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Statement of Objectives

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

- promoting the study of military medicine
- bringing together those with an interest in military medicine
- disseminating knowledge of military medicine
- publishing and distributing a journal in military medicine
- promoting research in military medicine

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

The Association is totally independent of the Australian Defence Force.

President's Message

Nader Abou-Seif

Welcome to 1997 and what promises to be a full year in the Australian military medicine calendar.

Health services tend to be something the community takes for granted, and military health services are not excluded from this attitude. Indeed the only time mention seems to be made is when things fail to reach the expected standard of excellence. The most recent example of this has been in the recent contribution to the search and rescue efforts for two shipwrecked lone yachtsmen in the Southern Ocean. The efforts of the search and rescue team received well deserved recognition, however the part played by the medical teams involved received very little comment. I would like to redress this and use this opportunity to congratulate those involved on their efforts.

It is part of the role of AMMA to encourage and acknowledge achievement in the fields of military medicine and I believe that the commitment to excellence is something which is ingrained in our military medicine community.

The skills and talents in our Association are also something which we wish to encourage. Part of our role is achieved through awards and grants to members of AMMA who have made or wish to make a contribution to the knowledge of military medicine. Once again, as the deadline for applications for the AMMA Grant draws near, I encourage you all to consider how AMMA may help you pursue your areas of interest and expertise, while enhancing the base of military medicine informa-

tion in this country. Details of the grant requirements and the application procedures are found elsewhere in this journal.

On a similar line, it is not too early to consider the upcoming 6th National Conference to be held in Melbourne at the Hotel Sofitel on August 29-31. Previous conferences have justifiably earned praise for the range and depth of the topics discussed, and participation in the conference as either a presenter or delegate should be pencilled in to your diaries from now. This is the main event in the AMMA calendar and indeed is becoming the premier event in the Australian military medicine calendar.

My message this month currently reads like a request for contributions to the Association, and indeed this is an ongoing requirement for AMMA's continued growth. The quality of the Association is wholly dependent on the input of its membership, and AMMA will be able to deliver more to all of us if we all continue to contribute to its activities. AMMA is driven by its membership, not by any other Association or affiliation. Our aims, as stated in the journal, are only achievable with your active involvement.

I look forward to 1997 being a year of consolidation as well as continued growth in the history of the society. I rely on your involvement to achieve these goals.

Editorial

Russ Schedlich

This issue of *Australian Military Medicine* concentrates, like the last, on operational medicine, which is the backbone of military medicine.

Continuing from their earlier article, Payne *et al* have analysed data on abdominal gunshot wounds from a major trauma centre to assess the types of injuries, and their outcomes, in victims who do not require massive blood transfusion. By doing this, the authors have sought to create a similar case mix to that which would be expected in abdominal trauma casualties presenting in a military hospital in combat operations, based on the premise that casualties requiring massive transfusion would either die on the battlefield or be triaged out of active treatment.

The authors make two important conclusions. First, that in casualties with abdominal injuries the presence of abdominal organ injury is unpredictable, and that exploration should be undertaken even where there is no obvious evidence of organ damage. Second, they conclude that the types of casualties seen in a major urban trauma centre are comparable to that which will occur on the battlefield, and that the use of such centres to provide clinical training for military health personnel is valid and invaluable.

In our second article, Rossiter has described the activities of an annual operation undertaken by the Indonesian Navy aimed at providing health care services to remote localities. As well as describing the different methods of treatment used as compared to what would be undertaken in an urban setting, the article emphasises the continuing and developing links between the ADF and the Indonesian military.

Readers may recall a suggestion made some years ago by the then Minister for Health, Senator Graham Richardson, for the military to provide health care assistance to remote aboriginal communities. Indeed, the ADF was tasked with providing details of a number of options available to do this. More recently, Army engineers have been given the job of providing assistance in the construction of the shelter and sanitation infrastructure in a number of communities. The use of the military for such tasks has not been a feature of ADF operations in the past, but Rossiter's article emphasises the important role such activities can play in training Service health personnel in the

conduct of operations, both military and surgical, in difficult environments.

Robertson continues his regular contributions to the journal in an article on non-lethal weapons. He demonstrates the enormous variety of these, and the equally wide variety of their effects. They range from non-lethal blunt trauma (rubber bullets, for example), through those affecting the special senses and pharmacological agents.

At the end of the article, Robertson talks briefly on psychological effects. Here, he brings out the point that there is a psychological effect generated by just about any non-lethal weapon, and in some cases it is the psychological effect that provides the greatest operational impact. A point not explored (perhaps wisely) is the debate presently waging about the morality of non-lethal weapons, especially those which permanently disable the special senses - lasers causing blindness, noise generators causing deafness. It is interesting that many believe permanently disabling a person in such a way is morally worse than killing them or producing a crippling-type disability; but we will offer no opinion on that matter.

Also in this issue is the speech given last February by Minister Bishop at the opening of the new facility for 3 RAAF Hospital, Richmond. This speech provides an important insight into the government's view on the importance of the ADF health service to the maintenance of operational capability. We trust the new Defence Health Service to be established under the Defence Reform Programme will continue to be able to deliver such a standard of health care, both in peace and war (see *AMMA Update*).

Finally, may I add to that of our President my encouragement to each and every one of you to consider producing a Paper for presentation at AMMA's Annual Conference in August. The best Paper will be reprinted in *AMM*. Other good papers will also be considered for publication. It is up to all of us to ensure that we make the effort to keep military medicine in Australia alive and well, kicking if necessary.

Original Article

Injuries and outcome after laparotomy in gunshot wound patients who have minimal bleeding¹

J.E. Payne,² H.J. Meyer,³ T.V. Berne⁴

Abstract

During 1990-1, 970 patients with gunshot wounds (GSW) were admitted to Los Angeles County - USC Medical Center. Of the 686 patients with trunk GSW, 433 had wounds of the abdomen or of the chest and abdomen. No blood transfusions were required in 323 of these patients, 5 of whom died (four of the deceased are omitted, being moribund on arrival). Up to four units of packed cells were transfused in 37 patients, 7 of whom died; 5-10 units were transfused in 30 patients, 8 of whom died. The remaining 43 patients received over 10 units of packed cells. The type of surgery was related to the injury severity score. Organ injuries were classified as chest, colon, gut, urological, liver and spleen and vascular. SPSS multivariate analysis showed 19 single or combined injuries of 64 to be significantly ($P < 0.05$) associated with bleeding and to be located in the thoraco-abdominal region. Of 318 survivors not transfused 1,2,3 and 4 organs were injured in 75, 59, 16 and 3 patients respectively; and 110 had only an injury of the abdominal wall. Stable patients not requiring blood transfusion with abdominal GSW are at significant risk of organ injury and require laparotomy.

Introduction

It is well recognised that in modern military warfare, extremity wounds occur with more than double the prevalence of wounds of the head and trunk.^{1,2,3,4} Landmines are mostly responsible for this problem, the massive wounds they produce result in traumatic amputations, multiple fractures, degloving and other tissue loss; these wounds often involve the buttocks, perineum, genitals and lower abdomen which are injured by blast and shrapnel.^{4,5} When the lower abdomen is involved the wound could be classified as a trunk wound.⁶

Abdominal wounds (and wounds of the trunk), on the other hand, are most prevalent in civil and urban warfare in almost double the prevalence of wounds of the other two main regions.^{6,7} In most situations including the military, abdominal wounds are caused by penetration by missiles or shrapnel. Abdominal wounds are associated with haemorrhage that is difficult to control by tourniquet or pressure. Gut contamination requires more extensive, time-consuming therapy which may overwhelm resources when there are large numbers of casualties. They therefore cause

¹ This is an authorised reprint of an article published in the journal of the Australian Military Medicine Association:

Payne JE, Meyer H-J, Berne TV. Injuries and outcome after laparotomy in gunshot wound patients who have minimal bleeding. *Aust Mil Med* 1996; 6(1)3-6

Presented at the Fifth Australian Military Medicine Association Conference in Canberra, September 7th 1996.

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³ H.J. Meyer. B App Sc. Research Officer, Department of Surgery, University of Sydney at the Repatriation General Hospital, Concord since 1974.

⁴ Thomas V. Berne. MD, FACS. Professor of Surgery at Los Angeles County University of Southern California Medical Center. Formerly Chief of Trauma. (LAC-USC Medical Centre is the largest urban trauma centre in the United States).

the most anxiety to those who might be responsible for triage in mass casualty situations.^{8,9}

This study was performed to analyse data from a consecutive series of patients who had abdominal gunshot wounds (GSW) in order to determine probabilities of injury and outcome in relation to blood transfusion and surgical therapy. Emphasis would be given to the group of patients who were not transfused, as this group would be very likely to reach hospital in any crisis.

Method

The methods of this study have been described in two previous reports.^{6,10} The reports are analyses of data recorded by trauma nurses on Trauma and Emergency Medicine Information Systems (TEMIS) about a consecutive series of patients admitted to the Los Angeles County-USC Medical Center between 1 September 1990 and 31 August 1991. Patients were classified as having abdominal GSW when their injury severity was recorded with an abdominal component, except when a head injury score was also present. This meant that patients with abdominal GSW (those who might require laparotomy) could also have had chest and extremity wounds caused either by a wound from one missile or by multiple wounds of chest, abdomen and extremities from more than one missile. The TEMIS data did not specify the number or type of missile wounds. This approach, however, is consistent with surface anatomy, the lower chest and upper abdomen overlapping each other. Patients who had chest surgery would include those who had either thoracotomy or placement of one or more chest tubes.

In order to simplify analyses, internal organs would be grouped together. Chest organs would include pleura, lung, heart and great vessels. The colon includes the rectum. Gastrointestinal tract (GIT) covers stomach, duodenum and small bowel. Liver, spleen and pancreas are combined. Renal includes kidneys, ureters and bladder. Vascular covers aorta and iliac arteries, vena cava and iliac veins. Patients with spinal cord injuries were included, however reference to the injury has been omitted.

Blood transfusion volumes include packed cells and fresh frozen plasma together. A 3 000 ml volume cut off was selected because this could be taken as the packed cell volume of an average male, and greater volumes could be defined as massive. A 1 200 ml volume (representing 4 units) was the median volume transfused in patients whose injury severity was 15 or below in the previous publication and who might therefore be expected to have minimal bleeding.¹⁰ Because bleeding can occur from wounding and during surgery, patients with replacement of up to 10 units are included in some

analyses. Statistics were computed with the SPSS advanced package Version 6.1.

Results

In the previous publication, 645 patients had GSW of the trunk in TEMIS records; 41 other survivors with trunk wounds were excluded from this study because their blood transfusion records were not available.⁶ Abdominal and thoraco-abdominal wounds were present in 433 patients whose blood transfusion volumes and outcome are given in Table 1. Table 2 shows the type of surgery according to injury severity in the whole group. The 43 patients who received massive transfusions were excluded from further analyses. Of the 67 patients receiving up to 10 units of blood, 37 received up to 4 units; and the mortality was evenly divided between the 4 unit and 10 unit groups. The median volumes of blood transfused and the outcome of "minimally transfused" patients are given in Table 3.

Table 1. Transfusions and outcome

Volume (ml)	Number Alive	Number Dead
> 3000	17	26
≤ 3000	52	15
Nil	318	5

Table 2. Surgery and injury severity

	ISS ≤ 15	ISS > 15
Dead	4	42
No Surgery	108	2*
Chest Surgery	8	2
Laparotomy	64	87
Laparotomy + Chest	16	36
Negative Laparotomy	62	2
TOTAL	262	171

* Extremities also

Table 3. Transfusion data (excludes massive transfusion)

	Number	Median (ml)	Mode (units)	Total Units
ALIVE	52	1 200	2	222
DEAD	15	1 926	9	84
TOTAL	67	1 200	2	306

Multivariate analysis (MANOVA) was used to rank organ groups according to blood transfused. Spinal injury patients were excluded because of the intrusion of spinal shock in volume requirements, leaving 359 patients at risk. Highly significant associations ($P < 0.002$) with volume in descending order were found when there were multiple injuries of kidney with vascular and chest, liver/spleen and foregut (GIT) and chest; and also with individual vascular and GIT wounds. The organs involved in the 15 fatalities are given in

Table 4. Fatalities - organs* involved

Transfusion/ Organ Groups	Vascular	Liver - Spleen	GIT	Chest	Renal	Colon
≤ 1200 ml						
1	X					
2		X		X		
3		X	X	X		
4	X	X		X	X	
4	X	X		X	X	
4	X	X		X	X	
6	X	X	X	X	X	X
1201-3000 ml						
1		X				
2	X				X	
2		X	X			
3	X		X			X
3	X		X			X
3	X		X			X
3	X	X	X			
4		X	X	X		X

*Organ groups injured

humanitarian role. In both cases there are obligations to go all out in saving the lives of the injured.¹¹ During any warfare, however, problems in evacuation and supply may hinder optimal care.^{14,15} Mass casualties may overwhelm resources; in the Gulf War casualty rates were manageable, however, and military surgical facilities were prepared to treat immediately any uncontaminated patient who presented with a penetrating wound.¹³ Triage

Table 5. Not transfused

Organ Groups (No.)	1	2	3	4
Chest	20%	51%	69%	100%
Colon	25%	42%	56%	67%
GIT	41%	48%	88%	67%
Liver/spleen	5%	46%	63%	100%
Renal	5%	10%	19%	67%
Vascular	3%	3%	6%	0%
Total (153 Patients)	75	59	16	3

The numbers in each column are percentages of the total number of patients in the bottom row. No organ or group was significantly associated with the absence of blood transfusion (MANOVA).

Table 4. It is important to note that in every chest injury in Table 4 the specific organ involved was the heart.

No blood transfusions were given to 318 survivors. The number of organs injured included abdominal (and/or chest) wall only in 110 patients. A negative laparotomy in 64 patients occurred after no organs were found to be injured. These patients obviously had an abdominal or trunk wall injury. The number and percentage of grouped organ involvement in the 153 not transfused patients with internal injuries are given in Table 5.

For information, a comparison of internal organ involvement between our previous study and data from Vietnam is given in Table 6.^{6,11} Table 7 compares our data with Vietnam and the Persian Gulf.^{10,12,13}

Discussion

Los Angeles County - USC Medical Center can be seen to devote immense and costly resources to the care of the victims of urban warfare.⁶ These patients have injuries which are likely to be similar to those received in most civil wars, during which time outside military forces may participate in an

Table 6. Percent organ injury at laparotomy - comparison with Vietnam

Organ	LAC + USC ⁶	LAI KHE ¹¹
Small Bowel	24	33
Colon & Rectum	21	23
Liver & Gall bladder	18	21
Stomach	10	8
Kidney	7	8
Spleen	5	5
Bladder	6	4
Pancreas	4	3
Vascular	5	0

Table 7. Transfusion comparisons

Hospital	Number	Volume (litres)	Units (mean)
Da Nang ¹²	478 RA*	2 676.8	5.6
	38 SD**	452.2	11.9
Khanjar ¹³	40	170	4
LAC + USC ¹⁰	64***	277	4
	194****	2373	12

* RA Released Alive

** SD Salvageable Death

*** < 3 litres

**** All Cases

is therefore a flexible process.

It is probably appropriate to assume that patients who are unstable in a war zone would be much less likely to reach an appropriate surgical facility or field hospital. This is the main reason patients who required massive transfusion were excluded from analyses in this study. Support for the inference that unstable patients are less likely to reach hospital in war situations comes from Table 6 where no vascular injuries were recorded at laparotomy in the Byerly and Pendse report.¹¹ By comparison, a small proportion of patients in Los Angeles transfused 10 units or less had vascular

injuries and vascular injuries were significantly associated with (the need for) blood transfusion. Transfusions were administered to six of the seven patients who died of GSW of the heart - it is presumed that those who received nothing or less than 1200 ml were moribund. (Another patient, who was not in this study, survived a GSW of the heart). Furthermore, mortality in the massively transfused was 60 percent compared with 22 percent in the "minimally" transfused ($P=0.00002$). Table 3 shows the larger volume requirements of fatalities. The transfused group obviously presents difficulties when there are resource limitations for although their number is small, their injuries are multiple, complex and difficult to control. Blood transfusion volume has been found to correlate in soldiers with vital sign measurements, which are being considered for inclusion in US military triage policy.¹³

Patients who did not require transfusion and who were stable, on the other hand, only occasionally (5 percent) had three or four organ injuries. The not transfused group was 75 percent of all patients with civilian thoraco-abdominal and abdominal wounds and 90 percent of the "minimal" (requiring less than 10 units of blood). It is probable that 65 percent of these stable patients had bullet wounds because it was hospital policy to explore all patients who had (tangential)

bullet wounds which were proximate to the abdominal cavity. The 64 patients who had a negative laparotomy were therefore about 27 percent of patients who had "bullet" wounds.

Conversely, patients with shotgun wounds were only operated upon if there was evidence that the gun had been discharged at close range. The 110 patients who had trunk wall injuries were likely to have had pellet or shrapnel wounds from a distance.

The vital message from these data is that the majority of stable patients with bullet wounds have internal injuries which require laparotomy. The presence or absence of internal injuries in these patients, even in the absence of positive clinical signs, is unpredictable. In most battlefield conditions, expectant therapy would not be appropriate in stable patients with abdominal GSW. If faced with even limited numbers of such casualties where facilities permitted observation, triage could be practised on clinical grounds.

It would appear that the wounding and the injuries of patients in this report were comparable with those from military combat. It should follow that appropriate training for management of combat casualties could be found in a civilian environment similar to that seen in Los Angeles.

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Operational Health

RAN Dental Officer participation in Indonesian Naval health operation¹

C-Y Rossiter²

Introduction

Following on from the Australian and Indonesian Governments' cooperation in the field of Defence since 1994, the Directors General of Naval Health Services from both Navies (DGNHS-RAN: Commodore Michael Dowsett AM RAN, and DGNHS-TNI-AL: Commodore Harijanto Mahdi TNI-AL) embarked on a series of Defence Health Exchange Programmes. Included amongst these programmes was the invitation for the RAN to participate in TNI-AL Naval Civil Health Operations, designated Operation Bhakti.

In 1995, the Australian Naval Attaché - Jakarta, Captain Jonathon Jones AM RAN, facilitated the posting of an Oral and Maxillofacial surgeon, Lieutenant-Commander Gregory Peek RAN, and Medical Officer, Lieutenant Richard Page RAN, for part of a mission which visited the remote islands of Irian Jaya.

The TNI-AL has previously mounted 31 such missions with the purpose of providing health services to remote locations in Indonesia. This involvement of the Indonesian Navy in their nation building stands as an example of the Indonesian military principle of "Dual Function" for the Indonesian Defence Force: to serve their nation in the military and civil roles.

In May 1996, Royal Australian Naval Dental Officer, Lieutenant-Commander Cheng-Yee Rossiter, who was on an exchange posting with the Indonesian Navy (TNI-AL), participated in one of these Naval Civil Health Operations. The mission, from 2 to 22 May 1996, involved the deployment of personnel in KRI Teluk Penyu 513 from Jakarta to the remote islands of West Ka-

limantan, visiting five islands and ten villages off its South West coast.

Operation BHAKTI Surya Baskara Jaya 32/96

A TNI-AL landing ship sailed from Jakarta to Pontianak, the provincial capital of West Kalimantan. From the 7th to 21st of May 1996 the ship visited the tropical islands (pulau) of Pulau Pelapis, P. Serutu, P. Karimata, P. Maya and P. Padang Tikar. These islands have a total population approaching 100 000. Most of the inhabitants live a semi-traditional lifestyle without modern housing and the supply of electricity, telecommunications, town water or sewerage. There are no medical or dental services permanently available on the islands.

The ship, KRI Teluk Penyu 513, had its usual company of 120 personnel supplemented by 300 extra personnel, including 52 members of the Health Team.

The Health Mission

The Indonesian Archipelago consists of over 12 000 populated islands, many of which have no health services. The mission was to provide medical and dental primary care to remote island communities which do not normally have access to it. Operation Bhakti deployments are aimed at returning to specific localities once every three to five years where the greatest need for health services exists.

The patients who attended were the economically poorer members of society. Often hundreds of people per day would seek treatment

¹ This is an authorised reprint of an article published in the journal of the Australian Military Medicine Association:
Rossiter C-Y. RAN Dental Officer participation in Indonesian Naval health operation. *Aust Mil Med* 1997; 6(1)7-9

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² Lieutenant-Commander Cheng-Yee Rossiter BDS RAN is currently the Senior Dental Officer at the Naval Air Station, HMAS Albatross. In his nine year career thus far, he has been posted to several shore establishments, the Fleet Travelling Dental Teams, and recently as the inaugural Exchange Dental Officer to the Indonesian Navy (TNI-AL). Whilst in Indonesia, he served at the Indonesian Naval Dental Institute, LADOKGI R.E. Martadinata, in Jakarta, and visited several key TNI-AL health facilities in Indonesia.

whilst the mission was in their village. These people would not have been able to afford transportation to the mainland of West Kalimantan to seek modern health services.

Primary Casualty Reception Facilities

During Operation Bhakti, the landing ship carried containerised medical operating rooms. In this particular deployment, however, they were not used as the ship did not land on the coral islands visited. Nevertheless, the containers are worth describing.

The modified containerised medical facilities can be compared to an RAN Primary Casualty Reception Facility (Level 3 health support). They consist of two modularised shelters made from modified shipping containers based on a Royal Navy design.

The Primary Casualty Reception Facilities (PCRf) are designed to receive patients and casualties for stabilisation prior to being aeromedevacuated by helicopter. Alternatively, the patient can be treated on board if specialist surgical care is available (ie surgeon and anaesthetist).

Thus, these PCRfs are useful for various roles, such as humanitarian support, disaster relief, a component of a medevac system, and peacekeeping operations.¹

The Health Team

During this Operation Bhakti, the Health Team of 53 personnel included generalist medical officers, paramedics, nurses, dental officers and dental nurses. All medical and dental officers deployed were general practitioners.

Treatment Modalities

The treatment modalities provided at each village and island included:

- Medical consultations with on the spot diagnosis, followed by primary care, eg drainage of an abscess.
- Minor operations, eg removal of growths.
- Dispensing of TNI-AL manufactured pharmaceuticals (all four Defence Force services manufacture their own pharmaceuticals), eg Antalgin, ampicillin and erythromycin.
- Health education, eg prevention of malaria.
- Prophylactic vaccinations, eg poliomyelitis
- Family planning, eg promoting the Government's policy of encouraging families of only two children.
- Procedures required by religious custom, eg circumcisions for young boys performed by the paramedics.
- Primary dental care for the relief of acute and chronic pain associated with dental disease.

Prevalent diseases in the remote tropical islands include:

- malaria
- dengue fever
- tuberculosis
- gastroenteritis
- hepatitis A, B and C
- sexually transmitted diseases (although there is only one documented case of AIDS in West Kalimantan)

Dental Mission

Dental care was provided by LCDR Rossiter and Kapten Sulistyo Wibowo TNI-AL, supported by two excellent dental sailors, SGT Munawir and PTE Anisa.

The demand for primary dental care was extremely high, such that it was the priority in dental services provided. In the period 7 to 22 May, over five islands and 10 villages were visited. There was no time allowed for the reviewing of patients or comprehensive dental treatment plans as there were too many patients waiting to be seen. Exodontia (tooth extraction) was the definitive treatment employed in every case for the relief of pain. This mode of treatment commenced daily at 08:00 and often continued beyond 20:00. Hundreds of patients waited patiently every day at the makeshift surgeries until they were seen, often the surgeries were located on the verandahs of primary school buildings.

In Operation Bhakti, over 800 dental patients were treated for the relief of pain, and over 1 600 teeth were extracted.

Routine exodontia/minor surgery was provided following administration of local anaesthetic. Contaminated waste following surgery was collected in buckets and ultimately buried in the fields.

Dental equipment provided included portable Dental Field Units, ie portable compressors for dental handpieces. However, in the villages visited, restorative and operative dentistry were not required in addressing urgent primary care needs.

School chairs were utilised as dental chairs and the school desks were used as makeshift instrument tables. There were no dental spittoons available, nor were there any dental operating lights or suction.

The typical patient had chronic debilitating dental health and had never used dentrifices due to the non-availability of dental care products. They had very poor oral hygiene and appeared to be malnourished, yet tended to be sweet-toothed. Consequently, rampant caries and aggressive/rapidly progressive generalised adult type periodontitis was present in all patients.

In one particularly interesting case, an 18 year old male required the full clearance of his remaining 18 carious and periodontally diseased tooth root stumps. This example of chronic de-

bilitating dental health was in fact very common in many of the villages visited.

A preventive dental programme and dental examinations were urgently required to improve the overall health of the islanders. As the demand for relief of chronic pain was the priority, civilian members of the health team provided basic oral hygiene instructions to children, whilst the dental team were constantly engaged in exodontia for the entire deployment.

Possible Future Research

The incredibly high prevalence of decayed, periodontally diseased and missing teeth requires epidemiological research, as do the possible aetiological factors.

Factors that could be investigated include:

- the malnutrition associated with the periodontal disease and caries
- malnutrition from low dietary calcium, vitamins and minerals
- high dietary refined carbohydrates, eg confectionary
- imbalance of food group intake, eg due to over reliance on one food group in the diet, such as fish, whilst lacking fruit, vegetables and meat
- absence of fluoridated water and the non availability of dentrifices

Further RAN and TNI-AL cooperation in researching the aetiology of the dental diseases could be explored in future joint exercises between the two Navies. As this is a closed population with minimal outside influences and with no fluoridated water, it could be used for researching the effects of dentrifices and topical fluoride on dental health.

Successful RAN and TNI-AL Cooperation

Throughout the mission, the entire health team worked hard and played hard in the true Navy

tradition. After working from sunrise (about 06:00) until beyond sunset (18:00), the health team observed a break and the nightly entertainment commenced.

The demand for dental services was so great that on the conclusion of the final day, all RAN and TNI-AL pharmaceuticals, local anaesthetics and infection control supplies were totally exhausted. As were the dental team.

Conclusion

The author was enriched by the unique operational and professional experience. The sheer quantity of people who required medical and dental treatment not only challenged and stimulated, but also instructed and rewarded the health team. The outpouring of gratitude of the hundreds of dental patients treated for the relief of pain alone was adequate reward for the dental team.

Working in the field also provided valuable lessons in the need to adapt to the tropical environment and its diseases, and the need to be well equipped and supplied for all facets of field medicine and dentistry, eg to be well supplied with the necessary infection control materials, local anaesthetics, pharmaceuticals and surgical instruments.

On completion of Bhakti SBJ (32/96), the Indonesian Director General of Naval Health Services formally thanked the Australian Naval Attaché - Jakarta, and the Australian Director General of Naval Health Services for the RAN participation in the mission, and also extended an invitation to the RAN to participate in future missions.

The RAN and Indonesian joint exercises in health services have become a successful chapter in the developing friendship between the Australian and Indonesian Medical and Dental Services.

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Review Article

The medical effects of non-lethal weapons. A review¹

A.G. Robertson²

Abstract

Non-lethal weapons have seen increasing use in the police forces and, more recently, the military forces, of various countries around the world. With increased use in military operations in areas such as Panama and Somalia, there is an increasing likelihood of military health service officers coming in contact with the medical effects of these weapon systems. This review summarises the physiological and psychological effects of these weapons, weapons which will be of increasing interest in the future.

Introduction

Non-lethal weapons have seen increasing use in the police forces and, more recently, the military forces of various countries around the world. Defined as those weapons which 'have a reversible effect on their human targets', the term non-lethal weapons is a misnomer as there will always be an element of risk associated with the use of any weapon system.¹ Historically, these weapons have been classified by their effects, principally whether they disable, disorient, discourage, demobilise or deceive.¹ The medical effects of these weapons do not easily fall into this taxonomy. Any discussion of these effects needs to be based on the target organ system or the specific psychological effect. Some non-lethal technologies aimed at weapon or communication systems may have peripheral effects on personnel. These may include burns from high powered microwaves or supercaustics, or falls on areas coated with very low friction substances. These collateral effects are not included in this review.

The medical effects of non-lethal weapons may be broadly categorised into:

- blunt trauma effects
- eye effects
- auditory effects
- electrophysiological effects,

- toxicological/pharmaceutical effects
- psychological effects.

Blunt Trauma Effects

Non lethal riot control ammunition uses rubber, timber or plastic projectiles to deliver a numbing blow and temporarily incapacitate the target. There are two main groups: unconventional ammunition fired from conventional weapons (eg stun bags), and large slow projectiles fired from riot guns and grenade launchers.¹ These projectiles aim to produce the maximum release of blunt trauma to the body without killing. This shock consists of impact shock and neurogenic shock. Impact shock is the mechanical effect of the blow and is caused by the elastic impact of the projectile. It produces localised bruising and, depending on the range, may cause fractures and ruptures of internal organs. Neurogenic shock is due to a temporary partial or complete blockage of the nervous system from high frequency shock waves spreading from the point of contact.¹

Plastic bullets cause fewer serious injuries to face and chest, although the laryngeal framework is particularly susceptible to injury because of its relatively unprotected position.² Plastic bullets, however, produce more serious injuries to skull and brain, and therefore cause more deaths

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than rubber bullets.² Wooden 'Broomstick' rounds may produce internal injury or death at close range and may leave splinters in the target at greater ranges.³

Stun bag ammunition may cause serious skull injury, liver damage or death at less than 5 metres, produces contusions and broken bones at 5-10 metres and is ineffective over 20 metres.³ Large slow projectiles have a similar effect to stun bags at close range but only distract at long range.¹

Other non-lethal weapons systems utilise water, lasers or sound to produce blunt trauma effects. High pressure water sprays, used to knock down targets, may produce blunt trauma.⁴

Pulsed chemical lasers may be used to produce plasma in front of a target. This will create a blast wave and subsequent blunt trauma to the target with a stun effect.^{5,6} Acoustic bullets use a high frequency non-penetrating sound wave to produce a plasma in front of the target, which creates an impact wave that produces incapacitation by blunt object trauma to the target.^{5,7}

Eye Effects

An anti-eye laser weapon has two main applications: temporary visual disablement, such as flashblinding at night, dazzle or veiling glare, or more permanent eye damage (partial or total blindness).^{8,9} Low-energy lasers can be used to dazzle and temporarily blind targets.^{1,10} More powerful lasers can be used to permanently blind human targets.¹¹ The eye magnifies any laser light hitting the eye by a factor of approximately 100 000. Given that only a low level of energy density is required at the retina to cause severe damage, lasers may produce extensive retinal damage and blindness. If the macula is affected, the target will become functionally blind. Even laser eye hits from oblique angles may produce retinal bleeding into the eyeball and subsequent blindness.⁸

Pyrotechnic Flash devices are devices formulated to produce intense flashes of temporarily blinding light of 1 to 6 million candela. As 10 million candela is required for temporary blindness, the current devices will only temporarily dazzle targets.¹ There are, however, more powerful devices. These are the optical munitions. There are two types of optical munition. The Omni-directional Radiator or Isotropic Radiator produces a very bright multidirectional broadband burst of visible light. The directional radiator produces a similar intensity uni-directional light.⁵ These systems may produce the dazzle, temporary blindness, or, rarely, permanent blindness, seen with laser weapons.^{1,8,12}

Strobing lights, particularly in the red and blue wavelengths, can effect the target's brain alpha patterns. This can create disorientation, vertigo and nausea (Bucha Effect).^{1,12} Epileptic seizures may be induced in susceptible personnel.¹² Bright lights can also be used, in conjunction with

noise, to prevent rest.¹ They may also be used to disorient a crowd at night by temporarily immobilising their night vision.³

Auditory Effects

Stun grenades produce temporary hearing loss, aural pain and stunning effect by single or multiple blasts of loud noise. These devices generate noise in the range 140-170 decibels. Confined spaces, however, may amplify the noise and may produce ruptured ear drums and other inner ear damage at levels above 180 decibels.¹

High intensity ultra-low frequency sound may disable by producing body organ resonance. The infrasound may be manipulated to produce distress and anxiety, or to produce temporary incapacitation from disorientation, vertigo, nausea, vomiting, bowel spasms or diarrhoea.^{6,10,13} At frequencies between 50 to 100 Hertz and intensity up to 153 dB, nausea, subcostal discomfort, cutaneous flushing and tingling may be produced. At 60 and 73 Hz, coughing, severe substernal pain, choking, salivation, and pain on swallowing can be produced.¹ At very high intensity with prolonged duration, death may result.¹⁴ The effects cease on turning off the generator.¹⁵ Other effects can also be produced by manipulating sound. Given sufficient intensity, ultrasound may be used to rupture internal organs.¹⁶

Electrophysiological Effects

Electrical Stun Guns are weapons which fire electrodes into a target to stun but not kill. The electrodes discharge up to 50 kV at low amperage. This electrical discharge overloads and temporarily disables the peripheral nervous system. A single shock will disable a limb briefly, a one second burst will drop a person to the ground and a 5 second burst will disable a person for up to 15 minutes.¹ These weapons may have effects on cardiac rhythm and respiratory function.¹⁷ In addition, they produce a round erythematous rash, with or without central paleness, which may be accompanied by circumferential abrasions.¹⁸

Toxicological/Pharmaceutical Effects

These effects include those produced by tranquilisers, soporifics, lachrymators, sternutators and incapacitants. Dart guns, injecting up to 3 ml of tranquilliser, have been developed. The effect is not instantaneous and depends on the route of administration with intramuscular routes being faster than subcutaneous routes.¹ Other routes for administering tranquilisers are less successful. Opiates and strong sedatives are too dangerous on account of their low margin of safety and milder tranquilisers cause little actual loss of performance capability.¹⁹

Soporifics are sleep inducing or sedative drugs which, when mixed with a solvent like di-

methyl sulphoxide (DMSO), are rapidly absorbed through skin or lungs.^{1,12} These may be variations of currently available compounds, like Lysergic Acid Amide (a milder form of LSD), or tailored synthetic neuroactive peptides, like Delta Sleep-inducing Peptide analogues.^{19,20,21}

Lachrymators are irritants characterised by a very low toxicity (chronic or acute) and a short duration of action.²² Little or no latent period occurs after exposure. Orthochlorobenzylidene malonitrile (CS) is the most commonly used irritant for riot control purposes. Chloracetophenone (CN) is also used in some countries for this purpose in spite of its higher toxicity. A newer agent is dibenzoxazepine (CR) with which there is little experience.

CS is used as a riot control agent in many countries. The limit of perception by taste ranges from 0.25-0.5 mg m⁻³. The minimal irritant concentration ranges from 0.1-1.0 mg m⁻³, the IC₅₀ from 5-10 mg m⁻³ and the LC₅₀ for man very much larger, estimated as 60 000 mg min⁻¹ m⁻³. This provides a high margin of safety in its use. The CS cloud is white at the point of release and for several seconds after release. Exposure is associated with a pepper-like odour, the presence of intense eye effects, dyspnoea, coughing and rhinorrhoea. During exposure an individual is incapable of effective concerted action.

CR is similar in its effects to CS, but the minimum effective concentration is lower and the LC₅₀ is higher. CN has a minimal irritant concentration is 0.3 mg m⁻³. It has been estimated from experimental data that the LC₅₀ for man is 7 000 to 14 000 mg min⁻¹ m⁻³, but inhalation of 350 mg m⁻³ for 5 minutes may be dangerous. The IC₅₀ is 20 to 40 mg min⁻¹ m⁻³. CN is more toxic than CS. Exposure to CN primarily affects the eyes, producing a burning sensation, lachrymation, inflammation and oedema of the eyelids, blepharospasm, photophobia and, at high concentrations, temporary blindness.²³ The severest of these symptoms is reached in a few minutes and then gradually decreases. After about one or two hours all symptoms disappear. High concentrations can cause irritation of the upper respiratory tract, inflammation of the skin with vesicle formation, visual impairment and pulmonary oedema. Drops or splashes in the eye may cause corrosive burns, corneal opacity and even permanent visual impairment. Drops or splashes on the skin may cause papulovesicular dermatitis and superficial skin burns. Ingestion of food or water contaminated with CN causes nausea, vomiting and diarrhoea.

Sternutators produce strong pepper-like irritation in the upper respiratory tract with irritation of the eyes and lachrymation.²² They cause violent uncontrollable sneezing, cough, nausea, vomiting and a general feeling of bodily discomfort. The principal agents in this group are

diphenylchlorarsine (DA), diphenylaminearsine chloride (Adamsite [DM]) and diphenylcyanarsine (DC). They are dispersed as aerosols and produce their effects by inhalation or by direct action on the eyes. The onset of symptoms may be delayed for several minutes after initial exposure (especially with DM); effective exposure may, therefore, occur before the presence of the smoke is suspected. Inhalation is followed by a burning sensation in the nose and throat, hypersalivation, rhinorrhoea, coughing, sneezing, nausea and vomiting. Mental depression may occur during the progression of symptoms. The paranasal sinuses are irritated and fill with secretions and severe frontal headache results. Prolonged exposure may cause retrosternal pain, dyspnoea and asthma like symptoms. Symptoms reach their climax after 5 to 10 minutes and disappear one to two hours after cessation of exposure. Effects on the eyes are slight and are restricted to a burning sensation and lachrymation. Exposure of the skin to high concentrations will cause erythema and itching, proceeding to a burning sensation and vesicle formation. Ingestion of food and water contaminated by sternutators may cause nausea, vomiting, diarrhoea (sometimes bloodstained) and weakness and dizziness have been reported.

High concentrations are not expected in the open owing to movement of air, but may be met within enclosed spaces (shelters, tents etc), and under these circumstances the skin may show vesicle formation, capillary damage and localised swelling, while corneal necrosis and pulmonary oedema are possible results. Unsteady gait and a positive Romberg sign have been reported. Other neurological results of severe exposure include hyperaesthesia, anaesthesia and paraesthesia, especially in the legs. Loss of consciousness has been reported.

Incapacitants²² are chemical agents which produce a temporary disabling condition that persists for hours to days after exposure to the agent has occurred. There are two major categories: CNS depressants (anticholinergics) and CNS stimulants (LSD).

CNS depressants produce their effects by interfering with transmission of information across central synapses. An example of this type of agent is BZ (3-quinuclidinyl benzoate). Small doses of BZ cause sleepiness and diminished alertness. Diagnosis can be made by noting increased heart rate, dry skin and lips, drowsiness and a progressive intoxication in the untreated individual as follows:

•1-4 hours:

- Tachycardia, dizziness, ataxia, vomiting, dry mouth,
- blurred vision, confusion, sedation progressing to stupor.

•4-12 hours:

- Inability to respond to the environment effectively
- or to move about.
- 12-96 hours:
 - Increasing activity, random unpredictable behaviour
 - with delusions and hallucination.

The principal CNS stimulant is LSD. The clinical manifestations of LSD (D-lysergic acid diethylamide) intoxication often include an early stage of nausea followed 45-60 minutes after dosage by a confused state in which delusions and hallucinations are common but not always experienced. Subjects intoxicated with LSD show evidence of sympathetic stimulation (rapid heart rate, sweating palms, pupillary enlargement, cold extremities) and mental excitation (nervousness, trembling or spasms, anxiety, euphoria and inability to relax or sleep). Hyperthermia has been reported. Subjectively, feelings of tension, heightened awareness, exhilaration, kaleidoscopic imagery, emotions of every type, hilarity and exultation are characteristic. Paranoid ideas and more profound states of terror and ecstasy may also occur, especially in highly suggestible individuals. True hallucinations are rare, as is homicidal or suicidal behaviour.

Foul smelling gases may be used to disperse crowds. Hydrogen Sulphide and NaSH have been proposed. Hydrogen sulphide, however, is a powerful asphyxiant in moderate doses. At lower doses, it may produce nausea, eye irritation, respiratory irritation and pulmonary oedema.^{10,19}

Psychological Effects

The psychological effects of non-lethal weapons may vary depending on the physical context in which it is used, whether the target is a crowd or an individual, whether the target is trained or not trained to expect or counter the effects of such weapons or whether it is used in a crowd control, counter-terrorist or battlefield situation. Camouflage and psyops are not part of the non-lethal weapons area as they are conceptually and operationally different.²⁴

The use of blinding lasers will have significant psychological impact once personnel realise that observing the terrain as well as looking to-

wards the enemy may entail a significant risk of being blinded.⁸ After an attack, medical companies can expect to handle many personnel who think they have been hit by lasers when they have not.⁹ These psychological casualties may be reduced by appropriate training.

With regard to other non-lethal weapons agents, obscuration foams may induce panic from a perceived difficulty in breathing coupled with restriction in sight and hearing.¹ There is little documented on the psychological effects of other non-lethal weapons and further research is required in this area.

Conclusion

This paper has reviewed the physiological and psychological effects of non lethal weapons. The definition and classification of non-lethal weapons remains unclear. Many authors use the term Non Lethal Weapons, and other similar terms, to include weapons that affect both weapon, and command and control systems, where there is little or no human element involved. The taxonomy used for military effects does not fit easily with physiological effects and further clarification of both the definition of non-lethal weapons and its categories is required. The health effects vary in severity from the temporary disabling effects of lachrymators, infrasound and stun grenades to the potentially permanently disabling effects of blinding lasers and non-lethal projectiles. In most areas, the information on physiological and psychological effects is limited and further research is required to delineate both short term and long term effects of these weapon modalities.

The Wall Street Journal notes that the 'move into nonlethality could pry open a Pandora's box of chemical, biological, and nuclear weaponry that diplomats have spent much of the 20th century trying to keep closed.'¹⁶ The majority of the chemicals cited are in contravention of the Chemical Weapons Convention and several of the other technologies would probably contravene the Inhumane Weapons Convention because of their indiscriminate effects. Further research is required to identify the legality of these weapon systems in the Australian context.

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Abstracts From The Literature

James Ross

Feuerstein M et al. Musculoskeletal-related disability in US Army personnel: Prevalence, gender and military occupational specialities. *J Occ Environ Med* 1997; 39(1):68-78

Research on military populations indicates that musculoskeletal-related disorders represent a prevalent source of outpatient visits, lost work time, hospitalisation, and disability. Despite the increasing role of women in the military, little is known regarding the association among military occupations, gender and disability. The study presented here analysed 41,750 disability cases to determine: (1) prevalence of work-related musculoskeletal disability, (2) specific jobs associated with greater risk of musculoskeletal disability and (3) association among gender, job-type and disability. Results indicate: (1) back-related disorders represent the most prevalent sources of disability, (2) certain occupations were associated with higher disability risk, (3) women experienced higher overall, and musculoskeletal, disability risk, and (4) specific jobs were identified in which women experienced higher rates of musculoskeletal disability. These findings highlight the need to consider the interaction between workplace factors and gender on disability in the military workforce.

Comment. Despite the attempt to say they were producing new information, it is hardly new to say that women are at greater risk of musculoskeletal injury in the military than men. It merely confirms the well established finding that women are some four times more likely to suffer a significant musculoskeletal injury during basic training than men. The rates are around twice for women than men in this study, which covers the whole of a military career, rather than only basic training. It may also be that with more women dropping out of basic training than men, those who survive are less likely to suffer injury over the rest of their career.

Gambel JM, Hibbs RG. US military overseas medical research laboratories. *Mil Med* 1996. 161(11):638-45

Many infectious disease threats to US Military operations are uncommon in the United States. The advanced development and testing of countermeasures, such as vaccines, drugs, or insect repellents, requires the capability to study militarily important infectious diseases where they occur. With formal agreements between the US and each host country, the US military operates seven overseas medical research laboratories. Six labs conduct infectious disease research and are distrib-

uted over three continents: Africa (labs in Egypt and Kenya), Asia (labs in Indonesia and Thailand), and South America (labs in Brazil and Peru). One other lab is located in Germany and conducts psychosocial related to military personnel and their families. In addition to product development, these labs play a vital role supporting overseas deployments, providing technical training, and promoting international relations. Also, these labs are well positioned to become part of a developing global surveillance and response system to help address the threat posed by emerging infectious diseases. This article will present an overview of this unique medical research capability, describe the history and some of the activities of each lab, and discuss the importance of maintaining these labs in the 21st century.

Comment: Undoubtedly an attempt to propagandise the importance of these labs. I hardly need to be convinced given the emerging infectious diseases (read *The Coming Plague*, by Laurie Garrett), and the increasing risk of biological warfare, but the reasoning for two labs in each continent I found to be a little tenuous. An interesting read, anyway.

Cooper JK. Preventing heat injury: Military versus civilian perspective. *Mil Med* 1997; 162(1):55-8

Guidelines for preventing heat injury (HI) among personnel are not directly applicable to civilian personnel. Military guidelines call for relatively large volumes of prophylactic water consumption and physical activity limitations depending on the wet bulb globe temperature. However, in civilian populations there is an increased prevalence of HI risk factors: older age, medications use, especially anticholinergic and psychotropic medications, obesity, previous HI and skin disorders. Although dehydration is a major contributor to HI in military situations, it is unlikely in classical heat stroke among civilians. Civilian guidelines are based on the heat index. Activity levels must be restricted more for civilians, and prophylactic water consumption (beyond replacing loss from sweat) is not necessary. This review discusses the pathophysiology of heat injury, contrasts the military and civilian approach to prevention of HI and describes appropriate field intervention for HI.

Comment: Dehydration is unlikely in classical heat stroke among civilians? In the military, water discipline is emphasised. Any commander failing to maintain such discipline should be harshly judged. No such discipline exists in the civilian situation. So where is

dehydration more likely to occur? I think Capt Cooper is suffering a little from heat injury himself.

Edwards M. Anthropometric measurements and ejection injuries. *Aviat Space Environ Med* 1996; 67(12):1144-7

Background: A previous study examined anthropometric variables to determine possible ejection seat risk factors. It concluded that individuals who weighed below the average body weight or who met the criteria of having a tall, thin physique as measured by body mass index (BMI) were significantly more at risk for acceleration induced back injuries. **Hypothesis:** Because of the increased number of female pilots and the potential need to modify ejection seats for lighter aviators, this retrospective analysis of Naval Safety Center data attempted to reproduce and confirm the same results with more current data, covering a 5-yr period from Jan 1989-Dec 1993. **Methods:** In this study, the same criteria were used to define back injury, including thoracic or lumbar vertebral fractures and soft tissue injuries, and the same anthropometric variables were used, including weight, height, BMI, and below average weight. Additional categories of injury were examined, including all spinal fractures alone without soft tissue back injuries, all injuries combined and severity of injury. Sitting height and trunk height were added to the variables. **Results:** Out of 810 aircrew involved in mishaps, 199 ejected. Of all the ejections, 111(56%) had some type of injury as a result of the ejection. Severe injuries occurred in 8 (4%) including 4 (2%) fatalities. Back injuries occurred in 44 (22%) and 8 (4%) involved spinal fractures. Although there were no significant risk factors for ejection back injury, weight and height were statistically significant risk factors for severe injury and spinal fracture, respectively. **Conclusions:** Aircrew with severe injury were heavier (average weight 88 kg vs. 79 kg), taller aircrew

(185 vs. 180 cm) were at increased risk for any spinal fracture.

Comments: Only 8 spinal fractures out of 199 ejections! It would be nice to achieve that in Australia. The expectation is that aviators at the very low end of the weight curve will be at significantly increased risk from ejection. This study does nothing to resolve that issue.

Rudland S et al. The enemy within: Diarrhoeal rates among British and Australian troops in Iraq. *Mil Med* 1996; 161(12):728-31

British and Australian medical teams working in Northern Iraq in 1991 providing primary care to refugees and the war wounded were subjected to a descriptive retrospective survey, 5 weeks after arriving in Iraq. The aim was to document different rates of diarrhoea in British and Australian troops. The British, who were not taking daily doxycycline and did not enforce a plate and hand washing routine, experienced higher rates of diarrhoea (69% of British troops compared with 36% of Australian troops), which was more severe and of longer duration ($p<0.001$) and resulted in twice as many days being lost ($p<0.001$) in spite of the British team being half the size of the Australian contingent, and the region having enteropathogens with a high rate of antibiotic resistance. Vigorous hand and plate washing routines along with doxycycline prophylaxis appear to significantly reduce incapacitation from diarrhoea in this military setting and have an important implication for operational effectiveness.

Comment: I suspect that the authors are correct in assigning the benefit in Australians to better preventive measures, but not all confounders have been dealt with. What was the exposure history of each team, for instance? Nevertheless, a good paper, and another pat on the back for the Australian military medical fraternity.

Andy Robertson

International Chernobyl Conference. Chernobyl - Ten years after. *IAEA Bulletin* 1996; 38(3):2-64

Comment. This whole issue is devoted to a perspective of Chernobyl 10 years after the event. In particular, the issue reviews the long term medical effects of the high radiation doses received by the local population. These have principally been increasing thyroid cancer in children. There has not, as yet, been an increase in the rates of leukaemia or other tumours. This is an excellent review of the medical effects of high levels of ionising radiation on an unprotected population, a situation we hopefully will not see again.

Scott IA, Bell AM, Staines DR. Fatal human melioidosis in South-Eastern Queensland. *Med J Aust* 1997; 166(4):197-9

Two simultaneous human cases of fatal melioidosis in temperate south-eastern Queensland involved patients who had had pre-existing multi-system illness, had sustained cutaneous lesions before illness onset, and dies from overwhelming sepsis. Onset of disease was preceded by unseasonably heavy rainfall. These and other features of these cases suggest that the source of infection was local, in which case the endemicity of *Burkholderia pseudomallei* in temperate regional Australia may be broader than is currently recognised,

and melioidosis may need to be considered in at-risk patients in these areas, as well as in tropical and sub-tropical areas, who present with severe pneumonia and septicaemia.

Comment. *Melioidosis is of considerable interest as both a public health risk and a possible biological warfare (BW) agent. As this paper notes, the pneumonic and septicemic form of the disease has an 80-90% mortality rate in diseased hosts. Given the possible use of melioidosis in a pneumonic form as a BW agent, this bacteria remains of considerable concern.*

Ward MS, Henderson AM, Rossi E, Raven JL. Lead poisoning in an electrician: A bad substitute for a bad habit. *Med J Aust* 1997; 166(1):23-4

An electrician presented with a four month history of unexplained abdominal pain and constipation, which had prompted four hospital admissions and numerous investigations. Blood film results suggested lead poisoning, and an occupational history revealed that he chewed about a metre of electrical cable (which contains lead) daily for ten years as a substitute for smoking.

Comment. *Whilst showing the importance of an occupational history, this case also illustrates the dangers of make-shift smoking remedies. Beware of what you chew on.*

Gardner M, Forbes C, Mitchell S. One hundred divers with DCI treated in New Zealand during 1995. *SPUMS J* 1996; 26(4):222-6

Comment. *Gardner et al. have presented an interesting review of the 100 patients treated for DCI at the Royal New Zealand Naval Hospital in 1995. Whilst a good descriptive study, the data generated would benefit from further statistical evaluation. The 30% failure*

rate, whilst consistent with other studies, remains an area of concern and provides ample reason for underwater medical physicians not to become complacent in this area.

Bachman RK. Turning an organisation on its head. *The Physician Exec* 1996; 22(8):25-9

How can you foster change in your organisation? Accomplishing major organisational change is difficult and extremely risky. However, change is necessary if health facilities are to survive in a competitive managed care world. Thrust into this environment, military health facilities are finding they must improve access and quality, while reducing costs. Keller Army Community Hospital at West Point was reengineered to meet this challenge. The results? A nontraditional hospital structure and management philosophy. Pipeline hierarchical chains of command and traditional professional boundaries have been modified. The strategy and transition process, as well as the obstacles to change, are explored in this article. Three years into a multi-year process, expected obstacles to change have been experienced, and success is predicted.

Comment. *This is an interesting review of reengineering of health care organisations within a military setting. The ADF health community needs to be constantly questioning whether we are providing the best quality customer-orientated service in the most cost-effective manner. Are we negotiating with private hospitals, radiography and laboratory services for the best rates for our patients? Are we innovative in our provision of health care? In essence, are we managing Defence health care or is it managing us!*

Book Reviews

Vic Jeffery¹

The U-Boat Far From Home. The epic voyage of U-862 to Australia and New Zealand
by David Stevens

I was delighted when I learnt that the Department of Defence's Director of Naval Historical Studies, David Stevens, was to write a book on the German submarine offensive against Australia during World War Two.

A former naval officer and a high respected naval writer, David Stevens has produced an excellent book in "The U-Boat Far From Home", filling one of the few remaining voids regarding the undersea war off Australia's shores.

Commanded by Kapitänleutnant Heinrich Timm, U-862 sailed from Germany for the last time when she departed Kiel for the Indian Ocean on May 21, 1944. U-862 became singularly responsible for the largest submarine hunt undertaken in Australian waters before slipping quietly away to sail undetected around New Zealand. Over the period of 12 months and two war patrols, U-862 travelled farther from home than any other German submarine. As David Stevens points out, 'she achieved all of this in the last year of the war, when it was obvious that for Germany the cause was already lost, and when virtually every communication concerning the boat was being intercepted and read by her enemies'.

Apart from her successes, the confusion U-862 caused and the tying down of valuable Allied naval assets, her cruise was a remarkable feat of endurance, battling illness, uncertainty and life under the waves for months at a time.

Funnily enough, most people who are aware of U-862's epic cruise immediately think of the unsubstantiated story that her crew went ashore in New Zealand to milk cows!

It was more than 50 years ago that Germany planned to mount a submarine offensive against Australia during the final months of World War Two. "U-Boat Far From Home" reveals the full story behind this desperate 1944 mission.

David Stevens makes good use of personal accounts from German and Allied sources and recently declassified documents to give an insight into life aboard U-862.

Four German U-boats were deployed from Japanese bases in south-east Asia for a surprise

strike deep inside Allied waters. U-862 was the only one to survive.

The U-862 sank seven merchant ships, shot down two aircraft, and was indirectly responsible for the loss of two others. My personal interest in this 'quiet achiever' came through my interest in the last Allied ship to be sunk by the enemy action in World War Two, the American Liberty Ship, SS *Peter Silvester*, in the Indian Ocean on February 6, 1945.

Peter Silvester was carrying the usual cargo of 317 US Army mules, 2 700 tonnes of cargo and 106 American servicemen as passengers. It was not until four days later that the alarm was raised and the Naval Officer-in-charge Fremantle, Commodore Pope, despatched the corvette HMAS *Dubbo* and the patrol frigate USS *Corpus Christi* with their respective sister ships HMAS *Warrnambool* and USS *Hutchinson*.

Finally involving the RAAF, RAF, other ships including two British Pacific Fleet escort carriers, HM Ships *Slinger* and *Speaker* which had been diverted, it was later claimed that 'this was the largest and most thorough rescue search mounted during the war', mainly due to the spirit of cooperation between the Allies with little red tape involved.

It is worth purchasing this book for the chapter on the sinking of the *Peter Silvester* alone. But this is just one of the interesting facets of this 282 page book which is supported by 33 black-and-white photographs, 11 maps, three diagrams, and a table of U-boat numbers, losses and sinking rates of 1944-45.

My only disappointment, be it a small one, is that a book of this magnitude and historic importance is not published in hard cover. However, being produced in soft cover has kept the price down to a very reasonable \$24-95, making it more affordable to more readers. Published by Allen & Unwin of 9 Atchinson Street, St Leonards, NSW, this book has been available in book stores from March 14.

I have always claimed that 'fact is often better than fiction' and this book is a good example. Definitely one of the best naval books I have read for some time. Highly recommended.

¹ Vic Jeffery is the Navy's Public Affairs Officer in Western Australia, based at HMAS STIRLING

The Armed Forces of Indonesia
by Robert Lowry

This is a timely book and the first book in an exciting new range titled 'The Armed Forces of Asia Series' which will present single-country studies in the arc from Pakistan in the west to the Russian Far East in the north.

Published by the renowned Australian publisher Allen & Unwin, forthcoming titles are: Australia, Burma, China, Japan, New Zealand, Malaysia, Pakistan, Singapore, Taiwan, Thailand, The USA in the Asian Pacific Region, and Vietnam.

Author Robert Lowry, a retired Australian Army lieutenant-colonel, provides an 'insight' into the Indonesian military, being a graduate of the Indonesian Army Command and Staff College.

Indonesia's armed forces have been major players in the country's politics and economics since its independence and will continue to play a major role in its future.

Straddling the important sea lanes between the Pacific and Indian Oceans to our north, Indonesia is the largest country in Southeast Asia and is located in an area of rapid economic growth.

The book is divided into chapters covering defence policy and strategy, command and control, the armed forces, servicemen and women, ABRI (Indonesian military) business, internal security, social-political role and strategy, and a conclusion. Each chapter contains many subsections. The book is also supported by an Appendix - Summary of Forces.

This is a very clear and enlightening book to read and is packed with information which allows one to develop one's own views on topics. It should appeal equally to professional and amateur students of the Indonesian military alike.

Comprising 282 pages, "The Armed Forces of Indonesia" includes detailed tables, figures and maps, which support the text.

The first volume, soft cover, and retailing at \$29.95, is destined to become keenly sought after if its following titles are of the same quality as readers attempt to backtrack to complete their series of "The Armed Forces of Asia".

Published on the 14th of February, this book is now generally available in book stores. A recommended read.

Opening of the New Medical Facility at RAAF Base, Richmond

Speech by the Minister for Defence Industry, Science and Personnel

The Honourable Bronwyn Bishop MP

On Thursday, 20 February 1997, a new medical facility to house No 3 RAAF Hospital at Richmond Air Force Base was officially opened by the Minister for Defence Industry, Science and Personnel, The Honourable Bronwyn Bishop MP. Australian Military Medicine is pleased to publish the Minister's speech at this auspicious occasion.

Thank you for asking me here today to open this magnificent, new, \$12.5 million medical facility.

I am pleased to visit Richmond again. I was last here for the presentation of the Governor General's Banner to the Hospital. The Banner has become a treasured icon to members of the Unit, and it is richly deserved after over half a century's uninterrupted care to our service men and women.

You don't often see so many senior Royal Australian Air Force Officers in one place. I think that underlines the importance of today's event. This new facility is one of two fully capable hospitals within the RAAF, and the only one that has been built as a single project.

No 3 Hospital

Number 3 RAAF Hospital was formed in 1940, as a collection of temporary and converted buildings. With World War II, the hospital expanded rapidly. By the end of the War, it reached a peak capacity of 500 beds.

In 1959, the hospital took on responsibility for aeromedical evacuations. It played an important role in the Vietnam conflict. One day in 1967, 51 casualties were evacuated from Vung Tau to Richmond in just 17 hours.

During Cyclone Tracy, 3 Hospital evacuated 2 000 people and 400 patients from Darwin to southern medical centres.

The hospital again came to the aid of the civil community during the 1994 Sydney bushfires. Over 100 elderly people were evacuated to 3 Hospital from nursing homes in the Blue Mountains.

The Hospital has been involved in a number of international humanitarian operations, notably the difficult United Nations' mission to Rwanda.

3 Hospital provides a comprehensive range of general hospital services here in Richmond. It also has an air transportable health centre, which

means members are always on stand-by for deployment. The hospital's motto, "Care Where Needed" is therefore entirely appropriate.

Medical Support to the ADF

When I was appointed as Minister for Defence Industry, Science and Personnel, I came armed with the Coalition's pre-election promise that we would maintain all health and dental benefits available to permanent and reserve ADF personnel - and we have kept that promise.

One of my prime concerns was the shortfall in medical and dental officers within the Australian Defence Force.

When I was briefed on the magnitude of the problem by the Surgeon General, I was appalled that the shortages had been allowed to reach this crisis level.

In many ways the situation is comparable with the problem of recruiting civilian doctors to work in remote rural parts of Australia.

However, the case of Defence is perhaps even worse: surely, we cannot expect our service men and women to fight for their country if we cannot guarantee them the clinical support they need - this is particularly important for deployable units. Free quality health care to serving members is not only a powerful recruitment tool, it is very important in terms of the maintenance of morale and the retention of personnel in uniform.

Consequently, we will review medical and dental officers' pay as part of a general review of officers' pay in 1997. The medical and dental officers' bounty and gratuity are currently under separate review. Pay and allowance reforms are to be progressed as part of a package of measures covering training, accreditation, professional development and improved career planning.

But the job of 3 Hospital goes beyond serving Australian military personnel. I have already given examples of how the hospital assists

the wider community in national disasters and local emergencies.

The completion of this new facility is long overdue. A former RAAF medical officer recalls that when he requested new lino for the floors of the wards in the old facility, his superiors turned

him down because "the new facility would be built within 18 months". Well, that was in 1955!

I would like to conclude by offering my best wishes to the staff of 3 Hospital. While we hope and pray that you will not have to deal with the casualties of war, we can rest assured that you will rise to the challenge - whatever it may be.

Conference Report

Wilderness Medicine Society Winter Meeting Steamboat Springs, Colorado Jan 31-Feb 5 1997

James Ross

At the risk of gloating, and getting some sideways glances, I will write of this outstanding conference. The Wilderness Medicine Society is a vibrant expanding organisation, which puts on some incredible meetings at some very appealing places.

Casualty Care in Special Operations

The winter and expedition medicine conference included as a further incentive a pre-conference workshop on wilderness medicine in military special operations. This was put on in cooperation between WMS and the US Special Operations Forces. Treatment protocols for management of injuries in the US military have mirrored those put out as part of the Acute trauma Life Support course. However, such protocols do not allow for the absence of diagnostic and interventional support when distant from definitive medical care. Thus, over 4 years, a new set of protocols have been proposed. They were published as a supplement to the journal 'Military Medicine' last year. (Butler F K et al Tactical Combat casualty Care in Special Operations. *Mil Med* 1996 161:8 supp p 3-16). On this occasion, 10 specialists, some with military affiliations, some without, were brought together with civilian and military medical personnel (doctors, nurses, pararescue) to validate the recommendations and to see how they would be utilised using 10 scenarios. Each scenario was discussed by the specialist, and then opened to discussion. Some of the particularly interesting aspects are:

- No resuscitation if pulseless and not breathing on a battlefield
- Withhold fluid resuscitation for uncontrolled bleeding of the chest or abdomen. Studies (in both humans and animals) consistently show that putting IV fluids into such patients dilutes

clotting factors and increases blood pressure, which permits further bleeding through the uncontrolled site.

- Resuscitate with newer colloid fluids which can sustain intravascular fluid, and even draw in some fluid from the interstitial space - 1 litre of colloid producing 1500 ml of intravascular fluid after one hour, as opposed to 1 litre of lactated ringers having only 200 ml remaining after one hour.

It appears the US military will be in the future training to a different protocol with a different course, one designed specifically for the military, rather than the civilian equivalent ATLS course. We in Australia, who have struggled to train our military medical personnel even in the Australian equivalent to ATLS, should look very closely at designing our own as the US military is doing.

The Rest of the Conference

There was a combination of didactic lectures, general interest presentations on expeditions - a preponderance of Everest attempts, including one from a survivor of the May 1996 disaster when 5 people, including two of the most experienced climbers in the world, died - and workshops on diverse topics such as Helicopter Safety in SAR, recent developments in diving equipment, Aircraft Crash Survival, management of the injured joint in the wilderness, abdominal and thoracic injuries, eye protection and many more. Some 600 registered, and many of the speakers have huge experience in the wilderness and wilderness pursuits. In all, a highly recommended conference. As a free advertisement, the next conferences are April 19-23, Cozumel, Mexico, Diving Medicine, and the annual scientific conference at Sun valley, Idaho, August 2-8.

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, publications, etc.

Members will note that, while these items are more accurate, they are not complete. The Assistant 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 Andy Robertson on (09) 553-2600 or e-mailed to: agrobert@perth.DIALix.oz.au

Australia Day Honours

The following members of AMMA were honoured on the occasion of Australia Day:

- **Captain Peter Habersberger, RANR** - AO for Services to Reserves.
- **Wing Commander Tony Austin, RAAF** - AM for Services to Aviation Medicine

Other Awards and Achievements

The following members of AMMA have received awards as shown:

- **Major Carol Vaughan-Evans** Gallantry Medal for her Service in Rwanda

Defence Force Promotions

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

- **Ed Eitzen, USA MC** - to Colonel and Head, Preventative Medicine Department, US Army Medical Research Institute of Infectious Diseases
- **Amanda Dines** - to Wing Commander, RAAF, and to SO1 MS(B) in Clinical Services in SGADF after 6 months as the resident medical officer with UNSCOM in Iraq.
- **Russell Searle** - to Wing Commander, RAAF, and CO 6 Hospital
- **Maxine Dahl** - to Wing Commander, RAAF, as SOHTEN, Training Command.
- **Stefan Rudski** - to Lieutenant Colonel, RAAMC, and OIC Canberra Area Medical Unit Duntroon.
- **Geoff Stacey** - to Lieutenant Colonel, RAADC, and SO1 DEN at Land Headquarters.
- **Ian Hosegood** - to Squadron-Leader, RAAF and to Iraq as resident medical officer with UNSCOM from March 1997.
- **Erika Vinczer** - to Major, RAADC, and OC Kapooka Dental Unit.

- **Jenny Black** - to Major, RAADC, and OC Randwick Dental Unit.
- **Paul Dunkin** - to Lieutenant Commander, RAN, and SMO at HMAS KUTTABUL in April 1997.
- **Carmel Moore** - to Lieutenant Commander, RAN and to CAMU(D).

Commander Coles Retires

Elizabeth Coles retires from the Royal Australian Navy as a Commander and the Personnel Services Officer, Sydney on 12 May 1997. Commander Coles has served in numerous positions, including CO HMAS LONSDALE, Director of Nursing Services and Health Service Training - Navy, and Deputy Director of Personnel Policy Human Rights (HQADF) in a career spanning 23 years of service with the RAN.

AMMA Conferences

1997 Conference

The 6th AMMA Scientific Conference will be held in Melbourne from the 29th to the 31st of August 1997. A Call for Papers for this Conference is included in this edition of the journal.

Conference Committee

The 1997 Conference Committee is:
Nader Abou-Seif
Bob Stacy

Defence Reform Programme

The Minister for Defence announced details of the Defence Reform Programme on 11 April 1997. The DRP, which is the final product of the Defence Efficiency Review, will result in a major restructuring of the Defence Force, affecting virtually every organisation within it. While the three Single Services retain their individual identities, a major theme throughout the DRP is integration of common functions. Another key theme is the early loss, by redundancy, of approximately 20 per cent of all positions and personnel at the rank of Colonel-equivalent and above.

For health, the major implication of the Programme is the formation of an integrated Defence Health Service, under the Surgeon General. This Service will be responsible for the delivery of all health care services to all uniformed personnel, both at the operational level and in the support areas. The Surgeon General will be responsible for the management of all health funding.

Like most of DRP, the detail of the Defence Health Service is still to be worked out. For those who have an interest in the continuing evolution of the permanent ADF Health Services, more in later editions as the new structure becomes clearer.

AMMA Contacts

For all general AMMA enquires contact the Secretariat:

Paula Leishman
Tel: (03) 6247-1850
(0412) 875390
Fax: (03) 6247-1855

Research Grants

Details of the AMMA Research Grant programme are included in this journal. Members are reminded that applications for the 1997 Research Grant must be received by 15 July 1997. Further details on the Grant can be obtained from:

Janet Scott:
Tel: (08) 8272-7399

AMMA on the Net

We are slowly developing our expertise in this area and we hope to get you a more complete calendar listing from the internet in future issues. A couple of useful internet addresses:

•Medical Journal of Australia:
<http://www.obraru/isud/edi/ai/MJA/>

•NEJM:
<http://www.nejm.org/>
•Department of Human Services and Health:
<http://www.health.gov.au/hsh>

If you have any other useful internet addresses, please e-mail them to:
agrobart@perth.DIALix.oz.au for future inclusion

Journal

Journal's for 1997 /1998 will be published as follows:

Issue	Copy Deadline
July 1997	31 May
November 1997	30 September
March 1998	31 January

All queries regarding the Journal should be directed to:

Russ Schedlich
Tel: (02) 9563-4504
(018) 47-3133
Fax: (02) 9563-4519

Library

The Association's Library has moved to 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:

Russ Schedlich
Tel: (02) 9563-4504
(018) 47-3133
Fax: (02) 9563-4519

Conference and Meeting Calendar

Date	Conference	Venue	Contact No
12-20 April 1997	SPUMS Annual Meeting	Bay of Islands, NZ	64 (3) 364-0817
6 May 1997	War-related PTSD	Sydney, NSW	(03) 9496-2538
7-9 May 1997	RACP Annual Scientific Meeting	Auckland, NZ	64 (9) 360-1980
7-13 June 1997	Risk Management for Practice Managers	Brisbane, QLD	(02) 922-2022
13-20 June 1997	Management for Clinicians	Sydney, NSW	(02) 9840-3637
19-20 July 1997	ACTM Tropical Medicine Meeting	Townsville, QLD	(077) 72-2322
27-29 August 1997	RACMA Conference	Melbourne, VIC	
29-31 August 1997	6th AMMA Conference	Melbourne, VIC	
18-24 October 1997	Risk Management for Practice Managers	Adelaide, SA	(02) 922-2022
1-5 September 1997	14th World Congress on Psychosomatic Medicine	Cairns, QLD	(02) 843-6414
17-21 November 1997	International Hospital Federation Congress	Melbourne, VIC	(03) 9696-2779

AMMA 1997 ANNUAL CONFERENCE HOTEL SOFITEL MELBOURNE 29/30/31 AUGUST

Thanks for the great response to the plea for speakers - the program is now almost completed, and it looks great.

If you'd like to register early for the conference, you can do so by phoning Paula Leishman, Conference Manager on (03) 62471850.

We're now busy working on the exhibition for the conference, if you know of any suppliers who would benefit from participating in the event, please call Paula and let her know the company and contact name.

I look forward to seeing all our members at the 1997 conference.

Nader Abou-seif

CONTRIBUTIONS

for the July issue should be sent to:

The Editor
Australian Military Medicine
PO Box 730
PYMBLE NSW 2073

Deadline is 31 May 1997

Instructions for Authors:

Articles submitted for publication in *AMM* should conform to the following guidelines:

- two hard copies should be submitted, typed double-spaced on A4 paper (single-side)
- if possible, an electronic copy on an IBM formatted 3.5 inch floppy disc in a standard word processing programme should be submitted
- the text in both hard and electronic copies should be unformatted
- references in the text should be numbered consecutively as they are cited and annotation of the references should accord with the style given in *Index Medicus*. Where there are seven or more authors, list only the first three then *et al*. For example:
Szilagyi M, Dawson RM. Phosgene - A research review. *Aust Mil Med* 1995; 4(2):16-19
- figures and tables should be submitted separately with an indication in the text as to where they should be located
- the originals of all photographs, ECGs, EEGs etc should be submitted to allow high quality reproduction

Articles submitted may be subject to peer review. Articles which have been published elsewhere will only be considered if they are of importance to the field of military medicine, and publication will only proceed with the prior approval of the original publisher.

Australian Military Medicine

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The Australian Military Medicine Association
Patron
Air Vice-Marshal G.D. Moller
Surgeon General, Australian Defence Force

President: Nader Abou-Seif
Secretary: Marcus Skinner
Journal Editor: Russell Schedlich
Assistant Editor: Andrew Robertson

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DISCLAIMER

The views expressed in this journal are those of the authors and do not reflect in any way official Defence Force policy or the views of the Surgeon General, Australian Defence Force or any military authority.