Fuscocephala, Anopheles annularis* and *An. vagus*.

Hosts

Birds and large mammals, especially pigs, are the favoured hosts. Man is an incidental host especially in rice growing areas or where there are pig farms. A recent outbreak of illness in Malaysia was thought to be JE as it was associated with areas of pig farming. This was eventually found to be a 'Hendra' type virus, not JE.

Risk

" The risk for acquiring JE is low for travelers. Only 11 cases have been reported in Americans since 1981, seven in military personnel or their dependents. In seven studies, JE attack rates among western military personnel in Asia have ranged from 0.05 to 2.1 per 10,000 per week with a median of 0.9. The low risk for acquiring infection and especially for developing symptomatic infection is explained by the following calculations. Typically, infection rates among vector mosquitoes are in the range of 5 per 1000. One estimate from India suggested that, during a transmission season, a child might receive 6000 bites from vector mosquitoes, of which only two might be infective. After infection, only one in 500 cases is symptomatic."[8]

Risk factors for disease relate to time, place and person:[8]

There are two aspects to time; seasonality and host seeking activity of mosquito vectors. "*Transmission is seasonal and occurs in the summer and autumn in the temperate regions of China, Japan, Korea and eastern areas of Russia. Elsewhere, seasonal patterns of disease are more extended or vary with the rainy season and irrigation practices.*" [9] For transmission to man it also relies on mosquito densities which are effected by the seasonal variance.

The areas where JE is mostly transmitted are rural areas of the Far East and SE Asia where pigs are abundant and rice fields provide a suitable habitat for mosquito breeding. Urban areas can be at risk where they are in close proximity to pig farming.

Individuals are at risk when their activities take them into areas of high transmission, for instance, rice farmers. Age is also a factor due to lack of immunity or an inability to 'fight' the illness. Displaced persons into areas of JE risk, are particularly susceptible if no previous exposure and because of the likelihood of inadequate mosquito protection strategies.

For the visitor, the risk factors for acquiring JE infection are:[10]

- Travel to endemic areas,
- Travel during transmission season,
- Extended period of travel or residence in the area,
- Outdoor activities, especially in the twilight period and evening,
- Poor protection against mosquito bites, and
- Lack of immunisation.

The risk to tourists travelling to endemic areas is quite low, less than 1:1,000,000. But the risk for visitors to rural endemic areas is increased during the transmission season to 1:5,000 per month. Despite this low risk, JE has occurred in a tourist to Bali after a short visit of only ten days.[11]

PREVENTION

Primary means of protection against JE is avoidance of mosquito bites. Personal protection includes the use of DEET insect repellent on exposed skin, the use of mosquito nets and insect screens, permethrin impregnation of clothing and mosquito nets and vaccination. Community protection includes monitoring of JE serology in pigs, the control of mosquito breeding areas, and community education.

Where possible, persons in JE risk areas should use DEET based insect repellent on exposed skin surfaces. They should wear shirts with sleeves down and long trousers. Clothing and mosquito nets should be treated with permethrin to reduce mosquito biting. At night mosquito nets should be used and where possible rooms with window screens and air-conditioned. The idea is to stop place a barrier between the person and mosquitoes. These precautions also reduce the risk of other diseases such as malaria and dengue, which often occur in areas of JE activity.

Monitoring of JE serology in 'sentinel' pigs is one way of predicting outbreaks of the disease.[6] Cases in the Torres Strait and one reported case in Cape York area have triggered concern over its spread to Australia in recent years.

It is very clear that control of mosquitoes is one area that can reduce the risk of JE to humans. This is only one area and it must be continually maintained. It requires community participation and government commitment. Longer-term strategies include vaccination of people and vaccination of host animals such as pigs.

All these strategies require education as often the disease is hidden from view. Such a strategy was employed in Malaysia during the suspected JE outbreak earlier this year.

The Vaccine

"*Japanese Encephalitis Virus Vaccine Inactivated JE-VAX is a sterile, lyophilised vaccine for subcutaneous use, prepared by inoculating mice intracerebrally with Japanese encephalitis (JE) virus, "Nakayama-NIH" strain, manufactured by The Research Foundation for Microbial Diseases of Osaka University ("BIKEN "). Infected brains are harvested and homogenised in phosphate buffered saline, pH 8.0. The homogenate is centrifuged and the supernatant inactivated with formaldehyde, then processed to yield a partially purified, inactivated virus suspension. This is further purified by ultra-centrifugation through 40% w/v sucrose. The suspension is then lyophilised in final containers and sealed under dry nitrogen atmosphere. Thiomersal (a mercury derivative) is added as a preservative to a final concentration of 0.007% w/v. The diluent, Sterile Water for Injection, contains no preservative. Each 1.0 mL dose contains 11 mg of Tissue Culture Medium 199, 5 mg monosodium glutamate, 470 mcg of gelatin, less than 100 mcg of formaldehyde, less than 0.0007% v/v polysorbate 80 and less than 50 ng of mouse serum protein. No myelin basic protein can be detected at the detection threshold of the assay (<2 ng/mL). Prior to reconstitution, the vaccine is a white caked powder, and after reconstitution the vaccine is a colourless transparent liquid. The potency of JE-VAX is determined by immunising mice with either the test vaccine or the JE reference vaccine. Neutralising antibodies are measured*

in a plaque neutralisation assay performed on sera from the immunised mice. The potency of the test vaccine must be no less than that of the reference vaccine. " [12]

The vaccine available in New Zealand is JE-VAX from CSL. It is available in New Zealand under Section 29 of the Medicines Act 1981 on a named patient basis.

It is considered to be at least 95% effective following its normal course of 0, 7 and 30 days. The vaccine can be given on days 0, 7 and 14 if there is insufficient time to vaccinate before departure. The vaccine may also be given as two doses on days 0 and 7, but this is considered to only confer up to 80% protection. In countries where JE is endemic, such as Japan, it is given as a two-dose course.

The current vaccine has a history of adverse reactions during the early 90s. It is thought that this may be due to a 'bad' batch and studies continue to assess the overall risk from the vaccine.[13,14] There is an accepted rule, internationally, of allowing ten days from the last dose of the vaccine before departing overseas. This is to allow for medical care of individuals who may have a delayed adverse reaction requiring hospitalisation.

As a general rule of thumb, JE-Vax is given to those travellers going to areas of JE risk, during the risk period, and staying in rural environment for periods exceeding 30 days.

Treatment

Once symptomatic JE is present there is no specified treatment other than supportive care.

Conclusion

Japanese encephalitis is referred to as the "Plague of the Orient". Its main victims are the young and the elderly. It is an arbovirus that is spread by the bite of mosquitoes, mainly of the *Culex spp.* The usual hosts for the disease are water birds and large mammals such as pigs and horses. Man is an incidental host, relative to his proximity to infected birds and domestic animals, the time of year and mosquito densities.

The risk of acquiring JE for the traveller is low. In areas of JE endemicity, it is likely that a substantial majority of the population will be serologically positive for JE. Those that become infected by JE are likely to be asymptomatic, however, of those that develop symptoms the fatality rate is 25%. Of those that recover, some 50% are left with neurological deficit.

There are vaccines for the prevention of JE. The one used in NZ is JE-Vax from CSL. It is available under Section 29 of the Medicines Act 1981. Concern has been raised about its safety due to adverse events in the early 90s. It is recommended for use for persons who will be staying in rural areas during times of JE transmission for periods greater than 30 days or for expatriates staying in JE endemic countries for over 6 months.

JE is spreading beyond its traditional region of the Orient. Concern has been expressed about its moving into Australia. Whether conditions are favourable for its spread to NZ could be debated, but it is important that one keeps an open mind and is always aware of the potential possibilities.

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Preventative Health Advice to Deploying Units[1]

K. Clifford, S. Frances, P. Nasveld, B. Russell[2]

Abstract

The aim of the article is to discuss the importance of providing adequate health advice and support to troops deploying within Australia away from base areas. This was developed through a briefing of a unit exposed to Ross River Virus (RRV) within SouthEast Queensland. The results of an epidemiological study conducted to investigate the above will be highlighted and the effects on the members involved, their unit and our understanding of the disease itself will be discussed. Recommendations in regard to ongoing basic health maintenance advice, preventative health refresher training and ongoing disease surveillance within Australia will conclude the article.

Introduction

Ross River Virus (RRV) is a mosquito borne Arbovirus active within Australia and areas of Australian strategic interest. The disease infects thousands of Australians a year, with economic effects through loss of man-hours and productivity amounting to millions of dollars. The latest Notifiable Disease statistics for Queensland (April 1999) report a seasonal pattern of notifications (Jan-Jun with peaks in March) with 1638 notifications reported for the year to date (2071 mean year to date 94-98).

Defence personnel are likely to be at a greater risk in some areas than the general community. They find themselves deployed in areas of risk, operating in environments representative of the vector's natural habitat. Troop concentrations facilitate the transmission of the virus between personnel. There is an associated risk that troops returning to home base areas can translocate the disease to new areas where the right conditions may exist for the disease to present as a short term problem, if not endemic.

Also known as Epidemic Polyarthritis, the disease is transmitted by a number of mosquito vectors via native animal hosts. Endemic in the Shoalwater Bay Training Area (SWBTA), Townsville and South Eastern Queensland, the disease causes symptoms ranging from a transient rash and flu-like illness to headaches, fevers and mild to severe polyarthritis. This last feature of severe joint pain has given its common name, and represents the most debilitating factor.

As the symptoms of RRV are similar to a number of other diseases, blood serum testing is needed for infection with RRV to be confirmed. The presence of IgM acutely after onset of symptoms should be noted, followed (usually within 10 days) by rising titres of IgG. As false positive IgM results are possible, it is necessary that IgG be identified before confirmation of infection can be made.

Background

During the period 18-28 March 1999, 169 mixed military and civilian contract personnel deployed to Tara, South-East Queensland for a 10 day exercise. In the weeks following their return, 3 members presented with debilitating illness and were found to be IgM positive RRV on investigative serology. Following discussion with the Army Malaria Institute (AMI) as to the extent that the disease may have infected the subject group as a whole, it was proposed that a study be conducted to establish the features of the exposure. This would assist understanding the disease as relatively little is known in this area of epidemiology.

Significance

Exposure of a sub-group was clinically suspected, but it was believed that an unknown additional sub-group was infected but only mildly symptomatic or asymptomatic. These cases should be IgM positive, but may not have presented for treatment or went unrecognised due to only minor symptom complaints.

AMI advised that the Clinical to Subclinical disease ratio in this type of population was as yet unclear and that, from a military health point of view, there was significant research value in investigating this group. Locally, we were also interested in whether preventative measures taken against mosquito borne infection by the troops in the field had any

[1] Clifford K, Frances S, Nasveld P, Russell B. Preventative Health Advice to Deploying Units. *Aust Mil Med* 1999; 8(3), 7-12.

[2] CAPT Kerry Clifford is the Acting Officer Commanding Health Services, Medical Centre, Army Aviation Centre.

relationship to the final epidemiological findings.

Conduct

A serological study was conducted under an ethics committee approved AMI standing protocol for Arbovirus Surveillance. A questionnaire tool was developed in order to obtain information relating to the exercise, possible previous RRV exposure, use of preventative measures and post-exercise illness.

Volunteers from members of the unit (and other similar local units) who did not attend the exercise were encouraged in order to provide control subjects and to assess the baseline RRV IgG status of the resident population.

A briefing was conducted 20 May 99 before a unit administration parade, and volunteers were called for. 100 members subsequently presented for enrolment, with questionnaires completed and blood samples taken later that day within the unit area. Volunteer attendance was facilitated through a coordinated release from normal workplace duties on a section by section basis.

Members were greeted on presentation to the study area, and questionnaires were provided for completion. Personal regimental details were recorded separate to questionnaires, with non-identifying sequential numbers issued to ensure privacy. As the privacy number was the only means of tying questionnaires and blood samples to individual members, the study coordinator secured the personal records as per ethical research guidelines.

Subjects	No.	Age (in years)	Height (in cm)	Weight (in kg)	Sex (M,F)
Exercise	67	28.7 (19-45)	176.7 (160-193)	83.1 (46-112)	59, 8
Non-Exercise	33	33 (22-58)	177.1 (155-193)	79.7 (51-117)	27, 6

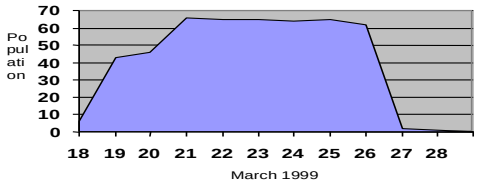
Table 1. Demographics of Study Subjects

Demographics

Of the 169 members who deployed to the exercise area, 39.6% (67) volunteered for enrolment in the study. 33 additional members from the unit, and other local units, were enrolled to participate as control subjects, to total 100 samples. Demographic data for the volunteers is at Table 1.

Duration of Exposure

Participants were asked to note the dates during which they were in the exercise area. All exercise participants identified deployment to the area within the 11 day period 18-28 March 1999, with peak occupancy of the area occurring 21-26 March 1999. 52.2% (35) of the participants reported being in the area for 8 days. The number of personnel in the exercise area (by date) is illustrated at Graph 1.



Graph 1: Number of Personnel in Exercise Area

Previous Exposure

Members were asked whether they believed they had been previously exposed, or diagnosed with RRV, and if so, when and where. 13.4% (9) of those who attended the exercise and 30.3% (10) of the control subjects reported possible previous exposure.

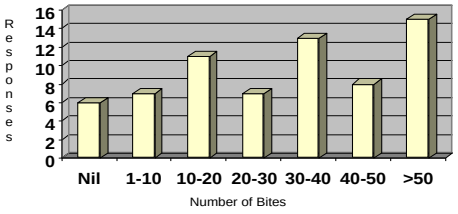


Chart 1: Number of Mosquito Bites reported

In nominating where they believed they were previously at risk of exposure, the following areas were identified per Table 2.

Area/s Nominated	Responses
Townsville	7
Darwin	1
Townsville/Tully/NT	1
Townsville/SWBTA	2
SWBTA	3
Murray River	1
Not identified	3
At risk everywhere	1

Table 2: Areas of possible previous exposure.

Preventative Measures

Volunteers were asked to address a series of questions regarding their awareness, prior to deployment, of a risk of mosquito-borne disease within the training area, and what

measures, if any, were taken with regard to the risk.

40.3% (27) reported they believed there was a risk of disease in the training area prior to deployment. 89.6% (60) reported using one or more mosquito avoidance measures, e.g. sleeves down, netting at night, or clothes dipping.

97% (65) reported using a topical repellent. Responses indicated a variety of brands and frequency of use. Nominated brands are at Table 3.

Brand	**Responses**
Army Issue	12
Rid	17
Skintastic	2
Aeroguard	4
Bushmans'	5
Combination/multiple brands	13
Not identified by brand	2

Table 3: Topical Repellents used

46.3% (31) reported attendance at preventative health briefings prior to deployment. In answering whether other preventative health measures were offered prior to deployment, 40.3% (27) indicated that additional training or resources were made available e.g. repellent, netting.

Mosquito Exposure

Symptoms and Treatment

Responses	**Number**	**%**
Rash	4	5.9
Unwell	30	44.8
Headaches	28	41.8
Fever	10	14.9
Joint pains/aches	18	26.9
Sought medical opinion	9	13.4
If not, self-treated	19	28.4

Table 4: Symptoms and Treatment

Members who had attended the exercise were asked whether they recalled having suffered any of the common symptoms of RRV infection. Over half (62.6%) reported having at least one symptom, the most common being feeling "unwell", with headaches also featuring. The results of the Symptoms and Treatment sought section of the questionnaire are at Table 4.

14 members reported having suffered only one symptom. An additional 14 members recalled having 2 of the listed symptoms, most commonly a combination of feeling unwell with either headache or joint pain. The results from this section are at Table 5 below.

No.	**Rash**	**Unwell**	**Head aches**	**Fever**	**Joint pains/ aches**
1		6	6		2
2	1	10	10	2	5
3	2	9	7	3	6
4		4	4	4	4
5	1	1	1	1	1

Table 5: Symptoms reported

9 members presented for medical opinion, reporting from 1 (felt unwell only) to all 5 of the listed symptoms. Of this group, the most common complaint was feeling unwell (8), with joint pain (7) the next most common symptom. Of the self-treatment group (19), a variety (and combinations) of relief measures were reported as per Table 6 below.

Treatment	Number
Sleep/wait/rest/untreated	8
Paracetamol	13
Aspirin	2
Cold and flu preparation	1
Antihistamine	1
Multivitamins/mineral supplement	1
Topical cream for rash	1

Table 6: Self-treatment reported

The reasons given by members who did not seek treatment varied from having only minor symptoms, to them not recognising possible infection and ascribing symptoms to other causes such as training injuries (aching joints) or over-work (lethargy).

Results of Serology

23% (23) of the 100 combined samples were found to be IgG positive for RRV; 16 from the exercise group and 7 from the control group. This represents 23.8% of the exercise subjects and 21.2% of control group. Two samples were found to be IgM positive for RRV, and another sample was found to be both IgG and IgM positive for Barmah Forest Virus, all from the exercise group.

9 subjects from the exercise indicated that they believed they had been previously exposed to RRV. Only 2 were found to be IgG positive, with 1 of these also IgM positive. Of the 10 control subjects who indicated possible previous exposure, 2 were found IgG positive.

The remaining 19 IgG positive results (14 exercise and 5 control subjects) had not indicated suspicion of previous exposure.

Of the 9 study members who reported for medical opinion, 2 were found to be IgG positive. Both reported feeling unwell with headaches and joint pain, with one also reporting fever. The member who presented for treatment and reported having all 5 of the listed symptoms was not IgM or IgG positive.

Summaries of IgM Positive Cases

RRV Case 1
• 27 yr old male: 7 days in exercise area • Not aware of risk in area, attended briefing before deployment • Reported used sleeves down and Aerogard tropical strength repellent • No known previous exposure • Reported 10-20 bites • No symptoms reported • Did not present for medical opinion
RRV Case 2
• 33 yr old male: 9 days in exercise area • Aware only of numerous mosquitos in area after recent rains • Did not attend health briefing, "preparing for other instructional periods". Sleeves down, Army issue repellent, Mosquito net used at night • No known previous infection, but noted 7 years of service in Townsville • Reported 30-40 bites. Reported small blistery rash on foot. • Felt run down for approx 2 months. Few infrequent headaches • No treatment sought from medics
BFV
• 20 yr old male: 8 days in exercise area • Unaware of risk in area • Did not attend briefings, unaware any available (? Night shift) • No known previous infection • Reported 40-50 bites • No reported illness

Summary of Overall Results

Including the initial clinical cases who prompted the study, 5 members were found IgM and IgG positive for RRV (2.9% of total on exercise). There were also 2 members found IgM and IgG positive for BFV (1.1% of total on exercise). Most were from the Advance Party that arrived several days prior to the majority of the respondents. Feedback from members of this group indicates that their reports of copious mosquitoes reinforced the need for preventative health briefings. Symptoms experienced by these members to various degrees included polyarthralgia, especially in wrists and ankles, general malaise, lethargy and headaches. These correlate to the disease symptoms reported by Flexman et al in 1998. An erythematous maculopapular rash with vesicular features was also reported one of the BFV cases, again correlating with the known disease features.

The sole member who reported having all of the listed symptoms, and reported for medical opinion, was found not to be IgM or IgG positive. This is indicative of the difficulties of interpreting and diagnosing RRV infection based on clinical signs and single sample serology alone.

Value in taking Preventative Health Measures

Had the Advance Party not recognised the mosquito risk to health within the exercise area would there have been as much emphasis, if any, on preventative health preparation for this exercise? The effects upon the manpower of this unit were minimised by the reported widespread application of topical mosquito repellent and other preventative measures. For the members who presented with clinical illness symptoms, significant periods of disability through being either unfit and/or on restricted duty, not to mention personal discomfort, were experienced. Flexman et al. note that over 50% of patients still complain of joint pains up to a year after onset, with an additional group suffering lesser symptoms for a similarly long time. [1] Relapses may also occur in subsequent years. Significant cumulative effects on unit productivity and personal morale and fitness could accrue from widespread infection within a military population.

Health briefings provided before deployment appear in this study to have shown their worth. The survey reports a high percentage use of netting, sleeves down, topical insect repellent etc, as well as a high degree of awareness of the risk pre-deployment thanks to preventative health briefings. A conclusion that could be drawn from this is that pre-deployment health briefings and the use of preventative measures in the field worked to restrict exposure to this form of disease risk.

Problems with the study

The fundamental problem, for military and civilian epidemiologists alike is that RRV IgM persistence remains essentially unknown, but possibly quite long term. As is the case for other virus infections, IgM antibody resulting from RRV infection may persist anywhere from months to years. This makes interpretation of possible acute infection from a single serum sample unreliable, even in the presence of clinical illness symptoms. Most of us have antibodies to measles, polioviruses, mumps,

etc. but we are not now ill with those viruses, and it is possible that symptoms experienced at any given time are produced by an illness unrelated to the antibody status. This also makes any attempts at correlation to a single event or location difficult.

A 1993 paper by Mackenzie et al, published in Australian Communicable Diseases Intelligence, advised that paired acute and convalescent-phase serum samples are required in order to make a confirmed diagnosis.[2] Tests of single serum samples, at best, can only be used to make presumptive diagnoses. Flexman et al. also noted the changes needed in IgG titres for a confirmed diagnosis to be made.[1] Reports of false positive IgM responses also limit the confidence in single sample test regimes.

The cases identified by this study are single sample IgM and IgG positives only. The combination of both IgM and IgG antibodies found suggests that infection may very well have occurred in those cases, but the question remains as to when. Serum samples taken within the acute illness phase would have been useful, with pre-deployment baseline samples providing even further data for interpretation. With the additional data, confirmed acute cases could have been sorted from those found to be representing only remote infections with RRV associated with clinically similar illnesses.

For accurate surveillance of the disease, each presentation needs to be associated with an illness as well as with a significant rise or fall in antibody titre. Paired acute and convalescence phase serum samples need to be taken to enable confirmation of acute disease. Until RRV and other virus infections reported to authorities are limited to those confirmed by the methodology outlined by the references, the epidemiological challenges will remain difficult to tackle.

Given the unknown persistence of both IgG and IgM, it is difficult to identify the optimal period for this study to have been conducted. It is believed that there may have been subjects who had been exposed during the exercise, who underwent only a minor immunological response with a correspondingly minimal production of IgM resulting. The references suggest however that as IgM is currently suspected to have a prolonged persistence, this is considered less likely than was suspected before the study, although further research into such cases is recommended. For those members found to be IgG positive, it is again impossible to draw any conclusions on possible time of infection.

In relation to the Questionnaire tool, the questions were far too subjective, with no definitions given for such broad terms as 'feeling unwell' and 'fever'. The time available and scope of this study limited the depth of inquiry, making such terminology necessary.

Members were also relied upon to recall details of interest, such as number of insect bites suffered, 8 weeks post-exercise. The findings cannot be relied upon to the same extent as results that could be gained from having members keep a diary, or similar record, of events of interest during a period for investigation.

The matching of the demographics of the control volunteers to the exercise subjects was imperfect, with control volunteers being on average 4.3 years older, as can be seen in the results at Table 1. It was desirable that members of similar age, rank, field experience and employment be enrolled in order for a number of possible correlations to be drawn. The volunteers who presented however tended to be more senior members of the base workshop staff, or similar. As a group, they could have been expected to have had spent more time deployed in the field during their career than those on exercise, with a relative IgG result found. Perhaps of some significance is that they were found to have a slightly lower incidence of IgG – 21.2% positive against 23.8% for the exercise group.

Recommendations

When planning for overseas deployment, the need for accurate health intelligence and the provision of prophylactic measures is recognised to be of significant importance. During peacetime when deploying on exercise within Australia, it is possible that such considerations as endemic disease within an exercise area are not considered, given our generally benign surroundings. Exercise planners and reconnaissance/advance parties need to consider the possibility of environmental disease risks when looking at an area of future interest. Public health authorities and local medical officers are able to provide information about possible hazards within their area, allowing plans for preventative health measures to be based on local knowledge.

The findings of this study suggest that basic preventative health measures limit the risk of exposure and infection from environmental hazards. Regular refresher lessons and appropriate health briefings/preparation before deployments can assist a unit to remain fully functional by negating these hazards.

Of interest from this study is the number of different types/brands of topical insect repellent reported to have been used. Given the wide variance in the content of active ingredient (DEET) in the nominated products, further analysis of the bites/topical repellent

relationship could be of interest. As the army issue solution can be demonstrated to have a cost-benefit advantage (free and effective), units should ensure that all members deploying to the field are encouraged to use, and have adequate supplies, of the inservice solution.

Timely post-exercise surveillance and follow-up of reported notifiable disease, including paired acute and convalescence phase serum sampling, is vital if understanding of disease risks is to be advanced. From initial discussions prior to this study, it was apparent that there is still much to yet be determined about Ross River Virus disease. Further research into the Clinical/Subclinical Infection Ratio, IgG/IgM serum persistence and interpretation, and disease prevention is required before forces can be assured that the risk is well understood.

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Review Article

Recent Advances in the Treatment of Nerve Agent Poisoning[1]

R.M. Dawson[2]

Abstract

The standard treatment of nerve agent poisoning is pretreatment with the carbamate pyridostigmine, and post-exposure therapy with atropine, an oxime (PAM, toxogonin or HI-6) and diazepam. Some of the literature published in 1998 bearing on this treatment procedure, and improvements to it, is reviewed in this document. A detailed study of the pharmacokinetics of pyridostigmine revealed that, for a significant number of individuals, there may be times during the course of pyridostigmine prophylaxis (3 tablets per day), when protection against nerve agents is doubtful. Physostigmine is an alternative to pyridostigmine, and there were 3 reports suggesting that slow-release systems of this carbamate may be feasible. Prophylaxis with enzymes has attracted considerable attention in previous years, but little progress was reported in 1998 on improving the hydrolytic activity (towards nerve agents) of these enzymes. Unmodified human butyrylcholinesterase was shown to be effective against inhaled soman; nerve agents had been given by i.v. injection in previous work.

The selective muscarinic antagonist CEB-1957, and the cholinolytic/anticonvulsant drug procyclidine were studied as possible alternatives to atropine, but without compelling evidence for their superiority over atropine. Similarly, there were no results reported for new oximes that would represent a challenge to the currently approved oximes. Even the promising HLö-7 was studied only for its effect on reactivation of cholinesterases inhibited by nerve agents, whereas reactivation is not a good predictor of efficacy in vivo. On the other hand, three anticonvulsants show promise as improvements over diazepam, and two of these are currently undergoing clinical trials (although for a different neuroprotective indication in each case). These drugs, GK-11 (gacyclidine), HU-211 and TCP, are glutamatergic receptor antagonists. The combination of procyclidine and diazepam also showed promise.

A search for an explanation of the Gulf War syndrome continues, with a recent focus on pyridostigmine as the possible cause, particularly in individuals with genetically-based low levels of the scavenger enzyme butyrylcholinesterase. However, the evidence tends to discount this theory. In another approach, a survey revealed that symptoms of the Gulf War syndrome tended to be more prevalent in service personnel whose period of service in south-west Asia commenced after the conclusion of hostilities, i.e.exposure to pyridostigmine or nerve agents could not have been a factor. A rigorous statistical analysis could not be performed, however, because of the low number of personnel in some of the groups of the comparison.

Introduction

This paper summarises the findings of papers relevant to treatment of nerve agent poisoning that were published in the calendar year 1998, and is an abbreviated version of the latest in a series of such reviews that have been written and forwarded to selected ADF personnel each year.

The currently accepted optimum treatment of nerve agent poisoning is prophylaxis with the carbamate pyridostigmine, followed by therapy after exposure with atropine, an oxime, and the anticonvulsant diazepam. The paper below is organised under these headings. Additional sections discuss enzymes as an alternative prophylactic approach and possible explanations of the Gulf War syndrome.

One of the oximes favoured by several countries is pyridine aldoxime methyl chloride, abbreviated PAM. It is used as the methylsulphonate salt in the U.K., where it is known as P2S. Another oxime, toxogonin, is sometimes known by its alternative name, obidoxime.

[1] Dawson RM. Recent advances in the treatment of nerve agent poisoning. *Aust Mil Med* 1999; 8(3), 13-17.

[2] Dr Ray Dawson is a Principal Research Scientist at the Aeronautical and Maritime Research Laboratory in Melbourne. He has been researching medical protection against nerve agents since 1971.

Carbamate prophylaxis

Current ADF policy for pyridostigmine prophylaxis is one 30 mg tablet orally every 8 hours. Marino *et al.* studied the pharmacokinetics and pharmacodynamics (mechanism of action) of this regimen in human volunteers over a 3-week period.[1] Plasma pyridostigmine concentration and red blood cell acetylcholinesterase were measured during this time. The pharmacokinetics of pyridostigmine were found to be both gender and weight dependent. It was also calculated that 30% of individuals may not have red blood cell acetylcholinesterase inhibition >10% at the trough of enzyme inhibition. Inhibition >10% is necessary for protection against nerve agent-induced lethality. Despite this drawback of the current dosage regimen, the authors concluded that it has utility in the possible protection of soldiers against nerve agents.[1]

Physostigmine has advantages over pyridostigmine as a prophylactic drug because of its ability to protect the central nervous system against the effects of the nerve agents. Achieving the right dosage is difficult, however, because of its low bioavailablity, short elimination half-life and narrow therapeutic index. Oral slow-release systems or transdermal systems have been proposed to overcome these drawbacks. Benech *et al.* described a transdermal system using a copolymer of acrylic acid and ethyl vinyl acetate to aid delivery.[2] The system showed promise in experiments on rabbits. Philippens *et al.* reported that another slow-release system (osmotic minipump, in guinea pigs) had the benefit of inducing tolerance to the behavioural and neurophysiological side-effects of physostigmine.[3] No side-effects were observed with this system (in contrast with acutely administered physostigmine), even in the absence of scopolamine which is normally necessary to antagonise the cholinergic side-effects of physostigmine. Both the acute and subchronic prophylactic regimes, when combined with atropine therapy, were able to protect the animals against the lethality due to 3 LD_{50} soman. An osmotic minipump was also used by Meshulam *et al.* in experiments with Beagle dogs, an animal model with cholinergic sensitivity similar to humans.[4] A combination of physostigmine and scopolamine conferred full protection against 2 LD_{50} sarin, in the absence of any therapy, with minimal symptoms of toxicity. Behavioural side-effects of the prophylaxis alone were not reported.

Prophylaxis with enzymes

Human butyrylcholinesterase has been shown earlier to protect mice, rats and monkeys against multiple lethal toxic doses of nerve agents, and to prevent the incapacitation caused by these agents. In these earlier experiments, the nerve agents were administered by bolus intravenous injections. Allon *et al.* investigated a more realistic scenario, namely inhalation of nerve agents.[5] They found that a ratio of human butyrylcholinesterase to soman of 0.11 was sufficient to prevent the manifestation of toxic signs in guinea pigs following exposure to 2.2 times the inhaled LD_{50} dose of soman. A slight increase in this ratio, to 0.15, produced sign-free animals after 2 sequential respiratory exposures with a cumulative dose of 4.5 LD_{50}. The protection achieved was far superior to that from pretreatment with pyridostigmine and post-exposure therapy with atropine, benactyzine and the oxime TMB-4 (which, however, is not the optimal therapy).

Anticholinergic drug

Trovero *et al.* reasoned that an alternative anticholinergic drug to atropine is desirable because of the undesirable ratio of therapeutic efficiency to adverse effects exhibited by atropine.[6] They reported that CEB-1957 reduced the mortality in rats due to 2 LD_{50} sarin at doses 10 times lower than those for atropine. The oxime PAM was administered with the anticholinergic drug in both cases. The study did not report, however, the dose at which CEB-1957 produces side-effects. CEB-1957 was found to have affinities for muscarinic receptor subtypes in the order M3≥M2>M1, whereas atropine is non-selective for these subtypes.

Kim *et al.* reported that procyclidine, in conjunction with physostigmine and PAM, was superior to atropine/physostigmine/PAM in protecting mice against lethality due to diisopropylfluorophosphate (DFP).[7] Procyclidine also prevented DFP-induced convulsions. DFP is not a recognised chemical warfare nerve agent, and the study was not militarily realistic in that the antidotes were all injected 10 minutes prior to DFP. Nevertheless, the study is relevant in that procyclidine possesses both central cholinolytic activity and anticonvulsant activity, and this combination of properties in the one molecule may be beneficial in treatment of nerve agent poisoning (See also the discussion on anticonvulsants below).

Oxime

HLö 7 has been the subject of research in recent years as a more effective oxime than

those currently in service, and it was further investigated by Worek *et al.*,[8,9] who compared it with HI 6, PAM, TMB-4 and toxogonin in reactivation of human erythrocyte acetylcholinesterase and plasma butyrylcholinesterase inhibited by any of 5 nerve agents. Although HLö 7 performed the best of the 5 oximes overall, the results have little predictive value, as reactivation *in vitro* does not correlate with protection against lethality *in vivo*.

Anticonvulsant

One of the drawbacks of diazepam (valium, a benzodiazepine) is its sedative properties. Tashma *et al.* reasoned that a partial agonist of benzodiazepine receptors (in contrast with diazepam, which is a full agonist) might be an effective anticonvulsant with fewer side-effects. They proposed bretazenil as such a partial agonist, although with little comparative data.[10]

Lallement *et al.* refined an earlier study on the protective effects of GK-11, a non-competitive antagonist of glutamatergic NMDA receptors, which are known to be involved in the maintenance of soman-induced seizures and the subsequent neuropathology.[11] The repeat study was designed to be a more realistic model of a field situation, in that monkeys were pretreated with pyridostigmine, exposed to 8 LD_{50} soman, treated one minute later with the human equivalent of one (but not two) autoinjector of atropine/PAM/diazepam, and then left for 45 minutes before receiving GK-11 i.v. It was found that GK-11 improved survival, prevented soman-induced seizures and motor convulsions, prevented development of neuropathology, and accelerated clinical recovery. The authors proposed that GK-11 represents a promising adjuvant to the currently available emergency therapy for management of organophosphate poisoning in man. GK-11 is presently being evaluated in a human clinical trial for a different neuroprotective indication.

The nonpsychotropic cannabinoid HU-211, another antagonist of glutamatergic neurotransmission in the brain, is also currently being evaluated in clinical trials as a neuroprotectant. Filbert *et al.* found that HU-211 protected rats against soman-induced brain damage, even though it had no effect on soman-induced seizure strength or duration.[12] Previous research had established a correlation between brain damage and the occurrence of seizures.

A third NMDA antagonist, N-[1-(2-thienyl)cyclohexyl]piperidine (TCP), was reported by De Groot *et al.* to be very effective, in conjunction with atropine and pyridostigmine, in treating guinea pigs that experienced soman-induced seizures for at least 30 minutes in the absence of treatment.[13] Seizures, neuropathology and behavioural deficits were prevented by the treatment.

Koplovitz *et al.* proposed that an additional anticholinergic drug be administered in conjunction with diazepam.[14] They administered the anticonvulsant drug combination to pyridostigmine-pretreated guinea pigs (who also received atropine–PAM therapy) 5 or 40 minutes after 2 LD_{50} soman, and found that the treatment was effective in terminating seizures. The anticholinergic drugs found to be effective were scopolamine, biperiden, trihexyphenidyl and procyclidine.

Gulf War Syndrome

Between the invasion of Kuwait by Iraq in August, 1990, and the end of the Gulf War in March, 1991, the U.S.A. had 697 000 military personnel in the Persian Gulf region. Since their return, approximately 30 000 (4.3%) have experienced a variety of complaints including chronic fatigue, muscle and joint pain, gastrointestinal disturbances, ataxia, rash, headache, difficulty concentrating, forgetfulness and irritability. There has been no explanation for these symptoms. Abou-Donia *et al.* suggested that an explanation might lie in synergistic toxicity resulting from simultaneous exposure of the service personnel to pyridostigmine (taken in expectation of a nerve agent attack), the insect repellent DEET (N,N-diethyl-*m*-toluamide) and the insecticide permethrin.[15] Subsequent papers provided evidence inconsistent with this hypothesis. For example, McCain *et al.* observed that the doses necessary for such synergy correspond with an average 70-kg service member simultaneously ingesting 107 pyridostigmine tablets, 23 six-ounce cans of 0.5% permethrin aerosol spray and 6.6 two-ounce tubes of 33% DEET.[16] Nevertheless, Olson *et al.* devised a study to investigate subtle neurobehavioural effects and neuropathology in rats due to exposure to combinations of low levels of sarin, DEET, chlorpyrifos (another insecticide which was used by some troops), pyridostigmine and botulinum toxoid. Their paper reported the study design only; results have yet to be published.[17]

The involvement of pyridostigmine in the Gulf War syndrome was also investigated by Lallement *et al.*[18] Their study was prompted by an earlier report that stress due to forced swimming allowed penetration of pyridostigmine into the brain of mice. Accordingly, it had been proposed that in troops exposed to emotional stress under the

conditions of the Gulf War, the blood-brain barrier may have unexpectedly become permeable to pyridostigmine, thus leading to an increased frequency of CNS symptoms. Lallement *et al.* showed that one cannot generalise based on this one set of experimental conditions.[18] Thus, in their experiments, guinea pigs were exposed to the stress of elevated temperature (such as troops might experience in wearing protective clothing in hot or even moderate climates). Penetration of pyridostigmine into the brain was evaluated directly (using radiolabelled pyridostigmine) and indirectly (inhibition of acetylcholinesterase). No entry of pyridostigmine into the central nervous system could be detected in any circumstance. The authors cautioned against extrapolating results of animal experiments to the human situation. This caution should be kept in mind in evaluating the results of Servatius *et al.*, who described experiments with rats to support their suggestion that individuals with impaired butyrylcholinesterase activity, caused by exposure to stress or as a product of genetics, may have been at greater risk of persistent central nervous system dysfunction after prophylactic pyridostigmine treatment. [19] In these experiments, Wistar-Kyoto rats, but not Sprague-Dawley rats, exhibited a delayed-onset, persistently exaggerated startle response after pyridostigmine, and this response was dose-dependent. Wistar-Kyoto rats have inherently lower activity of butyrylcholinesterase (a scavenger of pyridostigmine) than Sprague-Dawley rats. A link between pyridostigmine and the Gulf War syndrome in individuals with a genetic vulnerability to acetylcholinesterase inhibitors was also proposed by Shen,[20] but the link was based only on speculation, and lacked evidence for the claim. Some inaccurate statements in the paper do not help the author's case.

Kurt employed sophisticated statistical tests in a study of 249 Naval Reserve construction battalion men, and claimed an association between delayed-onset neurotoxicity and exposure to drug-chemical combinations.[21] He drew on the results[15] of Abou-Donia *et al.* and the supposed stress-induced penetration of pyridostigmine into the brain to support his findings. As explained above, there is doubt about the validity of these hypotheses. A contrasting conclusion to that of Kurt was reported by Spencer *et al.*,[22] who conducted a survey of service personnel from north-west U.S.A., and separated the population into 4 groups, based on the timing of their service in south-west Asia :- (a) August – December, 1990 (Desert Shield; pre-combat), (b) January – March, 1991 (Desert Storm; combat period), (c) April – July, 1991 (post-combat), and (d) combinations of these periods. The unexplained illnesses of the Gulf War Syndrome were divided into 3 groups - fatigue, cognitive/psychological, and musculoskeletal symptoms. Analysis of the results was limited by small population numbers in some of the time groups. Nevertheless, there was a trend for all 3 case symptoms to be most prevalent amongst service personnel who served exclusively in the post-combat period. This finding, if replicated in a larger study, indicates that exposure to chemicals is not the cause of the Gulf War syndrome.

Another factor that has been proposed as an explanation of the Gulf War syndrome is exposure to low levels of sarin at Khamisiyah, Iraq in March, 1991. Moore,[23] therefore, reviewed the literature on low-level, asymptomatic exposure to nerve agents in controlled studies of human exposures, reports of accidental exposures, and animal studies. No evidence was found for observable long-term adverse health effects following such exposure.

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BIOTERRORISM AND AUSTRALIA - WHERE TO FROM HERE?[1]

A. G. Robertson[2]

'Microbes are the foot soldiers of the 21st Century'
Jeremy Rifkin [1]

Bioterrorism, the deliberate use of biological weapons by a terrorist group, has become a major concern for Australian medical, government and military agencies over the past two to three years. The various forms of media, from reputable newspapers and journals to novels, documentaries and films regularly portray such attacks. In Australia, this depiction has varied from the fairly balanced recent Weekend Australian article on biological terrorism[2] to Tom Clancy's more outlandish 'Rainbow 6' [3] portrayal of terrorism at the Sydney Olympic Games. Whilst response planning to a bioterrorist attack has been a major issue in the United States since 1996,[4] Australia is now coming to terms with the issues involved and the possibility of Australians being a target.

The worldwide threat of bioterrorism is increasing and Australia can not be excluded from this trend. The dimensions of this threat need further exploration to enable a realistic appreciation of the response required.[5] Such a review will enable an objective appraisal of Australia's current response capability and what future capability is needed, not just for major events such as the 2000 Olympics, but beyond.

Bioterrorism

Biological weapons have been utilised in one form or another for over 2000 years.[6] Despite advances in detection and therapy, biological warfare remains a threat on the modern battlefield. The Russian and Iraq biological warfare programs have shown both the utility and the ease with which covert programs can be hidden.[7] Biological weapons may also prove to be a useful weapon in the armamentarium of the terrorist groups. The Aum sect has both researched and, unsuccessfully, tried to use anthrax and botulinum toxin.[8] Other terrorist groups, like Usama bin Ladin's organisation, have indicated a strong interest in acquiring these agents as weapons.[9]

So is 'Bioarmageddon' upon us?[8] Is it just a matter of time before Australia faces 'Bioterror' or 'Agroterror' ?[10,11] Various press articles and novels would certainly have us believe that. To gain an appreciation, however, of whether these claims are realistic or merely sensational, a review of the current trends in terrorism and biological warfare is useful. The media hype and claims that biological weapons are so easy to produce and use that they have become the veritable terrorist 'poor man's atomic bomb',[12,13] may even be detrimental. One unintended effect of the sensational media depiction of these weapons has been to make them more attractive to hoaxers, as evidenced by the recent spate of anthrax hoaxes in the United States.[14]

The Terrorist Threat

Terrorism may be defined as ' acts or threats of violence of national concern, calculated to evoke extreme fear for the purpose of achieving a political objective in Australia or in a foreign country'.[15] Australia, like the United States of the 1970's and 1980's, has been relatively immune to the spread of terrorism.[16] Certainly, Australia has not seen anything on the scale of the World Trade Centre bombings and there were no major terrorist incidents in Australasia in 1998. [17]

Australia, however, has not been totally immune. Australia has seen bombings, assassinations, extortion attempts and hoaxes. The Sydney Hilton was bombed in 1978 and the Israeli Consulate-General's Offices were bombed by 15 May Organisation in December 1982.[16] The Turkish Consul-General was assassinated in Sydney by the Justice Commando's of the Armenian Genocide in December 1980. Extortion attempts have included the 'Mr Brown' QANTAS extortion in 1971, the Woolworths' bomb extortions in 1975,[16] and the more recent Coca-Cola extortion attempt in 1998. The most infamous hoax, and one with a

[1] Robertson AG. Bioterrorism and Australia: Where to from here? *Aust Mil Med* 1999; 8(3):18-23.
[2] CMDR Andy Robertson is the SO1 NBC in the Defence Health Service Branch.

bioterrorist flavour, was the 1984 threat by a prisoner to release foot and mouth disease in Queensland.[18]

The terrorist threat is changing. Hoffman,[19] in a seminal article, reviewed the terrorist threat from the 1970's until the present day. Hoffman noted that terrorist groups, whilst radical politically, have generally been conservative in the way they have carried out their attacks, being more 'imitative than innovative'.[19] Indeed, the groups were far more interested in getting their message across than killing lots of people. Consequently, whilst a few groups dabbled with the idea of weapons of mass destruction, the only actual incidents were not weapons of mass destruction related but instead involved food tampering as a form of economic sabotage. These include terrorist attempts at different times to poison Israeli oranges with mercury and to lace Chilean grapes with cyanide. [19]

The nineties, however, saw a fundamental change in terrorist operations. Analysis of the Rand-St. Andrews University Chronology of International Terrorist Incidents, a database of over 8,000 incidents dating back to 1968, has shown some disturbing trends.[19] Whilst there has been an overall fall in the number of terrorist incidents, there has been a paradoxical rise in the percentage of incidents with fatalities. In 1995, 29% of all terrorist incidents involved fatalities as opposed to 17% of attacks in the 1970's and 19% of the attacks in 1980's.[19] This trend is associated with the growth throughout the 1990's of radical religious terrorist groups. These groups, arising from a wide spectrum of religious backgrounds, see violence as a `divine' duty and an expedient way to achieve their eventual aims.[20] The religious terrorist group members appear not to be constrained by the political, or even `moral', constraints of the more traditional terrorist groups. Interested only in themselves, and the small religious group they represent, these groups are not defending a perceived aggrieved constituency but instead aim to radically change the existing order.[19] Consequently, as outsiders, the religious terrorists are able to contemplate far more destructive and deadly attacks to fulfil this aim.[20] As such, these religious terrorist groups have come the closest to the effective use of weapons of mass destruction. The deliberate infection of the populace of The Dalles, Oregon with *Salmonella typhimurium* in 1984 by the followers of the Bhaghwan Shree Rajneesh was to be a forerunner to the Aum Shinrikyo cult's more deadly 1995 nerve gas attack on the Tokyo subway,[21] a historical watershed in terrorist tactics. The more traditional terrorist groups, however, should not be ignored. Bioterrorist attacks against animals and plants may get their point across without accruing the same retaliation.[11] Whilst there has been no major terrorist attack with biological weapons, many believe that this situation will not last.[12,19-21]

Biological Expertise

Whilst opinions vary, most authors believe that an individual or individuals with a modicum of technical skill could acquire the necessary expertise to produce biological weapons.[12] Whilst terrorist groups in the past may not have had the necessary technical expertise,[19] the previously esoteric skills required are now generally available. American industry employs around 60,000 biologists and there are nearly 1,900 biotechnology companies in the United States and Europe.[22] Similar expertise exists within Australia. As we have seen from the Russian and Iraq biological warfare programs, interest and expertise exists within a number of proliferant countries.[7]

The Threat to Australia

Australia, on the surface, does not appear to be a probable target for a terrorist attack, let alone a bioterrorist attack. Our close association with the United States, an avowed Usama Bin Ladin target,[23] the general openness of our society and the spectacle of the 2000 Sydney Olympics, with a host of possible targets, may make Australia more attractive for terrorists. Whether such terrorists will resort to biological weapons is a more vexing question. There are good reasons for terrorists not to use biological weapons. The inherent unpredictability of biological weapons, a personal fear of biological agents, anticipated governmental response to an attack, and a general satisfaction with current measures, may contribute to the terrorist's reticence.[12,19] The fear of collateral damage to friends and a desire to limit the number killed may also concern more traditional terrorist groups.[12] Most authors agree, however, that with the growth of religious terrorism and availability of agents, there will be future attempts, on a limited scale, to use these weapons.[12,19] Whether Australia would be a target of such terrorism is even more debatable.

Given intent, the next consideration is capability. A terrorist group, even with limited technical capabilities, may be able to acquire or import a biological agent into Australia. Potential biological warfare agents could be acquired from natural reservoirs, appropriated or stolen from medical or research facilities, bought from legitimate or 'black market' suppliers, or procured from 'friendly' governments.[12,18] Recently, concern has been

raised about the potential use smallpox as a terrorist weapon, however, limited availability would make it difficult to acquire and use.[24] Interest has already been shown by various overseas terrorist groups in acquiring anthrax, botulinum toxin and ricin. [18,25]

Whilst opinions vary, most authors believe that terrorists with a modicum of technical training could acquire the necessary technical expertise to produce biological weapons in small quantities.[12] The necessary technical skills and equipment needed, however, to produce agent in large quantities and to weaponise that agent are far more difficult to procure.[5,14]

Delivery is the critical step. Most authors agree that effective delivery of biological warfare agents is even more problematic than its production.[22] The most commonly proposed means of terrorist delivery is by the spread of a biological agent cloud over a city using a basic aerosoliser.[8,18] This process, fortunately, is more difficult than it first appears.[14,26] There are significant technical problems in keeping a biological agent in a cloud viable for long enough to infect or intoxicate the victim.[13] Humidity, sunlight, smog, temperature and winds will all impact on the final dose received.[27] Even with a good technical background, the Aum sect was unable to successfully deliver anthrax and botulinum toxin in Tokyo. [26,28] Whilst a smaller scale attack in an confined area may be more feasible, the technical ability to produce and weaponise sufficient agent to cause harm would probably be beyond the capabilities of most terrorist groups.[12]

The poisoning of a large water reservoir is also not as simple as postulated. An attack would require large quantities of agent and is unlikely to be successful due to problems with access to the site, dilution and environmental degradation.[12,29]

The Results

A successful bioterrorist attack has the potential to be disastrous. Even a relatively small attack might quickly overwhelm the resources of even the richest and most capable of countries.[30] In a human attack, death and disease would be only part of the problem. The potential psychological effects and resultant panic would impact adversely on the infrastructure and operations of any country.[10] Animal and plant attacks may have devastating affects on a country's economy and lead to hunger and further suffering. The financial impact would also be monumental. Kaufmann's model of the economic impact shows that, for every 100,000 persons exposed in an anthrax attack, the financial cost to a country could be over 26 billion American dollars.[31]

Defence Against Biological Terrorism

Defending against biological terrorism is a daunting task. Unlike chemical or nuclear weapons, the current biodetection systems are limited in their scope and availability, so emphasis has to be placed on other measures. Sensitivity analysis has shown that preventive programs are cost-effective in defending against biological terrorism.[31]

Overseas Response

With some notable exceptions, very few countries have grappled with the bioterrorism threat.[32] In the United States, Congress unanimously approved the setting up of a Department of Defense Domestic Preparedness Program in 1996 with an initial budget of $150 million.[33,34] Chemical and Biological Defense Command were tasked to help cities and State governments get ready for a chemical or biological terrorist attack. Simulations have already shown the different and potentially more devastating problems posed by bioterrorism.[33] National Guard rapid response teams have been established and Defense's efforts, to train first-response teams in 121 of the largest U.S. cities, are continuing.[35] The US military already has considerable chemical/biological counter-terrorism technology expertise. The Technical Escort Unit (TEU) provides world-wide recovery and render safe expertise for chemical and biological weapons while the Chemical/Biological Anti-terrorism Team is responsible for developing the fieldable hardware for TEU and other units to carry out their render safe role.[36] Despite this investment, both the Congress and the Government Audit Office are concerned that the money allocated for terrorism defence is not being appropriately targeted towards biological and other terrorist threats.[33,37] Many believe that a biological terrorist attack in the United States is inevitable and that the country remains unprepared.

The Australian Response

Australia faces the challenge of many developed nations. The face of terrorism is changing and Australia, like most countries, is unlikely to be immune in future. The move to religious terrorism increases the probability that future terrorist attacks will involve biological or chemical weapons. Improved technical skills and equipment make a bioterrorist attack both more probable and more likely to be successful, particularly if done on a small scale.

The Australian community has, until recently, been generally under-prepared. In the early 1990's, there was no policy, training or planning in this area. In 1998, the Australian Medical Disaster Coordination Group identified major deficiencies in the preparations for a chemical or biological terrorist attack and set out, with Emergency Management Australia, to rectify these deficiencies. Australia is now preparing for biological terrorism, and its defensive measures can be broadly grouped into four main areas.[12]

The first area is information collection. Security and police agencies are and will continue to focus on monitoring terrorist groups of concern and their state-sponsors. The movement of biological agents and microbiological equipment is regulated and controlled by Australian Customs and the Australian Quarantine Inspection Service. Australia is also fortunate enough to have a very well-developed Public Health laboratory network which both catalogues local endemic and epidemic disease and rapidly identifies and responds to epidemics through its surveillance network[38,39] This system provides input into the ProMED internet epidemic surveillance system which has been very effective in establishing baseline data. There are well-developed links between different Government agencies and the medical community,[38] through Emergency Management Australia and committees like the Australian Medical Disaster Coordination Group, which ensure that information is shared to assist in creating a coherent picture of the problem.[39]

The second area involves counter-acquisition strategies. Countries must make it very difficult for terrorist groups to acquire biological weapons. Australia has been at the forefront of such strategies over the last decade. Australia established the Australia Group, a group of like-minded nations, who meet in Paris on an annual basis. The individual countries in this Group monitor and control their national export of chemicals, biological agents, precursors and dual-use equipment to proliferant countries. Australia has also strongly supported the establishment of the Chemical Weapons Convention, the verification protocol for the Biological Weapons Convention, and the United Nation Special Commission (UNSCOM), who were responsible for disassembling Iraq's biological weapons program. While each of these strategies is not an end in itself, they contribute to the counter-acquisition web, which makes the acquisition and use of biological weapons more difficult. Counter-acquisition may require countries to both threaten, and be willing to carry out, retaliation against the terrorists and their state sponsors should biological weapons be developed or used.[39] Through military involvement with sanctions, Australia has been involved in bringing economic and moral pressure to bear on countries like Iraq to comply with international conventions, including the Biological Weapons Convention.[7] The availability of dangerous micro-organisms is tightly controlled in Australia and trade in this area is heavily regulated. Police are receiving the necessary training to identify these agents, and the production equipment required, in the acquisition and transport stages. Australia also has a well-developed and nationally agreed National Anti-terrorist Plan. This plan is regularly exercised and revised. The 7th Edition, which will comprehensively cover chemical and biological terrorism procedures, will be published later this year.[15]

Passive protection is the third area. New, innovative and rapid biological detection systems are a cornerstone of early and appropriate response.[24] The Australian Defence Force (ADF) has made substantial progress in this area following the Gulf War. The Defence Science and Technology Organisation (DSTO) commenced research into medical defences against biological weapons in 1995 and have made some excellent advances in the development of bio-detection systems. One of the most promising is the AMBRI biosensor, which can rapidly detect up to four agents at a time.

Similarly, effective disease surveillance systems are critical. Adequate epidemiology and pathology resources are key facets of this surveillance.[30] The current Australian notifiable disease system is very effective and able to detect acute changes. Enhanced surveillance will also be in place during the Games period.

Protection should also cover the stockpiling of vaccines and therapeutic agents; improved water supply, air-conditioning and food production security; development of better individual protection equipment, and increased research into medical defences against biological weapons.[12,25] The ADF, through DSTO has also contributed to the development of other detection systems, therapies for the management of biological weapons and improved individual protection equipment. The new lightweight suits, whilst giving the protection of older suits, will markedly reduce the heat stress encountered in the Australian environment. Policy on vaccination against biological weapons has been developed and various vaccines and therapeutic agents are stockpiled.

In November 1998, NSW Health identified a project manager to coordinate its CBR response. A review of equipment and standard operating procedures, and an audit of drug

supplies has been initiated. Various other States are also looking at protective equipment and detection requirements.

Finally, there must be measures that mitigate the effect of an attack. These measures, including better and more specific biological disaster planning, public health coordination, and evacuation planning, are all being developed in Australia.[12] Emergency and medical responders are learning what they are dealing with and how to manage it. Education and training in bioterrorism, at all levels, has become a priority.[25,40]

The ADF is able to decontaminate and render safe chemical and biological munitions whilst protecting its forces through detection systems, protective equipment, medical countermeasures and research. Doctrine for the management of biological munitions and casualties has been developed, and instructors, specialist advisers and medical officers trained. Such preparations, however, are focused on troops in the field and not on terrorist threats. The Commonwealth Government committed $23 million in the last budget to enhance this capability, with increased spending on response capability and protection and detection systems.

The Commonwealth Government is regularly exercising chemical and biological terrorism disaster plans through desktop and other exercises. Commonwealth Health has almost completed an Australian Emergency Manual, which provides doctrine for the management of chemical, biological and radiological casualties. This manual, coordinated by Emergency Management Australia (EMA), should be provisionally released in September 1999.[41] EMA has also provided awareness training material to all the States and Territories.[41] In November 1998, NSW Health trained 7 specialist medical personnel through the ADF Medical Officers Nuclear, Biological and Chemical Defence course. Between February and June 1999, over 150 personnel, including 50 health and ambulance staff, were trained on chemical and biological response 'train the trainer' courses. Further health service training will commence in late September 1999 and continue in a variety of forms throughout 2000. This course was developed utilising the manual and assistance from States and Territories through the Australian Medical Disaster Coordination Group. All States and Territories are looking at the contingency planning, health co-ordination and training requirements of such preparedness.

Sharp, in his review of medical preparedness for the 1996 Atlanta Olympics, outlined the resources available to counter a biological weapons attack. They included a specialist site assessment team, a science and technology centre to provide technical support, stockpiles of antimicrobials, specialised training for first-responders, enhanced public health surveillance, and a Chemical Biological Incident Response Force to decontaminate and stabilise casualties.[42] The Australian bioterrorism emergency response infrastructure is being progressively developed and should be equal to the world's best practice by the 2000 Olympic Games.

Conclusion

Bioterrorism will not disappear as a potential problem and will remain an area of political and media interest. Fortunately, the successful completion of even a small-scale bioterrorism attack is far more difficult than portrayed by much of the media. Even a very limited attack, however, may have a major psychological effect with the resultant panic severely hampering any emergency response. The Australian medical and emergency response communities have started to face this threat and will be better prepared to face both the bioterrorist and emerging exotic infectious disease challenges of the new century.

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History

BATTLEFIELD LEGACIES: THE AUSTRALIAN COLLECTION OF WWI PATHOLOGICAL SPECIMENS[1]

R. Hearder[2]

"All wars of any magnitude and duration must be won primarily on the medical front." [1]

On Remembrance Day 1993, the body of an unknown Australian soldier was lowered to its final resting place at the Australian War Memorial, Canberra. In the words of then Prime Minister Paul Keating, the body of this unknown man, found on the tortured landscape of the Somme, represented the loss of all Australians in war. "He is all of them", Keating declared, "and he is all of us."[2] As Australia honoured its Unknown Soldier, other unidentified human remains, sat without ceremony in glass jars, in a storage room in Canberra.

They were a collection of pathological specimens taken from casualties of the World War of 1914-1918 by Australian Army Medical Corps (AAMC) personnel. The collection consisted of jars containing preserved body parts illustrating the effects of modern warfare on the body. Examples included feet showing the consequences of "trench foot", lungs affected by Mustard gas attacks, and various wounds inflicted by bullets, shells and shrapnel.[3]

There are few aspects of Australia's involvement in WWI that have not been endlessly discussed and debated. But occasionally, a historian can be lucky enough to come across an interesting and important story that has not been told before. The Australian WWI pathological collection is one of those stories. It represents not only a fascinating aspect of Australian military history, but specifically of military medical history - an area that remains largely untapped by historians.

This story begins in 1919, when the ship *Wandilla* left England for Australia, carrying its unusual cargo – crates containing 700 pathological specimens collected from WWI battlefields. But *why* was this collection taken at all? For that, we must go back to 1915. Even at this early stage, it was clear to medical officers that this war was leading to injuries and illnesses, some of which had never been seen before, and on a scale previously unimaginable. So, under the combined direction of the British War Medical Committee and the Royal College of Surgeons of London (RCS), a decision was made to make a collection of specimens, as a permanent record of the unique nature of injuries sustained during battle conditions. British, Canadian, New Zealand and Australian medical personnel all collected specimens, on the understanding that each country would take their collection home with them. American medical personnel also separately formed their own collection.

The Medical Committee hoped to obtain approximately 2000 "wet" specimens, 600 bone specimens, and an accompanying collection of diagrams and X-rays.[3] Specimens were acquired at the autopsy of a patient or following surgery. Regardless of the nationality of the medical officer who collected it, each specimen was despatched to the College to be indexed, along with a clinical history of the patient from whom the specimen was taken. The majority of the specimens were collected from Casualty Clearing Stations (CCS) on the Western Front from 1916. To a lesser degree, specimens were later also collected from military hospitals in the Middle East. The role of collecting specimens at the CCSs was augmented in 1917, when general base hospitals also began to make significant contributions.

The importance given to the collection by the British Army medical authorities in 1916 is shown by the fact that during that year, at least thirty international military medicine

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1 Hearder R. Battlefield legacies: The Australian collection of WW1 pathological specimens. *Aust Mil Med* 1999; 8(3):24-28.

2 Rosalind Hearder BA (Hons) is a military medical historian who is currently doing her PhD in history at the University of Melbourne.

3 There no longer seems to exist any documentation that records the name or nationality of patients from whom specimens were taken.

authorities visited the RCS storehouse of specimens so far collected. By 1917, the RCS held over 1500 specimens, and by 1918, 2700.[4]

It was only in early 1917 that the interest and role of the AAMC in the collection greatly increased. This was despite lessons learned by the AAMC from the medically disastrous 1915 Gallipoli campaign.[5] At Gallipoli, medical staff were insufficient in number and supplies were grossly inadequate for the scale of injuries and disease that was to arise. This campaign was the key event "that opened the eyes of the War Office to the importance of pathologists in the diagnosis and prevention of disease".[6]

Specimen collection continued for a few months after the cease-fire of November 1918. By early 1919, the number of jars filled with various pathological specimens in the storerooms of the RCS Museum amounted to approximately 3893.[7] At this point, their allocation took place - those specimens collected by the medical corps of other Allied countries were forwarded - and those collected by the AAMC began the long journey back to Australia. The British collection remained in the RCS Museum, to be added to the many other pathological specimen collections held there.[4]

The specimens sent to Australia were to be utilised by Australian universities after the war, in the education and training of future military medical personnel. However, after their arrival in Australia, the collection was neglected. By the 1960s, all but 160 specimens out of approximately 700 had been destroyed, and these were put in storage, doomed to remain forgotten.

The collection's history has been largely characterised by apathy and ignorance of its potential value. To understand why, it is important to explain why this collection was initially deemed important by Australian military medical authorities during the war.

There were three main reasons why the collection came into existence. Firstly, it was envisaged as a military medicine educational tool, both during and after the War. The specimens would "serve as permanent records",[8] to teach future military doctors and pathologists about the medical conditions of the First World War, and the lessons learned. Despite predictions of a short war, WWI became long and bloody, resulting in many new and complex medical conditions. Wartime technological developments were a double-edged sword – on one hand, there were better communication systems and increased industrial efficiency, and on the other, improvements in weapons technology also directly contributed to the slaughter of millions of people. Retrieval and transportation times of the wounded to treatment often took several hours, or sometimes days. Trench and gas warfare, and the accompanying persistence of disease made it necessary to keep a record - not only of the War's effects on the body, but also as a measure of the nature of medical work required, and the advances made during the war in medicine as a result of exposure to these conditions.

A second less obvious motivation for Australian medical personnel was that to possess a part of the wider Allied collection would add prestige to Australian medicine. Apart from its educative worth, the AIF saw the collection as a tangible memorial to the work done by Australian medical officers. In December 1918, a *Medical Journal of Australia* article stated:

The medical experience of the war must be utilised for possible future use. The medical profession in Australia must be placed in a position to profit by the successes and failures of the great four year's war...[9]

A third important aspect of this collection was what it symbolised for national identity. At the outbreak of war, the AAMC was a small, part-time specialised adjunct to Britain's Royal Army Medical Corps, and subsequently "as there was no regular medical service, there was no authentic Australian tradition."[10] The research work of the AAMC during the War, including the specimen collection, represented a scientific maturity and coming of age for Australia in the field of military medicine, in the attempt to establish an identity distinct from their British medical colleagues. The AAMC's voluntary involvement in the specimen collection was not for Britain, but for Australia, which as medical historian Col. A. G. Butler wrote "was in 1914 almost completely *terra incognita*",[10] in the world of medical knowledge. An editorial in the *Medical Journal of Australia* in June, 1918, stated:

We remain the only country at war from which an Army Medical Service has been sent, planned and arranged according to an antiquated principle...[11]

Arguably, the collection represented an important part of the birth of an *Australian* military medical tradition.

After such high hopes for the collection, what actually happened when it reached its destination? Australia's portion was to be distributed between Australia's universities - Sydney, Melbourne, Adelaide, Tasmania

[4] All but a handful of these WWI British specimens were destroyed in a May 1941 bomb raid during the Second World War.

(Hobart), Queensland (Brisbane) and Western Australia (Perth). The latter three agreed that their portions of the collection to be held in trust by the Pathology Department of the University of Melbourne, pending their eventual creation of medical schools.

After inquiries made in 1919 by Major-General Sir George Cuscaden, Deputy Director-General of the AAMC, all six universities clearly stated their interest in gaining a portion of the collection, the understanding being the specimens would be used in medical training. On arrival, the entire collection was handed over to the head of the newly created department of Pathology at Melbourne University, Professor Sir Harry Allen. Defence records throughout 1919-1921 show that all the universities received their parts of the collection.

Despite a promising beginning, the collection's fate in Australia was far from what was planned. There is some evidence that until the early 1930's, the specimens were used in teaching at Sydney and Melbourne Universities, both by the military and in academic circles. However, by the 1940's, the collections at the Universities of Adelaide, Western Australia and Queensland had been destroyed, and the University of Tasmania collection had somehow been lost. Twenty years later, all but seven specimens of Sydney University's collection had been destroyed. Only three of these universities have any documentation left that confirms that the university did in fact have the specimens.

In 1933, the Melbourne collection was handed over to the Institute of Anatomy (IA) in Canberra, following a personal request from its curator, Professor Sir Colin Mackenzie - one of the AAMC personnel who participate in the specimen collection during the War. It is only this portion of the entire collection that survives today. This is probably due to the fact that these specimens spent the next 50 years in relative anonymity at the Institute, first as part of its larger exhibitions, and then in storage from the 1970s.

In 1931, the IA had been defined as having two central functions: that of a natural history museum and a human nutrition research centre. A collection of specimens illustrating unique war-related conditions and specifically intended for advancing education of military medicine did not fit that description.

In 1984, the Commonwealth Government officially closed down the Institute, considered an unproductive use of government building space. The IA's various collections were passed on to the National Museum. Government agencies were suddenly confronted with decisions about ownership and responsibility for an unknown war specimen collection from the past.

There are no clear answers why the value of this collection in Australia has taken so long to be recognised. Was the collection regarded as unimportant? Or was the neglect due more to the fact that its existence had simply been forgotten? There are three possible explanations. The first and perhaps most obvious is that after the War, there was an inevitable shift back to "civilian medicine". This probably resulted in a decline in the prestige attached to the collection, and a reluctance to remember the more disturbing parts of the War, in favour of its more heroic aspects. In the pre-antibiotic civilian era, research into infectious diseases would have probably been thought more important than specimens displaying war wounds when no war was taking place.

Secondly, by the time WWII and subsequent conflicts occurred there was a distinct feeling that medical developments had been such that knowledge of military medicine was perceived to be completely different and superior to that of twenty years earlier - the medical era to which the collection belonged. The Second World War medical officer had better treatments, equipment and medical knowledge at his fingertips. It had been said in 1920 that the WWI specimens would "serve to educate the Army Surgeon of the future."[12] Unfortunately, the Australian Army Surgeons of WWII were either not interested, or more likely, none of them were even aware of the collection's existence. For example, in 1939, at the University of Melbourne, a pathology lecture was given on war wounds and their treatments - only four years after Melbourne's collection of specimens were moved to Canberra. No mention was made of them at all.[13]

Had Australia not been involved in subsequent military conflicts, then the collection would have had little medical value. These further conflicts continued to exhibit medical conditions and injuries similar to those displayed by the WWI specimens. For example, an interesting aspect of the Korean War was that, as in WWI, part of the fighting took place in trenches, in appalling weather. A condition called "Rice Paddy Feet" developed - the Korean War's name for WWI's "trench foot", and was the cause of many medical evacuations.

There were also some similarities in the Vietnam War with WWI wounds. The use of mines and booby traps produced "multiple ragged and infected wounds",[14] similar to WWI shell wounds. Although there was a delay of only a few hours at most to treatment, with the average time around 20-40 minutes, there were still wounds that became septic from the

multiple nature of the injuries, especially those from mines.[14] Also, because many of the gunshot wounds were shot at close range with high-velocity bullets, these wounds exhibited gross tissue damage in the immediate wound and surrounding areas, as in WWI.[14] Trench foot was also a factor in Vietnam, with the constant damp, and troops' frequent partial immersion in water and swamps. Australian medical teams learned to combat it, yet it remained such a problem among American troops that they sought help from Australian medical units in dealing with it.

Thirdly, the impact of the Anzac legend must be considered when reflecting on the fate of the collection in Australia. It has been written that the legend of Anzac is "a complex mix of fact, remembering, forgetting, and longing."[15] It is, however, selective remembering. Anything that threatens to disrupt or introduce difficult issues into this national cultural marker becomes problematic. The collection of WWI specimens - one of the most graphic and real reminders of the horrors and real suffering of the "Anzacs" does not sit well with the mythologising of war. It drives home a reality that many people do not want to face - that thousands died from painful and chronic medical conditions, poor hygiene, and a general lack of knowledge and experience about effective treatment of unprecedented battle wounds. Understandably, Australians want to choose to believe that their soldiers died on the battlefield, shot cleanly, dying instantly. They do not want to think about men suffering from trench foot or a slow agonising death from gas poisoning or gangrene.

So, where does this collection now "fit in"? When the Institute of Anatomy closed down in 1984, several issues were raised about the future of the collection. There have been both supporters and opponents of its continued existence.

One of the most vocal opponents was the Hon. Dr Carmen Lawrence MP, who in 1996 brought up the issue in Parliament, in her capacity as Shadow Minister for the Environment and the Arts. Having learned about the collection in connection with the plans for the proposed National Museum (where the collection was being stored), Dr Lawrence said that her main concerns were on ethical grounds: firstly, of consent on the part of the dead soldiers to use their body parts as pathological specimens, and secondly, that families of the donors were never informed.[16] However, there is no information about these specimens that indicates the names or even nationality of the patients from which they were taken.

Others have argued that consent *was* given, by the act of men joining the army and agreeing to participate in acts of war. Whether a soldier would agree to donate his body to science was simply not a consideration. It cannot be stated with any certainty that the soldiers themselves or their families would have objected, as they were not given the opportunity. For issues of consent to be imposed upon the collection would be a matter of retrospective conjecture, within a framework of contemporary attitudes - a problematic exercise.

Some question whether this collection actually *does* present any ethical issues. As Air Vice-Marshal Michael Miller, Surgeon-General Australian Defence Force from 1990-1992, has pointed out, "most pathological and museum specimens are *not* collected with informed consent".[17] Why then is this collection seen as different? Even though the collection may contain body parts of Australian soldiers who are revered in our national culture, only *some* of the specimens may be Australian, which makes it problematic when judging how "our" soldiers should or should not be commemorated. This becomes particularly salient when one remembers that 23,000 Australian servicemen from WWI have no known grave.[18]

Another objection to the collection is that the nature of the specimens is too graphic for public display, and therefore if they are of no practical use, they should be destroyed. However, this argument loses force when it is remembered that the specimens were displayed - for over 40 years at the Institute of Anatomy, without any attention or objections. Many visitors and even schoolchildren had filed past them.

Those who do support the continued existence of the collection base their opinion primarily on the grounds that what remains is still useful in an educational context, and that to destroy it would be to lose a unique and irreplaceable body of reference from the medical history of WWI.

As Air Vice Marshal Graeme Moller, a recent Surgeon-General of the Australian Defence Force pointed out, a "thorough knowledge of mechanisms of injury is fundamental to military medicine ... an understanding of pathology underlies all military medical training."[19] Weapons and conditions have changed with every war after WWI and the role and focus of military medical research has shifted. Yet, research in military medicine is still based on the same general principle as in WWI - how warfare affects the human body. The WWI specimens represent medical lessons learned, and they were meant as a teaching tool for those lessons. As Air Vice-Marshal Miller said, "that's *why* people collect pathological specimens."[17]

A recent example is an article published in the US periodical *Science*, by Dr Jeffrey Taubenberger, who conducted research on the genetic characterisation of the 1918 "Spanish" influenza virus.[20] By using DNA samples taken from the American collection of WWI pathological lung specimens, the Americans were able to further understand the nature of the virus. This research would not have been possible without the WWI specimens.

Eighty years after they were taken, the specimens are finally being used as they were intended. The WWI specimens are currently housed at the NSW Institute of Forensic Medicine. Small groups of Australian military medical personnel study them, under the supervision of the Director, Associate Professor John Hilton (Group Capt. RAAF rtd.), to increase their knowledge of wounds and illness faced in this earlier conflict, and their continuing relevance.

Are these specimens of both medical and historical value? Yes. In a direct sense, each specimen powerfully and realistically represents a common part of the WWI soldier's experience - the battle with injury and disease. Medicine and its applications will always be an integral part of any wartime situation, and as much as possible of the experience must be recorded. The collection tells a story of the importance accorded military medicine during WWI, and the implicit desire to learn and avoid similar medical problems during future conflicts. Indirectly, the specimens provide a marker at which to compare subsequent improvements and advances in Australian military medicine over the past 80 years, in a way that no book, photo or memoir can portray.

Despite the similarity that both the Unknown Soldier and the specimen collection are human remains, the significance is that the *intention* behind each is different. The Unknown Soldier acts as a memorial to all those Australians buried overseas, or to those without known graves. It serves to remind those who see it of the tragedy of war, and the high cost of Australia's involvement in it. In contrast, the specimen collection was never *intended* to be something to commemorate, but to educate, in a specific setting and field - namely military medical circles.

The collection's distinctiveness as part of Australia's War experience lies in the fact that although it does have historical importance, its key function remains in what it can pass on about lessons learned.

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Obituary

Captain Charles Fison Aamc (1908 - 1999): A short biography of a paediatrician-soldier[1]

J.Pearn

The domain of military medicine has traditionally encompassed the disciplines of high-energy trauma management, tropical medicine, the management of the epidemic diseases of the Army and Navy and the ethos of preventive medicine. In the Australian Defence Force, unlike responsibilities undertaken by Service doctors in the United States, paediatrics and child care has not held a prominent place until the last decade of the twentieth century.

As the twentieth century ends, an audit of Australia's international operational deployments of recent years has shown that more than half have involved significant paediatric and child care. Deployments to Somalia and Rwanda, to Cambodia and to Papua New Guinea have included major core elements of paediatric care. In this context it is appropriate to review briefly the life of one of Australia's pioneer specialist paediatricians, and his uniformed service during the Second World War.

The Hospital for Sick Children in Brisbane, later (in 1944) named the Brisbane Children's Hospital, and later still (in 1968) renamed the Royal Children's Hospital, has had an outstanding tradition of combined civilian and military service. The senior paediatrician (1911-1922) at that Hospital was Dr A.Graham Butler (later Colonel Butler DSO, VD; 1873-1949), a leading doctor-soldier at Gallipoli, who went on to be a founder of the Australian War Memorial and the official Medical War Historian (World War One)for Australia. Butler served also as the professional predecessor to the writer as the senior paediatrician at the Royal Children's Hospital (1919-1923); and laid a foundation of traditions of service which continue to the present day. Other paediatricians and paediatric surgeons from the Royal Children's Hospital in Brisbane who served throughout the Second World War on operational deployments were Group Captain Sydney Fancourt McDonald (1885-1947), founder of the Melbourne University Rifles and later the Senior Paediatrician who followed Colonel A.G. Butler at the Hospital for Sick Children in Brisbane. Other paediatrician-soldiers have included Colonel Harold Forbes, Senior Paediatrician at that Hospital; and Colonel Peter Grant, Senior Surgeon and later Medical Superintendent. Both served as Representative Honorary Colonels of the Royal Australian Army Medical Corps. In this tradition of paediatric and military service also served Captain David Charles Fison AAMC, whose death in September 1999 saw the last of the paediatric physician-surgeon generalists who had rendered service in the Australian Army Medical Corps.

Captain David Charles Fison AAMC (1908-1999), paediatrician and soldier; and the longest serving Superintendent of the Royal Children's Hospital, Brisbane. Shown in his uniform of the Australian Army Medical Corps, 1941.

Captain David Charles Fison (1908-1999) was one of the longest serving Medical

1 Pearn J. Captain Charles Fison AAMC (1908 - 1999): A short biography of a paediatrician-soldier. *Aust Mil Med* 1999; 8(3):29.

Superintendents of any Children's Hospital; and one of the pioneers of the specialty of paediatrics as that term is used and understood today. He served in uniform during the Second World War whilst appointed as Senior Registrar at the Hospital for Sick Children in Brisbane. At a time of serious manpower shortage, and when there was an enormous clinical load of sick children in southern Queensland, he could not be released for overseas service although such postings had been promulgated on several occasions. This account records some of the details of his life.

David Charles Fison was born on the 7th July, 1908, the second son of David Fison, the Engineer to the Department of Harbours and Rivers, at the Port of Brisbane. He completed a Master of Science degree at the University of Queensland, but was retrenched during the Great Depression. In 1933 he enrolled in the Faculty of Medicine at the University of Sydney, graduating MB BS in 1937. In 1937 he was appointed as Junior Resident Medical Officer at the Hospital for Sick Children in Brisbane, serving continuously at that Hospital until his retirement in 1974. In 1946 he was appointed Medical Superintendent of the (renamed) Brisbane Children's Hospital, a position he occupied continuously for the next 28 years. During this extended period he helped in the training of a generation of graduating doctors from the University of Queensland; and was part of a great tradition of doctor-soldiers who either as fulltime staff members, or as Visiting Physicians and Surgeons, became leaders in the discipline of military medicine in Australia. He brought to Servicemen and women a special sympathy, and an understanding of the demands that such make on the institution in which they serve. He is recalled as a man of uncompromising integrity in every aspect of his personal and professional life. As the "live-in" Superintendent at the (renamed) Royal Children's Hospital in Brisbane, he cared for several thousand junior doctors who passed through that Hospital; and for tens of thousands of children for whom, as Medical Superintendent, he accepted ultimate care. He was one of the pioneers of paediatric electrocardiology in Australia; and for more than two decades taught registrars and residents the special skills of paediatric ECG interpretation. He rendered singular service to the Royal Queensland Bush Children's Health Scheme, serving in an executive capacity from 1946 until 1992. He advocacy was to become part of the terms of reference of that splendid institution which offered a "home away from home" to many thousands of children who would otherwise never have had the opportunity to receive tertiary medical care, or even to visit a capital or ever see the sea.

Fison enlisted in the Australian Army Medical Corps, and served throughout the Second World War with the rank of Captain. His civilian position was declared a Reserved Occupation, and although posted overseas on two occasions, he was unable to leave the Hospital because of his primary commitments to sick children. The war years were an era when desperate parents had little chance of access to specialist paediatricians. It was a time still of diphtheria and poliomyelitis epidemics; and a time when Captain Fison could be seen running, in his pyjamas at all hours of the night, to perform an emergency life-saving tracheostomy on a child suffocating from epiglotitis or diphtheria.

As part of his duty in the Australian Army Medical Corps, he attended extensively at nights and weekends to service Immunisation Parades. He is remembered extensively for his meticulous attention to detail, and in this role was particularly adept and valued for undertaking uncountable numbers of Service Medical Examinations. After demobilisation, and following his appointment as Medical Superintendent (in 1946), he remained the life-long professional colleague of many of the paediatric doctor-soldiers who returned to work at the Hospital. Such included the young spitfire pilot, Dr Kenneth Mitchell; and also Colonel (later Brigadier) Sir Kenneth Fraser, the irascible senior surgeon at the Royal Children's Hospital who was the Director of Medical Services for Northern Command, prior to and immediately after the Second World War. Captain Fison created an administrative ethos of sympathetic encouragement for doctors at the Children's Hospital who wished to render such military service to their country; and for such he is particularly remembered.

Conferences and Courses

SOMOS '99

R. Atkinson, P. Sharwood[1]

Background

The Society of Military Orthopaedic Surgeons is a US initiative that provides a forum for the exchange of medical knowledge as related to the practice of orthopaedic surgery in the military. Interestingly enough, it is not called the 'United States' Society of Military Orthopaedic Surgeons nor the 'American' Society, so it may be indeed that the founding fathers of this society saw a future greater than their own nation. Whatever the origins, however, it did give me an opportunity and the privilege the international aspects of the society and its future direction.

The meeting extended from Sunday 24 October to Friday 29. It was held at the Williamsburg Marriott Hotel in Williamsburg, Virginia, USA. The initial presentations began with military history, and immense lessons in military surgery have been learned from the War of Independence through the Civil War to modern times. It is easy for us, from the Australian history point of view, to forego the huge amount of information harboured by our compatriots in the US.

The independence of the US draw on their British and European heritage in regard to military surgery but their independent problem solving attitude, as a reflection of their newly formed nation, has produced the innovation of the leadership shown today, and I certainly consider an attitude shared by us as a not too dissimilar democracy.

Papers

Paper No. 4, titled 'Orthopaedic Surgical Care Delivery in Refugee Operations at Guantanomo Bay: 1994–1995', was presented by CDR Michael Muldoon MC USN and reinforced the view that we have discovered that refugee health care operations may result in high volumes of orthopaedic injuries and infections. The standard of care decided upon for a given operation does dictate the amount of resources required, and this decision needs to reflect national policy.

The pattern of the papers not only had a military bias but also sports injuries and general orthopaedics, as patient populations included dependants and veterans treated by the US medical services. Active Reserve Medical Officers presented on work from their civilian practices.

Paper No. 47, titled 'Biomechanical Evaluation of Chest Body Armor', by CDR Marlene DeMaio MC USNR, demonstrated the efficacy as well as vulnerability in that armour dissipates to some degree but still transmits a significant pressure force to the sternum and chest cavity which can be lethal if the energy transmitted is great enough.

A guest lecture by Andrew Burgess MD, who is the principal at the Baltimore Shock Trauma Center in Maryland, was on trauma and looked at the value of external fixation for immediate stabilisation and transport—in essence buying time—which would be applicable to the mass casualty military situation. It was noted that 70% of wounds over the last 150 years in the US military were of the extremity.

Paper No. 66, titled 'Functional Outcome of Endoscopic ACL Reconstruction in a Military Population: Assessment of Return to Duty with Analysis of Failures', by CDR Glen Ross MC USN, demonstrated the procedure to be reliable for restoring active duty military to full status in nearly 94% of cases, thus fulfilling short-term goals.

Paper No. 87, 'The Effectiveness of the Parachutist Ankle Brace in Reducing Ankle Injuries in an Airborne Ranger Battalion', by 1LT James T Schumacher, Jr, USA, studied a total of 13,782 static line parachute jumps and reduced the rate of ankle injuries from 4.5/1000 jumps to 1.5/1000 jumps, with no significant increase in other injuries.

Paper No. 88, by LTCOL MAJ Robert M Harris USA, was on 'Change on Lower Extremity Morbidity from Landmine Injury: An Analysis of New Protective Footwear' (photocopied p.108 and sent to Dr Alex Krstic). This military orthopaedic surgeon had visited the Defence Science and Technology Organisation in Salisbury in April '99 as part of the multinational team developing the surrogate model. This project had been initiated by BRIG Paul Buckley, the Director

[1] BRIG Rob Atkinson and COL Peter Sharwood are Army Reserve orthopaedic surgeons.

General Defence Health Services a number of years ago and this recent work coordinated with this; and the study suggested that the morbidity from landmine injuries may be reduced with certain protective footwear. The meeting ended with a workshop on shoulder surgery, utilising fresh, frozen cadaver shoulders.

CAPT Martin K. Deafenbaugh MC USN was the president and gave me the privilege of addressing the body, in the order of 200 orthopaedic surgeons, during the business meeting. The idea of international orthopaedic membership, and particularly an Australian chapter, was well received and may well develop over the next few years. The possibility of orthopaedic fellowships was discussed, along with the development of guest lecturers both in Australia and the US. It seemed to me there were a large number of areas where a common future could be developed.

The papers were of 6-minute duration and thus extremely rapid; but nonetheless, in their style, definite points were made and a large amount of information transferred. They were enthusiastic to receive Australian papers for the future and, as indicated previously, the topics could cover all orthopaedics including military.

Conclusion

In conclusion, the significance of the meeting in colonial Williamsburg, which featured prominently in the transition of the US to independence from Britain, was not lost on the two Australians present as we approached our referendum on the republic and its potential for a more peaceful transition—op tempus fugit.

A Course in Military Anaesthesia, 30-31 March 2000, Launceston General Hospital, Tasmania

The Surgeon-General of the Australian Defence Force (ADF), Major General J. Pearn AM RFD and the Hospital's senior clinical and administrative staff offer this drawover anaesthesia course.

Title:	"Military Anaesthesia"	
Design:	Hands-on; Didactic; Discussion	
Eligibility:	FANZCA or equivalent:	ADF Reserve/Regular
	Registrar, ≥ 2 years in ANZCA-accredited posts:	ADF Reserve/Regular
Numbers:	16 'students'	
Faculty:	Dr. George Merridew	FANZCA, WGCDR RAAFSR
	Dr. Haydn Perndt	FANZCA, joining RAAFSR
Enquiries:	LTCOL Paul Adams	CP-4-6-28 Campbell Park Offices, Canberra ACT
		Telephone 02 6266 3893 Fax 02 6266 6933

Background

The inaugural Australian *Remote Situations, Difficult Circumstances, Developing Country Anaesthesia* course held in March 1999 at the Royal Hobart Hospital, was convened by Dr. Haydn Perndt, who has taught and worked extensively in developing countries. His course delighted its 16 member-class which was heavily over-subscribed; 70 more had applied. Five ADF reservists attended, including one as a lecturer. The 4-day course is to be repeated 21-24 March 2000, at the Launceston General Hospital (LGH).

Surgery in the field requires anaesthesia of maximal versatility and safety, in a setting of what can be few resources. The ADF's anaesthetic apparatus is of high quality well suited to the spectrum of environments in which surgery can be undertaken. *At one extreme:* Elective cases, using ULCO military apparatus with the usual Western of drugs, monitoring, air conditioning, compressed gases and skilled help. *The other extreme:* Urgent surgery and general anaesthesia with either parenteral ketamine or a drawover inhalational agent, using a self-inflating bag to ventilate with ambient air± added oxygen, without electronic monitoring, at temperatures in the range from near freezing to day-time desert heat.

Most civilian anaesthesia training programmes in the Western world provide little or no clinical exposure to drawover anaesthesia, despite its well-established capabilities.

ADF anaesthetists' drawover training requirements can be met by a 2-day course which omits material appropriate to Developing Country anaesthesia but of limited relevance to the ADF. e.g. non-military apparatus and logistics, and long-term training of local civilians.

Outline of the military course[1,2]

Clinical

As for the 1999 *RS DC DCA* Hobart course, including State medical board sanction. Overall care of the cases to be overseen by the LGH consultant anaesthetist of the list.Monitoring to be at the contemporary standard (Datex AS/3). Diethyl ether will not be used.

Under the supervision of an anaesthetist experienced in the technique, each 'student' will conduct 1 and witness 3 inductions (intravenous or inhalational) using a drawover circuitand proceed to establish maintenance general inhalational anaesthesia. In each of 4 LGH operating rooms on the days of the course, the first cases a.m. and p.m. will be managed as above. Halogenated agent delivery will be by ULCO, Tri-service, PAC, and EMO systems.

Didactic

Drawover anaesthesia : Principles
Drawover anaesthesia : Performance data, *viz.*
Vapour ouputs, drawover and plenum -
OMV, EMO, PAC, Goldman plenum only - TEC-3
Oxygenation by and resistance to gas flow through drawover circuits
Drawover vs plenum circuits: determinants of inspired vapour concentration
Ketamine: its uses, titration, and outcome studies
Aspects of: obstetrics, paediatrics, ICU, retrieval, and endemic diseases
Australian-based medical aid programmes

Demonstration & Discussion

ADF's ULCO military anaesthesia apparatus
Drawover ventilators (Oxford, Manley Multivent, Acoma, compPAC)
Monitoring techniques, especially the monaural stethoscope
Maintenance of apparatus.

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Research Update

Army Malaria Research Institute - Malarone[1]

S. Kitchener

This is an exciting time for Antimalarials – well, exciting for us. The Malarone trial (Bougainville) is still being analysed, however, initial data analysis suggests the drug is as good and better tolerated than Doxycycline for daily prophylaxis in an operational setting.

Malarone is the old Proguanil and Atovaquone. Some of you may recall Proguanil as the mainstay of prophylaxis in the Malaya and early Vietnam operations (before Dapsone was added in the wet seasons). I have only used it for limited cases such as children not able to take Chloroquine due to epilepsy or other contraindications, as there is a reasonable amount of resistance around to it when used alone. The (ex)Brits amongst us will probably have experience with Proguanil as this was originally produced in the UK and remains a commonly used antimalarial with Chloroquine for travelling Brits. Interestingly, PG and CQ was the prophylaxis used in the Sandline Operations. Had operations escalated on BVL, the non-immune mercenaries would have suffered notable nonbattle casualties from malaria as was confirmed by our recent malaria surveys on BVL.

I digress - The sticking point for Malarone for some time to come will probably be the cost in comparison to Doxycycline. It is presently registered in Australia for treatment of malaria and not uncommonly used as a stand-by treatment in the retail sector of Travel Medicine (at around $40-50). In this respect, it is certainly an advance on Mefloquine stand-by treatment in being safer and probably more effective, particularly in areas of higher MQ resistance such as northern Thailand. Combined with the field rapid testing for Pf (and to a lesser extent Pv), it is a worthwhile addition to the kit in the appropriate circumstances of isolation from reasonable medical care.

To my knowledge, prophylaxis use in private Trav Med has been very limited. There is the concern for the private providers of TGA approval for use outside treatment. Of note is that Primaquine has been used by the ADF for many years for eradication while being approved for use in the country for treatment.

Finally, the first draft of the new HPD 215 has hit the streets – perhaps too many streets. There are some issues proposed in the draft representing significant changes for consideration by the wider military medical expertise available in the ADF. One of these changes is the use of Malarone as the second line prophylaxis after Doxy. It should be rememebered that this is a draft for limited distribution and comment among military medical/health officers.

[1] Kitchener S. Army Malaria Research Institute - Malarone. *Aust Mil Med* 1999; 8(3):34.

Abstracts from the Literature

Submitted by Andy Robertson

Weddle M, Prado-Monje H. Utilization of military support in the response to hurricane Marilyn: implications for future military-civilian cooperation. *Prehospital Disaster Med* 1999 Apr-Jun;14(2):81-6.

INTRODUCTION: The past decade has been a period of evolution for the Federal disaster response system within the United States. Two domestic hurricanes were pivotal events that influenced the methods used for organizing Federal disaster assistance. The lessons of Hurricane Hugo (1989) and Hurricane Andrew (1992) were incorporated into the successful response to Hurricane Marilyn in the U.S. Virgin Islands in 1995. Following each of these storms, the Department of Defense was a major component of the response by the health sector. Despite progress in many areas, lack of clear communication between military and civilian managers and confusion among those requesting Department of Defense health resources may remain as obstacles to rapid response. METHODS: This discussion is based on an unpublished case report utilizing interviews with military and civilian managers involved in the Hurricane Marilyn response. RESULTS: The findings suggest that out-of-channel pathways normally utilized in the warning and emergency phase of the response remained operational after more formal civilian-military communication pathways and local assessment capability had been established. CONCLUSION: It is concluded that delays may be avoided if the system in place was to make all active pathways for the request and validation of military resources visible to the designated Federal managers located within the area of operations.
Comment: *How well would it work for us?*

Fontana M, Lucha P, Snyder M, Liston W. Surgery aboard ship: is it safe? *Mil Med* 1999 Sep;164(9):613-5.

A retrospective review was performed on 684 surgical procedures done aboard U.S. Atlantic Fleet ships during a 3-year period from 1994 to 1996. These procedures were compared with similar procedures performed at the Naval Medical Center in Portsmouth, Virginia. Morbidity and mortality rates were calculated and compared. A very low morbidity rate (0.43%) was reported for surgical procedures performed while deployed compared with 1.69% for procedures at the Naval Medical Center. One mortality was reported. These extremely low rates are felt to be attributable to multiple causes, including a highly selected, healthy patient population, performance of only low-risk procedures, early presentation of surgical problems, and early medical evacuation of patients with complex medical and surgical problems. We feel that elective surgical procedures such as vasectomy, circumcision, inguinal hernia repair, and hemorrhoidectomy can be performed safely aboard ship. This would increase the training opportunity for all members of the medical department and at the same time decrease the costs and risks associated with medical evacuation.
Comment: *Elective surgical procedures are safe with a trained surgeon and Level 3 facility. The safety of such procedures in a less optimal facility is more debatable.*

Thummakul T, Wilde H, Tantawichien T. Melioidosis, an environmental and occupational hazard in Thailand. *Mil Med* 1999 Sep;164(9):658-62.

Melioidosis is a tropical environmental hazard that causes acute and chronic pulmonary disease, abscesses of the skin and internal organs, meningitis, brain abscess and cerebritis, and acute fulminant rapidly fatal sepsis. It is more common among adults, individuals with diabetes, and individuals with chronic renal disease, but it can occur in normal hosts and children. Burkholderia pseudomellei is the most prevalent cause of community-acquired pneumonia, liver and splenic abscess, and sepsis in northeastern Thailand. Melioidosis can reactivate years after primary infection and result in chronic or acute life-threatening disease. With increasing worldwide travel and migration, patients may present in nonendemic countries with reactivation melioidosis decades after leaving an endemic region. We discuss seven selected patients presenting with this disease to a tertiary care facility in Bangkok between 1995 and 1997. Awareness should allow early diagnosis and treatment, which can lead to decreased morbidity and mortality.

Comment: *Melioidosis remains an endemic problem in northern Australia and should be considered during operational deployment to these areas.*

Wong RM. Taravana revisited: Decompression illness after breath-hold diving. SPUMS J 1999; 29(3):126-131.

Decompression illness (DCI) following breath-hold diving is extremely rare. In the past there were numerous breath-hold divers around the world, such as Ama and Katsugi divers of Japan, hae-nyo divers of Korea and sponge divers of Greece and Turkey, but now this mode is much less common. These divers do not normally suffer from DCI.

Comment: *Bob has provided an excellent review of a rare but interesting condition. Given the breath-holding required in Submarine Escape training, this remains an unusual but important condition.*

AMMA Awards for 2000

AMMA Journal Editor's Prize	**$750**
Research Grant	**$1000**
AMMA Patron's Prize	**$250**
Australian Military Medicine Prize	**$500**

Deadline: 30th June 2000

To be eligible for AMMA Awards, applicants must be current members of AMMA, and remain financial members for a period of 3 years following acceptance of grants or awards.

Further information on these prizes and grants can be found on the AMMA Website: http//amma.trump.net.au/ or by contacting the Secretariat on 6247 1850

Conference Report

8th Annual Conference, Stamford Plaza, Adelaide

The 8th Annual Scientific Conference of the Australian Military Medicine Association was held at the Stamford Plaza Hotel, Adelaide, from the 8th to the 10th of October 1999. Over 90 delegates from both the Permanent and Reserve Defence Forces, as well as civilians with an interest in military medicine, were treated to a range of scientific and topical papers during the three days of proceedings.

Official Opening

More than 60 AMMA delegates attended a cocktail reception held at Government House. The Governor of South Australia, His Excellency, Sir Eric Neal officially opened the conference and then treated his guests to a grand, yet relaxed evening including a tour of Government House.

Social Programme

The Conference Dinner was held on the Saturday night in the Bradman Room at Adelaide Oval. A fun night was had by all with a Quiz Night successfully run by the one and only Quiz Master Russ Schedlich.

Conference themes:

The End of the 1900s: Yesterday, Today and Tomorrow

- History of Australian Military Medicine
- Prevention – Better than Cure?
- Provision of Health Care in War and Peace
- Weapons of Modern Warfare
- The Aftermath
- Towards the Future

Keynote Speaker

Dr Mike Hill from the NSW Department of Health spoke on Civilian approaches to CBR Defence.

'Weary' Dunlop Award

The 'Weary' Dunlop Award is presented annually for the paper judged the best original work at the AMMA Scientific Conference. The 1999 award was presented to Miss Rosalind Hearder for her paper titled "Careers in Captivity: Australian POW Medical Officers in WWII".

Sponsorship and Trade Display

The AMMA received support from the following sponsors.

Major Sponsor

- SMITH KLINE BEECHAM

Sponsors

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- UVEX SAFETY

AMMA Merchandise

A variety of AMMA merchandise was available for sale.

Conference 2000

Hotel Grand Chancellor
Hobart Tasmania

20-22 October 2000

AMMA Annual General Meeting

The 8th Annual General Meeting of the Australian Military Medicine Association was held at the Stamford Plaza, Adelaide at 1645 on Saturday 9 October 1999. The meeting was attended by 25 members.

Reports

The 1998-99 Annual Report (to be included in the December issue of *AMM*) was presented to the meeting.

The following verbal Reports were presented:

- President - Nader Abou-Seif
- Secretary – Fabian Purcell
- Treasurer – Russ Schedlich (presented in Andrew Robertson's absence)

Secretary's Report

Total membership 323 including 8 library. Financial 230, non financial 93. Since July 98, 20 new members joined, 7 of those joined via the AMMA Web site, 12 resignations (2 deceased).

Treasurer's Report

Fees

Russ Schedlich advised that there would be no fee increase for the 1999/2000 year.

FY 97/98 Books audited. FY 98/99 Books with auditor Adrian van Dongen in Hobart. Interim Statements presented.

- Loss of $4,728.15
- Principally in membership income:
- budgeted at $20,000
- actual only $13,455, down $2,400 from previous year
- 15 mths operating on 12 mths fees:
- change from calendar to financial year
- FY 99/00 will be 12 in 12
- Conference lost $1,000

Savings made:

- secretarial
- postal
- telephone
- accountancy fees
- Modest income increases from interest and merchandise sales

Conferences

20/21/22 October 2000 Hobart
19/20/21 October 2001 Brisbane
2002 Canberra

Council

The following members were elected unopposed to Council:

- President - Nader Abou-Seif
- Vice-President - Russ Schedlich
- Secretary – Fabian Purcell
- Treasurer – Graham Boothby
- Public Officer – Dave Emonson
- Member – Beverley Wright
- Member – Janet Scott
- Journal Editor – Andrew Robertson

General Business

MAJGEN Pearn thanked Russ Schedlich for his role as Journal Editor and Andy Robertson for his role as Treasurer.

The issue regarding the AVMED Conference and the consideration of holding a joint conference with AMMA was raised.

The issue of the Red Cross featured on the AMMA logo was raised. Red Cross was approached 2 years ago and they were happy with the AMMA logo.

Membership was raised. Membership is everyone's responsibility and unless we actively pursue new members all the corporate knowledge will disappear. The personal approach was a good method for recruiting within the Association.

AMMA Update

News and information for members of the Australian Military Medicine Association

Successes

The following AMMA members have achieved success through honours, awards, promotions and publications.

Members will note that these items are not complete. The Editor needs sources of information from the three Services and from our civilian members as well, so that this section of your journal can truly reflect the cross-section of our membership.

Updates can be faxed to CMDR Andy Robertson or SQNLDR Karen Gisler on (02) 6266 3933 or e-mailed to: agrobert@excite.com or kgisler@cyberone.com.au

Changing of the Guard

BRIG Paul Buckley is retiring after a distinguished career in the Defence Health Service. The new Director General Defence Health Service will be BRIG Wayne Ramsey.

Obituary

We note, with regret, that one of our Melbourne members, LTCOL Ian Stahle, passed away on 28 Oct 99.

Defence Force Promotions

The following AMMA members have been selected for promotion in the Defence Forces:

- LTCOL David Hutton to COL
- CMDR Jenny Firman to CAPT
- LCDR Neil Westphalen to CMDR
- CAPT Mike Rowell to MAJ
- FLTLT Kath Skinner to SQNLDR
- FLTLT Greg Norman to SQNLDR

Defence Force Movements

- CAPT Russ Schedlich RAN will be working as the SMO HMAS Kuttabul from Jan 2000 in a civilian capacity.
- GPCAPT Dave Emonson is posted as DHPPD in Jan 00.
- COL Peter Warfe will be retiring in Jan 2000 after a distinguished career in the RAAMC and DHSB.
- LTCOL David Hutton will be posting to JHSA at the end of 1999.
- CMDR Jenny Firman takes over as Director Health Promotion and Prevention in DHSB in Dec 1999.
- WGCDR Suresh Babu is posting to AVMED as CO.
- WGCDR James Ross will be posting to the Health Capability area in Defence Health.
- SQNLDR Karen Gisler will be posting to the Health Promotions area in Defence Health.
- SQNLDR Ian Hosegood is posting as SMO of 304ABW (Edinburgh) with acting WGCDR rank.
- LCDR Neil Westphalen posts to Maritime Headquarters as the COMFLOT MO from May 2000.
- FLTLT Greg Norman is posting to 301ABW (Amberley) as OIC MEDSVCS.

AMMA Conferences

2000 Conference

The 9th AMMA Scientific Conference will be held in Hobart from the 20th to the 22nd of October 2000.

AMMA Homepage

AMMA has a home page: http://amma.trump.net/

Whilst still under construction, there is lots to see. Let us know how we can improve the page and please provide us with links you have found useful.

AMMA Contacts

For all general AMMA enquiries contact the Secretariat:

Paula Leishman:

Tel: (03) 6247 1850

Mobile: (0412) 875 390

Fax: (03) 6247 1855

Email: paulaleishman@trump.net.au

Web Page: http//amma.trump.net.au

Journal

Journals for 2000 will be published as follows:

Issue	**Copy Deadline**
Mar 2000	29 February
Aug 2000	31 June
Dec 2000	31 October

All queries regarding the Journal should be directed to:

Andy Robertson

Tel: (02) 6266 3416

(0416) 106 966

Fax: (02) 6266 3933

AMMA Awards

Details of the AMMA Awards for 2000 are included in this journal.

Members are reminded that applications for the AMMA Awards must be received by 30 June 2000. Further details on the Awards can be obtained from the Secretariat on (03) 6247 1850.

Library

The Association's Library is located in the Fleet Medical Officer's office, Maritime Headquarters Sydney. Any member who wishes to browse through the Library (and visit the Librarian for coffee) is welcome to call.
Books from the library are available for loan of up to 12 weeks.

Contact: Mike Loxton

Tel: (02) 9563 4504

Mobile: (0412) 286 740

Fax: (02) 9563 4554

AMMA on the Net

Some useful pages:

AMMA Web site
http://amma.trump.net.au/

Medical Conferences:
http://www.pslgroup.com/medconf.htm

NBC Medicine:
http://www.nbc-med.org/

New Scientist:
http://www.newscientist.com/

Travel Medicine:
http://www.cdc.gov/travel/travel.htm

Medical Journal of Australia
http://www.mja.com.au/

Conference and Meeting Calendar

Date	Conference	Venue	Contact No.
21 Feb 03 Mar 00	Introductory Course in Diving and Hyperbaric Medicine	Randwick	(02) 9382 3880
13-15 Apr 00	Antimicrobials 2000	Sydney	(08) 8204 6873
15-19 Apr 00	Australasian Society for Infectious Disease Annual Scientific Meeting	Leura	(02) 9418 9396
02-5 May 00	RACP Meeting	Adelaide	(03) 9819 3700
06-14 May 00	SPUMS Meeting	Fiji	(03) 9885 8863
07-09 Jun 00	ACHSE 2000 Congress	Sydney	(02) 6622 1954
17-20 Aug 00	AVMED 2000	Broome	(03) 9899 1686
6-8 Sep 00	ANZ Burn Association 2000	Perth	(08) 9322 6906
20-22 Oct 2000	***9th AMMA Conference***	***Hobart, TAS***	***(03) 6247 1850***
03-04 Mar 01	Trauma 2001	Sydney	(02) 9956 8333
20-23 Sep 01	AVMED 2001	Canberra	(03) 9899 1686