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## Battlefield to Bedside to Recovery

This issue of *Pain: Clinical Updates* addresses acute pain management associated with traumatic injuries by presenting perspectives from military pain specialists from the United Kingdom and United States. It is hoped that the knowledge they have gained during recent major conflicts can be applied across nations and in all battle situations.

The recent wars in Iraq and Afghanistan, as well as previous wars fought by the United Kingdom, the United States, and their allies, have contributed substantially to the science and practice of pain management. In the context of these wars, referred to as Operation Enduring Freedom (OEF) in Afghanistan and Operation Iraqi Freedom (OIF) in Iraq, advances in battlefield medicine and protective armor have substantially enhanced the capacity to save injured service members who would have been killed in previous wars and conflicts. As a result, as many of 90% of service members who sustain traumatic injuries are expected to survive. Pain is almost certain to accompany serious injury in the battlefield, and management of acute pain in the battlefield and during the transition of care to other medical and rehabilitation facilities has emerged as a significant challenge, as well as an opportunity for improvements. Military pain medicine specialists from the U.K. and U.S. departments of defense, as well as their colleagues in the U.S. Department of Veterans Affairs—the integrated health care system that provides care to a large proportion of U.S. military veterans—have responded to the call for the development of comprehensive, integrated, and effective approaches to reduce acute pain and suffering associated with combat-related traumatic injuries. They also recognize the need to provide for long-term pain management in the context of continued recovery, rehabilitation, and reintegration efforts.

*Management of acute pain in the battlefield and during the transition of care to other medical and rehabilitation facilities has emerged as a significant challenge*

This article begins with a description of how the British military forces currently provide acute pain management from the time of injury. The British system has been developed in collaboration with other countries, but the specific details of the approach will vary from nation to nation. Many casualties are the result of non-battle injuries,<sup>1</sup> but this article focuses on those related to trauma. This discussion is followed by a brief description of the efforts of the U.S. Department of Veterans Affairs to develop a comprehensive approach to support U.S. military service members with painful traumatic injuries as they transition their care from U.S. military treatment facilities to Veterans Health Administration (VHA) facilities across the United States. In contrast to the earlier, detailed section highlighting the specifics of an approach to acute pain

management, the description of the VHA's approach is much more general and focuses on the broader perspective of recovery, rehabilitation, and reintegration for veterans in the post-acute and chronic pain management context. The article calls for continued research and enactment of evidence-based improvements in pain care across this continuum.

## The British Pain Medicine Experience

At the time of injury, those suffering a battlefield injury will usually have to provide their own care, which may very well include providing initial analgesia. In the case of British forces, initial emergency analgesia will take the form of 10 mg of intramuscular (i.m.) morphine; each individual is issued with two 10-mg morphine autojects. Members of the armed forces are glad to have this remedy available, because of morphine's reputation as a powerful analgesic. Of course, clinicians understand that 10 mg i.m. morphine is not necessarily a better analgesic than 1 g of paracetamol (acetaminophen),<sup>2</sup> although, unlike paracetamol, its dose can be repeated if necessary.

When conditions allow, one of the unit's "medics" will provide protocol-driven assistance, which may mean the use of more i.m. morphine. Of course, the arrival of a physician will make it possible to use alternative agents and routes. Current options are intravenous (i.v.) and intra-osseous routes for either further morphine or ketamine. There is interest in the idea of using the intranasal route, but currently this route is only regularly used for pediatric analgesia, typically with fentanyl as the agent. The use of i.v. paracetamol is encouraged early on, when it is available. Sometimes, oral transmucosal fentanyl citrate is available, and this option appears to be achieving a degree of success. The optimum dose is still unclear at present, but typical doses used range between 400 and 800 µg. This use is off-license, which may be a problem for some organizations.

The movement of an injured patient from the prehospital environment to a surgical facility follows the principles of any patient transfer—the better prepared the patient is for the transfer, the better the process will be. Thus, while the capability to provide further analgesia does exist, the back of a military helicopter flying in an environment such as Afghanistan is one of the most difficult conditions in which to provide any ongoing care. Ideally, good analgesia should be achieved before the start of the transfer.

*One of the recent developments in military analgesia has been the active encouragement of the use of regional anesthetic techniques*

In the field hospital, the analgesic options available mimic those of many civilian hospitals; further opioids, ketamine, and nonsteroidal anti-inflammatory agents are provided, if appropriate. One of the recent developments in military analgesia has been the active encouragement of the use of regional anesthetic techniques, particularly continuous peripheral nerve blocks, since many of the injuries currently encountered involve the

extremities. Although regional anesthetic techniques were first described over 50 years ago in military medical publications,<sup>3,4</sup> a number of recent developments have made them more useful. First, the operating theaters within a field hospital, although they may be no more than tents during the initial phases of a military deployment, are now sufficiently clean as to allow these techniques. Second, the advent of relatively small and robust portable ultrasound devices means that regional anesthetic techniques, particularly where catheters are left in situ, are now more likely to succeed. The use of "traditional" external nerve stimulation techniques for regional anesthesia is often complicated by the lack of a distal limb following traumatic amputations. Epidural infusions are also used, being particularly useful in the case of bilateral lower limb or abdominal injuries. The development of simple infusion devices, either electronic or elastomeric, has also helped give these regional anesthetic techniques a fundamental role in the strategic transfer of patients.<sup>5</sup>

*Preparation is particularly important with analgesic issues ... it is vital to confirm that analgesia has been optimized before repatriation*

Patient-controlled analgesia (PCA) devices are used in the field hospital. Although different mixtures are often advocated, the United Kingdom's current approach is to use plain morphine, with 1 mg being delivered every 5 minutes. This standardized approach is important because there is a regular turnover of health care providers, and opportunities for confusion must be minimized. The PCA device currently used is entirely mechanical and is disposable after use.

Repatriation of injured personnel occurs as soon as they are stable enough to move, with mobile intensive care capabilities for those who remain critically ill. Again, as with any transfer, the secret is in the preparation.<sup>6</sup> Preparation is particularly important with analgesic issues because there will be no chance to provide an analgesic agent or technique that has not been brought onto the aircraft before the journey begins. Consequently, it is vital to confirm that analgesia has been optimized before repatriation, and to ensure that appropriate analgesic supplies are on board for the duration of the journey home.

Arrival back in the home nation allows an opportunity to review the pain management plan for each casualty.<sup>7,8</sup> Regional anesthetic systems are reviewed, refilled, and replaced, when necessary. Medication prescriptions are reviewed. There is a low threshold for early prescription of agents to treat the neuropathic components of pain; tricyclic antidepressants and pregabalin are the first agents used. These drugs will be prescribed whenever there is thought to be a significant risk of nerve damage, such as with amputations and any extensive tissue loss. These drugs may have been initiated in the field hospital.

Pharmacological techniques are not the only ones employed. Physical therapists will use mirror boxes,<sup>9</sup> TENS machines, and

early rehabilitation techniques. Time will be spent educating injured service members about the reasons for their pain and the likely consequences of their injuries, as well as providing an understanding of the analgesic agents and techniques used to enable them to take control of their pain. The care of these patients together on military wards is also important because they will tend to turn to one another for support far more readily than to health care professionals.

Admission to the military rehabilitation center immediately follows discharge from the receiving hospital, although in the case of some wounds, patients will spend time moving between the two settings. During rehabilitation, a specialist pain management physician is available to support patients, when necessary. In fact, most patients are keen to reduce their analgesic intake, preferring the increase in control and reduction in side effects at the expense of less analgesia. Patients identified as having problems with pain in the receiving hospital will be booked directly into the military pain clinic at the rehabilitation center so as to ensure no break in their analgesic management. The same clinic can be accessed once patients have completed their rehabilitation and returned to primary care.

These processes are the result of specific attempts to organize analgesia throughout the chain of evacuation. In each field hospital, one consultant anesthesiologist has the role of running the pain service and being the first point of contact for analgesic issues. Working closely with an identified nurse, the anesthesiologist will undertake specific daily pain ward rounds looking for problems. He or she is also responsible for the regular audits, surveys, and research undertaken in the field hospital, conducting weekly “pain meetings.” Finally, after deployment, he or she will write a report of the issues, good and bad, that arose. The aeromedical evacuation team also has its lead pain clinician, who is responsible for maintaining the analgesic components of service. In the primary receiving hospital in the United Kingdom, a multidisciplinary team is responsible for similar activities, including audits, research, and education. As mentioned earlier, the education component applies not only to health care providers but also to patients. The team will also highlight patients who should be monitored during their rehabilitation phase.

*While the acute phase is important, what really counts are the long-term outcomes, which we assume may be related*

While the clinical activities are important, the nonclinical aspects of audits, research, and education and the way in which the system is organized are probably of greater importance because they provide the evidence and traction for the clinical developments. The entire process is overseen by a Military Pain Special Interest Group that meets every 3 months and reports to the Defence Consultant Adviser in Anesthesiology. This group is responsible for the wider education of the military population (army doctors now get a full day’s training in acute pain management). The

group also oversees specific research projects and develops overarching clinical strategies, which is important because we see the process as a continuum rather than as a number of discrete clinical areas.

But does it work? That is the most important question, and of course it is difficult to prove. We do know that over half of those injured rated their pain as “severe” at the point of wounding and that two-thirds of them thought their pain was helped by their initial analgesia.<sup>10</sup> We also know that the severity of pain on the military wards in the United Kingdom is significantly less than would be expected—fewer than 10% of patients have moderate and severe pain compared to an expected 20–80%.<sup>10</sup>

However, while the acute phase is important, what really counts are the long-term outcomes, which we assume may be related. At present we have no evidence of opioid dependence among our casualties, and a recent survey has suggested that only 5% of amputees have a severe problem with phantom pain.<sup>10</sup> These are two very encouraging findings, but not proof. Clearly, long-term outcomes are related to a myriad of other issues that we have little control over, but we can exert an influence over acute analgesia, which is probably one important link in a long chain.

## **The U.S. Department of Veterans Affairs National Pain Management Strategy**

In the United States, it is widely accepted that the historical roots of the development of anesthesia and pain management are closely linked with military events and military clinicians. Notable examples across the past centuries are the advances in acute injury anesthesia within military theaters, including Silas Weir Mitchell’s identification of certain forms of chronic pain (reflex sympathetic dystrophy and phantom limb syndrome) during the U.S. Civil War; and John Bonica’s establishment of pain management as an interdisciplinary discipline based on his innovations in practice during World War II.<sup>11</sup> From the latter part of the 20th century up to the present day, the veterans’ health care system has also played a crucial role in the advancement of pain management in terms of clinical protocols, educational programs, and research.

*The historical roots of the development of anesthesia and pain management are closely linked with military events and military clinicians*

In late 1998, the former Undersecretary for Health of the U.S. VHA established pain management as a high priority and chartered a National Pain Management Strategy. In October 2009, the VHA published additional policy guidance for the strategy that articulated key objectives, described the infrastructure responsible for implementation of the strategy, and outlined key standards of care across the domains of pain assessment and treatment, performance improvement, and provider competence.<sup>12</sup> The overall objective of the national strategy is to develop a comprehensive,

multicultural, integrated, system-wide approach to pain management that reduces pain and suffering and improves quality of life for veterans experiencing acute and chronic pain associated with a wide range of injuries and illnesses, including terminal illness. The VHA employs a stepped-care model of pain care that provides for management of most pain conditions in the primary care setting, supported by timely access to secondary consultation with experts from pain medicine, behavioral health, rehabilitation medicine, and other specialties, in coordination with palliative care. Access to tertiary care advanced diagnostic and medical management and rehabilitation services is available for complex cases involving comorbidities such as mental health disorders and traumatic brain injury.

A major focus of the strategy has been to strengthen VHA's existing pain management programs to provide optimal care for OEF/OIF veterans as they separate from the U.S. military and enroll for care with VHA. In 2007, VHA launched a major funding initiative to specifically support this effort by purchasing advanced pain medicine equipment, hiring staff, and supporting provider education and training. A major challenge relates to care for veterans with musculoskeletal pain that is not directly related to traumatic injury and is likely to be more chronic.<sup>13</sup> Major initiatives have specifically focused on challenges such as those related to chronic opioid therapy for veterans who require such therapy, as well as efforts to build the capacity for coordinated and integrated care that empowers OEF/OIF veterans to engage in pain self-management approaches. VHA has also partnered with the U.S. Department of Defense in developing evidence-based clinical practice guidelines for management of acute postoperative pain, management of low back pain, and chronic opioid therapy. Web-based educational courses for providers are available, focusing on topics such as the use of opioids to treat acute and chronic pain, the management of complex chronic pain, and pain and polytrauma.

At the same time, VHA has recognized the challenges associated with caring for veterans with acute, subacute, and chronic pain commonly associated with combat-related injuries. Specific efforts have focused on a partnership with VHA's rehabilitation medicine through its comprehensive and tiered Polytrauma System of Care. This network focuses on serving veterans with brain injuries as well as injuries to at least one other organ system, referred to as polytrauma. Among veterans with polytrauma, acute and chronic pain is almost universal. VHA has established four Polytrauma Rehabilitation Centers and Polytrauma Transitional Rehabilitation Programs at its Minneapolis, Palo Alto, Richmond, and Tampa facilities to provide care for some active-duty military service members and veterans with the most severe injuries, most often including severe head and brain injuries. Regional Polytrauma Network Sites at 22 locations and smaller Polytrauma Support Clinical Teams at an additional 84 sites have also been established for veterans with less severe injuries and for those ready to transition to less intensive care programs. Continuity of pain management plans that were initiated in military treatment settings is the first order of business, with the expectation that

these plans will be adapted and refined as the patient is medically stabilized and as comprehensive recovery and rehabilitation plans are developed.

Numerous published reports have documented the high prevalence and complexity of the pain experienced by patients in these settings.<sup>14-16</sup> For many patients, the multiple-systems injuries that have been sustained contribute to multiple sites of pain and a complex mix of nociceptive and neuropathic pain conditions, as well as headache. This complexity is magnified by the need for continued medical and surgical procedures that may cause additional pain. For most patients, management of pain occurs in the context of a process of rehabilitation and recovery in which primary reliance on opioid analgesics for pain control may be counterproductive. Given the objective of maximizing the patient's recovery and rehabilitation, optimal pain care is care that is comprehensive, integrated, individualized, and interdisciplinary.

*Management of pain occurs in the context of a process of rehabilitation and recovery in which primary reliance on opioid analgesics for pain control may be counterproductive*

VHA will continue its efforts to fully implement a stepped pain care model<sup>17</sup> to address the pain care needs of veterans returning from deployment in Iraq and Afghanistan. In 2007, VHA funded a major funding initiative to enhance its existing pain management services for OEF/OIF veterans. The initiative provided funding for pain medicine equipment to build its diagnostic and interventional pain medicine capacity, for enhanced staffing to support pain management services, and for provider education and training. Subsequent initiatives in the context of transformational efforts to promote veteran-centered pain care have also been supported. In addition to the dissemination of the VA/Department of Defense clinical practice guidelines and Web-based educational courses, VHA sponsors monthly provider educational teleconferences and face-to-face education and training programs at the local, regional, and national level that have targeted improvements in acute pain management, including advanced pain medicine diagnostics and interventions and evidence-based pharmacological and nonpharmacological approaches. The use of complementary and alternative medicine approaches has been highlighted.

## The Call for Research

The challenges of meeting the acute pain care needs of military service members and veterans during times of war have also provided opportunities for advances in the field of pain management through experimentation with novel therapeutic approaches and systematic investigation, including the use of quasi-experimental and naturalistic observational designs and methods. Of particular relevance are two major initiatives to promote optimal acute and subacute pain management for military service members. The Army Regional Anesthesia and Pain Management Initiative is a congressionally funded program

designed to perform research to develop effective strategies for improving pain management in soldiers, particularly acute pain associated with battlefield trauma. The program extends to the U.S. Army Regional Hospital in Landstuhl, Germany, a key transitional point of care for injured soldiers on their way to care in any of several U.S. military treatment facilities. Most recently, a Defense and Veterans Center for Integrative Pain Management has been funded to specifically foster collaboration between the Department of Defense and the VHA, including a focus on research.

*There are important empirical questions about the long-term effectiveness of acute pain management strategies in the battlefield*

As we noted in our description of acute pain care for U.K. soldiers, there are important empirical questions about the long-term effectiveness of acute pain management strategies in the battlefield, including potential differences in approaches employed by U.K. versus U.S. military physicians. For example, it is unclear what factors may account for observations of lower-than-expected rates of moderate to severe pain and of phantom limb pain among U.K. soldiers.<sup>9,10</sup> It is similarly unclear whether there are differences in the experience of acute or post-acute pain severity between U.K. versus U.S. soldiers and whether there are meaningful long-term differences in outcomes such as pain severity, social role functioning (e.g., return to work), and emotional well-being and overall quality of life as soldiers transition to veteran status. Factors such as subtle differences in the approach to analgesia in the battlefield, differences in the timing of transitions, and the focus of rehabilitation and recovery efforts, among other health-care-related factors, may prove important in accounting for differences in outcomes.

One potentially important study being conducted in the United States is designed to address the effectiveness of early and aggressive analgesia in improving long-term outcomes. The VHA, in partnership with the U.S. Army, has funded the Regional Anesthesia Military Battlefield Pain Outcomes Study that follows soldiers exposed to regional anesthesia and aggressive pain management in the battlefield through the process of recovery and rehabilitation. This controlled study promises to provide important answers regarding the benefits of early analgesia in reducing the development or severity of chronic pain.

*The current approach emphasizes early aggressive analgesia followed by activation of a highly orchestrated sequence of sophisticated, integrative, and coordinated systems of care*

It is also important to note that VHA funds an implementation science center focused on polytrauma and blast-related injury through its Quality Enhancement Research Initiative. This research center partners with other patient care program offices in the VA Central Office, including the Pain Management Program Office, to strengthen capacity for research related to polytrauma

and its comorbidities, including pain. Among its many projects, this initiative has funded research targeting system improvements in pain assessment in the Polytrauma System of Care and efforts to build research partnerships focusing on traumatic brain injury, post-traumatic stress disorder, and acute and chronic pain. These and similar partnerships will be important in our collective efforts to meet the acute pain care needs of the brave men and women of the military as we advance the field of pain management on behalf of all who experience acute pain throughout the world.

## Conclusions

Successful management of acute pain associated with trauma in the battlefield presents enormous medical and logistical challenges. This article describes the approach employed in the current theaters of war in Iraq and Afghanistan among armed forces from the United Kingdom, the United States, and their allies. The current approach emphasizes early aggressive analgesia followed by activation of a highly orchestrated sequence of sophisticated, integrative, and coordinated systems of care that provide for continuity of pain care as injured soldiers transition from the battlefield, through evacuation, to hospital care, to rehabilitation settings, and ultimately, to systems fostering recovery, reintegration, and long-term care, as necessary. Incorporated into these clinical care systems are opportunities to advance the field of pain management through efforts to promote theoretically and empirically informed innovation in care, systematic observation, and research. This approach promises to yield advances in pain management that will benefit those injured in current wars and both military service members and civilians worldwide in the future.

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## Disclaimer

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