CONCEPTS

Time to Reconsider Analgesia in Mass Casualty Incidents

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The provision of analgesia in mass casualty incidents has traditionally been viewed as low-priority and reserved for later stages of care. Poor pain management is commonplace in trauma victims, and inadequate acute pain management can hinder evacuation efforts and may lead to the development of chronic pain and posttraumatic stress disorder. New, safe, and simple methods for administering quality analgesia have proven to be safe and effective in the prehospital setting and, as such, could easily be implemented into mass casualty incident protocols and allow for analgesia at earlier stages in such incidents, thereby improving patient care.

Keywords: fentanyl lozenge, methoxyflurane, Major Incident Medical Management and Support, prehospital emergency care, sublingual sufentanil, trauma

Introduction

The act of providing analgesia is often overlooked when planning and managing a mass casualty incident (MCI). In the most recent version of the Major Incident Medical Management and Support manual, analgesia is referred to only 7 times (out of 216 pages), and no details are given concerning the modalities of pain control in the mass casualty setting.1 In the early stages of such events, the limited resources of emergency services and the great number of casualties mean that the scope of action of emergency personnel is usually limited to triage and providing essential life-saving interventions. Until now, analgesia has been deemed low-priority and reserved for later stages of management when resources become more abundant. New, easy, and safe ways of providing quality analgesia have shown promising results and may bridge the gap in allowing analgesia to be provided earlier in MCIs without needlessly consuming time or personnel, all the while increasing the quality of care to patients.

The Major Incident Medical Management and Support principles define a major incident as an “incident where the location, number, severity or type of live casualties requires extraordinary resources.”1 Recent events, such as the 2015 Paris attacks or the 2017 Manchester Arena bombing, have reminded us that planning and training for these situations are of paramount importance.2 When attending and managing these types of events, the main goal has always been to do the most for the greatest number, which means identifying critical yet salvageable patients through triage and delivering life-saving interventions.3 However, there has also been some criticism of the way we anticipate and prepare for these events. Current guidelines suggest implementing a robust command-and-control structure in major incidents, while some authors suggest that the way forward is by “supporting and facilitating” autonomous frontline teams.4 Another suggestion for change in current practice has been that patients with minor injuries and expectant patients should also benefit from a portion of initially available care without having to wait until all critical cases have been managed and evacuated.5

There is, to our knowledge, no existing literature on the experience, satisfaction, and/or expectations of major incident survivors concerning analgesia on the incident site. However, there is lots of evidence to suggest that poor pain
management is commonplace in trauma victims, even in resource-rich prehospital settings with a high provider-to-patient ratio. Furthermore, certain population groups are particularly affected by oligoanalgesia in trauma (women, patients of color, elderly patients). Poor management of acute pain may lead to the development of chronic pain and posttraumatic stress disorder. By contrast, early and effective analgesia, apart from its humanitarian value, can help with reducing anxiety and assist with evacuation and splinting. Victims have testified about agonizing pain during evacuation and transport in mass casualty situations, and advances should be made to prevent these situations from happening.

The military prehospital environment is a low-resource, high-acuity setting that could, to a certain extent and in certain situations, resemble a mass casualty setting. To allow for effective analgesia in the field, the military has turned away from traditional ways to deliver analgesia, such as intravenous (IV) morphine, which requires cannulation and titration, and moved toward use of other means of analgesia, such as fentanyl lozenges. More recently, some civilian Helicopter Emergency Medical Service providers have also added these to their inventory, with positive results and an excellent safety profile.

The ideal analgesic administered in MCIs should have the following characteristics: easily administered, rapid onset, wide therapeutic index, minimal mental status alteration, and ideally not require the need for surveillance or monitoring. In this review, we do not discuss IV analgesia because cannula placement and titration of analgesics are excessively time-consuming in the early phases of an MCI. Furthermore, oral first-line analgesics, such as paracetamol and nonsteroidal anti-inflammatory drugs, will not be discussed either because, while their administration is simple and their safety profile excellent, onset of their effect is slow (usually >30 min) and their efficacy for traumatic moderate-to-severe pain is insufficient. The intramuscular (IM) route allows for easy and rapid administration of analgesics in patients without the need for an IV line. However, in patients with shock, the bioavailability of drugs administered through this route may be reduced. Morphine and ketamine are widely considered the gold standard in the treatment of moderate to severe pain in the prehospital setting. However, we will demonstrate they are not the best suited for analgesia in early MCI phases.

**Morphine**

Morphine has existed since 1805, when it was isolated from opium by Friedrich Serturner. It remains one of the most widely used analgesics for moderate-to-severe pain and represents a standard against which most potent analgesics are compared in research. It can be administered orally, subcutaneously, and via the IM and IV routes. Morphine has a slow central nervous system penetration, which results in delayed analgesic onset. The risk of respiratory depression remains a concern with the use of opiates, and morphine’s slow onset of action means that this complication may occur in a delayed fashion. For all these reasons, while morphine is extremely useful and effective when providing analgesia to one or a few patients at a time, including in the prehospital setting, it is an unsuitable candidate for mass casualty analgesia. Many other opioids have been developed or isolated, such as oxycodone, hydromorphone, hydrocodone, and codeine. They can be easily orally administered but suffer from similar limitations as morphine and, as such, are unsuitable for analgesia in MCIs.

**Ketamine**

Ketamine has long been, and remains, a drug of choice for prehospital analgesia in the setting of trauma and is widely and effectively used in austere settings. While it is usually administered intravenously, it can be administered by IM or intranasal (IN) routes. The IN route is unpredictable, and the IM route is equally not ideal for reasons previously stated. The unpredictability of the IN and IM routes is acceptable when caring for one patient at a time, as the provider can adapt treatment following clinical response, but is unsuitable for MCI, where the surveillance of individual patients is limited. Ketamine is also appreciated for its lack of effect on respiratory drive, even though its dissociative effect at higher doses makes it a suboptimal choice in MCIs as it may impede evacuation efforts and influence triage scores.

**Fentanyl**

Fentanyl is a synthetic opioid 50 to 100 times more potent than morphine. It has long been used in prehospital emergency medicine and is conveniently used IN in adults and children, including in austere settings. Oral transmucosal fentanyl citrate (OTFC), in the form of lozenges, has seen extensive use in the military setting. In a 2012 review of use on the battlefield, 286 patients received OTFC, and only 1 patient presented with hypoventilation and saturation of less than 90%, requiring low-dose naloxone, and this patient had received high-dose OTFS (3200 micrograms) in addition to 20 mg of IV morphine. Use in the civilian setting is beginning to become widespread, and a recent review of its use in 177 patients by emergency medical service providers in 3 bike and ski resorts in Switzerland showed good efficacy and no major
adverse effects. Reported doses of OTFC in civilian prehospital use range from 400 to 800 micrograms.

**Sufentanil**

Recently, sufentanil has been made available in the form of sublingual tablets and is approved in Europe for postoperative pain. It has a high bioavailability with the lack of a first-pass effect, lack of active metabolites, and high lipid solubility. This allows rapid drug equilibration between peripheral and central compartments, resulting in rapid onset of analgesia. Its large therapeutic index, in addition to previously cited characteristics, makes it an interesting candidate for prehospital analgesia. For the moment, no studies have evaluated its use in prehospital analgesia, but with further experience, sublingual sufentanil might become a useful drug for prehospital analgesia in the mass casualty setting. The optimal dose for use in this setting is to be determined.

**Methoxyflurane**

Methoxyflurane is a fluorinated hydrocarbon anesthetic. It is marketed as a single-use inhaler. Having been used in Australia for almost 50 y, methoxyflurane was only recently approved in Europe for use in traumatic pain in adults. Use in children is currently being investigated. One inhaler allows for 25 to 30 min of analgesia with continuous use or almost up to an hour with intermittent use. Analgesia is obtained rapidly (4–5 min); however, methoxyflurane was found to be less effective than IN fentanyl and IV morphine.

**Dose**

The question of the dose must be determined in advance when planning for the use of single-dose transmucosal or sublingual analgesics in the mass casualty setting. A larger dose potentially means more complications, such as respiratory depression, and lower doses might result in suboptimal pain control. There cannot be a one-size-fits-all approach. One possibility would be color-coding devices and providing different doses, such as one dose for children, one for small adults/teenagers/elders, and another for large adults. To reduce complexity, a single, low-range dose could be provided, and 2 of those could be given to larger teenagers or adults.

**Other Factors**

Different factors may impact the implementation and use of transmucosal or inhalational analgesics for MCIs. The first factor is availability. Methoxyflurane is currently unavailable in North America, although efforts are being made to obtain US Food and Drug Administration approval. The second factor is price, as these formulations are far more expensive than their IV counterparts. For example, a single fentanyl 200-microgram transmucosal lozenge costs 17 USD, while a 50-microgram vial costs 50 cents. In the UK, a single methoxyflurane inhaler costs almost 18 GBP. If these products are only acquired with the purpose of being used in rarely occurring MCIs, expiration dates and wastage are also important elements to consider. The last factor is size, as inhalers are much more cumbersome than transmucosal lozenges or sublingual tablets.

**Conclusion**

While life-saving interventions must be prioritized over analgesia, it is time we rethink the way we provide early, high-quality, safe analgesia to mass casualty victims. Providing analgesia in the early stages of an MCI cannot be simply thought of as upscaling usual prehospital analgesia. As such, traditional ways of providing analgesia with IV morphine and ketamine might be inadequate in these situations. Other ways of delivering analgesics, such as transmucosal fentanyl lozenges or inhaled methoxyflurane, might bridge the gap by allowing patients to benefit from early pain control. More recently, the release of sublingual sufentanil is an exciting development in available options for analgesia in the prehospital setting. Mass casualty events are highly traumatizing to victims, and any way we can find to alleviate the suffering of injured victims as early as possible must be a priority and planned for accordingly.

Author Contributions: writing of the first draft (TdV); management of corrections after submission to the journal (TdV); critical revision of the manuscript (LS); final approval of the current version for publishing (TdV, LS).

Financial/Material Support: None.

Disclosures: None.

**References**


