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CASE STUDIES IN PAIN MANAGEMENT
Series Editor: Knox Todd, MD, MPH

Misconceptions About Opioid Dosing

A ranking physician stricken with a painful acute illness forces the emergency department staff to rethink their assumptions about morphine.

By Valerie C. Norton, MD, FACEP

The subjective nature of pain and the wide range of opioid effects on different patients have made it difficult to establish firm recommendations about how much to give, and how fast—even for the kind of severe, acute pain that accompanies kidney stones, burns, long-bone fractures and so many of the other ailments and injuries commonly seen in emergency medicine. In turn, this uncertain state of practice has fostered various misconceptions or myths about the treatment of pain. Three such myths explored in this article can be expressed as follows:

- "It's dangerous to push more than 5 mg morphine or 1 mg hydromorphone at once—the patient might become oversedated and hypoxic."
- "The usual maximum dose of IV opioids in the emergency department should be about 10 mg morphine or 2 mg hydromorphone. There's something fishy about anyone who needs more than that."
- "Thirty minutes is a reasonable interval between doses of IV opioids when treating acute pain in the emergency department."

PATIENT PRESENTATION

A 61-year-old man presents to a university hospital emergency department with severe left flank pain that started about 90 minutes prior to arrival and became rapidly worse. In the triage area, the patient, although writhing and moaning in pain, manages to show the nurse his faculty ID card and identify himself as chairman of the hospital's department of internal medicine. The nurse brings him back to a bed immediately and lets the attending physician know that "some VIP is in room 7."

On walking into the room, the attending sees a restless, ashen, older man, well-dressed and appearing to weigh about 70 kg, who is demanding pain medication from the nurse at his bedside as she tries to place an intravenous line. Before the physician can introduce herself, he orders her to get him some morphine, "pronto." She assures him he will be medicated as soon as possible. The chairman is not willing to answer many questions, keeps saying he knows this is a kidney stone, and denies any fever, abdominal pain, chest pain, shortness of breath, hematuria, or dysuria. He admits to nausea and two episodes of non-bloody emesis.

The patient's vital signs are: temperature, 98.2°F; respirations, 22; pulse, 92; blood pressure, 159/91; and oxygen saturation, 97%. On physical examination, he is alert and oriented, with moist mucous membranes, a supple neck, no jugular vein distension, clear lungs, and normal heart sounds. His cardiac rate and rhythm are regular, and he has a soft, nondistended abdomen with no pulsatile mass. Genitourinary and extremity examinations are normal. Mild tenderness is noted on the far left side of the abdomen, however, and there is marked tenderness at the costovertebral angle on the same side.

As the emergency physician finishes examining the patient, the nurse secures the IV and asks what should be administered. The physician tells her to push 5 mg morphine and 12.5 mg of promethazine.

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Hearing this, the chairman yells, "That won't be enough! Where did you train? Get me 10 mg of morphine right now!"

Neither the physician nor the nurse has ever pushed 10 mg of morphine all at once before, with the exception of a patient at the end stage of cancer who was used to very large doses of opioids, and they are apprehensive about doing it. However, this is the chairman of internal medicine, so the physician acquiesces to his demand, while telling the nurse to put him on both cardiac and oxygen saturation monitoring. She then calls her own chairman to let him know of the arrival of this august personage in the department, and he instructs: "Give him whatever he wants! I'll be there soon."

The patient gets his 10 mg of morphine and states his pain is down from an "11" to an 8. He agrees to have a CT scan done and provides a specimen for urinalysis. About 15 minutes after the first dose of morphine, while waiting to be taken to radiology, he calls the physician into the room again and asks for another 10 mg of morphine. His vital signs are stable, including pulse oximetry, so she orders another dose. When the nurse expresses concern about the large amount and the brief interval since the last dose, the physician relays the message from the department head to "give him whatever he wants," but asks her to keep the patient on the monitor in radiology and to accompany him there.

On return from his CT scan, the patient states he is still not comfortable and asks for another dose of morphine. His vital signs are stable, so he receives it. After a total of 30 mg of morphine, given over about 45 minutes, the patient is finally comfortable, and states his pain is now a 3 out of 10. His CT scan shows a 6-mm stone in the left proximal ureter with moderate hydronephrosis and hydroureter. His urinalysis shows 25 to 50 RBCs, but is otherwise negative, and his other labs are normal.

When the chairman of emergency medicine arrives at his bedside, the patient is cordial and pleasant and compliments his counterpart on the excellent and expeditious treatment he has received. Out at the nursing station, the residents and nurses are marveling at what just happened. By far, 30 mg of morphine is the largest amount of morphine any of them has ever seen given in that short a period of time, and they are quite surprised the patient isn't comatose. When the attending physician tells them she was anxious about pushing 10 mg morphine at once, instead of in divided amounts with gradual titration, one of the other faculty members points out that many clinicians are comfortable giving 1 or 2 mg of hydromorphone IV push, which is the equivalent of 7 or 14 mg of morphine. "It's only scarier with morphine because the numbers are bigger!" she jokes.

DISCUSSION

This real-life case caused quite a bit of soul-searching at the institution where it occurred. Clearly this patient, by dint of his authority in the institution, was able to request and be given much larger amounts of IV opioids than are typically given in many emergency departments. But obviously it took that much to get him comfortable, and he had no untoward side effects and no apparent sedation. After an experience like this, many emergency physicians might wonder if they had been seriously underdosing the majority of patients who were reporting severe pain.

What teaching and literature do we have to rely on for treating acute pain in the emergency department? Surprisingly little, as it turns out. Many of us were taught in residency that a reasonable dose of IV morphine that will achieve good pain control in the majority of patients is 0.1 mg/kg, often given in divided doses over 30 to 60 minutes. But is this really true?

A review of some comprehensive, standard references on pain management yields interesting results. Bonica's *Management of Pain* (third edition) cites several studies that show vast differences in response to opioid pain medications among different patients, with as much as an 8-fold difference in amounts needed to control pain in different opioid-naive patients.[1] This means that one 70-kg patient with severe pain might be comfortable after 5 mg of morphine, while another 70-kg patient might need 40 mg. Bonica also confirms that for hydromorphone, the most agreed-upon conversion is that 1.5 mg hydromorphone is equianalgesic to 10 mg morphine.[1] However, surprisingly, Bonica doesn't have much to say about an appropriate initial IV dose for acute pain, or an appropriate re-dosing interval, though it does say that morphine reaches peak plasma levels at 15 to 30

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minutes when given IV and that hydromorphone is a bit quicker, with peak levels at 10 to 20 minutes.[2]

The fifth edition of the American Pain Society's *Principles of Analgesic Use in the Treatment of Acute Pain and Cancer Pain* recommends 0.1 mg/kg of morphine as a standard IV dose for children older than 6 months. For adults, the standard starting parenteral dose is listed at 10 mg, but in a footnote it says to start with half of this (5 mg) when giving it intravenously.[3] Fine so far—this is what many of us were taught in residency, though the dosing difference between children and adults is somewhat puzzling. After all, most adults weigh more than 50 kg, and thus would get less than 0.1 mg/kg based on this recommendation.

On the next page it says that this starting dose can be repeated at the time of peak effect if pain persists, meaning in 15 to 30 minutes, and that repeat dosing can be done even more frequently in a carefully monitored setting for severe pain.[3] The authors stress the importance of "ICU-like" monitoring with this strategy, which presumably means continuous cardiac and oximetry monitoring. For rapid titration of morphine in severe pain, they recommend 0.03 mg/kg IV every 10 minutes until there is a 50% reduction in the patient's pain, or until the patient reports satisfactory relief.[3] That dosage will seem pretty substandard to most experienced emergency physicians. For the 70-kg patient in our example, 0.03 mg/kg would have meant only 2 mg every 10 minutes, which might have caused serious career advancement issues for the treating physician.

Most palliative care specialists recommend a much more aggressive approach: start with 0.1 mg/kg morphine IV (or the equivalent amount of hydromorphone), reassess every 10 minutes, and *double* the dose every 10 minutes until pain control is achieved. This is one typical method used for hospice patients, and has the advantage of allowing the palliative care team to figure out how much medication is needed when setting up a patient-controlled analgesia pump after the acute pain is under control. According to the palliative care experts, the actual time to peak clinical effect or maximum serum concentration is approximately 6 to 10 minutes with most parenteral opioids (not 20 or 30 minutes), so that a 10-minute reassessment time frame makes more sense in very severe pain.[4-6]

What can we take away from all this? First of all, frequent reassessment is key to the management of acute pain, since a few patients will be happy after one "standard" dose of IV opioids, but the rest will likely need repeat dosing. We know from the PEMI study that most emergency department physicians and nurses do a fairly good job of providing an initial dose of pain medication, but a poor job of reassessing to see if more is needed.[7] One way to address this deficiency is to change and standardize opioid orders to be written for repeat doses up front—for example, "hydromorphone 1 mg IV, then 1 mg IV q 10 minutes prn persistent pain" for an average-sized adult.

The second key point is that we should not be afraid to give large doses of opioids as long as patients have appropriate monitoring (continuous oximetry) and frequent nursing assessments. Thirdly, one size does not fit all. Initial doses should be at least roughly weight-based. Starting doses should be adjusted downward in infants and the elderly (though they may ultimately need similar total amounts) and upward in those who are known to be tolerant to narcotics.

Most nurses like orders when written as described above. It empowers them to use their clinical skills and judgment and not have to run after the physician every time they feel a patient needs more medication. They also can tell that it makes patients happy, which improves their interactions with patients and improves their job satisfaction. Emergency departments that do an excellent job of pain management are likely to find that their patient-satisfaction scores go up, and more importantly, that patients feel they are getting great care. □

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