

Potential application of innovative, topical, multimodal pain relief in situations associated with military combat and mass disasters

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Abstract

The ideal analgesic for military use should have a predictable action, no side effects, a long duration of action, a readily available antidote, be easily administered and be easily stored and transported.

A Combat Medic Healthcare Specialist will typically carry a backpack styled bag. Aid bags are available from many different manufacturers, in many different styles. Oral Transmucosal Fentanyl Citrate (Fentanyl Lozenge) is currently provided to deployed personnel as part of the operational immediate care requirement for pain relief. Side effects associated with ingestion can include:

- a. Respiratory depression increasing reliance on airway support.
- b. Constriction of the pupils resulting in visual impairment and potentially inhibit head injury diagnosis.

The goal in treating a casualty with mild-to-moderate pain is to provide pain relief that does not affect sensorium as this allows individuals to facilitate their own medical care and/or evacuation. Respiratory depression associated with Fentanyl administration may result in the requirement for airway support and bespoke MEDEVAC care that may not be readily available due to operational constraints. Combat injuries are often filthy, with embedded dirt containing multidrug resistant microbes such as *Acinetobacter* species initiating a chain of infection related challenges which can continue for significant periods post injury. Timely topical, multimodal administration of anaesthetic, adrenaline and antimicrobial agents may have potential to reduce the unnecessary application of pain suppressants and prevent early wound infection pre-emergency care.

Tri-Solfen® has been developed by Medical Ethics Pty Ltd, a Melbourne based company. This highly innovative veterinary product contains a mixture of short acting (lidocaine) and long acting (bupivacaine) local anaesthetics, together with adrenaline (to reduce bleeding) and cetrimide (a common antimicrobial agent). It was initially developed to provide pain relief for lambs after mulesing but has been widely

adopted throughout the livestock industry for other procedures that require pain relief. David Connolly, NORTHERN Territory Cattlemen's Association president, said the use of pain relief in the cattle industry not only delivered better animal welfare outcomes, but also helped increase productivity.

Medical Ethics is now developing this unique technology (known as Medi-solfen®) for pain management and infection prevention in the treatment of both acute and chronic wounds in humans:

In addition to military conflicts, disaster situations such as earthquakes, floods and conflicts might happen in areas where access to a regular hospital or treatment centres might be hours away or not available at all. The provision of effective analgesia for mass casualties needs to be simple in its scope and application, supporting the principle of providing the greatest good for the greatest number in the safest way. A product like Medi-Solfen® has the potential to become a critical component of the basic medicines supplied. It is ideally suited to such applications because it is cheap, portable and able to be applied immediately by rapidly trained lay personnel. It would provide a means of promptly treating wounds that otherwise may remain untended for prolonged periods of time particularly in war-torn or third-world countries. Indeed, in many cases such wounds may not receive any other anaesthetic. The monitoring of such casualties may need to rely on minimally trained personnel using simple clinical parameters. The benefits of having a cheap, simple to use product to relieve pain, minimise bleeding and protect against infection in these circumstances are considerable. Medi-Solfen® has the potential to act as the 'front line' pain relief for topical wound care product for victims of trauma throughout the world.

Biography

Lt Col Jeffery has over 35 years of experience as an active duty burns and plastic surgeon in the British Army. He has undertaken numerous operational tours, including four in Afghanistan. He is also Professor of Wound Study at Birmingham City University and visiting Professor at Cardiff University. Back in 2000 he spent nine happy months as burns fellow in Perth WA.

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Research activity in the Dept of Clinical Studies and Surveillance, ADFMIDI

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Biography

MAJ McCallum is a Scientific Officer/Veterinarian. She joined the Australian Defence Force Malaria and Infectious Disease Institute (ADFMIDI), Brisbane, Australia in 2010, and currently heads the department of Clinical Studies and Surveillance (CSS).

No consent to publish abstract

Role of RSDL in Management of Acute Sulfuric Acid Burns in Rabbit Model

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Abstract

Background:

There is a trend of increasing cases of acid attacks in various parts of the world which could lead to significant burn injury or even death. An increase in acid attacks with readily available acids, such as sulfuric acid, has prompted additional investigation of the RSDL® (Reactive Skin Decontamination Lotion Kit) as an emergency intervention to decontaminate the skin to diminish the consequences of sulfuric acid burn injury when water is not available. RSDL Kit is an accepted chemical warfare agent decontaminant which has been shown to effectively remove or neutralize CWAs (Chemical Warfare Agents) from the skin.

Objective:

The purpose of this study was to investigate the efficacy of the kit in a rabbit model of acute sulfuric acid burn injury, including the wound healing process, as compared to the current emergency treatment of water irrigation for dermal decontamination.

Methods:

Rabbits were randomly assigned to 1 of 3 treatment groups. Each rabbit received six individual dose sites of sulfuric acid for a duration of 30 seconds each. Group 1 rabbits were not decontaminated post sulfuric acid exposure while Group 2 and Group 3 rabbits were decontaminated via water irrigation or with the RSDL Kit after sulfuric acid exposure. The wounds in the three groups were observed at Days 3, 15 and 21. Punch biopsy and histopathology was performed on Day 3, 15 and 21 and reported.

Results:

Both groups (RSDL Kit and Water) performed similarly at decontaminating sulfuric acid. Microscopically, all wounds in all the groups had full-thickness epidermal and dermal necrosis. The pH of the wounds decontaminated with RSDL kit and water were higher than the untreated control group. While erythema persisted longer in the RSDL kit and water decontamination group to Day 21 compared to the control, wound areas treated with RSDL kit and water were significantly smaller. Edema developed by Day 3 for all groups of wounds and resolved by Day 15. Necrosis started in the control group and the RSDL kit group (to a lesser degree) by Day 3, but by Day 15 and 21, all wounds had necrosis.

Based on the necrosis observed in all wounds, there was no evidence of wound healing in any of the groups regardless of the day the wounds were biopsied. Compared to Group 1 (no decontamination), the scoring of wounds from the water and RSDL kit decontamination groups were not different.

Conclusion:

While RSDL kit and water decontamination were similarly effective in reducing the wound size and increasing the pH of the wound by Day 3 compared to the control, the histopathology data demonstrated that microscopic characteristics of tissue injury across all groups were similar and showed no signs of wound healing after a strong corrosive acid exposure. It is notable that RSDL kit was safe and non-inferior to water at decontaminating the wounds. Therefore, the RSDL kit may be an alternative decontamination method in absence of immediate access to water.

Biography

Laura Cochrane is currently the Senior Director of Global Medical Affairs for Emergent BioSolutions based in the UK with a long history in CBRN research and development. Early in her career, following her studies at the Royal Military College of Canada in Chemical and Materials Engineering she was furthered her studies with the Department of National Defence in Aerospace engineering later moving across Canada in a CBRN research capacity.

She continued her working career in CBRN across industry and cross government collaborations in research roles across partnerships with various institutions including Department of Foreign Affairs Canada, Defence Research Canada, EU Commission and Global Defence programs across NATO partner member states.

She has an extensive career in research development, enhanced by post graduate education at St. Andrews University with recent certifications at Cambridge University and London School of Economics. She also continues to maintain OPCW training with the Asser Institute in Disarmament and Non-proliferation of WMDs.

She is currently supporting activities in Biological and Chemical Threat medical preparedness with Emergent BioSolutions, and continues to publish, lecture, including support to the NATO Biological Warfare Defence Awareness Course. and speak on medical countermeasures across high risk pathogen disease areas, including but not limited to Smallpox, Anthrax, Botulism and Chemical Warfare threats.

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The Utility of Health System Insights in the Australian Defence Force

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Abstract

People are fundamental to Defence capability; poor health, illness or injury may pose a risk to a serving member's overall health readiness,

which consequently impacts upon the operational capability of the Australian Defence Force (ADF). Adoption and utilisation of data may be one way the ADF can reduce the likelihood of these risks. Data in the ADF healthcare context refers to volumes of medical administrative data (i.e., data routinely collected as part of care delivery) created by the adoption of electronic health systems. Collection of such large volumes of data - for conversion into relevant critical insights - has until recently been too costly and time consuming, thus preventing its use for predicting and solving health-related problems. Data - when used accurately and proactively - has the potential to improve access to and quality of care for ADF members by allowing for: (a) identification of health risk areas; (b) monitoring and evaluation of health initiatives; and (c) assessments of force health readiness. In short, the introduction of the Defence e-Health System in 2014 may be instrumental not only for assisting the ADF in maintaining medical records and delivering integrated health care, but also in provision of timely, reliable, and evidence-based information for decision-making. The purpose of this presentation is to outline one process by which Defence has begun to incorporate data into its health system in order to derive insights in line with its Digital Health Strategy.

Acknowledging the different health data and analytic needs across Defence, the capabilities of data processing can be organised into four quadrants, ranging from reactive to proactive reporting (low to high reporting maturity) and health system data to health system insights (low to high analytics maturity). This organisational flow allows flexibility to move from raw data description to hypothesis testing - informing decision making proactively - on an as needs basis.

Actioning this flow, begins with the collection of raw, unprocessed health system data (e.g., a log of an ADF member presenting at a clinic because of an injury). This type of product has the lowest level of analytics maturity and - alone - is of little value because it requires contextual, background and technical knowledge to aggregate and manipulate into information. To derive value from this raw data, the consecutive step involves querying, mining and exporting of historical data to shape reactive reporting. This form of reporting primarily relies on descriptive analytics (e.g., how many ADF members presented with the same injury in 2021?). We posit that such reporting is useful in aiding strategic communications: characterising and surveying the health of the force - promoting population health statistics and identifying potential health priorities.

Diving deeper, utilising advanced (e.g., regression) and new (e.g., machine learning) analytical methods provides the capability to test hypotheses to derive insights. This proactive, higher level of analytics maturity works to support ongoing monitoring and surveillance efforts, diagnostics (e.g., identifying injury aetiology), preventative medicine (e.g., identifying risk factors for injury), and reduction of adverse events (e.g., flagging potential adverse reactions). Predictive reporting may prevent illness and injury through intervention with forward looking clinical and policy decision-making, therefore potentially reducing medical discharge and improving quality-adjusted life years for ex-serving members.

ADF member health and Defence health service delivery enables/supports overall Force readiness and capability. Combining data analytics with outcome driven insights further support the enabling of capability and in maintaining a ready, responsive and resilient Defence Force. With these insights, the ADF can continue to accurately report and predict the health status of its members on a whole-of-ADF level, while making data driven policy decisions focussed on statistically proven priority areas.

Biography

Dr Jessica Marshall is a recent graduate from Melbourne University, where she completed her Doctorate investigating the genetic and pharmacological targeting of Heat Shock Protein 72 on a novel mouse model of Alzheimer's disease. Her research was funded by the Australian Dementia Research Foundation, in affiliation with the Baker Heart and Diabetes Institute and the Florey Institute of Neuroscience and Mental Health. Since joining the Department of Defence, Jessica has worked in the National Security space as a Policy Officer, before moving into the Joint Health Command, as a Health Insights Officer.

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Thematic Analysis of Remote Programme Management and its Potential Application to Best Practice in Defence Global Healthcare Engagement

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Abstract

Purpose:

Defence Healthcare Engagement (DHE) requires significant collaboration between stakeholders to develop programmes and increase UK influence internationally. Remote Programme Management (RPM) is a civilian mitigation strategy used in the humanitarian sector. The COVID19 pandemic has caused unparalleled disruption to international travel and compelled DHE activity not in direct response to COVID to be mainly conducted remotely.

Method:

In 2020 the authors undertook a literature search of all open access relevant articles on the topic of RPM. The authors applied a qualitative thematic analysis to these articles, using codes to extract key themes.

Results:

Eighteen articles relating to RPM covering international organisations, governmental organisations non-governmental organisations were reviewed by the authors. The thematic analysis highlighted key themes running throughout the literature.

RPM was indicated predominantly for security concerns; however, access restriction, usually governmental, was also commonly cited.

Several different strategies were featured throughout the reviewed literature:

- Develop relationships at a strategic level
- Understand the local networks and their capacity
- Develop community acceptance of the programme
- Develop community partnership arrangements

It is important to anticipate a high likelihood of requiring RPM and accommodating it early within

the planning stages and foster collaboration with the in-country/implementing team.

Novel technological support in the form of web-based monitoring or mobile phone monitoring apps have helped with monitoring and evaluation of programmes remotely. There is an increasing reliance on triangulation with multiple sources and the use of third-party monitoring. It also offers an opportunity for real-time feedback from direct beneficiaries with much shorter timescales than traditional methods.

Concerns for the risks of the use of RPM were increasing security risks to in-country workers and difficulty upholding humanitarian principles without direct oversight. Although these risks are not directly relevant to DHE content, the risk of reduced situational awareness and advocacy when maintaining remote relationships certainly can undermine projects.

Conclusions:

Lessons gleaned from the RPM literature should be applied to future DHE work. The aim of DHE is often to produce persistent engagement to foster and maintain key strategic relationships. Remote working is well suited to preserving “shallow” relationships, which can then be developed into less frequent deeper engagement opportunities.

Recent events have demonstrated rapid adaptation to virtual working globally. A hybrid model of initial small virtual meetings to build relationships and shape projects can make subsequent face-to-face engagements more meaningful and effective. An enduring partnership maintained virtually can greatly aid monitoring and evaluation of DHE activity. As these strategies are developed, they should be incorporated into defence engagement doctrine and shared with partner nations as a template for best practice.

Biography

Surg Lt Cdr Laura McCrae works as a senior Emergency Medicine trainee in the Royal Navy. As a General Duties Medical Officer, she served onboard a Type 23 frigate in the Arabian Gulf and RFA Argus, a Primary Casualty Receiving Facility. Laura also joined the US Navy on Pacific Partnership 2010, a multinational humanitarian and disaster response training exercise. Before returning to Scotland to complete her Emergency Medicine training, she worked in Emergency Medicine in Taranaki, New Zealand and Darwin, Australia. She is currently completing a global health fellowship with the Academic Centre for Defence Health Engagement and is part of the Military Global Health Engagement course faculty.

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Trauma Indexes and Indicators in the Pre-Hospital Environment - Evaluating Potential Utility for Paramedics

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Abstract

Objective:

Availability of practical, validated prognostic scoring tools could assist paramedic clinical decision making in cases of haemorrhagic shock. Appropriate scoring tools have not been tested in the pre-hospital setting. This study evaluated the potential utility of six trauma scoring tools and blood glucose levels (BGLs).

Methods:

A retrospective database review involving 12,562 trauma patients between 1st January 2018 and the 31st December 2018 was conducted. De-identified electronic patient clinical data from a state-based ambulance service were examined. A Shock Index (SI), Modified Shock Index (MSI) and Reverse Shock Index (RSI) were calculated for all patients. An Age SI was calculated for those aged ≥ 55 years, and a Shock Index Paediatric Adjusted (SIPA) for patients aged 4-16 years.

Results:

The SI and RSI tools were able to be calculated for the greatest number of cases (84.4%). MSI was calculable for 80% of trauma cases, while AgeSI and SIPA were calculated in 92.5% and 68.9% of target cases, respectively. Significant differences in the number of cases deemed severe were found between SI and age-specific tools. The incidence of trauma was similar in males (49.6%) and females (49.4%).

Conclusions:

A validated prognostic shock index can be a useful indicator of severe injury in the pre-hospital setting. Both the SI and RSI are practical tools for the detection of shock states, and warrant consideration for incorporation into paramedic trauma practice guidelines. In trauma situations, paramedics should

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consider patient age, however, more research is required in this area.

Keywords:

Emergency medical services, paramedic, pre-hospital trauma care, shock, trauma index, shock index

Biography

Kate Bohmer graduated with a Bachelor of Paramedicine from the University of Tasmania (UTAS) in 2018. Kate has a keen interest in research and this drew her to undertake an honours degree in paramedicine at UTAS. At the end of 2019 she completed her Honours research thesis, which focused on validated and simple trauma tools for assessing haemorrhagic shock in the prehospital setting. She is presently working in Sydney as a qualified paramedic with the New South Wales Ambulance Service. Kate is very passionate about her chosen career as a

paramedic and aims to one day in the near future return to research and possibly expand her Honours thesis into a PhD. By returning to research, she hopes to actively contribute to improving pre-hospital care and knowledge. She is planning on undertaking further paramedic training to become an Intensive Care Paramedic.

In her spare time Kate is an accomplished Harpist who has won many music competitions and she has performed with the Tasmanian Symphony Orchestra. Kate is a keen tennis player and has represented Tasmania in both junior and senior state teams. Kate's other interests include fitness, travelling and bush walking.

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TAILORED MEDICAL AND HEALTH SERVICES FOR DEFENCE AT HOME AND ABROAD

