

Regional anaesthesia in military medicine

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THERE HAS BEEN A RESURGENCE of interest in the use of regional anaesthesia over recent years. One example is a case report in a recent issue of *ADF Health*.¹ This resurgence is due to many factors, including the development of new equipment for locating nerves, an increasing collection of evidence attesting to the efficacy, value and advantage of regional anaesthesia, and the use of innovative technology to improve the reliability of techniques. New agents with lower toxicity, and techniques to provide continuous blockade have opened the way for blocks to be used for extended periods without increasing the risk of complications.

At the same time, there has been a change in the patterns of battle casualty. Improved body armour and better casualty evacuation systems mean that soldiers wounded on the battlefield are more likely to survive injuries that would previously have been fatal. There has been a steady increase in lethality (killing ability) of modern weapons, yet paradoxically a steady fall in combat mortality (killed-in-action to wounded-in-action ratio) since World War II.^{2,3} Improved body armour has reduced severity and mortality from penetrating thoracic and abdominal injury. There has also been a change to complex multiple wounding patterns, commonly due to the advent of the improvised explosive device.⁴ This has led to relatively greater injury due to blast, penetrating fragments and burns to the extremities. This is now the principal mechanism of injury in Iraq. With prompt management and evacuation to high-level care, these injuries are survivable, but pose formidable challenges to those managing the victims.

The use of regional anaesthesia in combat hospitals is not a new phenomenon, with its use being described throughout the 20th century. The predominant techniques were confined to spinal anaesthesia. As such, these techniques had limited applicability because of haemodynamic instability in shocked casualties, and risk associated with contamination and sepsis. Therefore, they tended to be reserved for stable patients undergoing repeat procedures on the lower limbs.⁵



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Abstract

- ◆ With changes in battlefield injury patterns and the development of new techniques and technology for anaesthesia, there has been a resurgence of interest in regional anaesthesia.
- ◆ Current injury patterns and the systems for rapid casualty retrieval and transport lead to many patients with profound limb injuries. These are the types of injury that will benefit most from regional anaesthesia.
- ◆ Training in regional anaesthesia needs to become more comprehensive, and for military anaesthetists should become part of usual practice.
- ◆ Appropriate equipment such as insulated needles, nerve stimulators, and ultrasound equipment needs to be supplied on deployments.

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Current research

There is a paucity of evidence in the literature showing that regional anaesthesia offers an advantage over general anaesthesia in austere environments, largely because of lack of research on the topic. Nevertheless, in theory, the use of regional techniques is immensely appealing. The advantages of peripheral regional anaesthesia are listed in the Box.

There is a significant body of work supporting the use of peripheral regional anaesthesia alone and in combination with general anaesthesia for management of acute and elective surgery in the civilian setting.^{6,7} It has been shown to reduce operative blood loss, improve operative conditions and lead to a more rapid recovery with less pain when compared with general anaesthesia alone. There is a significant sparing in the use of opiates and therefore complications from their use. In this article, I discuss some work that has been done on the subject of regional anaesthesia in the military combat setting.

A recent study followed 4100 casualties evacuated to Walter Reed Army Medical Center (WRAMC) between March 2003 and December 2004.² Of 1400 inpatients, 750 were injured in battle, with 500 of these having extremity injury. Of these patients, 57% were managed with surgical care that included some regional anaesthesia techniques. These included single shot, continuous nerve block and continuous epidural infusions. Over 900 procedures were performed on 287 casualties before arrival at WRAMC, and 634 after arrival; 35% of the group were amputees. In the study group, 646 advanced regional anaesthetic techniques were performed, including 361 continuous peripheral nerve blocks (CPNBs), with an average infusion time of 9 days. Catheter-related complications occurred in 11.9% of patients, but all were technical or minor in nature. This is despite universal chemoprophylaxis for deep venous thrombosis with low molecular weight heparin.^{8,9} The catheter

infection rate was 1.9%. There was a significant reduction in pain scores over the 7 days that CPNBs were used.

Another study looked at anaesthesiologists on a naval base providing regional anaesthesia for peripheral surgery that was then performed at a separate facility with lower levels of supervision. This study showed a high level of satisfaction from both surgeons and patients.¹⁰ This approach offers some advantages for a hard-pressed field hospital, allowing more care to be comfortably provided to more patients with less skilled staff and less use of resources that are difficult to resupply, usually with a faster and more stable recovery phase. This would potentially allow more rapid return to the battlefield and act as a force multiplier.¹¹

This approach is not new and has been described from earlier conflicts. During mass casualty situations in Vietnam, American anaesthesiologists used spinal, epidural and axillary blocks to allow simultaneous surgeries to be performed. This allowed the anaesthesiologist to be available to provide anaesthesia and resuscitation to the critically injured soldiers, while permitting the already blocked wounded to be operated on at the same time.^{12,13}

The use of CPNB in patients with limb injuries would also reduce the workload in the operating room by allowing painful dressing changes to be performed on the ward either by topping up the block or by using minimal sedation. Elastomeric pumps can be attached to the catheters and used to provide excellent analgesia for injured soldiers during repatriation. This will also free nursing staff to care for other injured patients in-flight, reducing workloads and improving care for all.

There have been several case studies presenting excellent outcomes when regional anaesthesia was used, and one presenting the use of ultrasound in the combat setting for placement of a brachial plexus block following traumatic amputation from an improvised explosive device.¹³

Techniques and training

Traditionally, regional anaesthesia was regarded as the technique of choice for the very unwell patient, as it avoided the risks associated with general anaesthesia, which had been described as “holding the patient over an open grave”. However, general anaesthesia is now regarded as a very safe procedure, with an unpredicted death rate as low as 1 : 250 000 in otherwise healthy individuals. As a result, use of and training in regional anaesthesia have generally declined over the past three decades. Regional anaesthesia became regarded as difficult, time consuming and unreliable, only worth the trouble for the very sick. Training in regional techniques fell to the point that many trainees did little or no training in anything other than spinal and epidural blocks.

As evidence demonstrating the advantages of incorporating regional anaesthesia into standard practice accumulates, many anaesthetists have to learn or relearn the techniques, and many trainees are actively seeking opportunities to learn them. The US military has established a Regional Anesthesia and Pain Management Initiative within the Department of Anesthesiology at WRAMC to specifically address this issue.² Their

I Advantages of peripheral regional anaesthesia on the modern battlefield

- Excellent operating conditions
- Profound perioperative analgesia
- Haemodynamic stability
- Limb-specific anaesthesia
- Reduced need for other anaesthetics
- Reduced or eliminated use of narcotics
- Improved postoperative alertness
- Minimal adverse effects
- Rapid recovery from anaesthesia
- Simple, easily transported equipment
- Cost-effectiveness

program includes sending trainees on overseas aid missions to gain experience in austere environments.

The past decade has seen the advent of new insulated needles and better nerve stimulators, which, combined with training, are improving the success rates of regional anaesthetic techniques and reducing the time taken to perform blocks, with less patient discomfort.

Introduction of portable and rugged ultrasound devices and the increasing understanding of ultrasound neuroanatomy have led to many blocks being performed under direct vision using ultrasound guidance. This approach allows direct visualisation of the nerve or surrogate structure and permits repeat injections for incomplete blocks. The use of ultrasound has also allowed the introduction of new blocks such as the transversus abdominus plane (TAP) block, which cannot be safely and reliably performed without ultrasound placement of the needle and agent.

The combination of the above technologies should lead to a block success rate approaching 100% with very high patient satisfaction, less time taken to perform blocks, and more rapid onset, as well as reduced complications due to damaging surrounding structures and accidental intravenous injection.

It is not within the scope of this article to detail all the options available to the anaesthetist for including regional anaesthesia in military practice. There are several publications available,¹³⁻¹⁶ which can be sourced for guidance. Attending workshops and receiving instruction from experienced practitioners provide the best short-term experience, but are no substitute for doing the blocks “hands on”.

There are many blocks suitable for use by emergency specialists and general duty medical officers. I have published a handbook on regional anaesthesia techniques that addresses this, and there are many other more detailed texts.¹⁷ A forum to discuss which blocks are suitable for non-specialists to learn would be useful, perhaps at a military medicine conference. Topics for discussion could include pharmacology of local anaesthetics, management of adverse reactions, and practical aspects of establishment and maintenance of regional anaesthesia. It must be remembered that with any major regional block there is the risk of severe and life-threatening adverse reactions. The person performing blocks must be skilled in resuscitation,

and have access to the appropriate equipment for managing adverse reactions.

Summary and comment

Treating injured soldiers on the battlefield requires adaptability, resourcefulness and courage from the medical teams. The current treatment and medical evacuation systems used by the Australian Defence Force have led to the highest injury to survival rates in history for a major conflict.³ This has resulted in many survivors with significant disability who need ongoing management and rehabilitation. Longer-term psychological and functional problems may result (eg, complex regional pain syndromes). The risk of developing post-traumatic stress disorder is also high in some studies.¹⁷ For these reasons, we must extend our goals beyond saving life to ensuring the best-quality management for the injured.

The patterns of injury from current conflicts and the systems of combat casualty treatment and transport have resulted in many patients with profound limb injuries. These are exactly the types of injuries that will benefit from regional anaesthesia and CPNB.

Regional anaesthesia applied appropriately in both the acute and secondary phases can help with some of these issues. The excellent quality of pain relief afforded by a CPNB can minimise dosage of sedative drugs, can improve the feeling of wellbeing and interaction with comrades, may reduce the risk of complex regional pain syndromes, and can allow injured soldiers to participate more actively in their own rehabilitation.

There is a significant obstruction to this objective.^{2,4,14,18} Training in regional anaesthesia needs to become more comprehensive and, at least for military anaesthetists, part of their usual practice. Specialists must be familiar with using insulated needles and nerve stimulators, and fluent in using ultrasound to guide blocks when the nerve stimulator is not feasible. This also means that this equipment needs to be available to military anaesthetists when deployed. Fortunately, for many deployments, this is now the case, with the portable SonoSite generally on line for use. We need to ensure adequate supply of needles and catheter systems for the provision of CPNB and appropriate resupply.

As with many innovations on the battlefield leading to better technologies in civilian life, the potential for improved patient care in trauma for civilian patients by the timely application of regional anaesthesia is likely. Our objective for managing our

injured soldiers should be the best possible outcomes in both survival and return to duty or a fruitful civilian life. The implications of appropriate regional anaesthesia on these objectives should not be ignored.

Competing interests

None identified.

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