

Prehospital Pain Management: Balancing Efficacy and Safety

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Abstract

Pain in the emergency setting is common, and its management prior to patients' arrival at the hospital is an important part of emergency medical services. Due to the complex integrated experience of suffering, pain should be addressed promptly and appropriately to increase the chances of positive outcomes for the patient as well as prevent the growing possibility of chronic pain. Being implemented today, these approaches are pharmacological and non-pharmacological, with an aim at reducing risks that might be faced by a patient and yet preserve benefits. However, there are still barriers like those we see in oligoanalgesia, resource constraints, and the lack of consistency in protocol compliance to impede ideal pain management in prehospital contexts. Avant-garde technologies, including tele-health and real-time patient monitoring,

present viable solutions on the way forward to address the problems. In this review, the gaps in pain assessment, failure to follow the guidelines set, and Multidisciplinary Team approaches are addressed with regard to minimizing the adverse effects of the pain. Further study should emphasize the approach that will help to overcome these operational hurdles and enhance the equity and quality of prehospital analgesia across the world.

Keywords: Pre-hospital, Pain, Emergency, Preoperative, Postoperative, Oligoanalgesia, Acute, Chronic, Pain control.

Pain is “an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage” whose measurement and appropriate and timely treatment is a measure of quality in the emergency care (Raja et al., 2020) Pain is one of

the leading signs in patients presenting to emergency department, and its prevalence in pre-hospital emergency medicine ranges between 20 – 53% and may as high as 70% based on some studies.

*** Pathophysiology of pain**

Gowans confirms that although the sensation of acute pain is inherently unpleasant, it serves a specific purpose: telling the organism how severe actual or possible tissue injury there is to a known kind of injury or disease (Grichnik et al., 1991). Even more specifically, acute pain is normally characterized as being of relatively brief duration. It occurs due to inflammation of the free nerve endings by tissue injury or by disease. These action potentials can be through mechanical, thermal or chemical mediators which include bradykinin, substance P, histamine and prostaglandins that occasion the site of injury. These action potentials move through the afferent nerve fibers to the dorsal horn of the spinal cord where aforementioned compounds are released to allow the signals to enter the spinothalamic system to ascend to the thalamus and midbrain. Then, by way of the thalamus, pain signals transmitted to other brain region, where the pains are felt, namely the cortex, limbic system, the frontal and parietal lobes.

First, pain is a highly subjective sensation that depends on a patient's mood, and stress and anxiety and apprehension had more impact on pain sensation (Geva et al., 2014).

*** Importance of effective pain management**

It is from the human perspective because one is able to manage a patient's acute pain when admitted hence reducing suffering. Enhancing the comfort of patients is actually another goal on its own. Another, indeed more practical, reason why adequate pain relief MATTERS is that inadequately treated acute pain leads to some decidedly negative outcomes such as chronic pain, increased length of stay, afflictive sleep, immobility and a decreased quality of life. Other delayed or ineffective analgesia outcomes contains immune suppression, increased numbers of emergency department re-admission, PTSD, hypertension, tachycardia, elevated myocardial oxygen demand workload, hyperglycemia, insulin resistance, changes in the metabolism of fat and protein, and coagulopathy. Following the initial injury, acute pain management can assist in reducing maladaptive changes in the sensitivity to typical peripheral acute pain. Acute pain failure is not unusual and can occur in varied proportions

depending on the type of trauma; it can range from 11% in patients with uncomplicated distal radius fractures to 96% in individuals with spinal cord injuries. Therefore, preventing the transition from acute to chronic pain is crucial. Where indicated by the mechanism of pain or other considerations, multiple therapy agents (opioids and non- opioids) given at different time points with different routes and methods of delivery should be used in the management of acute pain in an attempt to minimize the chances of developing chronic pain (McGreevy et al., 2011).

In addition to preventing chronic pain, it has been shown that effective pain management in the ED improves both immediate and long-term outcomes, including function, sleep, quality of life, and the avoidance of chronic pain. (Chelly et al, 2001) The length of stay in the emergency department is negatively impacted by any delays in the use of analgesics. The length of the analgesic interval was linked to the length of the patient's stay in the emergency department in a Canadian post-hoc analysis of real-time data. When analgesia is administered within 90 minutes as opposed to after 290 minutes, it can indicate a median reduction in length of stay of 1.6

hours, whether the patient was discharged from the ED or admitted to hospital ($p < 0.001$ for patients discharged; $p < 0.05$ for patients admitted in ED).

Anxiety, heart problems, and the worsening of general conditions (such as tachycardia, blood hypertension or hypotension, hypoventilation in abdominal pain, and delirium), as well as longer hospital stays with a higher risk of infection and chronic complications like post-traumatic syndrome and a lower quality of life, are all linked to inadequate assessment and treatment of acute pain. (Imbriaco et al, 2020) Effective pain management not only reduces potential risks but also makes the patient's transportation in emergency vehicles more bearable (Imbriaco et al., 2020). A common occurrence in prehospital emergency settings is ligoanalgesia, which is defined as either an insufficient dosage of analgesics (unachieved analgesia), a postponed analgesic treatment, or a total lack of analgesia (unrelieved pain). (Imbriaco et al, 2020) According to estimates, between one-third and almost half of all prehospital emergency care cases do not include a pain evaluation, and even when pain is noted, it is undertreated in roughly 43% of adult patients and 85% of paediatric

patients (Idrissi and Hachimi, 2020). However, for a number of reasons, pain treatment in this context is frequently insufficient: less frequent evaluation of pain, medical practitioners' reluctance to prescribe or administer opioids (opiophobia), lack of compliance to use of pain management protocols, prejudice and cultures, concern of exaggerated sedation diminishes adequate clinical evaluation (Hachimi-Idrissi., 2020).

Other managerial-organizational factors include the lack of planned quality management programs for acute pain management, the limited number of staff and opioids needed in pre-hospital emergency situations, and the decreased exposure of health personnel to education and training (Idrissi and Hachimi, 2020). According to the most recent guidelines, all patients experiencing pain must receive proper and effective pain management, beginning with prehospital emergency treatment. The major goals are to minimize negative consequences, maintain functionality, and reduce discomfort (Idrissi and Hachimi, 2020). It is advised to employ standardized procedures; in an emergency situation, each protocol ought to comprise: assessment of the patient's

condition following the administration of analgesics, effective pharmacological and non-pharmacological interventions for pain management with indications and contraindications, general evaluation of the presence and intensity of pain using standard scales and checks, and information sharing with other hospital staff (Hachimi-Idrissi., 2020). Additionally, individuals have stated that if their pain persists, they should be re-dosed. A few prerequisites for getting anesthesia rely on Many nations only allow doctors to administer pharmaceutical therapies, especially opioids; as a result, a number of preventative methods have been created to prevent oligoanalgesia. The exact procedures for treating pain and teleconsulting with a physician are included in oligoanalgesia. The latter allow highly specialised nursing services to be provided on state-of-the-art prehospital vehicles in place of a doctor following specific training. Nevertheless, the literature indicates that these strategies are not available. Specifically, a cross-sectional study that was carried out in 74 emergency-urgency service centers across 107 Italian provinces in 2021 found that less than half of the Italian provinces had nurse-provided analgesia

protocols. These findings indirectly suggest that prehospital pain may be undertreated (Lourens et al.,2019).

Prehospital care, which focusses on treating patients before they arrive at a hospital or other healthcare institution, was classified by Basson N et al. as part of emergency medicine (Patiño et al., 2022). Millions of people worldwide visit the emergency room after getting hurt or becoming unwell, and according to the WHO, the low- and middle-income groups are the most affected. Nonetheless, it is now well acknowledged that prehospital care is an essential and fundamental part of emergency care, which is still deficient in many nations and areas. Pre-hospital emergency medical care is unavailable in some places, and the care that is provided in et al might not be up to par. The American College of Emergency Physicians' (ACEP) International Ambassador Country Reports recently provided insight into the disparities in access to emergency medical services across the globe, highlighting issues such as disparities in utilisation, inadequate infrastructure development and resources, financial and geographic obstacles, and a general lack of cross-border collaboration (Patiño and et al, 2022). However, there is effort being made globally to eliminate inequities

and increase prehospital care. The WHO is currently working to improve EMS personnel's training and access to professional literature, as well as to improve emergency medical services' readiness in areas that don't receive enough attention. The prehospital phase is thus the initial time that a patient interacts with the health care system and usually has a great impact in minimizing mortality and morbidity associating with acute diseases and trauma. Research in prehospital clinical patients play a critical role as it aims at ensuring that patient's care that is provided in prehospital care is efficient and relevant. This kind of care is mainly conducted by EMS personnel with ability to offer number of treatments and intercessions for the purpose of stabilizing the patients and getting them ready for transport to the hospital (Debenham et al.,2017).

Prehospital care is critical in the process of enhancing the course of a patient's recovery as much as possible due to the fact that the initial response to illness may make a huge difference for patients. For that reason, evidence-based guidelines and protocols are necessary for enhancing the care given in prehospital setting and minimizing the risk for adverse events and

enhancing patient results (Martin-Gill et al., 2023). Despite the promising development trend that has been accelerated over the past decade, prehospital care has risen in complexity through the significant improvement in the use of technology and the availability of medical care. “The application of technology has consequently assumed a critical role especially in prehospital care in order to facilitate improvement of patient results.” The increase of demand of healthcare delivery services and products is largely due to an enhancement of the technologies like telemedicine, mobile health that not only covers mobile phone, tablet, but also includes the health smart watch. These innovations are highly important when facilitating the interaction between pre-knowledge of care givers and specialized personnel (Jobé et al., 2023). EMS personnel can now send real time patient data like patient temperature, pulse rate and ECG to the hospitals or other healthcare facilities through modern mobile technology. This makes hospital preparedness easier in the sense that the staff are able to know the possible needs of the patient, and what resources and personnel the hospital is likely to need, all before the patient arrives. On the same note, developed nations

have adopted additional measures that have enhanced precise scenarios and erratic abilities allowing EMS personnel offer life-enhancing treatments that have hitherto required a hospital base (Plummer et al., 2017). For example, paramedics are permitted to give intravenous medicine, use an advanced airway; emergency sonography in special conditions, use the complex equipment for central line access, analyse cardiac enzyme or electrolyte in the scene, and needle thoracostomy for tension pneumothorax (Rathore et al., 2022). These developments in the technology and in the practice of medicine keep on enhancing the operations of EMS; hence the enhanced patient care.

Over the last few years, increasing attention has been paid to the clinical research in out of hospital setting. There is a need to undertake more clinical research in pre-hospital care since these health care workers need to obtain measures on how they should treat patients in this challenging environment (Thygeson et al., 2023). Actually, and although some advances have been made in this area there is still much that remains unknown regarding the optimal ways of delivering prehospital care. In fact, the fundamental issues experienced in

clinical research in prehospital care include resource and infrastructure, ethical and regulation aspects, time limitation, safety issues, data acquisition, and selection of patient and controls (Cimino et al., 2021). Unfortunately, many prehospital care givers are employed in hostile environment, with limited access to resources, and many a time worked under time constraints. This can sometime be a challenge to conduct quality research in this area of science due to the following reasons. Yet another limitation on the conduct of clinical research in prehospital care is the dearth of adequate time to properly attend to the patient, irrespective of the need to conduct research. The prehospital care people always have to put the patient first and this can at times be in direct contradiction to what a researcher needs. However, prehospital care research has faced a number of hurdles, though there have been a number of significant milestones in the growth of clinical pre-hospital research throughout the world. For example, RCT has been used to determine the effectiveness of a number of prehospital care interventions, including advanced airway management, analgesia, and mechanical chest compressions in cases of cardiac arrest (El-Menyar et

al., 2018). Additionally, evaluations of the usefulness of the prehospital care protocols and recommendations now in use as well as assessments of the risks associated with unfavourable outcomes have been carried out through observational research in the prehospital context. Additionally, observational research has been helpful in identifying gaps in the best practices for prehospital care and generating research questions for the next investigation. (Martín-Rodríguez et al., 2020).

*** Principles of acute pain management**

Pain control is usually perceived to be the right of patients, and a key aspect of medical practice and professionalism. Any potential causes of acute pain should always be addressed priorly (if possible). The principles of acute pain management include ensuring treatment gives the least possible side effects while insisting on effectiveness with the patient's functions being upheld (Schöpke et al., 2011). The second purpose concerns the avoidance of pain becoming chronic. Both of these aims are likely to be achieved with greater success if pain is well measured and understood. Assessment of pain therefore through clinician validation of a patient's pain is invaluable for effective analgesic

planning. The present study has demonstrated that assessment and proper evaluation of pain leads to better treatment in the pre-hospital setting. Exercises to conduct the assessment must be tailored to the client; while choosing the pain assessing instrument; developmental, cognitive/ emotional/communication and cultural issues should be considered (Siriwardena et al.,2010) Hence, self-reporting should be used as often as nearly possible given that the measurement of pain is subjective in nature. However, where this is not possible, for example when the patients are unable to speak due to his condition, this cannot be regarded as if the patient is not feeling the pain, and does not deserve a good pain-relieving prescription.

Pain should be done as early as can be possible and strictly recommended that it has to be within a particular time frame. One need assesses 'reasonable' by the degree of pain, however, the time elapsed from the initial assessment to the time of delivering pain relief is further 20-25 minutes, if necessary, in terms of pain reassessment, this should be done based on the frequency of the degree of pain; the higher the degree the more frequently one tries to assess pain. Extra precaution needs to be taken while handling and treating the

pediatric as well as geriatric patients (Thomas et al., 2013). Researchers noted that both populations are usually treated for oligoanalgesia due to difficulties involved in attempting to measure pain (in infants as well as patients with dementia). Also well-known is the inability to put intravenous (IV) in pediatric patients considerably limits use and there are concerns about AEs in the elderly. As with pain management in any patient, the personnel involved in care with these groups must work effectively in interdisciplinary collaboration and communication in order to provide safe and effective acute pain management. Regardless of whether the clinician is prescribing a medication, asking questions about the pain, or explaining an aggressive pain management protocol, the patient must always know that the clinician is listening to and believes them. Alleviation of pain is important in handling patients because severe pain may complicate important functions necessary in clinical management such as taking a history or conducting a physical examination. Relief from pain also comes with its own medical advantages for example dealing with tachycardia associated with a complaint of pain in a cardiac patient (Thomas et al., 2013).

Using 1297 patients with out of hospital cardiac arrest due to heart disease and with a witness and attended by EMTs and paramedics Cummins et al 1985 found that early CPR increased survival (Cummins et al.,1985). This study further supports Keel et al.'s findings that hypotensive trauma patients require aggressive fluid resuscitation because prehospital intravenous fluid replacement therapy increased survival among such trauma patients, as observed by (Bickell et al., 1994). Sampalis et al. 1999 have proven that the elements of a well-managed trauma system are tertiary trauma centers and short pre-hospital times (Sampalis et al.,1999). Gausche et al. 2000 demonstrated that in children, out-of-hospital endotracheal intubation had the same, or worse, results in terms of survival or neurological prognosis than B–MV, Thus, airway management in children is a complex procedure (Gausche et al.,2000). For severe TBI, Davis et al., 2005 showed that prehospital oxygen supplementation did not reduce mortality but was a shift from the former practice of prehospital management of these patients. Richard et al. provided a better understanding of the management and prognosis of pediatric patients requiring EMS transportation in a

system of prehospital care in Canada. By means of the prospective cohort study, the research contributes to the understanding of the profiles, practices and results of emergency children's patients-care (Richard et al.,2006) Ortolani et al. also showed that prehospital triage of patients with acute STEMI complicated by cardiogenic shock, who might benefit from primary PCI. The findings show that patients who underwent prehospital triage had a lower mortality rate than patients who did not receive prehospital triage. In addition, the present research show that prehospital triage was related to increased probability of obtaining more appropriate revascularization (Ortolani et al.,2007). Kragh et al. 2009 carried out a study to determine appropriateness of tourniquets in traumatic cases in WZs. The study established that use of the tourniquet when shock was not present was directly connected with saved lives, as well as, pre-hospital use, which was directly connected with positive outcomes. According to Nassif et al. 2009, total and total care time is shortened by the protocol change in pre-hospital care to asthmatic children. It was also linked with reduced hospitalisation rates and lower utilization of critical care among the hospitalized. Future

research needs to be carried out to ascertain whether other variables were also influential. In today's study, Dracup et al. (2009) proved that educational intervention in ACS patients can improve time to treatment through the use of a post-intervention survey. It underlines the significance of patient knowledge as well as, the ways their involvement will enhance the search for early medical treatment. By increasing the identification of the symptoms, knowledge about the ACS symptoms, and addressing barriers to early seeking of medical attention the interventions available better result to ACS patients. (Bergs et al., 2010) showed that prehospital stroke scales are both valid and transportable in the Belgian environment. Outcomes show that stroke scales were appropriately implemented by EMS personnel for the objective identification and assessment of possible stroke patients. It also found important signal variability within and between providers of the EMS in terms of the usage of these scales. (Monsieurs et al., 2012) observed that higher compression rate is inversely with the chest compression depth hence to gain deeper; chest compression the frequency has to be lowered. In their study, Meretoja and colleagues showed the effectiveness

of optimizing the prehospital diagnosis and treatment by EMS through a dedicated stroke protocol. Similarly, (Brown et al., 2015) reported that prehospital blood product transfusion decreased mortality and improved functional independent mobility among trauma patients in medical evacuation. Previous study by (Lockey et al., 2015) realized that patient receiving prehospital ALS has higher chance of improving if the patient suffers from severe trauma emphasizing the need for proper early intervention. (Crewdson et al., 2017) in his systematic review and meta-analysis reiterated that any practice in prehospital RS I should be done to the best of standards in order to enhance the outcomes of the major trauma patients. (Wang et al., 2018) compared the outcomes of using endotracheal intubation (ETI) and using a laryngeal tube (LT) in out-hospital cardiac arrest adult patients and proposed that the LT can be used as a safe approach to ETI for the initial treatment of airway. Together, these results emphasize the significance of increasing optimization of operations during prehospital care. Guyette et al., 2021 giving tranexamic acid prior to hospitalization following an injury does not raise the risk of thrombotic

problems or adverse events. It is safe and actually increases the chances of survival for some patient groups when tranexamic acid is administered prehospitally to injured patients who are at danger of bleeding. Noninvasive ventilation lowers the probability of intubation in individuals with acute respiratory failure who require prehospital assistance, according to (Scquizzato et al., 2023). However, it has no effect on other negative outcomes including mortality, intensive care unit admission, or length of hospital stay.

*** The World Health Organization's (WHO) pain alleviation ladder for managing pain**

The information that is currently available indicates that improved outcomes have been achieved when acute pain treatment guidelines are followed in emergency care settings. According to the following Swiss interventional study, a straightforward clinical guideline on the identification, assessment, and management of pain from any cause by emergency department staff was linked to more frequent pain assessments, improved analgesia usage, and the overall dosage of analgesia administered. The patients showed a higher degree of pain relief

and a positive rating of the treatment provided (Sinatra et al.,2010).

The World Health Organization's recommended analgesic ladder, which was first created to treat cancer pain, is frequently used as a guide to manage acute pain in the absence of precise instructions (Blondell and et al, 2013). According to the analgesic ladder strategy, oral medications should be prescribed as soon as pain arises and continued until the patient is pain-free. Analgesics can be used in conjunction with or instead of adjuncts (such as corticosteroids, antidepressants, and antiepileptics) to reduce pain or regulate physiological processes that actually sustain contraction or spasticity. According to the pharmacodynamics of the medication, medications must be taken regularly "by the clock and not just on as the pain occurs" in order to prevent pain from encroaching. According to the World Health Organisation, further surgery may be used when medication is unable to cure the particular nerves that produce pain, such as oedema, swelling, anxiety, and muscle 3 discomfort (Figure 1).

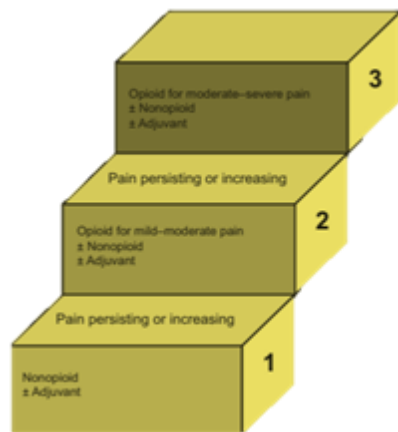


Figure1: The World Health Organization pain relief ladder(World Health Organisation (WHO., Accessed January 2020)

After the establishment of the WHO pain relief ladder in 1986 many changes were proposed as to classify various types of cancer pain and to modify the use of the ladder for instance acute pain. It also includes new developments dealing with pain control such as, nerve block and the sublingual or transdermal opioids. For patients in acute severe pain, the analgesic ladder may be applied in the opposite direction to start with opioids of the strong category then move downwards to the weak opioids and non-opioids once effective pain has been managed (Vargas-Schaffer et al., 2010).

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