



# Pain management in emergency department: intravenous morphine vs. intravenous acetaminophen

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### ABSTRACT

Pain is the most common complaint in emergency department and there are several methods for its control. Among them, pharmaceutical methods are the most effective. Although intravenous morphine has been the most common choice for several years, it has some adverse effects. There are many researches about intravenous acetaminophen as an analgesic agent and it appears that it has good analgesic effects for various types of pain. We searched some electronic resources for clinical trials comparing analgesic effects of intravenous acetaminophen vs. intravenous morphine for acute pain treatment in emergency setting.

In two clinical trials, the analgesic effect of intravenous acetaminophen has been compared with intravenous morphine for renal colic. The results revealed no significant difference between analgesic effects of two medications. Another clinical trial revealed that intravenous acetaminophen has acceptable analgesic effects on the post-cesarean section pain when combined with other analgesic medications. One study revealed that administration of intravenous acetaminophen compared to placebo before hysterectomy decreased consumption of morphine via patient-controlled analgesia pump and decreased the side effects. Similarly, another study revealed that the infusion of intravenous acetaminophen vs. placebo after orthopedic surgery decreased the consumption of morphine after the surgery. A clinical trial revealed intravenous acetaminophen provided a level of analgesia comparable to intravenous morphine in isolated limb trauma, while causing less side effects than morphine.

It appears that intravenous acetaminophen has good analgesic effects for visceral, traumatic and postoperative pains compare with intravenous morphine.

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## Introduction

Pain is the most common complaint that makes the patient to seek medical care. Pain management is one of the most important issues in emergency department (ED) that can reduce patient anxiety and stress. Pain can be controlled by several methods, for example, casting an injured organ and use of analgesic agents (1). Administration of analgesic agents is the mainstay of acute pain treatment. For effective

pharmacologic pain management in the ED. It is important to select an appropriate agent for the intensity of pain, prompt onset of analgesic effect, ease of administration, efficacy and safety (1).

### Pain evaluation

It is important to document the pain on initial assessment. Pain has a dynamic pattern and changes

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with time, thus periodic pain reassessment is needed. Pain assessment in ED involves determination of its duration, location, severity, quality and factors that exacerbate and alleviate it. There is a poor correlation between the patient's report of severity of pain and nonverbal signs, such as tachypnea, changes in patient expression and tachycardia. Therefore, they should not be used to estimate the severity of a patient's pain (1).

Although there are several standardized scales for measuring the intensity of pain, it is unknown to what extent the use of these scales can affect patient treatment and care. It may be well enough to ask the patient if he/she requires more analgesic because this may even be simpler for the patient than the use of any standardized pain scale (1).

There are several self-report instruments for pain measurement in patients with acute pain. Visual analog scale (VAS) is a 100-mm scale that is marked no pain and worst imaginable pain at the end of this linear scale (Figure 1). The patient marks on the scale at the point that is the best represent of his/her pain. The distance from this mark to either end of the scale is measured. A change of at least 13 mm on the scale is the minimal significant change of the pain noticeable by patient. A decrease of 30 mm on the visual analog scale appears to be an acceptable change of the pain (1).

Ethnicity has an effect on different concepts of

**Figure 1.** Visual analog scale



pain. Because the visual analog scale is the least affected by factors such as language difficulties or cultural differences, it is the preferred pain assessment modality when there are such disparities (1).

### **Analgesic agents**

As mentioned earlier, the administration of pharmacologic agents is the mainstay of acute pain management. Acute pain is usually associated with feelings of loss of control and anxiety. If an analgesic administration and reassurance does not suffice, an anxiolytic agent may be necessary.

Opioid agents are the most important pharmacologic treatments of moderate to severe pain. Administration of opioid in the emergency department may be associated with some adverse events, such as hypotension, respiratory depression, allergic reactions secondary to histamine release or facilitating of drug seeking or abuse behavior (1).

On the other hand, some of the patients quitting opium abuse, are reluctant to receive opiates for

reduce pain.

Acetaminophen is a proper analgesic that is sufficient for moderate to severe pain. Platelet aggregation is not affected by acetaminophen and it is not an anti-inflammatory drug. For patient with renal failure or mild hepatic failure, no dose adjustment is required (1). Although acetaminophen has a central analgesic effect, its detailed mechanism(s) is unknown (2).

Acetaminophen has an antipyretic effect. The temperature set point within the hypothalamus is increased by prostaglandins and acetaminophen, which inhibits prostaglandin formation and applies its antipyretic effect (3). Safety and tolerability profile of acetaminophen is one of the important advantages of this analgesic over other analgesic agents for the treatment of postoperative pain (4). Although nonsteroidal anti-inflammatory drugs (NSAIDs) are commonly used for postoperative setting, these agents can increase the risk of cardiovascular events and impair renal function (5). Furthermore, NSAIDs have an adverse effects on platelet function and mucosal integrity, which can increase risk for bleeding, a complication that is problematic in the postoperative patients (6). Intravenous administration of acetaminophen rather than oral administration results in a higher plasma peak levels and rapid elevation in plasma concentrations (7). The clinical analgesic effect of acetaminophen appears within 5 to 15 minutes of administration (8), peaks approximately 1 hour and lasts for about 4 to 6 hours (9). Acetaminophen can penetrate the blood-brain barrier and its antipyretic and analgesic effects correlate with its cerebrospinal fluid concentrations (7,10,11).

Because of the idea that acetaminophen is a weak analgesic agent, many clinicians are reluctant to use this medication. On the other hand, opioids are potent analgesic agents but have more adverse effects.

According to aforementioned adverse effects of opioid analgesics, we decided to compare the analgesic effects of intravenous acetaminophen and intravenous morphine. Therefore, some electronic resources such as PubMed, Scopus, EBSCO, Google Scholar, TRIPDATABASE, etc. were searched for such clinical trials comparing analgesic effect of intravenous acetaminophen vs. intravenous morphine for acute pain treatment in emergency setting. Among these clinical trials about 15 studies matched our clinical question. We elected some of the studies that were more scientific and well-organized. Moreover, we did not find any meta-analysis regarding this issue.

### **Literature review**

In two clinical trials, the analgesic effect of intravenous acetaminophen has been compared

with intravenous morphine for renal colic. In one of these studies that was published in *Annals of Emergency Medicine Journal* in 2009, a randomized, double-blind, placebo-controlled clinical trial compared a single intravenous doses of morphine (0.1mg/kg), acetaminophen (1g) and placebo (normal saline) for 146 patients presenting to the emergency department with renal colic. The results revealed no significant difference between analgesic effects of two medications (12). In another clinical trial that was published in *Journal of Emergency Medicine* in 2001, a randomized double-blind study was performed to compare the efficacy of 0.1 mg/kg intravenous morphine and intravenous acetaminophen (1g) in 133 patients with renal colic. The analgesic effects of two drugs were measured by a visual analog scale at baseline and after 15 and 30 minutes. The need for rescue medication (1µg/kg intravenous fentanyl) and adverse effects were also recorded at the end of the study. The results revealed no significant difference between analgesic effects of two drugs (13).

Intravenous acetaminophen also has acceptable analgesic effect on the post-cesarean section pain when combined with other analgesic medications (14). In another study published in the *British Journal of Anesthesia* in 2006, the analgesic effect of two medications was compared over 80 patients with posttonsillectomy pain. The results revealed that intravenous acetaminophen provided less sedation, adequate analgesia and earlier discharge from recovery room among patients undergoing tonsillectomy surgery (15).

One study with over 90 patient that was published in the *Journal of the Turkish Society of Anesthesiology* in 2009, revealed that administration of intravenous acetaminophen vs. placebo decreased the consumption of morphine via patient-controlled analgesia pump and decreased side effects before hysterectomy (16). Consumption of morphine via patient-controlled analgesia pump was lower when intravenous acetaminophen was given before induction rather than before suturing (16). Similarly, another study revealed that the infusion of intravenous acetaminophen compared to placebo decreased consumption of morphine for pain control in 15 minutes to 6 hours after the orthopedic surgery (8).

A clinical trial published in the *Journal of Emergency Medicine* in 2012, revealed that intravenous acetaminophen provided a level of analgesia comparable to intravenous morphine in isolated limb trauma, while causing less side effects than morphine (17). Additionally, there was no significant difference in the rescue analgesia, another analgesic agent for some patients that their pain have not been controlled by the first analgesic

agent. There were also more adverse effects in the morphine group (17).

## Conclusion

According to aforementioned clinical trials, intravenous acetaminophen appears to be a good alternative to intravenous morphine for control of acute pain. This pain can be due to traumatic bone fracture, surgery or visceral pain, which acetaminophen provides a level of analgesia comparable to intravenous morphine in all cases. Additionally, it appears that the adverse effects of acetaminophen is lower than the morphine. Probably additional trials is necessary to confirm the conclusion.

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## Conflict of Interest

The authors declare no conflict of interest.

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