Lumbar puncture (LP) is used in the diagnostic evaluation of central nervous system (CNS) processes, most commonly in cases of suspected infection and subarachnoid hemorrhage. Less commonly, the procedure is used for therapeutic purposes (eg, in cases of idiopathic intracranial hypertension).

Pain Points

Opioid-related overdose deaths have doubled since 2000 – a startling statistic that heightens the risk of complications and therapeutic misadventures. Emergency physicians have long been charged with delivering analgesia in information-poor environments; however, it is increasingly important to understand how to manage acute and chronic pain with non-opioid treatments such as cutaneous or local anesthetic, ultrasound-guided nerve blocks, non-narcotic systemic analgesics, and dissociative sedation.

Dazed and Confused

The ever-growing elderly population presents several significant challenges for emergency physicians, who must be prepared to assess and manage the unique disease patterns frequently seen in these vulnerable patients. Of particular concern is altered mental status, a common but often dangerous disturbance in brain function that manifests as changes in awareness and/or cognition in as many as one-quarter of geriatric patients.
Dazed and Confused

Altered Mental Status in the Elderly

LESSON 19

By Danya Khoujah, MBBS, FAAEM; and Phillip D. Magidson, MD, MPH

Dr. Khoujah is an assistant professor of emergency medicine at the University of Maryland School of Medicine, and Dr. Magidson is a resident physician in the Department of Emergency Medicine at the University of Maryland Medical Center in Baltimore.

Reviewed by Amal Mattu, MD, FACEP

OBJECTIVES

On completion of this lesson, you should be able to:

1. Identify patients at high risk for delirium.
2. Differentiate between delirium and dementia as a cause of altered mental status.
3. Identify etiologies of altered mental status in geriatric patients.
4. Explain how to manage delirium in geriatric patients using both nonpharmacologic and pharmacologic treatments.
5. Devise a safe disposition plan for older patients presenting to the emergency department with altered mental status.

FROM THE EM MODEL

1.0 Signs, Symptoms, and Presentations
   1.3 General
      1.3.1 Altered Mental Status

CRITICAL DECISIONS

- How can delirium be diagnosed in the emergency department?
- What common etiologies for delirium should be considered?
- What is the best way to approach an elderly patient with altered mental status?
- How is new-onset delirium differentiated from underlying dementia?
- What is the best treatment for acute agitated delirium?
- Which patients with altered mental status require hospital admission?

The elderly constitute the fastest growing segment of the American population; this modern reality challenges emergency physicians, who must be prepared to assess and manage the unique disease patterns of geriatric patients. Of particular concern is altered mental status, a presentation seen in as many as 25% of patients 65 years and older. Defined as a disturbance in brain function that manifests as changes in awareness and/or cognition, the disorder can have serious — even life-threatening — consequences.
Delirium is an acute, fluctuating alteration in consciousness accompanied by impaired cognition or perceptual disturbances that are not explained by preexisting dementia. It usually emerges over the course of hours to days and may fluctuate considerably over short periods of time (Table 1). Patients can present with hyperactivity in the form of agitation and combativeness; hypoactivity, which is subtler and commonly overlooked; or a combination of both.

More than half of these cases go undiagnosed—an unacceptable miss rate, given the significant disease burden of delirium, particularly in the elderly population. In addition to an overall functional decline, the disorder is associated with an 11% increase in the risk of death at 3 months following the initial episode. The Geriatric Task Force of the Society for Academic Emergency Medicine recommends delirium screening as one of the key quality indicators for emergency geriatric care.

The Confusion Assessment Method (CAM) is a well-studied screening tool that can reliably help clinicians diagnose delirium with a sensitivity and specificity of approximately 95%. CAM measurements are based on the acuity of onset, fluctuant course, and levels of inattention, disorganized thinking, and altered level of consciousness (Table 2).

Inattention is the hallmark of delirium, best assessed by observing the patient’s interactions and asking the patient to count backward from 20 or recite the months of the year or days of the week in reverse. This assessment should be a routine part of the cognitive evaluation in any patient with altered mental status.

Inattention also can be assessed as part of the more time-consuming mini-mental status examination, used less frequently in the emergency department. The modified
Richmond Agitation and Sedation Scale (mRASS), which has a reported sensitivity of 64% and a specificity of 93%, also can be useful for assessing delirium (Table 3). The diagnosis is likely in a patient who scores anything other than zero on the mRASS scale.

**CRITICAL DECISION**

What common etiologies for delirium should be considered?

Some patients are predisposed to delirium (commonly referred to as “lacking the reserve”), which can be trigged acutely when they are exposed to a precipitating “insult.” The most common predisposing factors are increasing age and dementia (present in 50% of delirious patients); other factors are listed in Table 4. The most common etiology of delirium is infection followed by medications. Illicit drug use and withdrawal syndromes should be considered as well.

Myriad medical conditions can trigger delirium, including intracranial diseases such as strokes, hemorrhage, seizures, neoplasms, and hypertensive encephalopathy; localizing neurologic deficits may be difficult to elicit in uncooperative patients. Cardiovascular diseases such as acute coronary syndrome may present atypically in older patients, especially diabetics and women, who may only exhibit signs such as shortness of breath, sweating, vomiting, confusion, or dizziness (without chest pain). In addition, metabolic and endocrine disorders (eg, hypoxia, hypercarbia, significant derangements in temperature, glycemic control, and electrolyte balance) can cause altered mental status. Hepatic and uremic encephalopathy, thiamine deficiency, thyroid disorders, dehydration, and malnutrition are other possible culprits.

Iatrogenic etiologies of altered mental status also should be considered — the most common of which is polypharmacy. Other causes include prolonged emergency department length of stay, use of physical restraints, bladder catheters, sleep deprivation, undertreated pain, and procedural interventions. These factors should be avoided to the extent possible to minimize the likelihood of inducing delirium in elderly patients.

**Infections**

Approximately 50% of cases of delirium in both community-dwellers and institutionalized patients are caused by infections, which can be challenging to identify. Older patients are more susceptible to infections than their younger counterparts, given their compromised physical barriers and age-related decreases in both humoral and cellular immunity. Elderly patients also tend to present atypically, with confusion, decreased in functional status, failure to thrive, frequent falls, and generalized weakness.

Fever is an uncommon sign of infection; less than 20% of geriatric patients with proven bacteremia report a fever prior to presentation, and up to 30% remain afebrile in the emergency department. This factor probably can be contributed to a lower baseline temperature and blunted fever response. Other indications of infection include hypothermia, tachypnea, bandemia (>6%), vomiting, and altered mental status.

Urinary tract infections and pneumonia are the most common culprits, followed by intra-abdominal and soft-tissue infections. The presence of symptoms that point toward involvement of a specific organ system is neither sensitive nor specific. For example, patients with pyelonephritis can present with gastrointestinal or respiratory symptoms. Only 35% of older patients with pneumonia exhibit the classic combination of cough and fever, and 25% to 35% of patients with intra-abdominal infections do not have abdominal tenderness on presentation.

It is necessary to expose the entire patient during the examination to look for cellulitis and infected pressure ulcers and reveal any hardware or indwelling...
Table 3: Modified Richmond Agitation Scale (mRASS)

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>+4</td>
<td>Combative (Overtly combative, violent, danger to staff)</td>
</tr>
<tr>
<td>+3</td>
<td>Very agitated (Pulls or removes tubes or catheters, aggressive)</td>
</tr>
<tr>
<td>+2</td>
<td>Agitated (Frequent, non-purposeful movements)</td>
</tr>
<tr>
<td>+1</td>
<td>Restless (Anxious, but movements not aggressive)</td>
</tr>
<tr>
<td>0</td>
<td>Alert and calm</td>
</tr>
<tr>
<td>-1</td>
<td>Slightly drowsy (Responds to voice and can make eye contact for &gt;10 seconds)</td>
</tr>
<tr>
<td>-2</td>
<td>Moderately drowsy (Responds to voice, but can only make eye contact for &lt;10 seconds)</td>
</tr>
<tr>
<td>-3</td>
<td>Severely drowsy (Responds to voice, but does not make eye contact)</td>
</tr>
<tr>
<td>-4</td>
<td>Unarousable (No response to voice or physical stimulation)</td>
</tr>
</tbody>
</table>


catheters.

Reliance on fever or neck stiffness to diagnose meningitis or encephalitis will result in missed cases. There appears to be no significant difference in the frequency of meningitis and encephalitis or cerebrospinal fluid pleocytosis between patients who are febrile and those who are not.11

Polypharmacy

It’s no secret that prescription drug use in the United States is steadily on the rise. According to the National Center for Health Statistics, nearly 40% of patients over the age of 65 were taking five or more prescription drugs in 2010 — a three-fold increase since the 1980s. In contrast, only 16% of people between the ages of 45 and 64 were taking this many medications.12

This dangerous trend is of particular concern in patients over the age of 65, who are more susceptible to problems caused by drug reactivity.13 The most frequently documented independent patient-related risk factor for serious adverse effects is the number of drugs being taken; this risk climbs as high as 82% when seven or more medications are involved.14,15 Eleven percent of all emergency department visits by elderly patients are related to adverse drug events, while fewer than 4% of visits by younger patients are precipitated by medication reactivity.16

Although clinicians should maintain a high degree of suspicion in all elderly patients presenting with delirium, certain characteristics may heighten the concern for drug reactivity. One prominent study showed that patients who were sicker at baseline (as measured by the Charlson Comorbidity index), were taking more medications and had a serum creatinine concentration of 1.4 mg/dL or greater were significantly more likely to have an adverse drug event leading to an emergency department visit than were age-matched controls.19 Female gender and a lower body weight also have been associated with higher rates of adverse drug events, approximately 6% of which are confusion or agitation.19

Although a variety of medications have been implicated in cases of altered mental status, several stand out as consistently problematic in older patients (Table 6). Four drug classes are associated with an increased risk of delirium — opioids, benzodiazepines, dihydropyridines, and antihistamines — with odds ratios between 1.8 and 3.20 Diuretics, antidiabetic agents, and analgesics are among the most common culprits of altered mental status in the elderly.18

CRITICAL DECISION

What is the best way to approach an elderly patient with altered mental status?

Once delirium has been diagnosed, the next priority is identifying the cause. A thorough history and examination must focus on the onset of symptoms and their fluctuance or progression, signs of infection, and any history of

<table>
<thead>
<tr>
<th>Table 4. Predisposing Factors for Delirium</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Dementia</td>
</tr>
<tr>
<td>- Old age</td>
</tr>
<tr>
<td>- Premorbid functional impairment</td>
</tr>
<tr>
<td>- Visual or hearing impairment</td>
</tr>
<tr>
<td>- Preexisting depression</td>
</tr>
<tr>
<td>- Underlying stroke or seizure disorder</td>
</tr>
<tr>
<td>- Chronic use of medications such as narcotics or benzodiazepines</td>
</tr>
<tr>
<td>- Alcohol or drug abuse</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 5. Precipitating Causes of Delirium</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Infections</td>
</tr>
<tr>
<td>- Medications and toxins</td>
</tr>
<tr>
<td>- Intracranial diseases</td>
</tr>
<tr>
<td>- Cardiovascular disease</td>
</tr>
<tr>
<td>- Metabolic disorders</td>
</tr>
<tr>
<td>- Endocrine disorders</td>
</tr>
<tr>
<td>- Dehydration and malnutrition</td>
</tr>
<tr>
<td>- Iatrogenic</td>
</tr>
</tbody>
</table>
trauma. An accurate medication list should be obtained and reviewed, with specific attention directed toward any recent changes in types or dosages. The patient’s skin should be examined for infection, and neurologic function should be assessed to elicit any focal deficits. Subtle signs of trauma should be sought, as these patients often are too stoic or altered to disclose injuries and falls. The possibility of elder abuse should not be overlooked, and the subsequent investigative process must be tailored to the specific clinical situation.

Diagnostic studies should include at a minimum an ECG, complete blood count (CBC), and basic metabolic panel to measure electrolytes, renal function, and glucose. A partial septic screening, including urinalysis and a chest radiograph, also should be obtained. A further workup should be pursued as clinically indicated, including head computed tomography (CT), electroencephalogram (EEG), lumbar puncture, liver function tests, and measurements of ammonia levels, cardiac enzymes, thyroid-stimulating hormone, and arterial blood gas (ABG) for hypercarbia.

The yield of head CT in the undifferentiated delirious patient is very low — and possibly zero in the absence of a decreased level of consciousness, focal neurologic deficit, or trauma. However, if no obvious reason for the delirium can be found, the test should be performed to rule out subdural hematoma or a slowly expanding mass; a lumbar puncture also should be strongly considered to investigate for meningitis and encephalitis, as the onset of such infections can be insidious in the geriatric patient.

**CRITICAL DECISION**

**How is new-onset delirium differentiated from underlying dementia?**

Delirium is an acute, fluctuating alteration in consciousness combined with impaired cognition or perceptual disturbances. In contrast, dementia is a gradual and progressive cognitive defect that affects multiple areas, especially memory (Table 7). Dementia is a relatively common disorder, occurring in 1% to 2% of 65-year-olds and increasing to 10% to 15% at age 80.

Disorientation, especially to time, may be present early in the disease. Patients with severe dementia might display disorganized thinking and perceptual disturbances, features that can be mistaken for delirium.

Dementia has many causes (Table 8), the most common of which is Alzheimer disease, which affects nearly 10% of people older than 71 years and tends to be slow in onset. The second most common manifestation is dementia with Lewy bodies (DLB), which can be associated with perceptual disturbances; the disease is more difficult to distinguish from delirium as its onset is more rapid (over hours to days, rather than weeks to months). Patients with DLB may also exhibit Parkinsonian motor symptoms such as cogwheel stiffness and a shuffling gait.

It is prudent to remember that even though investigation into the cause of a patient’s dementia usually is conducted on an outpatient basis, it might fall on the emergency physician or hospitalist team to seek the source. Reversible causes of dementia should be considered in the emergency department (eg, hypothyroidism, vitamin B12 deficiency, depression, neurosyphilis, and normal pressure hydrocephalus.)

**CRITICAL DECISION**

**What is the best treatment for acute, agitated delirium?**

Hyperactive or agitated delirium is less common than hypoactive delirium in geriatric patients, and its management can be significantly more challenging. As previously mentioned, underlying etiologies in this patient population range from infection to medication complications, dehydration, inadequate pain control, and sleep deprivation. Treatment should focus on finding and addressing the underlying cause of the symptom; however, the management of these patients must be addressed promptly to ensure the safety of both the patient and health care providers.

**Nonpharmacologic Treatments**

Numerous critical care physician and nursing publications give nonpharmacologic interventions a high level
Critical Decisions in Emergency Medicine

of recommendation in the management of delirium in the intensive care unit and on general medicine wards. However, these techniques frequently are overlooked in the emergency department for the treatment of agitated patients.

Sensory deficits (ie, hearing impairment and decreased visual acuity) can contribute to confusion in the elderly. Simple steps such as ensuring patients have their glasses and hearing aids can be beneficial. Medical tethers such as Foley catheters, telemetry monitors, and oxygen and pulse oximetry tubing can aggravate those who are already agitated and delirious and should be used only if clinically indicated, rather than placed reflexively. Finally, reducing ambient noise and allowing family members and other familiar faces at the bedside can assist in quieting a delirious patient.

The Tolerate, Anticipate, and Don’t Agitate (T-A-DA) approach encourages clinicians to tolerate some behaviors of delirium and allows patients to respond to their environment while being monitored closely to prevent harm. The method reminds physicians to anticipate actions that can worsen symptoms and consider alternative management strategies. For example, a patient may become agitated with the placement of an intravenous line; a faster rate of administration may be beneficial (eg, bolus) and can reduce the amount of time a patient is under duress.

Although most emergency physicians will consciously avoid agitating a delirious patient, further distress can be exacerbated unintentionally. It may be helpful to assemble all members of the care team (eg, nurses, attending physician, house staff physicians) and consider alternative management options. For example, a patient may become agitated with the placement of an intravenous line; a faster rate of administration may be beneficial (eg, bolus) and can reduce the amount of time a patient is under duress.

Although most emergency physicians will consciously avoid agitating a delirious patient, further distress can be exacerbated unintentionally. It may be helpful to assemble all members of the care team (eg, nurses, attending physician, house staff physicians) and consider alternative management options. For example, a patient may become agitated with the placement of an intravenous line; a faster rate of administration may be beneficial (eg, bolus) and can reduce the amount of time a patient is under duress.

TABLE 8. Causes of Dementia

<table>
<thead>
<tr>
<th>Primary</th>
<th>Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Alzheimer disease</td>
<td>• Multi-infarct dementia</td>
</tr>
<tr>
<td>• Dementia with Lewy bodies</td>
<td>• Trauma</td>
</tr>
<tr>
<td>— Parkinson’s disease</td>
<td>• Infectious</td>
</tr>
<tr>
<td>— Huntington’s disease</td>
<td>— HIV</td>
</tr>
<tr>
<td>— Wilson’s disease</td>
<td>— Viral</td>
</tr>
<tr>
<td>— Progressive supranuclear palsy</td>
<td>— Syphilis</td>
</tr>
<tr>
<td>• Fronto-temporal dementia</td>
<td>— Cryptococcus</td>
</tr>
<tr>
<td></td>
<td>• Drugs and toxins</td>
</tr>
<tr>
<td></td>
<td>• B12 deficiency</td>
</tr>
<tr>
<td></td>
<td>• Normal pressure hydrocephalus</td>
</tr>
<tr>
<td></td>
<td>• Intracranial mass/hemorrhage</td>
</tr>
<tr>
<td></td>
<td>• Vasculitis</td>
</tr>
</tbody>
</table>

patients. These medications have lower rates of acute dystonias and extrapyramidal side effects than haloperidol. Although no studies on the use of ziprasidone in this specific population can be found, the drug has been associated with fewer cardiac dysrhythmias and other side effects than haloperidol due to its minimal anticholinergic properties.

As a general rule, physical restraints should be avoided and used only when absolutely necessary during the administration of chemical restraints.

CRITICAL DECISION

Which patients with altered mental status require hospital admission?

Hospital admission usually is viewed as the simplest and safest approach for all altered geriatric patients presenting to the emergency department, but this strategy is not in the best interest of every patient. Patients with the resources to receive treatment in the home setting recover more quickly and with fewer complications than those who are admitted to the hospital.

The appropriate disposition differs according to the underlying cause of the altered mentation. Patients presenting with worsening dementia may be discharged home safely if they have good family support. Patients with acute delirium are more likely to have a poor outcome when discharged from the emergency department, and geriatric patients who are discharged home with non-detected delirium appear to have a lower 6-month survival rate than those without the disorder. Discharge to home should be considered only if the cause of the delirium has been found and quick reversal is expected.

Although there are no published
protocols on the appropriate disposition of geriatric patients with altered mental status, there are several risk-stratification tools that may help guide these important decisions. The Triage Risk Screening Tool (TRST) can help identify elderly patients at risk for repeat visits, hospitalization, or nursing home placement within 30 and 120 days following an emergency department discharge (Table 9).31 Patients identified as high risk (ie, those with 2 or more points) might benefit from admission, particularly when the altered mental status is thought to be secondary to polypharmacy issues. Although medications can be adjusted in the outpatient setting with ample social and medical support, hospitalization provides a controlled environment in which dosages can be reviewed and monitored.

Regardless of how the disposition is approached, geriatric patients experience worse outcomes the longer they remain in the emergency department and are at an increased risk of delirium when disposition is delayed.

**Summary**

Given the frequency of altered mental status in the ever-growing elderly population, emergency providers are bound to face this clinical situation with increasing regularity. Geriatric patients should be screened for delirium using a standardized test such as CAM or mRASS, and clinicians should employ a systematic approach to diagnosing the underlying etiology. Patients should be assessed for hidden infections, all medications should be reviewed for potential adverse reactions, and a thorough history and physical examination should be used to guide the remainder of the workup.

Nonpharmacologic interventions should be used whenever possible to prevent and treat delirium; chemical restraints (typical or atypical antipsychotics) only should be employed when absolutely necessary. Finally, it is particularly important to secure the appropriate disposition for these vulnerable patients, as admission is not always the safest option.

**CASE RESOLUTIONS**

**CASE ONE**
The 74-year-old woman was diagnosed with a urinary tract infection. Her delirium was thought to be complicated by mild decompensated heart failure and the use of lorazepam. She initially was given gentle diuresis and antibiotics for her infection.

Her TRST score was 3, which further validated the clinician’s decision to admit the patient to the hospital for further management. She remained delirious albeit slightly less confused, and was transitioned to oral antibiotics the next day. The delirium soon resolved and she was discharged home on continued heart failure medications; the lorazepam and Foley catheter were discontinued.

**CASE TWO**
The head CT scan of the confused 92-year-old man revealed mild volume loss but no acute abnormalities; other than unchanged baseline anemia, basic laboratory values were normal. A chest radiograph and urinalysis were normal, and no acute, reversible causes of his altered mental status could be found.

The cause of this patient’s worsening confusion was assumed to be advancing dementia. In consultation with the patient’s daughter, the decision was made to admit the man to the hospital, where he could be supervised. The inpatient team’s further workup was otherwise negative. He was ultimately discharged to a dementia unit at a long-term care facility.

**CASE THREE**
The combative 68-year-old man was moved into a quieter private room. After multiple attempts at redirection, he allowed the nurse to place him on a monitor and draw a blood sample — but then promptly pulled out his IV line. Because his agitation showed no signs of abating, intramuscular haloperidol (2.5 mg) was administered. Once subdued, he was given oxygen via nasal cannula, which improved his oxygen saturation to 98% on 4 L/min. A chest radiograph revealed right lower lobe pneumonia, for which he was treated with IV antibiotics and fluids.

His son arrived and assisted the care team in reorienting the patient to the time and situation; he became cooperative without requiring any physical restraints or further parenteral antipsychotics or sedatives. His oxygen saturation and mental status improved greatly after 3 days of hospitalization and he was discharged home.

**Pearls**

- Use a simple screening tool such as mRASS in every encounter with older patients to screen for delirium.
- Consider an underlying infectious condition (eg, urinary tract infection or pneumonia) in all patients with delirium, even if afebrile.
- Be familiar with nonpharmacological methods for preventing and treating delirium.
- Calculate the TRST score as a risk-stratification tool that helps determine the appropriate disposition for geriatric patients with altered mental status.
Pitfalls

- Missing a diagnosis of delirium, especially in patients with preexisting dementia.
- Using physical restraints reflexively in all patients with agitated delirium.
- Using medical tethers such as cardiac monitor leads, oxygen tubing, and Foley catheters, which heighten the risk of delirium in geriatric patients. The use of such tethers should be avoided during emergency department care or discontinued as soon as possible.

ACKNOWLEDGMENTS

The authors thank and acknowledge Linda J. Kesselring, MS, ELS, for copyediting the article and incorporating revisions in the final article.

REFERENCES


ADDITIONAL READING


Article 5
A Randomized Trial of Colchicine for Acute Pericarditis
• Colchicine historically has been recommended for the treatment of chronic pericarditis. This is the first prospective trial to study the drug in acute pericarditis.
• Colchicine was shown to reduce rates of both recurrent and incessant pericarditis as compared to placebo. It also reduced the length of symptoms, number of recurrences, and hospitalization associated with pericarditis.
• These results were seen with low-dose colchicine without a loading dose. This regimen may help reduce the rate of diarrhea, the drug’s most common adverse side effect.

Article 6
Physician Orders for Life-Sustaining Treatment and Emergency Medicine: Ethical Considerations, Legal Issues, and Emerging Trends
• POLST documents allow patients to communicate their specific care goals more clearly than the traditional DNR or DNI orders, and can be implemented more easily and widely than standard advance directives.
• Emergency physicians should familiarize themselves with POLST forms to minimize potential errors in interpretation and execution.
• Regardless of the documentation patients bring to their visit, all care decisions should be discussed with the patient and/or their proxy if available.

Article 7
Acute Liver Failure
• Acetaminophen toxicity is the leading cause of acute liver failure in the US, while viral etiologies are most common in the developing world. Although confirming the etiology of the disease may aid in treatment, it should not delay early discussion with and referral to a liver transplant center.
• The initial treatment is similar to that of other critically ill patients and should focus on improved systemic perfusion and airway protection. Special attention must be paid to infection control; these patients are functionally immunosuppressed, and infection exacerbates encephalopathy.
• The development of encephalopathy is a poor prognostic indicator, and the resultant cerebral edema and intracranial hypertension is the leading cause of death in these patients.

Article 8
Adult Small Bowel Obstruction
• Causes of small bowel obstruction (SBO) include adhesions, neoplasms, hernias, and Crohn’s disease; adhesions are the most common.
• Abdominal pain plus constipation or a history of prior small bowel obstruction increases the likelihood of obstruction.
• Physical examination findings suggestive of SBO include abdominal distention and decreased bowel sounds.
• CT scan is the most sensitive and specific testing modality for making this diagnosis. With appropriate training, however, an emergency medicine practitioner can accurately diagnose an SBO using ultrasound.
The Critical Procedure

AURICULAR FIELD BLOCK

Regional anesthetization can be used for procedures involving the ear such as laceration repair or auricular hematoma drainage. An auricular field block helps avoid distortion of the involved tissue and is relatively simple to perform.

CONTRAINDICATIONS
- Cellulitis overlying site
- Allergy to anesthetic

Risks and Benefits
Outside of anesthetic-related complications (eg, allergic reactions to lidocaine/toxicity), the procedure carries a minimal risk of infection at the injection site and failure to take effect. The superficial temporal artery lies anterior to the ear; however, puncture and/or injection easily can be avoided by using the technique described on the next page. Although the research is scant and controversial, there is some evidence to suggest that anesthetic agents with epinephrine pose a propagated risk of tissue necrosis of the ear.

Auricular field blocks offer the benefits noted with most regional blocks. The procedure can potentially reduce the number of required injections and provide adequate anesthesia without distorting local tissue — a benefit that can improve cosmetic outcomes related to laceration repairs.

By Steven J. Warrington, MD, MEd
Dr. Warrington is a core faculty member of the general surgery and emergency medicine residency programs, and the associate medical director for emergency department outreach and education at Kaweah Delta Medical Center in Visalia, California.
Alternatives

- Local infiltration of the anesthetic
- Patient sedation
- Aborting/not performing the procedure

Reducing Side Effects

While topical anesthetics may lengthen the procedure and the patient’s hospital stay, treatments such as lidocaine/prilocaine cream may offer benefit. Oral or intravenous anxiolytics or pain medications also can improve patient comfort when used before or in combination with an auricular block. Thorough disinfection and efforts to avoid contamination of the needle and injection site can help reduce the risk of complications. Vascular injection can be avoided by using continuous aspiration when the needle is advanced; this technique can help prevent inadvertent puncture of the superficial temporal artery.

Special Considerations

Longer-acting anesthetics such as bupivacaine may extend the duration of pain control better than short-acting agents. Some literature supports the use of anesthetics that contain epinephrine in sites that are anecdotally avoided (eg, fingers, nose, penis, toes, ears). However, the addition of epinephrine adds little benefit to an auricular block performed in the emergency department and is not recommended.

It is crucial to position the patient and organize the room appropriately to ensure success. A poorly placed chair or bed can restrict access to the insertion site and restrict movement during the procedure — as can an uncomfortable patient. It also is important to provide the patient with a clear description of the steps involved in the procedure. Clear communication prior to and during the procedure can reduce patient anxiety.

TECHNIQUE

1. Obtain consent and notify staff of the procedure.
2. Prepare the room.
   a. Consider topical, oral, or intravenous adjunct medications.
   b. Ensure anesthetic and equipment at bedside: 10-mL syringe and 27-gauge 1.5-cm needle (or semi-equivalent), blunt fill needle, and method for cleaning skin.
   c. Position patient/room to ensure ease of access.
3. Prepare the skin above and below the ear for needle insertion.
4. Insert the needle approximately at the level of the superior helix. Aspirate until it is advanced to a point just anterior to the tragus, then withdraw while depositing 2.5 mL of anesthetic until the needle has reached the entrance site. (Some suggest >2.5 mL per injection.)
5. Redirect and aim the needle at an imaginary point posterior to the mid ear, and use the same technique described in step 4 to form the second side of an imaginary diamond around the ear.
6. Withdraw the needle and reinsert it just inferior to the lobe; complete the imaginary diamond around the ear using the additional 5 mL of anesthetic.
7. Allow adequate time for the medication to take effect, and test the site(s) for proper anesthetization prior to starting the procedure.
A 75-year-old man with lightheadedness.

The Critical ECG

Sinus rhythm (SR) with second-degree atrioventricular (AV) block type I (Wenckebach, Mobitz I), rate 55, nonspecific intraventricular conduction defect (IVCD). The rhythm was originally misdiagnosed as atrial fibrillation because of the baseline artifact and the slight irregularity of the rhythm. However, closer inspection does reveal regular atrial activity. Distinct P waves are most easily found in lead V₁, excluding the diagnosis of atrial fibrillation. Close inspection of the lead II rhythm strip reveals regular atrial activity and gradual prolongation of the PR interval until a non-conducted P wave appears. The cycle then repeats.

Some of the P waves are hidden within T waves. Nonspecific IVCD is diagnosed based on the presence of slight QRS complex prolongation without meeting formal criteria of any of the usual causes of a prolonged QRS interval (hypothermia, hyperkalemia, Wolff–Parkinson–White syndrome, bundle branch block, ventricular ectopy, paced beats, left ventricular hypertrophy, and sodium channel-blocking medications).

By Amal Mattu, MD, FACEP
Dr. Mattu is a professor, vice chair, and director of the Emergency Cardiology Fellowship in the Department of Emergency Medicine at the University of Maryland School of Medicine in Baltimore.

OBJECTIVES
On completion of this lesson, you should be able to:
1. Explain the routes and doses for ketamine in patients with acute, subacute, and chronic pain.
2. Identify the adverse effects of narcotic analgesics administered in the emergency department and prescribed upon discharge.
3. Incorporate a pain management algorithm into the management of patients in the emergency department.
4. Understand and implement non-narcotic pharmacologic approaches to treating pain.
5. Recommend alternative routes of medication delivery to effectively manage pain in the emergency department.
6. Manage the specific concerns related to treating pain in the pediatric population.

FROM THE EM MODEL
19.0 Procedures and Skills Integral to the Practice of Emergency Medicines
19.3 Anesthesia and Acute Pain Management

CRITICAL DECISIONS
- What is the ideal pain control medication for injured patients who are potentially unstable?
- What are the potential complications of treating a patient with opioids?
- How can ultrasound-guided regional blocks be used to treat acute pain?
- What medications are most effective for managing chronic pain in the emergency department?
- What nonopioid medications can be used in the emergency department to treat acute exacerbations of chronic pain?
- When should trigger point injections be used?
- What additional challenges are faced when managing pain in pediatric patients?
Pain is ubiquitous — particularly in the emergency department, where 80% of patients present with the complaint. Emergency physicians have long been charged with delivering analgesia in information-poor environments; however, it is increasingly important to understand how to manage acute and chronic pain with a wide variety of treatments that extend beyond opioids, the overuse of which has become a cause for grave concern.

Opioid-related overdose deaths have doubled since 2000 — a startling statistic that heightens the risk of complications and therapeutic misadventures (Figure 1). This recent trend should encourage clinicians to capitalize on the many non-narcotic alternatives available for the management of acute pain in children and adults, including cutaneous or local anesthetic, ultrasound-guided nerve blocks, non-narcotic systemic analgesics (Figure 2), and dissociative sedation.

**CRITICAL DECISION**

**What is the ideal pain control medication for injured patients who are potentially unstable?**

Ketamine is a unique agent that works by dissociating the central nervous system from external painful stimuli by blocking NMDA (N-methyl-D-aspartate) receptors. This mechanism induces a trance-like state that results in strong analgesia, sedation, and amnesia while preserving airway reflexes, spontaneous respirations, and cardiovascular stability.

These features provide a large margin of safety. Unlike other analgesics and procedural sedation agents, ketamine has no dose response continuum and its dissociative effects appear reliably with intravenous (IV) doses of 1.5 mg/kg. There is no need for titration; additional quantities of the drug simply result in a longer duration of action.

Ketamine can be administered via multiple routes. When dissociation is desired for cases of acute pain, the recommended dose is 2 mg/kg (intranasal), 1 to 2 mg/kg (intravenous), and 4 to 5 mg/kg (intramuscular). The typical pattern for subdissociative analgesia is an intravenous loading dose of 0.2 to 0.3 mg/kg followed by an infusion of 0.2 to 0.3 mg/kg/hr.

---

**CASE PRESENTATIONS**

- **CASE ONE**
  
  An ill-appearing 23-year-old man is brought in by EMS after being hit over the head with a bar stool. Paramedics report that the patient was combative when they arrived on scene. His vital signs were blood pressure 80, radial pulse 110, and oxygen saturation 86% on room air; he showed a depressed Glasgow Coma Scale score, decreased breath sounds, and crackles in the left lung base.

  In the emergency department, the young man remains agitated and must be restrained by hospital personnel. Faced with multiple clinical priorities, the emergency physician approximates the man’s weight and pushes the administration of intravenous ketamine (2 mg/kg over 45 seconds). The patient’s combativeness soon stops, his oxygen saturation increases to the low 90s, and his blood pressure improves to 100/palp.

- **CASE TWO**
  
  A 27-year-old woman limps into a rural emergency department in visible pain and covered from waist to feet in mud. She explains her horse was startled and bucked her onto the ground, where she hit her leg on a large rock. The patient is speaking in complete sentences; her vital signs are blood pressure 145/90, heart rate 115, and respiratory rate 20.

  Distal pulses are intact and the only sign of trauma is her noticeably swollen right thigh; any hip movement causes severe pain. Intravenous access is obtained and fentanyl is ordered for pain control. The patient refuses opioids and explains she has a history of narcotic addiction. She has been clean for 3 years and is afraid of relapsing, but reluctantly agrees to an injection of ketorolac.

  Radiographs of her right lower extremity reveal a nondisplaced transverse distal femur fracture. Orthopedics is consulted and recommends bracing in favor of immediate surgery; however, the patient experiences severe pain when casting is attempted. After thoroughly discussing the alternatives, the clinician decides to attempt an ultrasound-guided nerve block of the femoral nerve to provide adequate relief.

- **CASE THREE**
  
  An otherwise healthy 3-year-old boy is rushed into the emergency department by his parents after falling onto a pair of open scissors and cutting his cheek. The laceration appears to be only 3 cm wide and .5 cm deep, but he recoils and cries loudly when an examination is attempted. The physician turns on the television in the room to distract the child, who momentarily stops crying. He is afebrile and his vital signs are blood pressure 90/55, heart rate 130, and respiratory rate 30.

  The clinician shows the Faces Pain Scale-Revised to the patient, who points toward his laceration and chooses 8 to describe his level of pain. Analgesic options are discussed with the parents, including nitrous oxide, intranasal ketamine, and a facial nerve block. The family ultimately chooses nitrous oxide, which is prepared in a 70:30 ratio of N2O:oxygen.
Ketamine is indicated for a variety of painful procedures, both brief and long. The drug’s only absolute contraindications are in patients with schizophrenia and those younger than 3 months. Like any other pain control agent, ketamine increases the risk of airway obstruction, laryngospasm, and apnea in very young children. Symptoms of both controlled and active schizophrenia may be exacerbated.

Relative contraindications primarily are related to upper-airway conditions that predispose patients to laryngospasm, and cardiovascular disease that could be exacerbated by the medication.

As with any potent agent, the patient and family should receive a thorough explanation about the potential effects of ketamine, including a description of the dissociative state. Dose-dependent complications can be avoided with initial doses less than 2.5 mg/kg IV and total doses less than 5.0 mg/kg IV. Starting doses of 2.0 mg/kg IV or 5.0 mg/kg intramuscularly (IM) are more reliably effective than lower doses. Respiratory depression can be avoided with intravenous doses administered over 30 to 60 seconds.

Patients can be pretreated with midazolam (.03 mg/kg IV) to mitigate recovery agitation. Ketamine-induced emesis, which peaks in adolescence and is most common with the IM delivery route, can be mitigated by odansetron.

Local anesthesia and supplemental oxygen are not required or recommended with the administration of ketamine, which has no effect on a patient’s respiratory rate and cardiovascular status. In addition, there is no evidence that patients need to tolerate food or liquids or ambulate with assistance prior to discharge. These activities can be done at home at the patient’s own pace once they’ve returned home.
CRITICAL DECISION
What are the potential complications of treating a patient with opioids?

It is well known that opioid-related problems have skyrocketed in recent years; more than 16,000 deaths were blamed on these medications in 2013 alone.1 The crisis appears to be further compounded by prescribing clinicians — the source of most misused opioids.6

The potential for narcotic abuse can be objectively measured by utilizing the Opioid Risk Tool (ORT) found at MDCalc (mcalc.com), which evaluates various risk factors such as age and mental health, substance abuse, and family histories.7

Adverse gastrointestinal (GI) effects such as constipation and nausea are common with the use of opioids, which prolong GI transit times and potentially delay absorption.8,9 Allergic responses are common due to opioid-induced histamine release and include flushing, itching, hives, sweating, and reactions at the injection site. Mild peripheral vasodilation may result in orthostatic hypotension. Stronger opioids such as fentanyl and hydrocodone are less likely to cause these side effects than less potent agents such as morphine and codeine.10

Marked respiratory depression can be seen with moderate-to-severe intoxication and can override the body’s hypoxic drive to breathe. Acute lung injury is suggested by pink frothy sputum, muscular rigidity, dyspnea, hypoxia, and bronchospasm.

Nightmares, anxiety, agitation, euphoria, dysphoria, depression, paranoia, and hallucinations primarily are encountered with high doses. Although uncommon, generalized seizures can occur in infants and children because of their vulnerability to initial central nervous system excitation. Long-term opioid use can lead to tolerance, dependence, and addiction.8,9 Additionally, opioids are the second leading cause of drug-induced serotonin syndrome, which carries a mortality rate between 2% and 12%.11,12

CRITICAL DECISION
What medications are most effective for managing chronic pain in the emergency department?

Chronic pain, defined rather vaguely by discomfort that persists longer than expected, constitutes a substantial challenge for the emergency physician.11 In somatic tissue injuries, peripheral (somatic) and central (neuropathic) pain receptors cause the symptoms. In patients with chronic pain, neuropathic pain signals persist even after the tissue injury has resolved, and the emotional burden can surpass the somatic component.

Patients with acute, somatic pain (eg, a fractured ankle) may benefit from opioids, nonsteroidal anti-inflammatory agents, and muscle relaxers. Total elimination of pain is unlikely with a significant injury; attempts to resolve all symptoms can lead to overtreatment, loss of function, and drug dependency. Chronic narcotic therapy contributes to sedation, lethargy, lack of engagement in physical therapy, and limited exercise. It also can lead to poor socialization, isolation, and assumption of the “sick” role.

Patients should be informed with their first prescription of narcotics that the longer they take opioids, muscle relaxants, or other potentially sedative medications, the harder it will be for them to stop.15 The upfront goal should be increased function, not the elimination of pain.15 It also is import to remember that the longer the symptoms persist, the less effective and more harmful opioids become; there is little to support the use of these agents for the treatment of long-term pain.13,15

More than 10% of patients who begin taking opioids remain on them chronically; nearly all of those on long-term opioid therapy develop tolerance and dependence, one-quarter become non-medical users, and another 10% become addicted to the drug.16,17

Finally, it is helpful for both clinicians and patients to understand that the non-medical use of opioids can result in catastrophic consequences, including heroin addiction.18,19 Rehabilitation is the mainstay of therapy, but the emergency physician can start by setting realistic expectations and treating chronic pain with antidepressants, usually the medication of choice.14

Virtually any antidepressant that works on serotonin and norepinephrine can help relieve neuropathic pain. Selective neurotonin reuptake inhibitors (SNRIs) such as duloxetine and venlafaxine are the first line, and treat both pain (at higher doses) and comorbid depression and anxiety (at lower doses). Although tricyclic antidepressants such as amitriptyline and imipramine are effective, they may not be tolerated as their anticholinergic and alpha-blocking properties can cause orthostasis and a prolonged QT interval. These agents are effective for pain at lower doses and for depression and anxiety at higher doses — the reverse of SNRIs.14

Almost any anticonvulsant will help relieve neuropathic pain. Carbamazepine is the drug of choice for the treatment of trigeminal neuralgia; and gabapentin is preferred for postherpetic neuralgia; pregabalin is formally indicated for fibromyalgia. These agents can be combined with antidepressants, which have a different mechanism of action.14

Topical lidocaine patches, which work both neurologically and at the placebo level, may benefit some patients. Clonidine, which is available orally and as a topical patch, is a central-acting adrenergic alpha-agonist that can help alleviate complex pain regional pain syndrome (ie, regional sympathetic dystrophy). Antiarrhythmics block sodium and calcium channels — much in the same way SNRIs and tricyclic antidepressants do — also can be used to treat neuropathic pain.14

CRITICAL DECISION
How can ultrasound-guided regional blocks be used to treat acute pain?

Regional anesthesia has become an emergency department staple for performing common procedures such as laceration repairs and reductions of dislocations and fractures. A peripheral
nerve block can be an excellent option when there is a need to anesthetize a large surface area. The procedure interferes with sodium-gated channels located on the axoplasmic side of nerve cells; just as in local anesthetics, this mechanism prevents the influx of sodium ions and subsequently blocks excitation of the nerve.

Interest in the role of ultrasound has piqued with the growing availability of sonographic equipment in emergency departments around the country. In addition to its utility as a rapid imaging modality for clinical assessments, ultrasound has been shown to improve the success of nerve blocks, decrease the total volume of local anesthetic required (thus reducing the risk of toxicity), and decrease the time of analgesic onset.20

Brachial plexus blocks commonly are used for anterior shoulder dislocations; sciatic nerve and femoral nerve blocks can provide pain relief for lower extremity or hip fractures and crush injuries that require manipulation and stabilization prior to surgery.21 The largest barrier to success is technical skill. The decision to perform the procedure rests on the clinician’s comfort and proficiency with the technique, ability to obtain informed consent, and absence of contraindications.

Absolute contraindications include patient refusal and allergy to anesthetics; relative contraindications include antithrombotic drug use, coagulopathy, active infection at the injection site, and pre-existing peripheral neuropathies. Patients who are coagulopathic or taking antithrombotic drugs are at an increased risk of hematoma formation at non-compressible sites — a complication that can lead to limb ischemia and end-organ damage.21 All patients should be evaluated thoroughly before receiving a nerve block, and the motor and sensory function of the target area should be well documented.

CRITICAL DECISION
What nonopioid medications can be used in the emergency department to treat acute exacerbations of chronic pain?

As in any other case, the first step when assessing chronic pain is to rule out an emergent etiology; it is important to avoid the cognitive trap of attributing all symptoms to the patient’s pain condition. Once all acute culprits have been eliminated, the tendency to reflexively administer opioids must be questioned. Many patients who suffer from chronic pain are under the ongoing supervision of pain management specialists and have signed a contract that forbids them from obtaining opioids from other prescribers. The pharmacological management of acute worsening of chronic pain often can be fully addressed in the acute setting with nonsteroidal anti-inflammatory drugs (NSAIDs), acetaminophen, and anticonvulsants, among other less addictive medications.

NSAIDs exert their analgesic, anti-inflammatory, and antipyretic effects by inhibiting cyclooxygenases (COX)-1 and -2, a mechanism that reduces the acute inflammatory response downstream. Common nonspecific NSAIDs include ibuprofen, diclofenac, naproxen, and ketorolac. Selective COX-2 inhibitors such as celecoxib were designed to have a safer side effect profile. Although they carry a lower risk of bleeding and gastrointestinal issues (eg, ulcers and dyspepsia), they may increase the danger

<table>
<thead>
<tr>
<th>TABLE 1. Nonopioid Pain Medications24</th>
<th>Emergency Department</th>
<th>Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Abdominal Pain</strong></td>
<td>IV Ketorolac: 10-15 mg IVP</td>
<td>PO Ibuprofen: 400 mg</td>
</tr>
<tr>
<td></td>
<td>IV Acetaminophen: 1g over 15 min</td>
<td>PO Diclofenac: 15 mg</td>
</tr>
<tr>
<td></td>
<td>IV Ketamine: 0.2 mg/kg over 10 min, + IV drip at 0.15 mg/kg/hr</td>
<td></td>
</tr>
<tr>
<td><strong>Abdominal Pain</strong> (traumatic)</td>
<td>IV Acetaminophen: 1 g over 15 min</td>
<td>PO Ibuprofen: 400-800 mg</td>
</tr>
<tr>
<td></td>
<td>IV Ketamine: 0.2 mg/kg over 10 min, + IV drip at 0.15 mg/kg/hr</td>
<td>PO Acetaminophen: 1000 mg</td>
</tr>
<tr>
<td><strong>Back Pain</strong></td>
<td>IV Ketorolac: 10-15 mg (or Ibuprofen 400 mg if they can take PO)</td>
<td>PO Ibuprofen: 400-800 mg</td>
</tr>
<tr>
<td></td>
<td>IV Acetaminophen: 1 g over 15 min</td>
<td>PO Acetaminophen: 1000 mg</td>
</tr>
<tr>
<td></td>
<td>IV Ketamine: 0.2 mg/kg over 10 min, + IV drip at 0.15 mg/kg/hr</td>
<td>PO Methocarbamil: 500 mg-1500 mg</td>
</tr>
<tr>
<td></td>
<td>IV Lidocaine: 2%-1.5 mg/kg over 10-15 min</td>
<td>PO Diazepam: 5 mg</td>
</tr>
<tr>
<td></td>
<td>IV Clonidine: 0.3-2 mcg/kg/hr</td>
<td></td>
</tr>
<tr>
<td><strong>Headache</strong></td>
<td>IV Metoclopramide: 10 mg</td>
<td>PO Ibuprofen: 400 mg</td>
</tr>
<tr>
<td></td>
<td>IV Diphenhydramine: 25-50 mg</td>
<td>SQ Sumatriptan (migraine): 6 mg</td>
</tr>
<tr>
<td></td>
<td>IV Prochlorperazine: 10 mg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IV Ketorolac: 10-15 mg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SQ Sumatriptan (migraine): 6 mg</td>
<td></td>
</tr>
<tr>
<td><strong>Neuropathic</strong></td>
<td>PO Ibuprofen: 400-800 mg</td>
<td>PO Ibuprofen: 400-800 mg</td>
</tr>
<tr>
<td></td>
<td>PO Gabapentin: 100-300 mg</td>
<td>PO Gabapentin: 100-300 mg</td>
</tr>
<tr>
<td></td>
<td>PO Prednisone: 25-50 mg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IV Ketamine: 0.2 mg/kg over 10 min, + IV at 0.15 mg/kg/hr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IV Lidocaine 2%: 1.5-2.5 mg/kg /hr drip x 2-4 hrs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IV Dexmedetomidine: 0.2-0.3 mcg/kg/hr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IV Clonidine: 0.3-2 mcg/kg/hr</td>
<td></td>
</tr>
</tbody>
</table>
of cardiac events. Short courses of maximal-dose NSAIDs can be initiated after carefully considering patient compliance, risk factors, and follow up. Caution should be used when prescribing these medications to patients with a prior or ongoing history of gastrointestinal bleeding or renal issues (ie, prostaglandin inhibition leading to decreased renal blood flow).

Acetaminophen is a popular choice for the treatment of mild or moderate discomfort, but it also can be effective for the management of acute exacerbations of chronic pain when used in conjunction with NSAIDs. The mechanism of action postulated for acetaminophen involves the inhibition of prostaglandins. Some research shows in vivo effects similar to those seen with COX-2 inhibitors, while other studies credit COX-3 inhibition for the drug’s analgesic effects.

Acetaminophen poses a lower risk of cardiac and renal side effects than NSAIDs. The parenteral administration of acetaminophen in post-surgical cases has shown promise; however, its availability is limited in many medical centers across the country. Rectal administration has shown similar efficacy as an alternative route. Co-administration with NSAIDs often yields better pain outcomes than acetaminophen alone in patients who can tolerate both drugs. The major adverse effect of acetaminophen is dose-dependent liver damage; however, doses in the acute care setting seldom approach toxic levels.

Anticonvulsant medications often are prescribed as adjuncts in pain management programs, especially when there is a predominant neuropathic component. As discussed earlier, common agents include carbamezapine, gabapentin, and pregabalin. The tricyclic antidepressant amitriptyline also can be prescribed under similar circumstances.

Anticonvulsants (specifically, gabapentin) appear to demonstrate the opioid-sparing effect. See Table 1 for sample regimens for the nonopioid treatment of pain in the emergency department.

CRITICAL DECISION
When should trigger point injections be used?

Myofascial pain syndrome is a musculoskeletal disorder characterized by the presence of trigger points — the definition and treatment of which have been long debated. Although the pathophysiology is unclear, trigger points are believed to be comprised of palpable, tense bands of skeletal muscle fibers that produce local and referred pain when compressed. The compression causes ischemia, leading to the accumulation of inflammatory products such as kinins and prostaglandins; when these trigger points are treated, they revert to baseline and the pain generator is removed.

Trigger points (Figure 3) often can be palpated as nodules or bands of muscle fiber that are tender to the touch; the pain may radiate to other sites. These points can be classified as active or latent — the only major difference being that latent trigger points do not cause spontaneous pain.

More objective methods of identifying trigger points have been sought, including handheld pressure meters and ultrasound. Specific sonographic findings remain under investigation, but the appearance of trigger points has been described as elliptically-shaped hypoechoic regions. The major advantage of ultrasound is that it enables the clinician to visualize the vascular and nervous system structures surrounding the trigger points, which currently must be treated blindly.

When other pathologies have been ruled out as the source and the diagnosis of myofascial pain seems clear, trigger point relief usually can be provided quickly and with minimal risk. Local anesthetics and dry needling appear to be equally efficacious, and are believed to relax and lengthen the muscle fibers by interfering with chemical signals.
Technique

The injection site should be sterilized with alcohol or chlorohexadine and then held in a pinching grip by the index and thumb of the clinician’s nondominant hand. The dominant hand should be used to insert the needle 1 to 2 cm from the trigger point at an acute angle, advancing toward the diagnosed point. Patients may feel sharp pain, sometimes accompanied by muscle twitching.

If local anesthetic is to be introduced, the needle should be aspirated to avoid intravascular injection. Clinicians commonly will retract the needle slightly and reorient it in multiple planes until the muscle twitch response is diminished or the muscle fully relaxes. Following the procedure, direct pressure can be applied over the site to reduce hematoma formation.

Risks include infection, bleeding, increased pain, local irritation, and adverse reactions to local anesthetics. Patients should be encouraged to begin stretching and range of motion exercises as tolerated after the procedure.

**CRITICAL DECISION**

What additional challenges are faced when managing pain in pediatric patients?

It is optimal to understand a child’s pain level prior to initiating treatment, but this can be particularly challenging in very young and/or nonverbal patients. While multiple pain scales have been developed, the Faces Pain Scale – Revised (FPS-R) is among the best studied (Figure 4). The tool’s reliability and validity for assessing pain intensity in children between the ages of 4 and 12 years is well documented, and it also has demonstrated excellent interscale agreement in 4-year-old children.

As challenging as it may be to measure a pediatric patient’s discomfort, it is critically important to identify and treat pain appropriately to minimize its long-term adverse effects. Repeated and sustained pain can have direct and enduring consequences on neonatal development. Short-term detrimental effects include extended procedure duration and length of stay, slower surgical healing, and emotional trauma and suffering.

In addition, untreated pain actually can alter the way the child processes pain, leading to avoidance/heightened sensitivity to medical care and fear/increased discomfort related to clinical evaluations. Pain affects the normal development of the nociceptive neural circuits and leads to lowered pain thresholds during later infancy, hypalgesia after puberty, and hyperalgesia in adulthood.

**Nonpharmacological Interventions**

Methods such as nonnutritive sucking, swaddling, and facilitated tucking have a favorable effect on pulse rate, respiration, and oxygen saturation, and appear to reduce motor activity and excitation states after invasive measures.

There are several nonpharmacological interventions specific for infants. Breastfeeding and breast milk have been shown to temper discomfort, but their efficacy has not
been established for repeated painful procedures. Oral sucrose (2 mL) can reduce distress in infants when given 2 minutes prior to a procedure; its analgesic effects can be augmented with nonnutritive sucking via a pacifier.31 An infant warmer or warm blanket also can be used to swaddle the patient.

Music has been shown to minimize the pain and anxiety associated with painful procedures in toddlers and older children. One simple, low-cost distraction technique is to use a smartphone or tablet device — either the clinician’s or the parent’s — to play a child’s favorite music. In addition, guided visual imagery may benefit pediatric patients, who generally are accepting of fantasy and suggestion. Ketamine’s dissociative effects make it an ideal agent for employing this technique.

**Topical Treatments**

There are a variety of topical analgesic options for venipuncture. Lidocaine/prilocaine mixtures, which have an onset of 60 minutes after application, are not as useful in the emergency department setting. Tetracaine gel (4%) and liposomal lidocaine (4%) have an onset of 30 minutes and also are effective for lumbar puncture. Lidocaine-epinephrine-tetracaine (LET) gel can be used on any laceration and has been shown to decrease pain in children with injuries treated with skin adhesive.32

Although the analgesic onset of vapocoolant spray is immediate analgesic, its effects last only briefly. Jet injection with buffered lidocaine is a needle-free system for providing rapid analgesia (1 to 3 minutes) that eliminates the “second poke” often required for venipuncture.33 Nitrous oxide, which has anxiolytic, analgesic, and amnesic properties, has a rapid onset of 5 minutes and a recovery time of 5 to 15 minutes.34

**Intranasal Route**

The intranasal (IN) route, a particularly pediatric-friendly mode of delivering medication, can be dosed roughly at twice the normal intravenous limit. Intranasal fentanyl (2 mcg/kg) offers a rapid onset and high bioavailability. The most concentrated form can be given via an atomizer; if more than 0.3 mL is needed, the dose can be split in each nare to maximize the absorptive area.35 Intranasal ketamine (1 mg/kg) in patients between 3 and 13 years old with isolated limb injury and moderate to severe pain appears to offer pain reduction similar to that provided by IN fentanyl (1.5 mcg/kg).36

**Summary**

Various pain control techniques exist and should be tailored for specific patient care situations. The emergency physician should be facile with the administration of cutaneous and local anesthetic, ultrasound-guided nerve blocks, non-narcotic systemic analgesics, and dissociative sedation.

Targeted analgesia (ie, nerve block) can provide substantial, long-lasting relief and may help clinicians bypass the use of opioids. Ultrasound imaging is another excellent tool for treating pain; it carries minimal side effects and is well-received by patients.

The pain management of children poses unique challenges, as young patients often are unable to adequately communicate their level of pain. A number of nonpharmacological techniques can help alleviate discomfort, including distraction with toys, music, or television; skin-to-skin contact with a parent; and swaddling (in neonates).

It is imperative to discuss the benefits, drawbacks, and complications of treatment with responsible guardians. Noninvasive approaches such as nitrous oxide administration and intranasal ketamine or lidocaine-based creams also may provide adequate analgesia with minimal adverse effects.

**REFERENCES**

CASE RESOLUTIONS

## CASE ONE
The clinician chose to manage the unstable, uncooperative young man with ketamine (2.0 mg/kg IV), which reduced his stress level and allowed him to tolerate treatment. He underwent an uneventful intubation, and an extended FAST examination at the bedside confirmed the presence of a hemopneumothorax. A repeat dose of ketamine (1.0 mg/kg IV) was administered to extend the period of dissociation and allow the necessary tube thoracostomy. Other than a blood alcohol level of .28, the trauma workup was negative. The patient had an uneventful stay in the ICU and was transferred to the stepdown unit, where he recovered fully.

## CASE TWO
The horseback rider was positioned supine on the bed; her anterior superior iliac spine and inguinal crease were located and surrounding areas were prepped with chlorohexidine before being covered with sterile draping. The physician used the linear high-frequency probe to localize the femoral nerve, and 30 cc of ropivacaine was administered.

The patient was monitored closely for signs of toxicity, including convulsions and perioral numbness. Her pain was reduced considerably by the nerve block, and her injury was successfully stabilized. She was instructed to follow up with an orthopedic surgeon and was discharged with a prescription for ibuprofen (800-mg tablets to be taken with meals 3 times a day for 7 days).

## CASE THREE
The young boy became visibly more relaxed within a minute of nitrous oxide administration; his cheek laceration was irrigated with normal saline (30 mL) and LET gel was applied around the wound for increased anesthesia. The clinician had intranasal ketamine ready at bedside in case the patient became upset during the procedure.

With the child calmly lying in bed and watching television, six simple interrupted sutures were placed without any complications, further blood loss, or the need for additional sedation.

Once the nitrous oxide was removed, the child returned to baseline within 5 minutes. The parents were instructed on wound care, appropriate home medications for pain (acetaminophen and ibuprofen), and told to follow up in 10 to 14 days with their pediatrician for suture removal.


ADDITIONAL READING
CASE

A 51-year-old man with chronic obstructive pulmonary disease presents with increasing dyspnea. The patient regularly uses 3 liters of oxygen by nasal cannula and has noted shortness of breath with even modest exertion over the past 4 days. He reports associated chest pain on the right side. He is afebrile, does not have a new productive cough, and denies leg swelling. Vital signs are blood pressure 136/71, pulse rate 131, temperature 36.8 °C (98.2 °F), respiratory rate 28, and oxygen saturation 86% on room air and 98% on 3L oxygen.

The patient appears cachectic but alert and in mild respiratory distress, with tachypnea and increased accessory muscle use. His lung examination demonstrates diminished breath sounds bilaterally in the upper lung fields. He has no peripheral edema, and his cardiac examination is regular; sinus tachycardia is noted on ECG.

A chest x-ray is performed, followed by a chest CT.

A. Posteroanterior (PA) chest radiograph.
The lungs are hyperinflated to such a degree that the pleural spaces can not be visualized on a single detector plate. The paucity of lung markings in the lung apices mimics pneumothorax, although no pleural line or subcutaneous emphysema is seen. By comparison, the lower lung fields appear dense and may be mistaken for an infiltrate; bullous disease can compress the adjacent normal lung, causing atelectasis.

B. Lateral chest radiograph.
The retrosternal space is hyperinflated and again shows a paucity of lung markings.
KEY POINTS

- Patients with advanced bullous emphysema are at risk for spontaneous pneumothorax. Examination findings can overlap between bullous emphysema and pneumothorax, which both can result in decreased lung sounds. Chest radiographic findings of bullous emphysema mimic pneumothorax, with a paucity of lung markings. Some distinguishing features include a pleural line, which may be seen with pneumothorax but not bullous emphysema, and subcutaneous emphysema, which may be present with pneumothorax but is not seen with uncomplicated bullous emphysema.

- When doubt persists, additional imaging may be needed. CT distinguishes bullous emphysema from pneumothorax. Bullae are seen as collections of air within the lung parenchyma exceeding 1 cm in size; blebs are collections of air trapped between layers of the visceral pleura.1 Intravenous contrast is not needed for the recognition of pneumothorax but may be indicated for evaluation of other diagnoses such as pulmonary embolism or aortic dissection.

- Unstable patients or patients in severe respiratory distress may not tolerate supine positioning for CT. Point-of-care ultrasound provides an alternative modality for these patients, with high sensitivity (98.1% [95% CI = 89.9% to 99.9%]) and specificity for pneumothorax (99.2% [95% CI = 95.6% to 99.9%]).2 B-mode ultrasound can identify the normal sliding lung sign, the sonographic visualization of the sliding interface of the parietal and visceral pleura in the absence of pneumothorax. The lung point sign, where normal lung sliding gives way to an absence of sliding at the location of a pneumothorax, may be seen. The absence of any lung sliding may indicate more extensive pneumothorax. M-mode ultrasound allows evaluation for the normal “seashore” sign, or the presence of the abnormal “stratosphere” or “barcode” sign seen in pneumothorax.

- Case reports suggest that ultrasound can distinguish blebs and bullae from pneumothoraces.3 However, while some investigators have reported that the lung point sign is specific to patients with pneumothorax,4,5 others have questioned the accuracy in patients with severe bullous emphysema, where blebs may create a false-positive lung point sign, also called the “bleb point.”6 Emergency physicians should be aware of this possibility and avoid premature placement of a thoracostomy tube if the patient’s condition allows further assessment with CT.

REFERENCES


CASE RESOLUTION

The patient was admitted for management of a chronic obstructive pulmonary disease exacerbation and did not require placement of a thoracostomy tube.
CME QUESTIONS

1. Which of the following tools can be used to guide the disposition of a geriatric patient with altered mental status?
   A. Confusion Assessment Method (CAM)
   B. “Get-up-and-Go” test
   C. Tolerate, Anticipate, and Don’t Agitate (T-A-DA)
   D. Triage Risk Screening Tool (TRST)

2. When compared to haloperidol, what is the advantage of ziprasidone in the treatment of delirious geriatric patients?
   A. It can be given intramuscularly
   B. It has virtually no anticholinergic actions
   C. It is not sedating
   D. Numerous reports of its use in geriatric patients have been published

3. Which of the following statements regarding medical tethers is true?
   A. A patient’s exploration of medical tethers should not be tolerated
   B. Physical restraints should be the first-line approach to managing agitation
   C. Their reflexive use in the emergency department should be avoided
   D. They can decrease delirium and agitation

4. Which of the following medications is least likely to precipitate delirium in older patients?
   A. Anticholinergic agents
   B. Benzodiazepines
   C. Nonsteroidal anti-inflammatory drugs (NSAIDs)
   D. Oral hypoglycemic agents

5. An 80-year-old man presents with a cough and shortness of breath. He has a heart rate of 115 and an oxygen saturation of 90% on room air; other vital signs are normal. Which tool can be used to screen this patient for delirium?
   A. A complete blood count to assess for bandemia
   B. CAM
   C. T-A-DA
   D. TRST

6. Which of the following symptoms is the hallmark of delirium?
   A. Agitation and hyperactivity
   B. Altered level of consciousness
   C. Disorientation to time
   D. Inattention

7. Which of these statements regarding delirium is accurate?
   A. A complete list of the patient’s medications (including over-the-counter products) is an essential part of a thorough assessment
   B. All patients with delirium must be admitted to the hospital for symptom management
   C. An infectious etiology should be suspected only in febrile patients
   D. It is frequently and accurately identified in the emergency department

8. A 75-year-old woman with a history of diabetes presents with AMS; there is no evidence or history of trauma. You suspect delirium. Which diagnostic test should be obtained first?
   A. Fingerstick glucose measurement
   B. Head CT
   C. Lumbar puncture
   D. Thyroid function test

9. Which of the following is a reversible cause of dementia?
   A. Alzheimer disease
   B. Dementia with Lewy bodies
   C. Normal pressure hydrocephalus
   D. Vascular dementia

10. Which of the following assertions should be considered when managing a patient with agitated delirium?
    A. Benzodiazepines are safer than antipsychotics
    B. Parenteral antipsychotics can be used to calm the patient, providing a safe environment for all concerned
    C. Pharmacologic restraints are the first line of treatment
    D. Physical restraints should be used early

11. Ketamine would be inappropriate in which patient?
    A. 23-year-old man with an abdominal gunshot wound and a history of asthma
    B. 32-year-old man with chest pain and a history of schizophrenia
    C. 37-year-old woman with a dislocated shoulder and depression
    D. 67-year-old woman with pain from diverticulitis and hypertension

Qualified, paid subscribers to Critical Decisions in Emergency Medicine may receive CME certificates for up to 5 ACEP Category I credits, 5 AMA PRA Category 1 Credits™, and 5 AOA Category 2-B credits for completing this activity in its entirety. Submit your answers online at acep.org/newcriticaldecisions; a score of 75% or better is required. You may receive credit for completing the CME activity any time within three years of its publication date. Answers to this month’s questions will be published in next month’s issue.
12 Which of the following accurately describes a characteristic of ketamine?
A. It can only be given intravenously and intramuscularly and cannot be reliably dosed intranasally
B. It provides a large margin of safety because it provides strong analgesia, sedation, and amnesia while preserving airway reflexes, spontaneous respirations, and cardiovascular stability
C. It provides a narrow margin of safety because even small deviations from the recommended dosage can cause hypotension and apnea
D. Prior to the administration of ketamine, patients should receive prophylactic doses of anxiolytic and antiemetic agents to prevent vomiting

13 Opioids would be an appropriate analgesic for which of the following patients?
A. 23-year-old man with an acute exacerbation of chronic low back pain
B. 27-year-old man who is discharged home after being treated for a wrist fracture
C. 34-year-old woman with an acute exacerbation of chronic migraine headaches
D. 58-year-old woman with an acute exacerbation of fibromyalgia pain

14 Which of the following is associated with the chronic use of opioids?
A. Adverse reactions related to histamine release (eg, flushing, itching, hives, sweating, or itching) are more likely to arise from potent opioids such as fentanyl and hydrocodone than weaker ones such as morphine and codeine
B. Chronic narcotic therapy contributes to sedation, lethargy, lack of engagement in physical therapy, and limited exercise
C. Only a small percentage of patients become non-medical users of opioids
D. Opioid abuse often escalates to the recreational use of methamphetamines

15 Which medication(s) are appropriate for patients being discharged home following treatment for neuropathic pain?
A. Ibuprofen and diclofenac
B. Ibuprofen and gabapentin
C. Metoclopramide
D. Prednisone

16 Which of the following tools is not a reasonable option for controlling pediatric pain?
A. Distraction with music or videos
B. Nitrous oxide
C. Oral sucrose
D. Tramadol

17 Which of the following is a benefit of the intranasal route of medication delivery?
A. A wide variety of medications can be delivered intranasally
B. It is painless, rapid, and effective
C. It requires 50% less medication on average than the typical intravenous route
D. Diluted forms are available and can be used to avoid irritating the nasal mucosa

18 Trigger point relief can help mitigate pain in patients with which of the following disorders?
A. Depression
B. Myofascial pain
C. Neuropathy
D. Somatic pain

19 Which of the following is not a relative contraindication for trigger point injections?
A. Allergy to anesthetic agents
B. Anticoagulation or bleeding disorders
C. No sonographic findings
D. Presence of local or systemic infection

20 Which of the following is an absolute contraindication for an ultrasound-guided peripheral nerve block?
A. Antithrombotic drug use or coagulopathy
B. History of opioid abuse
C. Patient refusal or allergy to anesthetics
D. Schizophrenia or age <3 months

ANSWER KEY FOR SEPTEMBER 2016, VOLUME 30, NUMBER 9

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
<td>C</td>
<td>B</td>
<td>C</td>
<td>B</td>
<td>D</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>A</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>C</td>
<td>D</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td></td>
</tr>
</tbody>
</table>
TRAMADOL

By Tarann Henderson, MD; and Hannah Malashock, MD, Maricopa and Banner University Medical Centers, Phoenix, Arizona
Reviewed by Frank LoVecchio, DO, MPH

Tramadol commonly is prescribed for analgesia. Naloxone only partially reverses the toxic effects of tramadol overdose and may increase the risk of seizures.

**Mechanism of Action**

Tramadol and its active metabolite O-desmethyltramadol (O-DSMT) bind to µ-opioid receptors in the central nervous system, inhibiting ascending pain pathways and blunting the response to pain. It is also a serotonin-norepinephrine reuptake inhibitor.

**Indications**

Management of moderate to moderately severe acute and/or chronic pain

**Dosing**

- **Immediate release:** 50-100 mg every 4-6 hours (maximum: 400 mg/day) PO
- **Extended-release:** 100-300 mg every 24 hours (maximum: 300 mg/dose) PO
- **Off-label dosing:** 50-100 mg every evening (maximum: 100 mg) PO

**Side Effects**

Seizures, cutaneous flushing, headache, dizziness, drowsiness, insomnia, nausea, vomiting, constipation, dyspepsia, xerostomia, pruritus, and weakness

**Precautions**

Use with caution in patients with hypersensitivity to other opioids, or in the setting of other sedating drugs due to cumulative effects. Risk for serotonin syndrome rises when given within 14 days of MAO-I's, SSRIs, SNRIs.

**Pregnancy and Lactation:** Class C. Chronic use during pregnancy may cause opioid dependency in the newborn and lead to neonatal abstinence syndrome. Excreted in breast milk; may cause infant sedation.

CROTALID SNAKE ENVENOMATION

By Bryan Corbett, MD, University of California, San Diego
Reviewed by Christian A. Tomaszewski, MD, MS, MBA, FACEP

North American crotalids include rattlesnakes (genus Crotalus and Sistrurus), cottonmouths and copperheads (genus Agkistrodon). Most rattlesnake bites occur in the Southwest, but their habitat includes most of the United States. Cottonmouths and copperheads are found in the eastern and southern states. North American crotalids (ie, pit vipers) can be distinguished from most nonvenomous snakes by their triangular head, vertically elliptical pupils, and heat-sensing pits behind their nostrils.

**Presentation**

- **Local tissue effects:** (within 30 min) swelling, pain, erythema; (within several hours) ecchymosis, hemorrhagic bullae, necrosis
- **Hematologic effects:** thrombocytopenia and/or coagulopathy with hypofibrinogenemia (DIC and life-threatening bleeding are rare)
- **Neurologic effects:** myokimia (fasciculations) and weakness (eg, Mojave rattlesnake (C. scutulatus)
- **Rare anaphylactic reactions:** circulatory collapse and angioedema

**Clinical and Laboratory Evaluation**

- Assess and stabilize ABCs.
- Examine bite site for local envenomation effects.
- Check distal pulses and capillary refill while performing serial circumferential measurements (every 15-30 min for first 1-2 hours) in extremity bites.
- Assess hematologic toxicity (ie, CBC, fibrinogen, and INR measurements).
- Compartment syndrome is rare; check pressures if concerned.

**Treatment**

- **Antivenom (Crotidae polyclonal immune Fab) is mainstay of treatment:**
  - 4-6 vials in 250 mL of normal saline infused over 1 hour; may give 8-12 vials if life-threatening (acute hypersensitivity reactions are rare)
  - Give additional 4-6 vial aliquots if swelling and/or hematologic toxicity does not improve <1 hour post completion of infusion (may repeat if needed).
- Some use maintenance doses of 2 vials x 3 every 6 hours after initial stabilization
- Recheck labs ~1 hour after administration of antivenom, and every 6-8 hours after stabilization.
- Treat anaphylactic reactions as usual, plus antivenom.
- Give blood products for life-threatening bleeding or recalcitrant coagulopathy (always in conjunction with antivenom).
- Treat elevated compartment pressures with antivenom; consider surgical consult for fasciotomy if no improvement is seen.

**Disposition**

- ~25% are “dry bites” (no venom injected); observe 6-8 hours; discharge is appropriate if no local or laboratory manifestations are evident.
- Patients with stable swelling and laboratory parameters for ~24 hours can be discharged.
- If antivenom is given, follow up 2-3 days from last administration to recheck CBC and fibrinogen; delayed or recurrent hematologic toxicity is common.