Is intramuscular morphine satisfying frontline medical personnels' requirement for battlefield analgesia in Helmand Province, Afghanistan? A questionnaire study

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Abstract

Background: All deployed British Army personnel carry intramuscular (IM) morphine auto-injectors to treat battlefield casualties. No other nation supplies parenteral opiate analgesia on individual issue. Studies highlight this agent's inefficacy and safety issues, but are limited by a relative lack of inclusion of frontline personnel. We aimed to determine the opinions of frontline medical personnel on current battlefield analgesia.

Methods: We surveyed 88 British Army frontline medical personnel (medical officers (n = 12), nurses (n = 7), combat medical technicians (CMTs) (n = 67), paramedics (n = 1) and health-care assistants (n = 1)) upon completion of a six-month deployment (September 2011 to April 2012) to Helmand Province, Afghanistan, using Likert scale questions on the efficacy of battlefield analgesia, complications of IM morphine, safety of morphine auto-injectors and its suitability for treating child casualties.

Results: A total of 88/88 questionnaires were returned. Of these, 61/88 had treated casualties on the battlefield, 26/86 agreed that current battlefield analgesia is effective, 80/87 agreed that a more potent analgesic with a faster onset than IM morphine is desirable in the first hour following injury, 47/65 CMTs agreed that they can manage complications of current battlefield analgesia and 53/86 respondents correctly disagreed that current battlefield analgesia is suitable for child casualties. The potential for accidental self-injection was reported.

Conclusions: A more potent, faster onset analgesic than IM morphine is desirable in the first hour following injury. Pre-deployment training should emphasise management of complications of opiate analgesics and treatment of child casualties. Oral transmucosal fentanyl citrate is now being issued to all frontline medical personnel. IM morphine will remain on individual issue to all deployed soldiers for environments where an oral agent is not suitable, for example, chemical, biological, radiological and nuclear warfare.

Summary points

1. Frontline medical personnel agree that a more potent, faster onset analgesic than IM morphine is desirable in the first hour following injury.
2. The two most desirable features of the ideal analgesic were ranked as rapid onset of action, and when fully onset produces a high degree of pain relief.

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3. Oral transmucosal fentanyl citrate (OTFC) has now been issued to all frontline medical personnel as an adjunct to IM morphine.
4. IM morphine will remain on individual issue for situations where parenteral analgesia is required.
5. Consideration should be given to individual issue of OTFC to all deployed personnel in the future.
6. Pre-deployment training should emphasise management of complications of opiate analgesics and treatment of child casualties.

Keywords

Analgesia/pain control, military, pre-hospital care, trauma, remote and rural medicine

Introduction

The British armed forces are unique in supplying parenteral opiates to all deployed soldiers, comprising two 10 mg morphine auto-injectors designed for intramuscular (IM) administration to casualties.¹ Medical officers (MOs) are qualified doctors who carry additional analgesics including fentanyl and ketamine.¹ In the early stages of the current campaign in Afghanistan, casualties were transferred from the point of wounding (POW) to a medical treatment facility (MTF) or were reviewed by an MO prior to evacuation to a field hospital. Evolution of the aeromedical evacuation chain has enabled direct evacuation of casualties from the POW. Current casualties frequently bypass the MO during evacuation,² in which case analgesia may be administered by the casualty themselves, another soldier, by a combat medical technician (CMT), paramedic or nurse. IM morphine is therefore frequently the sole pharmacological analgesia available. In contrast to civilian pre-hospital care, where intravenous (IV) analgesia use is commonplace, the challenges of obtaining IV access in the austere battlefield environment cannot be underestimated.

Despite IM morphine being distributed to every deployed British soldier, a systematic review of 21 studies of pre-hospital analgesics in 6212 patients did not include any studies of this agent,³ and its use by the British military appears historical. The earliest documentation of its use first appeared during the Crimean War.⁴ There is a perceived placebo response to IM morphine when administered to battlefield casualties but no evidence exists to support this.

A survey of 25 MOs and six nurses, semi-structured interviews and visits to Afghanistan reported consistent inadequacies of IM morphine and identified institutional resistance within the British military to provide an effective alternative.⁵ Similar issues were raised by a survey of 122 UK and US military medical personnel, with just over half of respondents disagreeing that IM morphine is an ideal analgesic agent for a battlefield casualty with severe pain.⁶ However, only

12 respondents in this study were CMTs, with the remainder comprising mostly of secondary care clinicians whose experience of treating casualties in a forward battlefield environment was not recorded (JE Smith, personal communication, 2013), but is likely limited.

Developments in resuscitation techniques have led to unprecedented survival rates among battlefield casualties in recent campaigns⁷ and lessons learned have informed civilian trauma care.^{8,9} In contrast, the provision of battlefield analgesia at the POW has not changed over the past decade.

We aimed to determine the opinions of recently deployed British Army personnel with forward medical care experience on the importance of effective battlefield analgesia, the efficacy and shortcomings of current battlefield analgesia and desirable features of the ideal battlefield analgesic. Our secondary aims were to determine opinions on the practical usage, safety and complications of IM morphine administered by auto-injectors, and use in child casualties.

Methods

Frontline medical personnel were identified at the end of a 6-month tour of duty (Operation Herrick 15 – September 2011 to April 2012) to Helmand Province, Afghanistan. We asked personnel to complete a questionnaire to quantify their opinion on issues relating to their experience of battlefield analgesia during the preceding six months.

We collected data on respondents' career employment group (MO, CMT, nurse, paramedic or health-care assistant), whether they were regular or reserve forces, whether they had treated a casualty forward of an MTF, that is, on the battlefield, and for the non-MOs, whether they had treated a casualty within an MTF without an MO present.

Our questionnaire included Likert-scale¹⁰ questions to elicit respondents' opinions on the importance of

Table 1. Respondents' characteristics, N = 88.

Career employment group	N	Treated forward of a medical treatment facility, n (%)	Treated casualties in a medical treatment facility without a medical officer present, n (%)
Combat medical technician class 1	67	55 (82)	48 (72)
Medical officer	12	4 (33)	Not applicable
Nurse	7	1 (14)	2 (29)
Paramedic	1	0 (0)	1 (100)
Health-care assistant	1	1 (100)	0 (0)
Total	88	61 (69)	51 (67)

delivering effective analgesia, the efficacy and shortcomings of current battlefield analgesia, suitability of current analgesia for use in child casualties, the perceived risk of complications and ability of personnel to manage complications of IM morphine, and the ease and safety of operation of the morphine auto-injector. Respondents were asked to rank six features of their ideal analgesic in order of priority from one to six. We invited respondents to give free-text comments on current battlefield analgesia and two authors (T.N.B., L.M.G.) coded responses into themes.

We piloted the questionnaires on two CMTs and one MO. No significant amendments were made prior to distribution. We distributed 88 questionnaires that were returned to the study authors (T.N.B. or M.A.C.). No data were collected that could identify the respondents. Participation was voluntary.

The deployed local audit committee granted approval for this survey as a service evaluation project. The Ministry of Defence Research Ethics Committee Secretariat confirmed the questionnaire did not require committee consideration.

We collated results in Microsoft Excel and generated descriptive statistics. We attributed scores to the ranked features of an ideal analgesic (six points if ranked first, reducing to one point if ranked sixth). We calculated the total score of each feature and used this to rank from most important (highest score) to least important (lowest score). We excluded four questions from the analyses as wording was considered ambiguous (see supplementary data file: questionnaire).

Results

A total of 88 questionnaires were returned (see supplementary data file: results table) and included in the final analysis. Of these, 11 questionnaires were returned partially completed, but no single question had more than three non-respondents. One respondent was an Army Reservist. See Table 1 for respondent characteristics.

The importance of effective battlefield analgesia

The majority (95%, 81/85) agreed or strongly agreed that the ability to deliver adequate pain relief was important.

Perceived efficacy and shortcomings of current battlefield analgesia and the ideal battlefield analgesic

A total of 30% (26/86) agreed or strongly agreed that current battlefield analgesia is effective. Of the remaining respondents, 47% (40/86) disagreed or strongly disagreed, and 23% (20/86) neither agreed nor disagreed with this statement.

Of 86 respondents, 61% (52/86) disagreed or strongly disagreed that current battlefield analgesia is strong enough for battlefield casualties and 64% (55/86) disagreed or strongly disagreed that current battlefield analgesia has a fast enough onset for battlefield conditions. The majority (92%, 80/87) agreed or strongly agreed that an analgesic that is more potent and has a more rapid onset than morphine is desirable in the first hour following injury. Rapid onset of action and when fully onset produces a high degree of pain relief were ranked as the two most important features of an ideal analgesic.

When asked if current battlefield analgesia lasts long enough, 39% (33/85) agreed or strongly agreed, 31% (26/85) of respondents neither agreed nor disagreed and 31% (26/85) disagreed or strongly disagreed with this statement.

Of CMTs who had treated casualties forward of an MTF, only 33% (18/54) agreed or strongly agreed that the quality of battlefield analgesia that they can provide with current methods (IM morphine via auto-injector) is sufficient. The majority (96%, 52/54) agreed or strongly agreed that having additional methods of analgesia available would increase the quality of the medical care they could provide.

When asked if morphine given by IM injection has optimum analgesic properties to manage severe pain

before the patient reaches a military medical facility, 44% (38/87) either agreed or strongly agreed, and 44% (38/87) of respondents either disagreed or strongly disagreed with this statement. Of respondents who had treated casualties on the battlefield forward of a MTF, 48% (29/61) agreed or strongly agreed, and 41% (25/61) disagreed or strongly disagreed with this statement.

Suitability of current analgesia for use in child casualties

When asked whether current battlefield analgesia is suitable for use in children, 62% (53/86) disagreed or strongly disagreed. When asked whether current methods of battlefield analgesia provide effective analgesia for a child, 56% (48/86) disagreed or strongly disagreed with this statement.

Ease and safety of operation of the morphine auto-injector

When asked whether the morphine auto-injector is simple for different groups to use, 76% (65/86) of respondents agreed or strongly agreed that it is simple for a casualty to self-administer, 74% (65/88) agreed or strongly agreed that it is simple for a soldier who has undergone basic casualty drills training (BCDT) to operate and 94% (83/88) agreed or strongly agreed that it is simple for a team medic to operate.

Of respondents who had treated casualties forward of a MTF, 66% (40/61) of respondents agreed or strongly agreed that the morphine auto-injector function is reliable and 82% (50/61) agreed or strongly agreed that it is possible to accidentally inject oneself with a morphine auto-injector.

When asked to rank six features of an ideal analgesic in order of importance, simplicity of use and reliability of use were ranked third and fourth, respectively, by the 85 respondents who answered this question. Delivery without requiring injection was ranked fifth, and rapid offset of action was ranked sixth.

Perceived risk of complications and the ability of personnel to manage complications of IM morphine

When asked whether current methods of battlefield analgesia have a low risk of complications, 61% (52/85) agreed or strongly agreed, and 67% (58/86) agreed or strongly agreed that the side effects of morphine auto-injectors are acceptable.

Of CMTs, 95% (62/65) agreed or strongly agreed that they could recognise potential complications of current methods of battlefield analgesia, and only 72%

(47/65) agreed or strongly agreed that they can manage potential complications of current methods of battlefield analgesia. Two CMTs did not answer these two questions (one of whom had treated casualties forward of a MTF, and the other had treated casualties within an MTF without an MO present).

A total of 31 respondents wrote free-text comments on the topic of battlefield analgesia, 17 comments related to one theme, 13 comments related to two themes and 1 comment related to three themes (see supplementary data file: free-text responses).

Discussion

Of 88 British Army frontline medical personnel surveyed at the end of a 6-month tour of duty in Helmand Province, Afghanistan, only 30% agreed that current battlefield analgesia is effective. Almost two-thirds of respondents disagreed that current battlefield analgesia is strong enough or has a fast enough onset, and the vast majority of respondents agreed that an analgesic that is more potent and has a faster onset than IM morphine is desirable in the first hour following injury.

Responses were split on whether current battlefield analgesia lasts long enough, as 39% agreed and 31% disagreed with this statement. Based on 28 UK casualties during Operation Herrick 15, we calculated the mean time from POW to arrival at the field hospital as 44 minutes (standard deviation (SD) ± 14), whereas IM morphine has a time to onset of 5–20 minutes and time to peak analgesic effect of 60 minutes.¹¹ Due to the speed of evacuation, it is likely that respondents did not observe casualties for an adequate time period to accurately assess if IM morphine lasts long enough.

Treatment of relatively few casualties and the varying severity of injuries may contribute to respondents' differences in opinion as to whether IM morphine has optimum analgesic properties to manage severe pain before the casualty reaches a military MTF (48% agreed and 41% of those who had treated forward disagreed with this statement). British casualty numbers in Afghanistan have been in decline since 2010.¹² In our study, 55/67 (82%) of CMTs and 4/12 (33%) of MOs had treated casualties on the battlefield. Casualties with injuries resulting in hypovolaemic shock are unlikely to benefit from the same analgesic effect of IM morphine compared to a haemodynamically stable patient, as the absorption and therefore efficacy of IM morphine is impaired in hypotensive states.¹¹

Over a third of our respondents were unsure of or thought IM morphine was suitable for paediatric casualties. One-quarter of CMTs did not agree that they could manage the complications of IM morphine. During extensive pre-deployment training, frontline

medical personnel are taught that the only pharmacological analgesic suitable for paediatric casualties is 0.1–0.2 mg/kg IV morphine titrated to pain. CMTs are trained to provide supportive measures for managing opiate overdose. Our results may reflect the low incidence of use of IM morphine due to relatively low casualty numbers per frontline medic, the even lower incidence of complications of IM morphine and of paediatric casualties, who account for 7–15% of the workload at the Camp Bastion field hospital,^{13,14} and skill fade that occurs during deployment.

Most frontline medical personnel work in geographically isolated locations with clinical supervision provided remotely in a hub and spoke model.² This laydown of personnel limits opportunities for face-to-face refresher training during deployment and delivering training via radio communication is difficult. Emphasising training on treatment of paediatric casualties and managing the complications of analgesia during basic medical training, providing opportunities to gain practical experience during peacetime, and incorporating a formal programme of continuation training may help consolidate knowledge.

Despite extensive practical pre-deployment training, over three-quarters of our respondents agreed it was possible to accidentally inject oneself with an IM morphine auto-injector. The auto-injector is a pen-shaped spring-driven needle device.¹¹ The red safety cap must be removed in order to activate the device, then the opposite end applied to the casualty. The pressure of application deploys the needle and administers morphine into the casualty. Our respondents and a previous survey report incidents of personnel accidentally injecting themselves in the thumb while attempting to administer the morphine auto-injector which may be due to its non-conventional colour coding.⁵ A proposed change to the colour coding has not been supported by the manufacturers. Provision of a label on the device casing illustrating 'thumb this end', and 'leg this end' has been suggested as an alternative.⁵ Provision of analgesia that does not require injection would eliminate this safety issue.

Oral transmucosal fentanyl citrate (OTFC) has been shown to provide rapid onset, effective and safe analgesia for battlefield casualties,¹⁵ and is now being issued to frontline medical personnel as an adjunct to IM morphine (D Aldington and Joint Medical Command, personal communication, 2014).

Comparison with other studies

We found that 92% of respondents agreed or strongly agreed that an analgesic that is more potent with a more rapid onset of action than morphine is desirable in the first hour, compared to 70% in a cohort of 122

both frontline, but mostly, hospital-based British and US medical personnel.⁶ In contrast, we surveyed the opinions of medical personnel with recent deployed experience, most of whom had provided frontline care to casualties at, or close to the POW, and are therefore better placed to make a judgement on the requirements of analgesia within this timeframe.

There are inherent difficulties with the assessment of the effectiveness of analgesia delivered within the battlefield environment and published data on patients' experiences are limited. Recent studies which attempted to estimate pain levels among battlefield casualties were conducted weeks to months after injury and may be influenced by recall bias and small sample size with nine of nine patients reporting that their pre-hospital analgesia was ineffective,¹⁶ and only 48%¹⁷ of 65 patients reporting that their initial analgesia helped to relieve their pain (D Aldington, personal communication, 2013). These studies report that patients were in pain, and that the initial analgesics did not help with this pain. These limited data suggest that initial analgesia did not effectively manage patients' pain close to the POW, an opinion shared by 70% of our respondents and previously voiced by military clinicians,⁶ indicating that the provision of an alternative option to IM morphine should be considered. The introduction of OTFC as an adjunct will help address this issue. We acknowledge the limitations of surveying care providers on their assessment of the effectiveness of analgesia interventions. While the provider may feel there is a deficiency with the analgesia, this does not directly correspond with the effectiveness of the intervention. Given the difficulties of accurately gathering data on pain scores and the effect of analgesia in the battlefield environment, due to the time pressures, limited resources and the multiple echelons of care that casualties pass through, provider opinion may provide a pragmatic substitute.

Limitations

The main limitation of our study is that we did not specifically ask respondents whether they had administered IM morphine to battlefield casualties. It can be reasonably expected that respondents who treated casualties on the battlefield ($n = 61$, 69%) have had first-hand experience of assessing pain levels at and very close to the POW and to have an appreciation of the effects of IM morphine delivered in this setting.

Our use of the term 'current battlefield analgesia' rather than specifically 'IM morphine' in questions relating to efficacy, complications and use in child casualties may have caused some ambiguity. MOs ($n = 12$, 14% of respondents) have access to opiates and

ketamine for IV/intraosseous (IO) administration in addition to IM morphine, while the non-MO cohort (86% of respondents) only had access to IM morphine. It was our anecdotal experience that analgesics other than IM morphine were not used by the MOs due to the impracticalities of gaining IV/IO access and drug delivery in the battlefield environment, and therefore, it is likely that respondents were referring to IM morphine when answering these questions.

The total number of medical personnel working in the frontline environment during the study period is not known; therefore, the proportion of those who were included in our study cannot be accurately established. We invited all frontline medical personnel who were attached to the combat units to respond, but we were not able to access medical personnel embedded within these units.

Implications for clinical practice

Our results support existing evidence for the introduction of an adjunct to IM morphine.^{3,5,6,18,19}

In our study, a higher proportion of CMTs had treated casualties on the battlefield compared to MOs. This is likely to be due to the hub-and-spoke distribution of medical staff, with CMTs providing forward medical capability and MOs providing centralised clinical support.² The provision of OTFC to frontline medical personnel will go some way to delivering effective analgesia to battlefield casualties. Consideration should be given to the wider issue of OTFC to all deployed service personnel to ensure maximal coverage and reduce the occurrence of analgesic failure. Parenteral delivery remains an important requirement for situations when the oral route is unsuitable, for example, chemical, biological, radiological and nuclear environments. IM morphine therefore continues to be issued to all deployed service personnel (D Aldington, personal communication, 2013). Further assessment of alternative analgesics and routes of administration is required.

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