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Acute Pain Management in the Emergency Department: The Evidence-Based Approach to Controversial Issues.

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"Pain is a more terrible lord of mankind than even death itself"

Albert Schweitzer (1875-1965)

Introduction

Pain is the most common reason that patients seek care in emergency departments. Pain does not respect person, nor discriminate on the basis of gender, race or age. It strikes acutely or lingers chronically, causing physiological and social disturbances and forcing people to seek assistance. In light of the impact that pain has on patients, Emergency Physicians need to be the experts in efficient and effective management of painful conditions. There are challenges to successful pain management that Emergency Physicians are dealing with on a daily basis. In my opinion, the most controversial issues are these:

1) Should ED nurses initiate intravenous opioid analgesia at triage?
2) What is the optimum intravenous dose of opioid analgesics for the treatment of acute pain in the Emergency Department?
3) Do pain scales truly improve acute pain management in the ED?
4) Should antiemetics be given prophylactically with intravenous opioids while treating acute pain in the Emergency Department?
5) Should Patient-Controlled Analgesia (PCA) be used in treating acute pain in the Emergency Department?

6) Are there any alternative methods of delivering analgesics in the ED?
7) Is Ketamine really suitable for acute pain management in the ED?

Question1: Should ED nurses initiate intravenous opioid analgesia at triage?

The undertreatment of pain, or "Oligoanalgesia" remains a pressing issue in the Emergency Department despite over two decades of extensive research (1). In the era of overcrowding, emergency departments are faced with an even bigger challenge for providing timely and efficient analgesia (2,3). The concept of nurse-initiated intravenous opioid analgesia at triage appears to be a great mechanism for the efficient delivery of pain medication in the ED as it might contribute to a decrease in wait time and increase patients' satisfaction without compromising patients' safety. In a retrospective chart review of patients receiving nurse-initiated analgesia, 19 patients out of 345 sustained adverse events: 17 patients had an episode of hypotension of which 7 patients required no interventions and 10 patients responded to fluid bolus; one patient had a hypersensitivity reaction and another patient had a vagal reaction. None of the patients had respiratory depression nor required naloxone (4).

In another prospective trial that included 345 patients, 10 patients had hypotensive episodes without the need for resuscitation and 5 patients had a drop in the oxygen saturation that was easily corrected by supplemental oxygen. There were no episodes of bradycardia, bradypnoea or reduced level of consciousness (5).

Some of the current trends in EM literature support the use of nurse-initiated intravenous opioid analgesia at triage.

A study that evaluated the effect of an intravenous morphine triage pain protocol on timing and frequency of analgesia in ED patients with severe musculoskeletal pain demonstrated a significant reduction in time to medication administration (76 minutes vs. 40 minutes) and a significant increase in the number of patients receiving pain medications (45 vs. 70%) (6). A retrospective chart analysis of patients presenting to the ED with renal or biliary colic that were treated with nurse-initiated opioid analgesia demonstrated a reduction in the median time to first medication dose (57 minutes vs. 31 minutes) (7). Another prospective trial demonstrated significant decrease in pain score (from 8.5 to 4 on Numerical Rating Scale [10-worst pain, 0-no pain]), and the mean time to the first dose of intravenous analgesics was 18 minutes (8). Patients with severe traumatic injuries who have received analgesia via fentanyl-based protocols at triage had a significant decrease in time to medication administration (54 minutes vs. 28 minutes) and a significant increase in likelihood of receiving pain medication during the first 30 minutes of arrival (44% vs. 75%) (9).

Conclusion

Emergency Departments across the country are faced with unacceptably long delays in providing analgesia to their patients. The implementation of nurses-initiated parenteral opioid analgesia at triage has great potential for timely, efficient and effective pain management in ED's. Despite regulatory and licensing concerns and issue of patients with aberrant drug-related behaviors, the nurse-driven pain protocol at triage should be an integral part of patients care.

Question 2: What is the optimum intravenous dose of opioid analgesics in treating acute pain in the Emergency Department?

Opioids are traditionally accepted as the cornerstone of acute pain management in the Emergency Department. Emergency physicians are armed with a large variety of opioid analgesics, including meperidine, morphine, hydromorphone, fentanyl and methadone (Table 1). Due to lack of the analgesic ceiling for pure opioid agonists, their dosages can be titrated upward until satisfactory pain relief is achieved or adverse effects become unacceptable (10). Some of the recent data demonstrates large variations in initial intravenous dosing of opioids when treating acute painful conditions in the ED (9-12).

Table 1

Opioid Analgesics Equianalgesic Table (Morphine 10 mg IM is the comparison standard)

DRUG	Equianalgesic Dose (mg)		Duration (hours)
	Parenteral	Oral	
Morphine	**10**	**60**	**3-4**
Hydromorphone	**1.5**	**7.5**	**2-4**
Fentanyl	**0.1**	**0.5**	**.5-1**
Meperidine	**100-150**	**300**	**1-3**

1. **Morphine**

It is commonly stated that the initial analgesic dose of intravenous morphine should be equal to 0.1 mg/kg with subsequent titration of 0.05 mg/kg until pain is relieved (11-13). However, a prospective study of 119 ED patients showed that 67% of patients who received intravenous morphine at 0.1 mg/kg reported a less than 50% decrease in pain 30 minutes after opioid administration (14). Similarly, results of a randomized trial of 280 ED patients with painful conditions demonstrated less than a 50% reduction in pain scores after 60 minutes of administering 0.1 mg/kg of morphine for 47% of patients (15). In addition to the aforementioned data, children receiving 0.1mg/kg of morphine for abdominal pain had no difference in pain scores compared to placebo 30 minutes following analgesic administration (16). Subsequently, a larger dose of 0.15 mg/kg of morphine was studied with respect to optimizing pain relief in the ED. The results of this randomized placebo-controlled trial that compared 2 regimen of morphine: 0.1 mg/kg vs. 0.15 mg/kg demonstrated no difference in pain relief at 30 minutes between the two groups and marginal difference at 60 minutes with respect to change in pain scores (4.5 vs. 5.3 on NRS) (15). However, the 0.15 mg/kg dose of morphine was delivered in divided doses for optimal patient safety, thus posing a question regarding the possibility of a superior effect of a single 0.15 mg/kg loading dose of morphine in comparison to 0.1 mg/kg. Contrary to a single dose of morphine, a titration protocol of 3 mg of morphine administered every 5 minutes to ED patients with severe pain, demonstrated optimal pain relief to 99% of patients within 30 minutes of protocol initiation (17).

In summary, a standard single 0.1 mg/kg dose of morphine is inadequate to control acute pain in the ED; however should this dose be chosen for initial analgesia, it MUST follow with subsequent doses of 0.1 mg/kg given every 20 minutes. Small aliquots of 3-5 mg of morphine given every 5 minutes would be ideal in providing effective analgesia with fewer side effects (17); however it seems impractical in our overcrowded ED's to have a nurse at the patient's bedside for 15-20 minutes administering small aliquots of analgesics. The bottom line is, whether you choose to use fixed or weight-based doses of Morphine, it MUST follow with subsequent titration until pain is minimized. A single dose of intravenous Morphine plays no role in acute pain management in the ED. Further research in evaluating analgesic effects of a single dose of Morphine at 0.15 mg/kg is warranted.

2. Hydromorphone

Hydromorphone is a feasible alternative to morphine for the management of acute pain in the ED as there still exists among emergency physicians an apparent fear to administer 8 - 10 mg of morphine as an initial intravenous bolus (18). The proposed regimen utilizes weight-based doses of hydromorphone at 0.015 mg/kg every 5 minutes to pain relief (13).

This dosing approach has been studied in the EM literature with mixed results. A randomized trial that compared analgesic efficacy of 0.015 mg/kg of hydromorphone to 0.1 mg/kg of morphine demonstrated marginally better pain relief in the hydromorphone group at 30 minutes (5.5 vs. 4.1) (19). The caveat of this study however lies in the comparative arm as morphine at 0.1 mg/kg does not provide adequate pain relief, which makes the proposed hydromoprhone dose suboptimal to adequate pain relief. Another study that used a hydromorphone titration protocol by providing 1mg initially and 1mg 15 minutes later at patients' discretion, showed provision of adequate analgesia to 96% of patients within 1 hour of initiation (20, 21). Subsequently, in a study that evaluated safety and efficacy of a single 2 mg dose of hydromorphone, results demonstrated drastic decrease in pain score from 10 to 1 within 5 minutes of medication administration and to 0 at 30 minutes. None of the 269 patients enrolled in the study required naloxone, however 32 % of patients had a decrease in oxygen saturation below 95 % (22).

In summary, a single dose of 0.015 mg/kg of hydromorphone is suboptimal in treating acute pain in the ED; titration **with an initial bolus** of 0.015 mg/kg (1mg) with similar subsequent dose every 10-15 minutes is a recommended alternative.

In light of the presented data, one particular study deserves special mention. O'Connor and colleagues in their prospective cohort analysis of 691 ED patients who received intravenous morphine or hydromorphone demonstrated that initial dosages were by a factor of 27 (from 1 mg of Morphine to 4 mg of hydromorphone). Authors discovered that 291 patients received 4 mg of morphine,131 patients received 2 mg of morphine, 121 patients received 1 mg of hydromorphone and 64 patients received 2 mg of hydromorphone. These dosages accounted for 89% of the initial dosages, significantly below the recommended initial weight-based doses. In addition, only 21% of patients had their opioid titrated (18).

The bottom line: the majority of ED patients receive non-weight based initial dosages of intravenous opioids and the minority of patients have their opioids titrated.

3. Fentanyl

Much of the data supporting intravenous administration of fentanyl in the Emergency Department comes from pre-hospital pain management (23-26). In these studies, fentanyl (25mcg - 100mcg IVP) provided rapid analgesic response (within 5 minutes), maintained a good hemodynamic profile (even in hypotensive trauma patients), and resulted in very few side effects (25). The respiratory depression seen with fentanyl was less than with morphine. Histamine release was minimal compared to morphine, and there was less hypotension and

less nausea and vomiting. Of 2,129 study patients who received fentanyl for pre-hospital analgesia, only one patient received naloxone for respiratory depression (25).

Some literatures advocates for the use of fentanyl for alleviating pain in the ED without a general consensus on the optimum dose.

A study that compared pre-hospital fentanyl administration of 1 mcg/kg with morphine dosing of 0.1mg/kg showed that the fentanyl group had similar pain score reduction at 30 minutes with provision of excellent analgesia to 76% of the patients (27). Implementation of a fentanyl-based protocol for trauma patients in the ED with an initial dosing regimen 25-50 mcg and subsequent titration every 15 minutes demonstrated absence of any significant adverse effects and great pain relief (28). Several studies demonstrated significant pain relief and lack of adverse effects in patients in the ED after the administration of 1.5 mcg/kg of fentanyl in a single IVP dose (29, 30).

In summary, a loading dose of 1-1.5 mcg/kg of fentanyl with subsequent titration of 0.25-0.5 mcg/kg every10 minutes might be a good initial alternative to morphine in treating acute painful conditions (30); direct comparison of the intravenous loading dose of fentanyl and morphine or hydromorphone in randomized fashion is warranted.

4. Meperidine

The role of meperidine in acute pain management in the ED has been a subject of controversy and there is a tendency to avoid its use due to lack of superiority to alternative parenteral opioids, a more malignant side effect profile due to accumulation of a toxic metabolite (normeperidine), and severe and often fatal drug-drug interactions. Accumulation of one of meperidine's metabolites, normeperidine, can result in neuroexcitation and lead to seizures, especially in patients with renal or hepatic insufficiency. This type of seizure is not reversible with naloxone. In addition, due to meperidine's inhibition of the reuptake of the monoamine neurotransmitters dopamine and norepinephrine, its interaction with other MAOI can lead to serotonin syndrome that can result in death (31-33).

Despite the available data, meperidine is still used for analgesia in the ED without an agreement on optimum dosages. Meperidine administered at 50 mg as single IVP for patients with biliary and renal colic had similar pain relief as intravenous ketorolac, but caused more nausea and dizziness (34-36). Another European study compared intravenous tramadol and meperidine given at 50 mg per dose to patients with renal colic and demonstrated suboptimal pain relief (48%) in the meperidine group and a need for an additional rescue dose of 50 mg of meperidine (36). The empiric loading dose of Meperidine of 50 mg chosen in the

aforementioned studies is not supported by Meperidine's pharmacokinetics and, especially, by an equianalgesic dosage conversion (Table 2). Meperidine produces pain relief for a maximum of 3 hours, so in order to provide pain relief equivalent to 10 mg of morphine given intravenously every 4 hours, meperidine should be administered at 1.5 mg/kg every 3 hours (37).

In summary, current literature does not support intravenous use of meperidine as a first- line opioid analgesic mostly due to the severe neurotoxic effects. Should meperidine be used, a loading dose of 1-1.5 mg/kg with additional titration of 1 mg/kg is the recommended approach but might need to be reduced in elderly patients due to its renal and neurotoxic effects (37).

Conclusion

At present, the known optimum **single** intravenous dose of opioid analgesics in treating acute pain in the ED does not exist. The best available evidence advocates for **titration** regardless of the choice of dosing (weight-based or fixed) until pain is relieved or side effects become intolerable (Table 2).

Table 2. Intravenous Opioid Dosing Strategy for Severe Acute Pain

Protocol Type	Intravenous Dose[a]	Frequency	Comments
Morphine			
Standard			
weight-based	0.1 mg/kg	10-15 min	Titrate to NRS ≤4 or based on pt. request; most likely will require subsequent dose in 10-15 min; if partial response achieved, may consider dose reduction on subsequent doses
fixed dose	6-10 mg		
Nurse-initiated[b]	2.5 mg	5 min	Titrate to NRS ≤4 or based on pt. request
Hydromorphone			
Standard			
weight-based	0.015 mg/kg	10-15 min	Titrate to NRS ≤4 or based on pt. request; most likely will require subsequent dose in 10-15 min; if partial response achieved, may consider dose reduction on subsequent doses
fixed dose	1-1.5 mg		
Nurse-initiated[b]	0.4 mg	5 min	Titrate to NRS ≤4 or based on pt. request
Fentanyl			
Standard			
weight-based	1 µg/kg	5 min	Titrate to NRS ≤4 or based on pt. request; most likely will require subsequent dose in 5 min; if partial response achieved, may consider dose reduction on subsequent doses
fixed dose	60-100 µg		
Nurse-initiated[b]	25 µg	5 min	Titrate to NRS ≤4 or based on pt. request

NRS = numeric rating scale.
[a]Consider dose reduction in obstructive sleep apnea, pulmonary disease, or elderly patients. Higher doses may be needed in opioid-tolerant patients.
[b]Initiated prior to evaluation by the physician.

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Question 3: Do pain scales truly improve acute pain management in the ED?

Pain is an inherently subjective experience and finding a proper quantifying assessment tools is challenging. In 2001, JCAHO mandated that pain must be assessed and documented on every patient that presents to the ED by using pain scales (38).Various pain scales, including Visual Analog Scale (VAS), Verbal Numeric Rating Pain Scale (NRS), and the Wong-Baker FACES Pain Rating Scales have been validated and used extensively in Emergency Departments (39-41). In brief, the Visual Analog Scales utilizes a 100mm (10cm) line with "no pain" at left and "maximal pain" at the right; the Numeric Rating Scale is an eleven point graph (0-10) where 0 equals no pain and 10 signifies unbearable pain; the FACES pain scale uses 6 facial expressions with a range from no hurt to the worse hurt ever (42).

From a practical point of view, attaching meaning to a patient's score on the pain measurement tools poses challenges, particularly the necessity to convert a subjective experience into an objective number (43). Several research papers have challenged the concept of routine use of pain scales in order to improve pain management in the ED.

One of the studies demonstrated that the incorporation of the Wong-Baker FACES pain scale into medical records in the ED improved pain assessment by increasing the pain score documentation by 25%, however, there was neither reduction in time to analgesic administration nor overall improvement in analgesia (44). Results of another prospective observational study of trauma patients showed that implementation of the Verbal Pain Scale improved documentation of pain and analgesic administration for those patients with documented scores; however, patients with pain scores of 4 or less on the 10 point scale did not receive any analgesics (45). Prospective trials have attempted to find correlation between the Visual Analog Scale and patients' desire for analgesia and revealed that no single cutoff on the pain scale could reliably predict a patient's desire for medication (46).

Conclusion

The evidence demonstrates that currently available pain scales are focused primarily on the pain intensity at a single point in time, which leads to underestimation of pain experience and undertreatment of painful conditions. Additionally, no data supports the overall improvement in acute pain management in the ED via use of pain scales.

Question 4: Should antiemetics be given prophylactically with intravenous opioids while treating acute pain in the Emergency Department?

Gastrointestinal side effects such as nausea and vomiting are common following opioid analgesia for chronic pain and are considered to be a limiting factor in effective pain therapy (47). It has been the author's observation at his own institution that the majority of residents often administer antiemetics to patients receiving opioids for acute pain despite the fact that the EM literature is challenging this concept and advocating against the prophylactic administration of antiemetics in the ED.

A prospective trial (122 patients) that evaluated the incidence of nausea and vomiting after morphine and meperidine analgesia showed a low incidence of nausea and vomiting: seven patients (5.7%) experienced nausea and one patient (0.8%) had vomiting (48). An observational study of 205 patients demonstrated a cumulative incidence of vomiting of 1.5 % at 30 minutes and 2.4 % at 60 minutes after administration of opioid analgesics (49). Another randomized trial of 259 patients treated with metoclopromide or placebo after opioid administration revealed the overall incidence of nausea and vomiting in the whole study population of 2.7% with incidence of vomiting of 1.6% in the metoclopramide group and 3.7% in the placebo group (50). Lastly, a pre-and post-intervention trial of an educational initiative in the ED that was designed to reduce the prophylactic use of metoclopromide with initial morphine administration demonstrated a significant reduction of the proportion of patients receiving metoclopromide from 22.6% to 4.1% ($P<0.001$) (51).

Conclusion

The routine administration of antiemetics with intravenous opioids while treating acute pain in the ED is not necessary. Nausea and vomiting are infrequent after opioid use and the potential benefit from prophylactic antiemetics administration is small at best and outweighed by potentially undesirable additive sedation and extrapyramidal side effects. Side effects are more prominent with the use of metoclopramide (sedation, akathisia, dystonic reactions and oculogyric crisis) and promethazine (sedation, akathisia, tardive dyskinesia) than with the use of ondansetron (constipation, dizziness and headache).

Question 5: Should Patient-Controlled Analgesia (PCA) be used in treating acute pain in the Emergency Department?

Patient controlled analgesia (PCA) has revolutionized acute pain management over the last quarter century with greater effective postoperative pain control. Two published evidence-based reviews concluded that PCA offers better analgesic efficacy as well as superior patient satisfaction (52, 53).

PCA provides on-demand, intermittent, intravenous delivery of opioid analgesics under the patient's control that is administered with or without a continuous background infusion. This type of analgesia requires a sophisticated microprocessor-controlled infusion pump that delivers a pre-programmed dose of opioids when the patient pushes a demand button. PCA includes several modes of administration of which demand dosing (a pre-set dose is self-administered intermittently) and continuous infusion plus demand dosing (a constant-rate fixed background infusion is supplemented by patient demand dosing) are the most commonly used. Each PCA mode has 4 basic components: initial loading dose, demand dose, lockout interval and background infusion rate (54). The initial loading dose provides titration of medication once activated by the programmer (not the patient); the demand dose is delivered to the patient upon activation of the demand button; the lockout interval defines the length of a pause after patient demand dose (overdose prevention); and background infusion is a constant rate infusion (54).

The majority of the opioids have been used in PCA, with Morphine the most common (Table 3).

Table 3 – Sample PCA Algorithms

Opioid	**Demand Dose**	**Lockout (min)**	**Continuous Basal Infusion**
Morphine	**1–2 mg**	**6–10**	**0–2 mg/h**
Fentanyl	**20–50 mcg**	**5–10**	**0–60 mcg/h**
Hydromorphone	**0.2–0.4 mg**	**6–10**	**0–0.4 mg/h**

Recently, several studies have attempted to evaluate the safety and efficacy of intravenous PCA for the management of acute pain in the ED. IV-PCA demonstrated similar relief of pain and patient satisfaction in comparison to titrated, intravenous opioid injections for trauma patients in the ED (55). In patients with sickle cell crisis, IV-PCA was equally safe and effective to intermittent intravenous injections of morphine in controlling pain (56). Patients with hip fractures that were given IV-PCA had a significant reduction in pain scores and lack of serious side effects (57).

Advantages of IV-PCA in the ED include: individual dosage that can be titrated to pain relief, adequate analgesia by maintaining constant plasma concentrations, decreased frequency of opioid administration by ED nurse and increase in overall patients' satisfaction (55).

Limitations to its use in the ED include patients' oversedation, steep learning curve of the ED nurses, programming error that might lead to respiratory depression, and cost of the PCA (58, 59).

Conclusion

PCA is slowly emerging as a desirable route of providing pain relief among ED patients. Great patient satisfaction and a good safety profile make PCA an attractive modality in providing timely and efficient analgesia in the overcrowding environment of the ED. Further study will be required to evaluate the cost-effectiveness of using PCA in the ED.

Question 6: Are there any alternative methods of delivering analgesics in the ED?

Parenteral (intravenous analgesia) is the main modality that provides rapid and titratable analgesia in the ED. In situations when IV access is unobtainable or not preferred, the so-called "non-standard" routes of administration play an important role in providing effective analgesia (60).

A randomized trial involving children with extremity fractures who received nebulized fentanyl at 4mcg/kg vs. 0.1 mg/kg of intravenous morphine demonstrated clinically significant pain decrease at 15 minutes in the fentanyl group by 3 points on the Numerical Pain Scales as compared to 1.9 points in the morphine group (61). Another randomized trial demonstrated significantly better pain relief for patients receiving nebulized fentanyl (3mcg/kg) than those who received intravenous fentanyl (1.5mcg/kg) (62). A comparison trial of patients with severe posttraumatic thoracic pain that received nebulized morphine or PCA morphine showed less sedation and slightly better pain relief in the nebulized morphine group (63). Borland and colleagues demonstrated comparable analgesic effectiveness of intranasal fentanyl to intravenous morphine (1.7 mcg/kg dose) that was administered to children with acute long-bone fractures (64). Finally, Mahar et al, designed a randomized controlled trial comparing oral transmucosal fentanyl citrate (OTFC) at 10-15mcg/kg with IV morphine at 0.1mg/kg in controlling acute pain in children presenting to the ED with extremity deformity and/or fracture. The results demonstrated significantly better reduction in pain scores after 30 minutes in the OTFC group (46mm vs.34mm on VAS) that persisted throughout a 75 minutes observation period (65).

Conclusion

The superior effect of nebulized fentanyl as compared to intravenous opioid is based on the fact that mucosal surfaces are rich in blood supply, providing the means for rapid drug transport to the systemic circulation and avoiding, in most cases, degradation by first-pass hepatic metabolism. Thus, nebulized, intranasal and transmucosal routes of opioid analgesics should be considered for acute pain management in the ED. The aforementioned studies demonstrated that these alternative modalities provide equivalent analgesia to that achieved with intravenous dosing. However, the aforementioned studies evaluated the effect of a single dose of alternative methods of analgesia delivery in the ED which resulted in a very short duration of pain relief (15-30 min). The effect of multiple nebulized and intranasal doses of analgesics warrants further research.

Question 7: Is Ketamine really suitable for acute pain management in the ED?

Ketamine is a noncompetitive N-methyl D-aspartate (NMDA) receptor antagonist that blocks the release of excitatory neurotransmitter glutamate and provides anesthesia, amnesia and analgesia. Due to its high lipid solubility, Ketamine rapidly crosses the Blood-Brain Barrier, provides quick onset of action (peak concentration at 1minute after IVP) and rapid recovery to baseline (duration of action 5-15 minutes after IVP) (66). At subdissociative doses of 0.1-0.5 mg/kg either as an adjunct to opioid analgesics or as a solo agent, ketamine provides good analgesia while preserving airway patency, ventilation, and cardiovascular stability (67). In addition, a small dose of ketamine may increase the analgesic potency of opioids thus decreasing their requirements (68). Based on the aforementioned facts, ketamine represents an attractive analgesic modality in the ED, particularly in patients with opioid-resistant pain (vasoocclusive pain crisis in patients with Sickle Cell Disease or patients with chronic pain) or polytrauma patients who are hemodynamically unstable.

Several papers reviewed the analgesic and opioid sparing effects of subdissociative doses of intravenous ketamine in the ED with recommendations for its use.

A double-blind trial of 40 adult patients with acute musculoskeletal trauma compared low-dose ketamine by subcutaneous infusion (0.1 mg/kg/h) with intermittent morphine (0.1 mg/kg IV every 4 hours) and demonstrated better pain relief, less sedation and less nausea and vomiting with ketamine infusion than with intermittent morphine. In addition, none of the patients in ketamine group required supplementary analgesia (69).

A prospective, randomized trial compared two analgesic regimens, morphine with ketamine (K group) or morphine with placebo (P group) for severe acute pain in 73 trauma patients with a visual analog scale (VAS) score of at least 60/100. Morphine was administered at 0.1mg/kg and patients in the K group received 0.2 mg/kg of intravenous ketamine over 10 minutes, and the patients in the P group received isotonic sodium chloride solution. The results showed comparable change in VAS score at 30 minutes (34 mm (K) vs. 39 mm (P)) but reduced morphine consumption in the ketamine group (0.14 mg/kg (K) vs 0.2 mg/kg (P)) (70).

A chart review analysis of 35 ED patients receiving low dose ketamine at doses 0.1mg-0.6mg/kg in addition to intravenous morphine, demonstrated a decrease in pain intensity for 54% of the patients by a documented 3 point pain decrease on a 10-point scale. The ketamine doses ranged from 5 mgs to 35 mgs with median dose of 10 mg and mean dose of 15.7mg. In addition, only one patient had a brief dysphoric reaction that did not require intervention (71).

Lastly, from a practical point of view, Dr. Ducharme, who is a Clinical Professor of Medicine at McMaster University and an expert in ED pain management, recommends the following algorithm for administration of low-dose ketamine in the ED: Initial bolus of 0.2 – 0.3 mg/kg IV over 10 minutes with subsequent infusion of 0.1 - 0.3 mg/kg/hour with the premise that this is not a solitary analgesic plan but rather an adjunct to commonly used opioids (72).

Summary

Despite a paucity of literature supporting the use of ketamine in the ED, advances have been made to integrate the subdissociative doses of this unique medication into the arsenal of available analgesics in the ED with very promising results. Further research will warrant a head-to-head comparison of ketamine with opioids and NSAIDS in treating acute pain in the ED.

Conclusion

We have a great responsibility to relieve pain by all possible appropriate means in a timely, efficient and effective manner. I hope that this brief review has shed some light on controversial issues in acute pain management in the ED. I believe that current evidence will greatly improve your practice in treating acute pain and will make your ED’s pain-free.

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