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Age Restrictions

Emergency department visits and hospital admissions are on the rise in patients older than 65, who comprise the fastest growing segment of the US population. Preparation is the key to providing age-appropriate care, avoiding iatrogenic harm, decreasing the risk of morbidity and mortality, and averting unnecessary hospitalizations. Simple modifications to emergency department design, triage and discharge protocols, medication reconciliation, and targeted educational initiatives can pay big dividends for geriatric patients.

In Too Deep

While pediatric drowning is more prevalent in regions populated by large numbers of swimming pools, lakes, rivers, and beaches, younger children are also at risk in poorly controlled situations that involve bathtubs and even buckets of liquid. An estimated 85% of drownings are preventable with adequate supervision and public safety initiatives. Because early resuscitation is vital to a good outcome, emergency clinicians must be prepared to recognize and manage drowning and submersion-related injuries without hesitation.

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IN THIS ISSUE

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Age Restrictions

The Geriatric Emergency Department

LESSON 17


By **Nicole E. Cimino-Fiallos, MD;** and **Danya Khoujah, MBBS**

Dr. Cimino-Fiallos is an attending physician in the Department of Emergency Medicine at Carroll Hospital Center in Westminster, Maryland. Dr. Khoujah is an assistant professor in the Department of Emergency Medicine at the University of Maryland School of Medicine in Baltimore.

Reviewed by **Amal Mattu, MD, FACEP**

OBJECTIVES

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

1. Describe the unique challenges that geriatric patients face in the emergency department.
2. Recognize the shortcomings of current triage systems for geriatric patients.
3. Implement simple emergency department improvements to enhance the care of elderly patients.
4. Summarize strategies and resources to develop personal and department knowledge of geriatric emergency care.
5. Use evidence-based strategies to safely discharge geriatric patients from the emergency department.

FROM THE EM MODEL

20.0 Other Core Competencies of the Practice of Emergency Medicine

20.4 Systems-Based Practice

CRITICAL DECISIONS

- How should elderly patients be triaged?
- What early interventions should be considered when managing geriatric patients?
- What are the specialized needs of geriatric patients, and how should they be addressed?
- What is the best way to prevent returns to the emergency department or rehospitalization?
- How can emergency providers increase their knowledge of age-specific problems in geriatric patients?

Emergency department visits and hospital admissions are on the rise for geriatric patients, who comprise the fastest growing segment of the US population.[1,2] Preparation is the key to providing age-appropriate care, avoiding iatrogenic harm, decreasing the risk of morbidity and mortality, and averting unnecessary hospitalizations. Simple modifications to emergency department design, triage and discharge protocols, medication reconciliation, and targeted educational initiatives for emergency clinicians can pay big dividends for older patients.

CASE PRESENTATIONS

CASE ONE

A 79-year-old man presents with weakness and a cough. He is diagnosed with pneumonia, started on antibiotics, and admitted to the hospital. Because a room is not immediately available, he waits on a stretcher in the emergency department's hallway for 6 hours. By the time an inpatient bed becomes available, he is confused, agitated, and tachycardic. The hospitalist no longer feels comfortable managing him with a floor level of care, so he requests a step-down unit or intensive care unit (ICU) admission.

CASE TWO

While out driving his classic Corvette, an 85-year-old man is T-boned at an intersection. The driver of the other car is taken to a level 1 trauma center by helicopter, and the elderly man is transported to the local emergency department. He has chest and hip pain but no loss of consciousness or head injury. On arrival, his vital signs are blood pressure 110/70, heart rate 98, respiratory rate 20, and oxygen saturation 98% on room air. He is afebrile but appears uncomfortable. He complains of localized tenderness on palpation to the right lower chest wall; his examination is otherwise normal. The emergency physician evaluates him and orders x-rays. When the patient requests pain medication, the nurse relays that the doctor did not order anything because of the patient's age.

CASE THREE

A 67-year-old woman presents with vomiting for the past 2 hours. She is well appearing, her vital signs are stable, and she has a benign abdominal examination. Her laboratory values are normal. During her visit, she does not vomit and is able to tolerate saltine crackers. She is discharged home with written instructions and return precautions. The patient lives by herself and promises that she will read the instructions as soon as she finds her glasses at home.

In 2010, 15% of the 130 million patients who visited a US emergency department were over 65 years of age.[1] Extra care must be taken when managing this special population, which suffers from high rates of cognitive impairment, functional impairment, depression, and polypharmacy.[3] Geriatric patients have more emergent problems, need more diagnostic tests, and are more likely to be admitted to the hospital or ICU than those in any other age group.[4] Every emergency department visit should be considered a high-risk event that puts the elderly at increased risk of medical errors and adverse drug interactions when compared to the general population.[5]

Although the number of older adults presenting to emergency departments has been increasing steadily, the number of those admitted to the hospital has increased more than those who were discharged, with an almost doubling of the use of ICU services.[2] These changes may indicate a more critically ill population but could also be due to the overutilization of services. Hospitalization itself can be dangerous for geriatric patients: They are susceptible to delirium, hospital-acquired infections, falls, iatrogenic complications, and loss of functional status. With Medicare deducting reimbursements for iatrogenic complications, such as catheter and wound infections, the need to take better care of admitted elderly patients has a financial incentive.[6] Geriatric patients also require more services after discharge to prevent their immediate return to the hospital. Even if these services are provided, they are still at higher risk for bouncing back to the emergency department and requiring readmission than younger patients.[7]

Most patients over the age of 75 years are affected by functional problems and geriatric syndromes. Approximately 50% are dependent on others for personal activities of daily living, a number that increases to 75% after presentation to an emergency department. About 25% of elderly emergency department patients exhibit one form of cognitive impairment, and 50% cannot walk unsupervised.[8]

The unique challenges facing this population and the successes of prior initiatives focused on disease entities (eg, stroke) and patient populations (eg, pediatrics) have contributed to the birth of accredited geriatric emergency departments. These facilities are designed for older patients, including quality improvement and enhancements of the physical environment — a safer layout — and geriatric-focused supplies. Geriatric emergency departments provide special education and interdisciplinary staffing, including specially trained providers and case managers. Standardized protocols are implemented to address common age-related issues, improve safety, decrease admissions, optimize discharges, and decrease moribund outcomes.[6]

Geriatric emergency departments focus on older patients as a whole, rather than on the acute chief complaint, as is the model with traditional emergency care (*Figure 1*). These facilities may also be better equipped to address comorbidities, such as depression, cognitive impairment, and medication interactions. In addition, they strive to optimize transitions to inpatient, home, community-based, rehabilitation, and long-term care settings. To learn more, visit the American College of Emergency Physicians (ACEP) website for the geriatric emergency department accreditation program at https://www.acep.org/geda.

Although studies have not yet proven whether geriatric-focused emergency departments can achieve all the goals set out above,[9] this new approach has

already been associated with a decreased rate of hospital admission.[5] Fellowships in geriatric emergency care and specially designated geriatric emergency departments are two approaches that enhance the delivery of age-appropriate care to older patients, but neither option is available to all providers. Regardless, emergency physicians should be cognizant of the differences in the care required for older patients.

CRITICAL DECISION

How should elderly patients be triaged?

The most common triage system in the United States is based on the Emergency Severity Index (ESI), which risk stratifies patients according to the severity of their presentation and how quickly they should be seen.[10] In a 2010 study that focused on older patients, the third iteration of the ESI algorithm (ESI-3) demonstrated validity, as it correlates with hospitalization, length of stay, resource utilization, and survival.[11]

This is important from a patient safety standpoint, as it ensures that sicker patients are seen first. However, when addressing individual outcomes in older patients, the ESI has many shortcomings. Its dependence on vital signs makes it less sensitive, as vital signs can be deceptively normal for this population.[12] Specifically, a trigger for the "danger zone" in the ESI is a heart rate of 100 beats per minute (bpm), but tachycardia is not easily mounted by older patients. In addition, altered mental status or "disorientation" warrants a higher acuity triage level, yet delirium is frequently missed on evaluation of geriatric patients.[13]

Other vital signs that are not explicitly addressed in the ESI, but that are used for consideration of triage level by nursing staff, are blood pressure and fever, both of which have different normal ranges in older patients. Thus, older adults without grossly abnormal vital signs, those with dementia or other cognitive disorders, patients with nonfocal complaints and atypical presentations, and seniors with less apparent illness, in general, can be easily assigned to lower triage acuities.[14] Under-triage leads to increased wait times, with subsequently worse outcomes; a more negative patient experience; discomfort, nervousness, mistrust, and confusion; and feelings of abandonment and anxiety.[15,16]

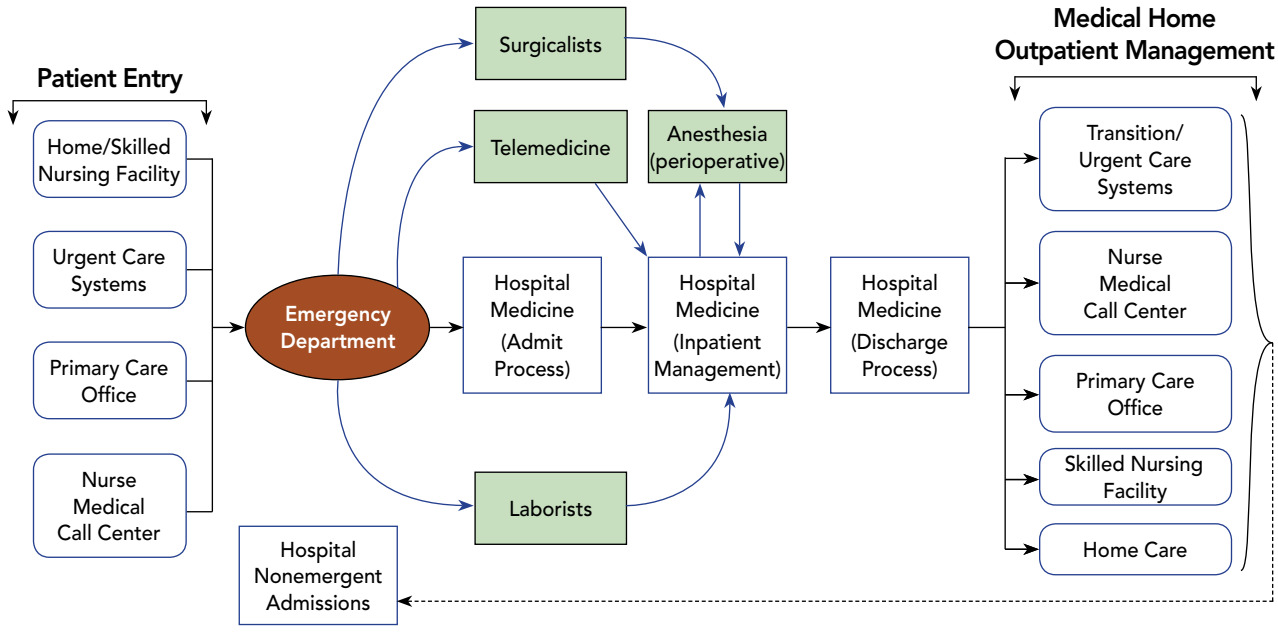
These challenges have led many experts to propose geriatric-specific modifications to the ESI, specifically increasing the sensitivity of vital signs (*Table 1*) and the level of consciousness, which follows the logic of pediatric-specific parameters. Research is still required to validate this approach. Another important intervention is to encourage the involvement of a family member or care provider in the process,[6] especially for patients who are cognitively impaired.

Even when geriatric patients are accurately triaged, they are less likely to be seen within the appropriate time frame for their assigned urgency.[17] It is unclear why the elderly wait longer for care, even though they are more likely to be sicker and to require admission and critical care.

Triage for geriatric trauma patients is a robust area of interest. As injuries to elderly people increase in frequency, so do the associated rates of morbidity and mortality. These increases are not limited to major traumatic injuries; they also occur among people with seemingly minor injuries, such as those sustained in falls. One obvious reason for the two- to five-fold increase in mortality is the abundance of comorbidities in this population; under-triage becomes an additional complicating factor.[18]

An estimated one-third of older trauma patients are under-triaged,

FIGURE 1. The Central Role of the Emergency Department in Geriatric Care



REPRODUCED WITH PERMISSION FROM TEAMHEALTH'S PATIENT CARE CONTINUUM MODEL

TABLE 1. Suggested Thresholds for Vital Signs in Older Patients

Vital Sign	Current Abnormal Threshold	Proposed Abnormal Threshold
Heart rate	>100 bpm	>90 bpm
Blood pressure	<90 mm Hg	<110 mm Hg
Temperature	>38°C (100.4°F) (oral)	>37.4°C (99.3°F) (oral)

TABLE 2. Risk-Stratification Tools for Geriatric Patients

Identification of Seniors at Risk (ISAR)
Triage Risk Screening Tool (TRST)
Silver Code
Variables Indicative of Placement (VIP) risk
Mortality Risk Index
Rowland
Runciman
Score Hospitalier d'Evaluation du Risque de Perte d'Autonomie (SHERPA)

with the rate climbing to almost 60% for patients 90 years and older, which negatively affects both mortality rates and costs.[18,19] A unique initiative in Ohio, started in 2009, used an evidence-based triage protocol in the field for injured patients older than 70 years to determine destination, utilizing lower thresholds for transfer to a trauma center. This protocol improved the sensitivity of identifying injury severity and increased the proportion of individuals discharged home, but it failed to change the mortality rate.[19,20]

CRITICAL DECISION

What early interventions should be considered when managing geriatric patients?

In addition to applying the classic triage model to identify patients' ESI levels, emergency department visits are used as opportunities to screen patients for a variety of conditions, including depression, suicide, abuse, and substance abuse, and direct them toward appropriate resources. Clinicians should also assess for those at high risk for an adverse event after discharge, such as hospital readmission, another emergency department visit, institutionalization, functional decline, or death. An awareness of these events can help focus the use of time, personnel, and resources, which are hot commodities in an era of decreased federal funding for health care.[6]

A recent meta-analysis[21] evaluated a variety of screening tools (*Table 2*) with regard to their ability to identify at-risk patients during triage and, thereby, improve care through targeted management. By definition, screening tools should be sensitive, have a good negative predictive value, and be simple and reproducible. Unfortunately, none of the screening tools evaluated yielded "compelling evidence" to justify recommendation of their use.[21,22] An earlier review article evaluated a targeted screening process, in which geriatric patients underwent a brief evaluation. Patients identified as high risk then underwent a comprehensive geriatric assessment. In this review, evidence supported the two-step process to identify at-risk patients in need of further intervention and to decrease emergency department readmissions.[22]

While the meta-analysis could not advocate a specific screening test, given the lack of statistical evidence, it did emphasize the need for a focused, evidence-based tool that can identify high-risk populations at the time of triage and positively influence management decisions. This recommendation is consistent with the *Geriatric Emergency Department Guidelines* compiled by ACEP, the American Geriatrics Society (AGS), the Emergency Nurses Association (ENA), and the Society for Academic Emergency Medicine (SAEM), available online at https://www.acep.org/geda/resources/pdfs/GEDA-Guidelines.pdf.[6,21]

CRITICAL DECISION

What are the specialized needs of geriatric patients, and how should they be addressed?

Physical Environment

Building a geriatric emergency department with amenities specifically designed to accommodate elderly patients seems difficult for many providers working in small community hospitals or crowded academic centers. However, not all changes require a contractor or a large budget (*Table 3*). When seniors were asked what they would like to see in an emergency department, they reported that they wanted their independence, mobility, and safety prioritized.[23]

Ideally, hallways should be clear from clutter and easily accessible by someone using a walker or a wheelchair. Handrails should be installed, and signage with easy-to-read graphics should be clearly visible to direct patients to amenities such as the bathroom, the waiting room, and the exit to parking. Orientation in each patient's room, including an easy-to-read clock and a sign denoting the date and day of the week, would also help patients at high risk for delirium (*Figure 2*).[23]

TABLE 3. Emergency Department Interventions to Improve Outcomes for Geriatric Patients[6]

Physical Environment	Staffing	Patient Care Initiatives
Handrails	Pharmacist	Frailty assessment
Clutter-free hallways	Volunteers	Delirium detection
Large clocks	Social worker/case manager	Pain management
Signage indicating date	Physical therapist	Palliative care
Ambient light		
Lower-level beds		
Even walking surfaces		
Bedside interventions		
Avoidance of medical tape		
Thick, soft mattresses		

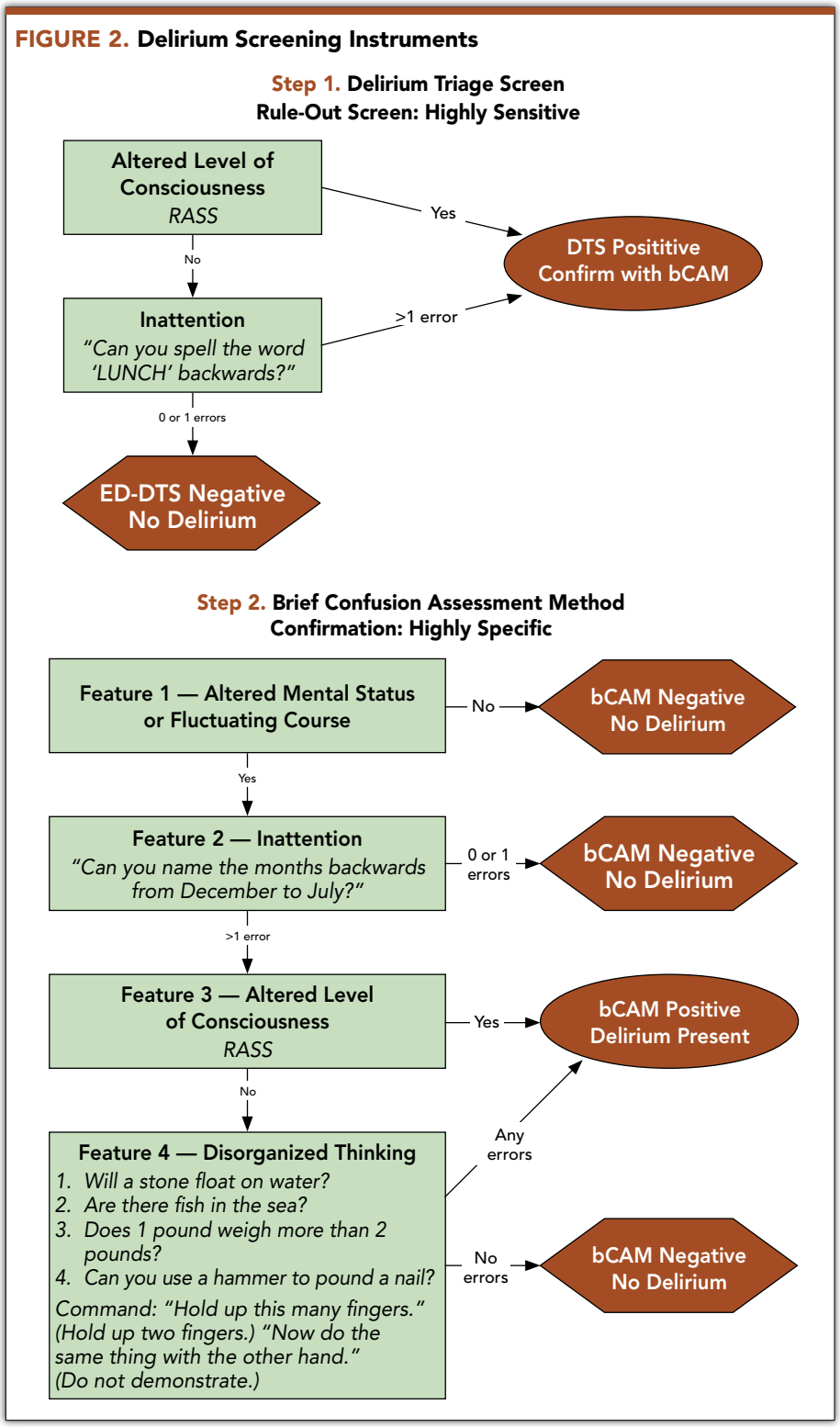
Improved lighting is a simple way to decrease the risk of adverse events, such as falls and delirium. Patients should be able to control the light in their rooms; older adults require three times as much light as younger adults for visual clarity. In addition, they should be able to turn off the lights in their rooms at night, which can lessen the disruption to their circadian rhythms and subsequently decrease the risk of delirium. Indirect light is preferred to spot lighting, which increases glare and makes it more difficult for elderly people to see.[6]

Elderly patients are at significant risk for falls. While some interventions such as fall-risk bracelets do not improve outcomes, others can decrease complications and should be implemented. Bed rails should not be used. They do not reduce fall risk and actually increase the risk of injury if the patient does fall.[6] Beds should be kept at low levels to allow patients to stand more easily. Elevated thresholds in room doorways should be removed. Uneven walking surfaces, textured tiles, rugs, and carpets should be eliminated. Reducing the number of patient transfers during the emergency department stay also decreases the risk of falls.[6] Bedside radiological studies and portable laboratory equipment for bedside blood draws limit the number of transports and decrease the risk of disorientation by keeping the patients in one treatment space for the entirety of their stay.[6]

Geriatric patients are also at high risk for skin breakdown while in the hospital. Simple changes in practice can limit this complication. The use of medical tape and adhesive should be limited because it can injure frail skin.[5] Extra-thick, soft mattresses are usually available in the hospital and should be requested for geriatric patients who are expected to have an extended stay in the emergency department. Patients should be given the option to use a soft reclining chair, instead of a stretcher, if it does not interfere with treatment. Furniture should be easy to clean and soft to protect frail skin.

The emergence of delirium in the emergency department is common and may have an iatrogenic component.

FIGURE 2. Delirium Screening Instruments



Interventions that decrease the risk of delirium include frequently orienting patients to the time and place, using signs or sitters, avoiding unnecessary tethering in the form of monitor leads or urinary catheters, and turning the lights off in patients' rooms at night.[6] Patients should be encouraged to use their glasses and hearing aids to help them remain oriented and engaged.

Staffing

The role of emergency department pharmacists in managing the geriatric population is unclear. Polypharmacy

is prevalent in older patients, making them prone to medication errors, adverse events, and drug interactions. In addition, given the physiological changes and comorbidities typical among the elderly, some medications are inappropriate for older patients and have been identified in several initiatives, including Beers list and the Screening Tool of Older Persons' potentially inappropriate Prescriptions (STOPP) criteria.[24,25] It therefore seems reasonable that the presence of an emergency department pharmacist, who could address this population specifically, could improve outcomes. One study reported that an emergency department–based pharmacist or clinical pharmacy specialist identified at least one medication-related problem in almost half of those in an elderly patient cohort; however, the presence of a pharmacist was not associated with improved clinical outcomes in previous studies.[26]

Although many emergency departments have limited budgets and staff, they often have access to a plethora of hospital volunteers. Engaging this supplemental workforce in efforts to improve geriatric outcomes can pay off with improved patient experiences. On patient satisfaction surveys, many seniors report not receiving enough attention and reassurance during their visit. They describe the emergency department as busy and chaotic and feel that their basic needs (eg, hunger or use of the toilet) are addressed insufficiently. A robust volunteer service can fill many of these gaps and support a strained clinical staff.[23]

Patient Care Initiatives

Several specific aspects of care should be addressed when managing any elderly patient in the emergency department. For example, delirium screening can be very effective in decreasing in-hospital morbidity and can detect patients at heightened risk of death, thereby prompting appropriate interventions. When health care professionals do not use a dedicated screening tool, they miss the diagnosis of delirium more than 50% of the time.[27]

The Mini-Mental State Examination (MMSE) is cumbersome and not suitable for the emergency department. Alternatives include the Quick Confusion Scale, the Brief Confusion Assessment Method (bCAM), and the Modified Richmond Agitation and Sedation Scale (mRASS), specifically because each takes less than 1 minute to administer. The Quick Confusion Scale is a shorter version of the MMSE and is the test with the best performance-to-time ratio in the emergency department.[22] The bCAM is derived from the Confusion Assessment Method (CAM) used in ICUs for the detection of delirium.

Undertreatment of pain is also a common problem for geriatric patients. One study showed that older patients are 20% less likely than their younger counterparts to receive pain medication.[28] This difference probably stems from concerns about the use of opioids in the elderly population. It is important to consider alternatives to opioids for pain management, such as acetaminophen, topical anesthetic treatments like lidocaine patches, and nerve blocks. The use of low-dose opioids, with titration, is safe in older patients; however, increased bioavailability and medication interactions must be factored into dosing decisions. Uncontrolled pain, especially after an injury, increases the risk of delirium in susceptible patients and is frequently associated with functional decline, disability, and an increased risk of falls.

Introducing the concept of palliative care early and correctly is essential in the care of all patients, but even more so in those with multiple comorbidities. It is important to recognize that palliative care and hospice care are not one and the same. Palliative care is an interdisciplinary approach focused on improving the quality of life for persons of any age who are living with serious illness and their families. Hospice care, on the other hand, provides palliative care to dying patients in their final months of life. Clarifying this distinction helps to enable patients and their families to accept a referral to palliative care, if appropriate, and to improve the quality of life for the patient, reduce hospital stays, and decrease the cost of care.[29]

CRITICAL DECISION

What is the best way to prevent returns to the emergency department or rehospitalization?

Prior to discharge, consider that as many as 80% of elderly patients who are discharged from the emergency department have at least one unrecognized geriatric problem — delirium, dementia, depression, undernutrition, or an unmet social service need.[30] Emergency providers should take the time to look for insidious diagnoses, while determining a safe discharge plan.

Pearls

- Reduce bounce-back visits by making follow-up phone calls to high-risk elderly patients.
- Geriatric patients typically want more information about advance care directives, elder services in the community, and the compilation of medication lists. Include this material in your standard discharge paperwork.
- Make small physical changes to the emergency department — hang a clock with large numerals, display a calendar with the day and date, ensure patients can control the light settings in their room — to help prevent complications such as delirium.
- Make educational resources on geriatric care readily available. Staff members want to know more about how to care for elderly patients.

A multidisciplinary approach is necessary for a safe discharge and can improve patient outcomes. An emergency department pharmacist should review the medication list; a geriatric life specialist should conduct screenings for depression, neglect, abuse, and other geriatric-specific topics; a social worker should create a safety plan; and a physical therapist should assess the patient's needs.[5] One barrier to the safe discharge of elderly patients from the emergency department is the limited availability of ancillary staff, such as social workers, who typically work during usual business hours. Expanding the resources that are already in place can improve the process.

Prior to discharge, a few other things should be assessed. One is the patient's mobility, which affects safety and fall risk at home.[6] Interestingly, older adults overestimate their ability to perform simple tasks — like getting out of bed, walking 10 feet, and then returning to bed — up to 20% of the time, even more so if they are cane or walker dependent. Therefore, a member of the emergency care team should observe the patient's mobility directly prior to discharge. The timed "Get Up and Go Test" is used in inpatient settings and in emergency departments as a predictor of return visits and hospitalizations.[31]

The importance of discharge protocols that enhance communication between the emergency department team and outpatient care providers has been supported by various specialty societies.[6] However, one study found that communication with community physicians by emergency care providers was infrequent and that telephone follow-up after discharge was rare.[32] As expressed in the *Geriatric Emergency Department Guidelines*,[6] emergency department personnel should contact the patient's outpatient care provider to relay information about the complaints that precipitated the visit, the available test results, the treatment administered, the patient's response to treatment, any consultations obtained, the discharge diagnosis, any new prescriptions, and a concrete follow-up plan.

The discharge instructions handed to an elderly patient should be in a large font. As applicable, they can also be shared with family members in accordance with the parameters of the Health Insurance Portability and Accountability Act (HIPAA). Best practice is for the emergency physician to personally review the discharge instructions with the patient. Emergency department staff can improve the discharge experience by providing additional information about geriatric topics to patients and families. Popular topics in a geriatric patient survey included information about advance care directives, elder services in the community, and how to create a list of medications.[23] If written in general terms in an easy-to-read style, patients and families appreciate this relevant information.

The most appropriate disposition for a patient might not be the place they left to come to the emergency department. For example, a patient who lives at home might be better served by entering hospice or an assisted living facility. Other placement considerations should include the need for rehabilitation or observation.[5]

If a patient is discharged home, follow-up phone calls can reduce the likelihood of bounce-backs and improve outcomes. In a 2014 study, nurses with training in geriatric emergency medicine made follow-up calls 1 to 3 days after discharge and again at 10 to 14 days after discharge.[33] The calls aimed to assess pain, answer medication questions, confirm the scheduling of outpatient follow-up appointments, and inquire about home health-care status. Rates of return visits to the emergency department within 3 days and hospital admissions were lower in the group that received the follow-up consultation than in the group that did not. Follow-up phone calls are an easy, inexpensive way to reduce admissions and bounce-backs to the emergency department.

CRITICAL DECISION

How can emergency providers increase their knowledge of age-specific problems in geriatric patients?

In an ideal geriatric emergency department, physicians would be fellowship-trained geriatric emergency physicians with a support staff that includes geriatric life specialists and nurses with special training in elder care.[5] While these standards may not be possible for all emergency departments, physicians and nurses can pursue education in geriatric topics with minimal extra effort.

In surveys about geriatric care, providers often report moral angst about the quality of care and cite a lack of education as the main reason for their discomfort.[23] When surveyed about their comfort level in caring for geriatric patients in the emergency department, staff cited a need for education and training on geriatric-specific issues — the health problems associated with aging, communication with elders, elder abuse, and cultural sensitivity.[23] Clinicians also wanted to learn more about appropriately managing patients with dementia and about responding to

Pitfalls

- Ignoring age-specific factors when triaging geriatric patients.
- Making elderly patients wait longer for care than is appropriate for their acuity level.
- Failing to recognize that 80% of elderly patients have one of the following undiagnosed conditions at the time of discharge: delirium, dementia, depression, undernutrition, or an unmet social service need.
- Neglecting to look for signs of elder abuse. Have a system in place to fully evaluate every elderly patient.

CASE RESOLUTIONS

CASE ONE

The 79-year-old man with pneumonia responded well to antibiotics and started to improve. When his family arrived in the emergency department, their familiar faces, plus some rest, helped resolve his delirium. He was eventually admitted to an inpatient floor, but his stay in the emergency department had been prolonged significantly. Once he got to his hospital room, his nurse noticed a stage 1 decubitus ulcer on the left side of his sacrum. In his hospital bed, the patient was adequately turned, but the ulcer progressed. He then developed a fever and superinfection, which significantly lengthened his hospital stay.

CASE TWO

The 85-year-old man's x-rays showed a sternal fracture, left hemothorax, and grade II pelvic fracture. He was under-triaged by the paramedics at the scene when they decided not to transport him to the trauma center for evaluation. In the emergency department, the patient was stabilized with a pelvic binder and a left-sided chest tube. Given the patient's age, the physician was afraid to prescribe opioids, so he was transferred without pain medication. He suffered significant delays in care and pain control.

CASE THREE

When the elderly woman returned home, she was unable to find her glasses and she could not read her discharge instructions. When her vomiting resumed, she called an ambulance, which took her to the emergency department across town. A CT scan of her abdomen revealed diverticulitis complicated by an abscess. She was treated with intravenous antibiotics and a percutaneous drain and was discharged home from the hospital 5 days later.

confusion, aggression, and agitation.[23] Other topics of interest to emergency department staff include living wills and the community services available to elders.

The *Geriatric Emergency Department Guidelines* are presented as a consensus publication of ACEP, AGS, ENA, and SAEM. While not a mandate or requirement, they provide evidence-based material that is relevant to the acute care of geriatric patients. Topics include atypical presentations of disease, pain management and palliative care, the effect of comorbid conditions on current presentation, common complaints that prompt older patients to seek emergency care, and the logistics of making an emergency department more geriatric friendly. These high-yield topics can help practitioners target areas where geriatric patients have been shown to have delays in diagnosis or worse outcomes than their younger counterparts.

Summary

Geriatric patients require careful consideration. They are at high risk for complications and have increased morbidity and mortality after they present to an emergency department. All providers can make small changes to their emergency departments and can focus on continuing medical education in geriatric care to improve the experience and outcomes of the oldest and most vulnerable patients.

For those who wish to learn more about creating dedicated geriatric emergency departments, email the ACEP Geriatric Emergency Department Accreditation (GEDA) program at geda@acep.org or visit https://www.acep.org/geda to learn more about the accreditation levels, application process, GEDA guidelines, GEDA criteria, news, events, articles, podcasts, and more on the evolving trends in geriatric care and emergency medicine.

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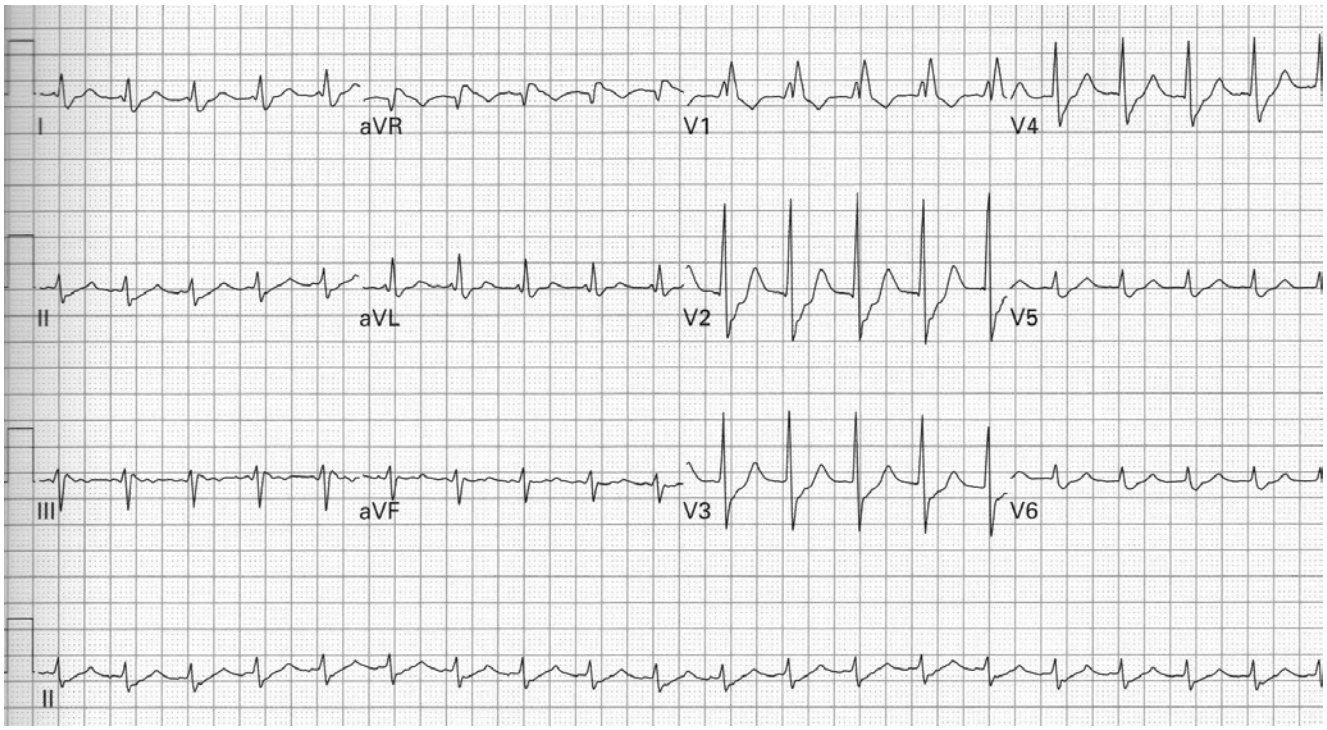


A 67-year-old man with palpitations.

The Critical ECG

By Amal Mattu, MD, FACEP

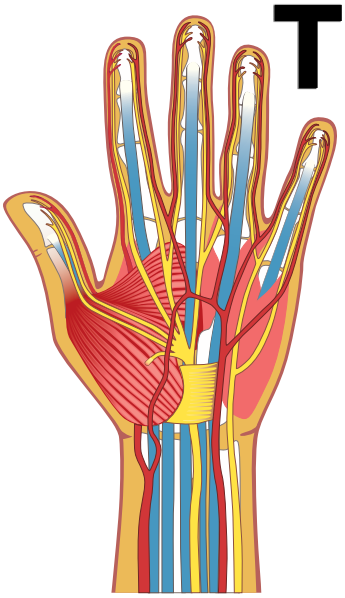
Dr. Mattu is a professor, vice chair, and director of the Emergency Cardiology Fellowship in the Department of Emergency Medicine at the University of Maryland School of Medicine in Baltimore.

Accelerated junctional tachycardia, rate 115, bifascicular block (right bundle branch block [RBBB] and left anterior fascicular block [LAFB]), prolonged QT-interval. Subtle P waves are noted on the rhythm strip. However, the PR interval is too short (<120 msec) for normal sinus rhythm, unless an accessory pathway were present. (There is no evidence of an accessory pathway.) The most likely alternative cause of such a short PR interval is a junctional rhythm. A normal atrioventricular junctional rate is 40 to 60 beats/min; thus, this is referred to as an accelerated junctional tachycardia. An RBBB (QRS duration >120 msec, rsR' pattern in lead V_1, wide S waves in the lateral leads) and LAFB (leftward axis, rS pattern in lead III and qR in I and aVL) are also present.

This patient was initially misdiagnosed as having sinus tachycardia. He was treated for several hours with intravenous fluids with the assumption that the tachycardia was due to hypovolemia. When his rate showed no evidence of improvement, the proper diagnosis was finally made. He then received a small dose of a beta-blocker medication and immediately converted to sinus rhythm with a rate of 75.

From **Mattu A, Brady W.** *ECGs for the Emergency Physician 2*. London: BMJ Publishing; 2008. Reprinted with permission.

The Critical Procedure



Regional Anesthesia of the Median Nerve at the Wrist

By **Vytautas Vaicys, MD**
Baylor Scott & White Medical Center, Dallas, Texas
Reviewed by **Steven Warrington, MD, MEd**

Regional anesthesia of the median nerve at the wrist is a simple and effective pain management tool when treating complex trauma or performing procedures involving multiple fingers and/or the palm.

Contraindications

- Allergy to anesthetic
- Infection overlying the site of injection
- Suspected risk of compartment syndrome
- Upper-extremity trauma to the area proximal to the wrist (such injuries may be better managed by more proximal regional anesthesia)

Benefits and Risks

The procedure can anesthetize a large area of the hand with a single injection. This allows for proper irrigation, a thorough motor examination, the debridement of tissues, and laceration repairs. The technique can also be used in conjunction with other nerve blocks and local infiltration, as indicated.

Risks are relatively limited and include infection, bleeding, the vascular or intraneural administration of anesthetic, vascular trauma, hematoma, and allergic reaction.

Alternatives

Regional anesthesia of the median nerve may be done more proximally at the elbow, depending on the clinical picture. Other options include operative care, local anesthetic only, and procedural sedation.

Reducing Side Effects

Proper patient positioning is important to achieve easy access to the injection site. The use of ultrasound guidance can also help the clinician achieve more consistent anesthesia while minimizing the rate of complications. The use of a sterile technique can further reduce the risk of infection.

Special Considerations

Special consideration should be used in patients with obvious anatomical irregularities and those who report prior injuries and surgeries to the wrist. This procedure is also contraindicated in severely injured patients at risk for compartment syndrome; in such cases, the injected volume can increase the compartment pressure. Patients with a history of carpal tunnel syndrome may experience neurapraxia in the medial nerve distribution. Additionally, it is important to avoid systemic toxicity by considering maximum doses based on the patient's medical history. Because of the superficial location of the nerve, care should be taken to avoid inserting the needle and anesthetic too deep, which can cause the procedure to fail.

TECHNIQUE

1. **Select** the anesthetic based on the clinical situation (eg, ideal duration of block), and prepare the anesthetic (5 mL) and needle (23-27 gauge).
2. **Identify** the injection site and confirm laterality.
3. **Position** the patient's wrist on a tray table, dorsiflexed at 30 degrees.
4. **Clean** and drape the area. If using ultrasound, identify the injection site prior to this step.
5. **Locate** the median nerve, which lies within the carpal tunnel and runs along the palmaris longus and flexor carpi radialis. These can be located by asking the patient to flex the middle finger, or by approximating the thumb with the fifth digit.
6. **Insert** the needle at a 45-degree angle, aimed proximally on the radial side of the palmaris longus slightly proximal to the volar wrist crease. Advance until a puncture of the retinaculum is felt (likely within the first cm of insertion), and deposit 3-5 mL of anesthetic. Resistance and severe pain can indicate intraneural injection; in such cases, withdraw the needle 1-2 mm.

Note: Full anesthesia is achieved in about 10 minutes.

For ultrasound-guided administration:

1. **Place** the probe on the volar side of the wrist, setting the depth to 2-3 cm.
2. **Locate** the median nerve by noting a lack of movement, with flexion and extension of the phalanges. When sliding the probe proximally, tendons become thicker and eventually muscular in appearance, while the nerve remains solid and round.

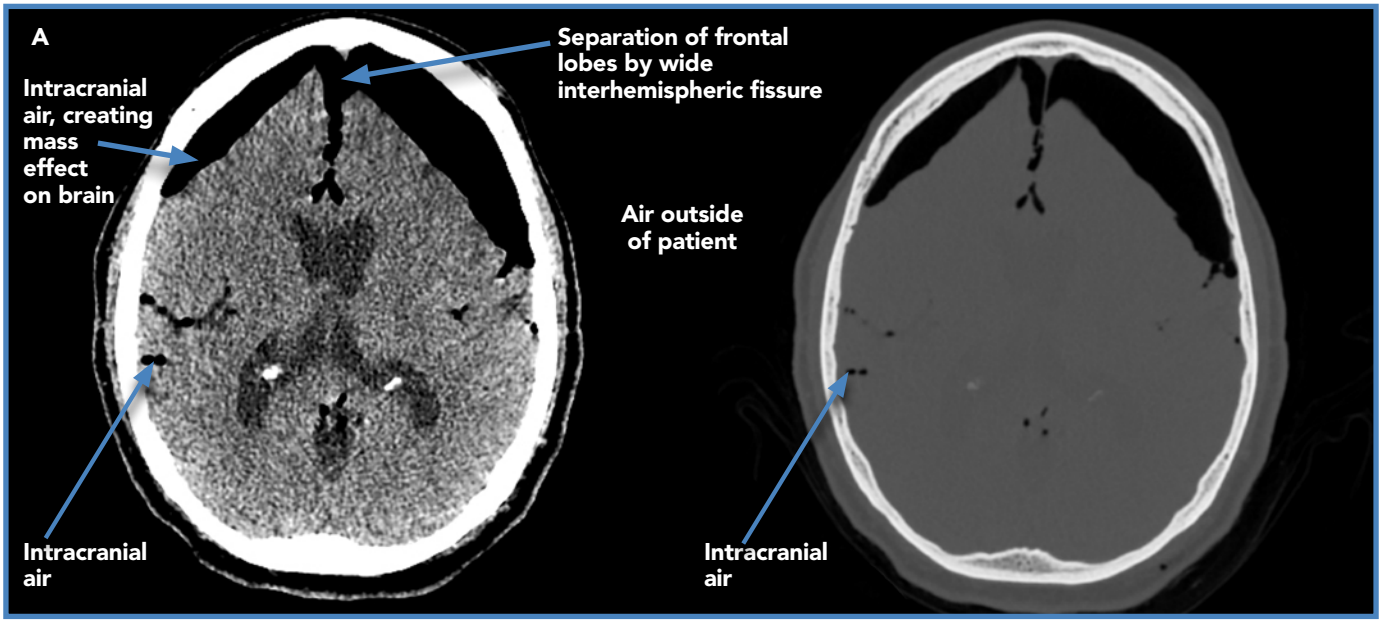
The Critical Image

By Joshua S. Broder, MD, FACEP

Dr. Broder is an associate professor and the residency program director in the Division of Emergency Medicine at Duke University Medical Center in Durham, North Carolina.

Case contributor: **Amanda Wessel, MD**

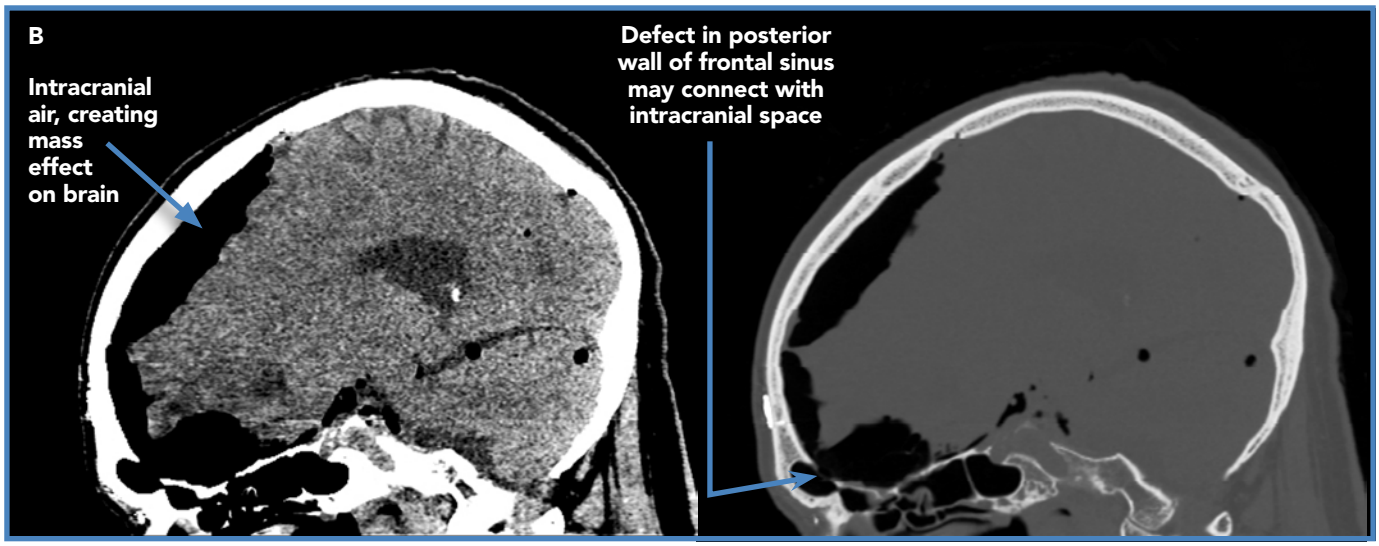
A 78-year-old man presents after an unwitnessed ground-level fall at home. His son reports that the patient previously suffered a remote traumatic brain injury and has recently developed progressive dementia, with several falls in the past week. He says the patient's mental status today appears to be at his recent baseline. The patient complains of a mild headache. Clear fluid is draining from his nares, and his son suggests that the patient may have an upper-respiratory infection. His vital signs are blood pressure 132/64, heart rate 60, respiratory rate 18, temperature 36.8°C (98.2°F), and oxygen saturation 100% on room air. The patient is awake and alert, but dried blood is visible on his posterior scalp. A cervical collar is in place. The remainder of the examination shows no evidence of trauma. He has no epistaxis or fluid from his nose at this time. He does not recall falling and is unable to provide the date or his location. An ECG shows sinus bradycardia. His laboratory tests are notable for a WBC count of 18.3. The nurse reports that the patient's pillow is now soaked with watery fluid. A noncontrast CT scan of the head (*below*) and cervical spine (*not shown*) are performed.



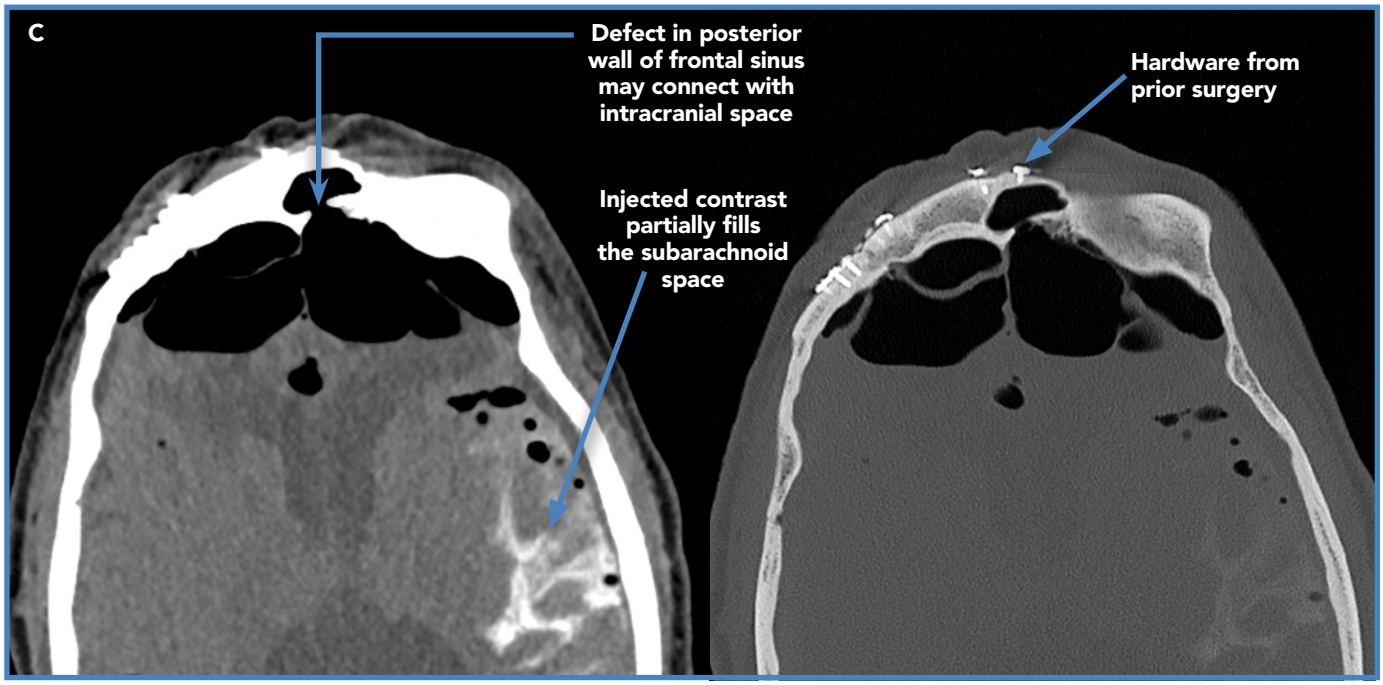
A. Noncontrast head CT, axial images, brain and bone windows. Extensive pneumocephalus (*black*) is present; it compresses the bilateral frontal lobes, giving a mass effect similar to that seen with intracranial hemorrhage. The interhemispheric fissure is widened by air. The appearance of flattened and separated frontal lobes, known as the "Mount Fuji sign," can indicate elevated intracranial pressure (ICP) from accumulated air — tension pneumocephalus. When accompanied by clinical signs of high ICP, this finding is considered a neurosurgical emergency.[1]

KEY POINTS

- Pneumocephalus is a common finding on head CT following trauma and may indicate air entering the skull through an open fracture, or air communicating with the intracranial space from facial airspaces (eg, frontal, ethmoid, sphenoid, or maxillary sinuses). In many cases, pneumocephalus requires no specific intervention, but when extensive and accompanied by clinical signs of a cerebrospinal fluid (CSF) leak such as CSF rhinorrhea, additional evaluation to identify the source of leak is essential. Surgical repair may be necessary for persistent (>7 days) or high-volume leaks.
- An examination of a brain or facial CT using bone windows and a bone reconstruction algorithm can identify bony discontinuities that may accompany a tear in the dura mater. When uncertainty persists, CT cisternogram (injection of iodinated contrast into the lumbar thecal sac to enhance intracranial CSF spaces) can be performed to identify the site of a CSF leak.
- Contrast normally fills all CSF spaces (cisterns, ventricles, and subarachnoid space); contrast found outside of these expected locations can indicate the leak site.
- Provocative maneuvers (eg, prone positioning) can accentuate a CSF leak and assist with localization. A fluorescein injection into the lumbar thecal sac can aid the intraoperative identification of a leak.
- A CSF leak can predispose patients to meningitis, but prophylactic antibiotics are controversial, with no systematic evidence supporting their use.[2]



B. Noncontrast head CT, sagittal images, brain and bone windows (same scan as in A and B). Again, mass effect on the brain is seen, with a concave surface of the frontal lobe. A defect in the posterior wall of the frontal sinus appears to communicate with the intracranial space.



C. A CT cisternogram performed after the injection of iodinated contrast (*white*) into the lumbar thecal sac. From there, the contrast is expected to diffuse into the intracranial CSF spaces, and then to the site of any persisting leak. In this patient, no leak was identified by this maneuver, but he continued to have a CSF leak on clinical examination. Hardware from prior facial surgery is seen, and a communication is present between the frontal sinus and intracranial space — potentially the leak site.

CASE RESOLUTION

Although the patient's CSF WBC count was 41, his RBC count was more than 15,000 (therefore, not suggestive of infection). He remained afebrile, and his CSF culture showed no bacterial growth. Endoscopic surgery was performed by otolaryngology and showed multiple defects of the skull base, which were repaired.

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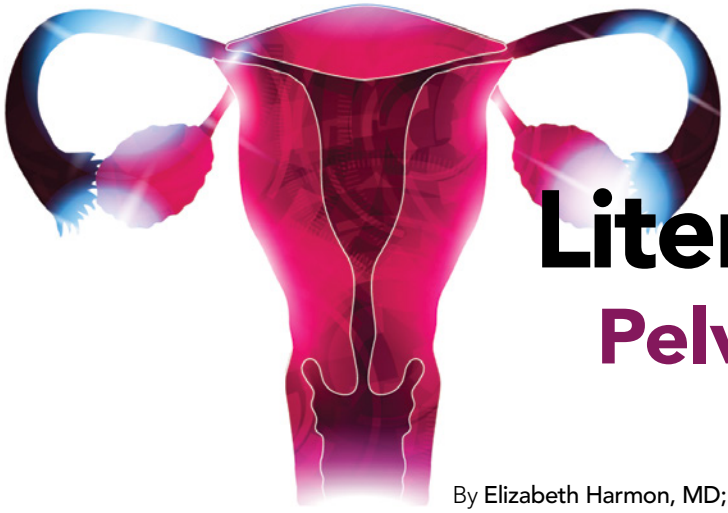


The LLSA Literature Review

Pelvic Inflammatory Disease

By Elizabeth Harmon, MD; and Laura Welsh, MD
University of Washington School of Medicine, Department of Emergency Medicine, Seattle
Reviewed by Andrew J. Eyre, MD, MHPEd

Brunham RC, Gottlieb SL, Paavonen J. Pelvic inflammatory disease. *N Engl J Med.* 2015 May 21;372(21):2039-2048.

Pelvic inflammatory disease (PID) is an inflammatory disorder of the female upper-reproductive tract, including the endometrium, fallopian tubes, and ovaries. The disease is caused by infection-induced inflammation that ascends from the vagina or cervix to the upper-genital tract.

Acute pelvic inflammatory disease (lasting ≤30 days) is most often caused by the sexually transmitted cervical pathogens *Chlamydia trachomatis* and *Neisseria gonorrhoeae*, but *Mycoplasma genitalium* and bacterial vaginosis-associated pathogens are also common culprits. Approximately 15% of cases are caused by respiratory or enteric pathogens that colonize in the lower genital tract.

PID can be difficult to diagnose due to the wide variation in signs and symptoms, including lower abdominal pain, abnormal vaginal discharge, intermenstrual bleeding, and dyspareunia. The clinical diagnosis is based on findings of pelvic organ tenderness, including cervical motion tenderness, adnexal tenderness, or uterine tenderness, with associated signs of lower genital tract inflammation, such as cervical mucopurulent discharge or friability. Cervical or vaginal nucleic acid amplification tests for *N. gonorrhoeae* and *C. trachomatis* should be performed on all patients with suspected PID. Ultrasonography can be helpful to identify an alternative diagnosis. However, while imaging might be specific in identifying thickened, fluid-filled fallopian tubes indicative of salpingitis, ultrasound lacks sufficient sensitivity.

The treatment of PID involves combination antibiotic regimens that empirically treat the likely pathogens; *N. gonorrhoeae* and *C. trachomatis* should always be covered. Outpatient regimens include a 2-week course of doxycycline and a one-time dose of a parenteral third-generation cephalosporin (eg, intramuscular ceftriaxone). Metronidazole can be added to this regimen to cover anaerobic pathogens. Indications for hospitalization include pregnancy, severe illness with the inability to tolerate oral medications, or complications such as a tubo-ovarian abscess. Inpatient treatment involves doxycycline and a parenteral second-generation cephalosporin with anaerobic coverage (eg, cefoxitin or cefotetan), or a combination of clindamycin and gentamicin.

Long-term complications of PID include tubal infertility and an increased risk of ectopic pregnancy due to tubal epithelial inflammation, scarring, and adhesions. Short-term complications include tubo-ovarian abscesses and Fitz-Hugh-Curtis syndrome, a rare complication that causes liver capsule inflammation and adhesion formation. Early diagnosis and treatment is necessary to prevent both short-term and long-term complications of PID.

KEY POINTS

- PID is caused by an ascending infection from the lower female genital tract to the endometrium, fallopian tubes, and pelvis.
- The most common causes of PID are *C. trachomatis* and *N. gonorrhoeae*; other culprits include bacterial vaginosis-associated anaerobes and respiratory or enteric pathogens.
- The clinical diagnosis is based on pelvic organ tenderness with cervical discharge or friability. Nucleic acid amplification tests for *N. gonorrhoeae* and *C. trachomatis* should be performed in all patients with suspected PID.
- Early treatment is essential to prevent both short- and long-term complications.

Critical Decisions in Emergency Medicine's series of LLSA reviews features articles from ABEM's 2018 Lifelong Learning and Self-Assessment Reading List. Available online at acep.org/llsa and on the ABEM website.

In Too Deep

Pediatric Drowning and Submersion Injuries

LESSON 18

By **Christina Long, MD, FACEP**

Dr. Long is an emergency physician at Loyola University Medical Center in Hines, Illinois, and a clinical assistant professor in the Department of Emergency Medicine at the Stritch School of Medicine in Maywood, Illinois.

Reviewed by **Sharon E. Mace, MD, FACEP**

OBJECTIVES

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

1. Define drowning and use acceptable terminology.
2. Recognize risk factors for drowning.
3. List the steps involved in rescuing and resuscitating a pediatric drowning patient.
4. Manage hypothermia in a drowning patient.
5. Recognize different end-organ complications that result from drowning.
6. Determine the appropriate disposition for a drowning patient.
7. Identify poor prognostic indicators after drowning.

FROM THE EM MODEL

6.0 Environmental Disorders
- 6.5 Submersion Incidents

CRITICAL DECISIONS

- What condition determines whether an incident is defined as drowning?
- What steps should you take to rescue and resuscitate a pediatric patient after drowning?
- What is the pathophysiology of drowning?
- What end-organ complications coincide with drowning?
- What is the appropriate disposition for a pediatric patient after drowning?
- What factors indicate a poor prognosis for a pediatric drowning patient?

While pediatric drowning is more prevalent in regions populated by large numbers of swimming pools, lakes, rivers, and beaches, younger children are also at risk in poorly controlled situations that involve bathtubs and even buckets of liquid (*Figure 1*).[1,2] An estimated 85% of these cases are preventable with adequate supervision, swimming lessons, and public safety initiatives. Because early rescue and resuscitation are vital to a good outcome, emergency clinicians must be prepared to recognize and manage drowning and submersion-related injuries without hesitation.

CASE PRESENTATIONS

CASE ONE

A 9-month-old girl arrives via ambulance after a frantic babysitter called Emergency Medical Services (EMS) with a report of drowning. The babysitter told the medics that she was giving the child a bath when she stepped away briefly to get her a towel. When she returned, the infant was face down in the tub, flailing. She quickly pulled her out and gave her a few back blows; the child began to cry.

On arrival, the child is alert, is breathing spontaneously, and appears well perfused. Her vital signs are blood pressure 82/40, heart rate 172, respiratory rate 40, rectal temperature 37.1°C (98.8°F), oxygen saturation 99% on room air, and weight 7 kg. Her exam reveals normal heart sounds and normal lung sounds. The secondary exam does not reveal any bruises or signs of trauma. Her neurological examination is normal.

CASE TWO

EMS notifies a Florida hospital that a 4-year-old girl is being transported to the emergency department in critical condition after being found unresponsive in the family's pool. EMS states that the family was having a party, when the child slipped away unnoticed. An adult found her in the pool and pulled her out of the water, but she was unresponsive. Nobody at the party knows how long she was down. A family friend, a nurse, started cardiopulmonary resuscitation (CPR) immediately.

Attempts to intubate were unsuccessful in the field, so she was bagged. Attempts at IV were also unsuccessful. CPR was continued en route to the emergency department. The emergency physician prepares the trauma bay, crash cart, and airway cart. The on-call pediatric intensive care unit (PICU) physician is also notified in advance, and puts ECMO on standby. The nurse prepares the Broselow chart and PALS resuscitation medications. The respiratory therapist prepares oxygen, suction, an end-tidal CO2 monitor, a pediatric bag valve mask, and a ventilator. On arrival, she is cool and apneic, with thready pulses.

CASE THREE

A 16-year-old boy arrives via rescue helicopter after a drowning injury. His friends admit that they were drinking alcohol and were taking turns diving off a nearby cliff into the river. The patient jumped into the river but did not resurface. His friends were unable to rescue him and called 911. Medics recovered his unresponsive body after about 20 minutes and pulled him to shore. Signs of head trauma were noted.

The patient was pulseless and apneic; an automated external defibrillator (AED) showed asystole. A cervical collar was applied, and cervical spine precautions were maintained as CPR was initiated. The medics were unable to intubate the boy in the field. A peripheral IV was established and epinephrine (0.8 mg IV) was administered prior to emergency department arrival, based on an estimated weight of 80 kg.

According to the Centers for Disease Control and Prevention, approximately 10 victims die every day from accidental drowning; 1 in 5 of these victims are children 14 years or younger.[3] These injuries have a bimodal age distribution, with a peak incidence in those under 4 years old and another peak in adolescence.[4] Children between the ages of 1 and 4 years have the highest drowning rates; the majority of these incidents occur in home swimming pools.[3] Older children, particularly males older than 15 years, are more likely to drown in natural water (eg, rivers, lakes, or beaches).[1,2]

Risk factors (*Table 1*) for fatal and nonfatal drowning include inadequate childproofing barriers around pools, the inability to swim, lack of appropriate adult supervision, failure to use life jackets, alcohol or drug use, risk-taking behavior, cardiac events, seizure disorders, and behavioral/developmental disorders.[1,2,3]

CRITICAL DECISION

What condition determines whether an incident is defined as drowning?

Nonfatal drowning and submersion-related injuries are frequent and significant causes of pediatric morbidity and mortality. Nonfatal drowning is hallmarked by survival after a temporary submersion in water or other liquid medium. Drownings were previously divided into two categories: "wet" (in which fluid was aspirated into the lungs) and "dry" (indicating a period of asphyxia secondary to laryngospasm).[1] This terminology, and other terms such as "near drowning," "secondary drowning," and "delayed drowning," should no longer be used. The American Heart Association (AHA) recommends using the definitions set by the Utstein Style guidelines, which were formed by an international group of researchers with scientific expertise in the field of drowning.[1,5]

According to these guidelines and the World Health Organization (WHO), drowning is defined "as a process resulting in primary respiratory impairment from submersion in a liquid medium."[1,5] Fatal drowning, as the name implies, is a submersion injury leading to respiratory impairment that results in death. Any submersion or immersion incident that does not result in respiratory impairment should not be considered a drowning injury; it should be considered a water rescue. Therefore, drowning is either classified as *nonfatal* or *fatal*. Drowning outcomes have been simplified to death, morbidity, and no morbidity.[4]

CRITICAL DECISION

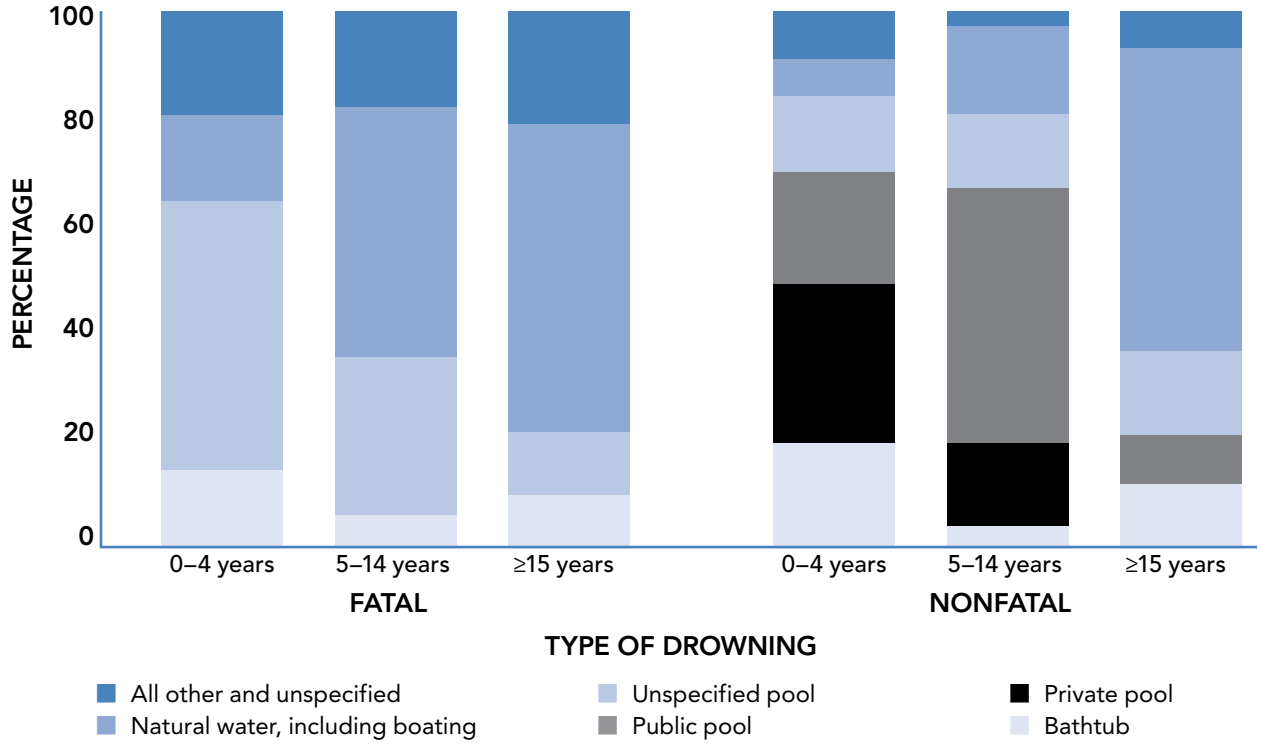
What steps should you take to rescue and resuscitate a pediatric patient after drowning?

Prehospital care is paramount to a drowning child. Immediate rescue and resuscitation, including initiation of bystander CPR, improves the outcome. The patient should be brought to land in the supine position, and then checked for responsiveness and breathing. In-water resuscitation, consisting of ventilation only, should only be attempted by a highly trained rescuer. The Heimlich maneuver is not a beneficial technique in drowning and should not be performed.[6] If the patient is unconscious but breathing, the patient should be placed in the lateral decubitus position.[7] If the patient is not breathing, two rescue breaths should be given. Respiratory arrest usually precedes cardiac arrest, making ventilation essential. Unlike the adult cardiac arrest patient, immediate ventilation is emphasized over uninterrupted chest compressions in pediatric patients ("ABC" [airway, breathing, circulation], not "CAB" [circulation, airway, breathing]).

If the patient does not respond to two rescue breaths, high-quality chest compressions at a rate of 100 to 120 bpm should be started. CPR is also indicated for any pediatric patient with bradycardia (heart rate <60 bpm) and signs of poor perfusion. When available, an AED should be placed. Most patients with cardiac arrest due to drowning present in asystole or pulseless electrical activity (PEA); however, they can also present with fatal arrhythmias such as ventricular fibrillation, especially when hypothermic.[7] Wet clothing should be removed, and passive rewarming should be initiated in the field. A decreased response to defibrillation and resuscitation medications can occur in a hypothermic patient, but should still be used when indicated. Cervical spine injuries are rare in drowning patients, and cervical spine precautions are not indicated unless there is an associated high-risk mechanism involved, such as diving or water sports.[1,7]

On arrival to the emergency department, high-quality CPR should be continued. Indications for intubation include apnea, an inability to maintain a PaO_2 above 60 mm Hg or oxygen saturation above 90% on high-flow oxygen, a $PaCO_2$ above 50 mm Hg, signs of neurological deterioration, or an inability to protect the airway.[1] If the patient requires intubation, a nasogastric tube (or orogastric tube) should also be placed to decompress the stomach. Resuscitation medications should be given according to the AHA and pediatric advanced life support (PALS) guidelines; refer to the Broselow chart if a weight is not available. Patients who are bradycardic (heart rate <60 bpm) and showing signs of poor perfusion should be given atropine 0.02 mg/kg IV or IO, up to two doses, with a maximum dose of 0.5 mg, followed by epinephrine 0.01 mg/kg every 3 to 5 minutes (1:10,000 concentration). Any pediatric patient in cardiac arrest should be given epinephrine 0.01mg/kg IV or IO (1:10,000 concentration) every 3 to 5 minutes.

FIGURE 1. Distribution of Fatal and Nonfatal Drownings by Location and Age Group



Derived from the National Vital Statistics System and National Electronic Injury Surveillance System — All Injury Program

Having a high suspicion for hypothermia is crucial. A low-reading rectal thermometer or, ideally, a central core probe should be used to assess for hypothermia. Hypothermia is defined as a core body temperature below 35°C (95°F). It can be categorized as mild (32°C to 35°C [89.6°F to 95°F]), moderate (28°C to 32°C [82.4°F to 89.6°F]), or severe (<28°C [<82.4°F]).[8] If not already started in the field, passive rewarming should be initiated immediately. If the patient remains hypothermic with a core temperature of <32°C (<89.6°F), active rewarming should be started with a target core temperature of 34°C to 35°C (93.2°F to 95°F).[8] Active external rewarming measures include applying warm blankets or using external heating devices that use radiant heat, convection, or forced air rewarming. In a patient with signs of poor perfusion and moderate to severe hypothermia, the benefits of external rewarming may be limited and could potentiate circulatory compromise; external rewarming in such cases has been associated with afterdrop (further cooling), hypotension (rewarming shock), ventricular fibrillation, and asystole.[8] If active external rewarming is performed, the trunk should be rewarmed first. In a patient with moderate to severe hypothermia, active internal rewarming measures should be instituted. Active internal rewarming measures include warmed humidified oxygen via endotracheal tube, warmed IV fluids, warmed fluid irrigation or lavage of body cavities such as the pleura or peritoneum, and extracorporeal cardiopulmonary resuscitation (ECPR) using extracorporeal membrane oxygenation (ECMO), when available.

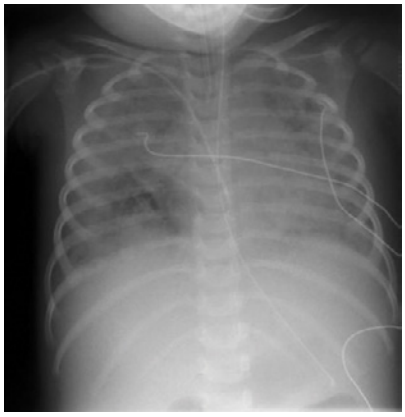
Resuscitative efforts should be continued in a hypothermic patient until the core temperature reaches 34°C to 35°C (93.2°F to 95°F) or spontaneous circulation returns to the patient.[8] Survival has occurred in patients with hypothermia and cardiac arrest, even after prolonged resuscitation, hence the saying "not dead until warm and dead." This may be due to the neuroprotective effects of hypothermia.

Whether an emergency physician should use targeted or induced therapeutic hypothermia in a cardiac arrest patient depends on the patient's age. Targeted therapeutic hypothermia after cardiac arrest has been very successful in adult patients; however, its use in pediatric cardiac arrest has not been definitively proven to improve outcomes, perhaps due to a lack of reporting of outcome improvement, the known harmful effects of hypothermia, or a lack of standardized measures for inducing hypothermia in children.[9] In particular, one study looked at therapeutic hypothermia versus therapeutic normothermia in pediatric comatose survivors of out-of-hospital cardiac arrest due to drowning. It did not show a statistically significant benefit in survival with a good functional outcome or mortality at 1 year in those treated with hypothermia compared to normothermia.[10] Therefore, current recommendations are to continue prolonged resuscitative efforts until the patient is rewarmed to at least a core temperature of 32°C (89.6°F).[8] Once the patient has reached a core temperature of 34°C to 35°C (93.2°F to 95°F), without return of spontaneous circulation, efforts can be stopped.[8] Children who suffer cardiac arrest and hypothermia, who do not have return of spontaneous circulation within 30 minutes of resuscitation, experience extremely poor outcomes.[11]

FIGURE 2. The Osborn Wave

The Osborn wave (commonly called the J wave) is typically seen when body temperature falls below 32°C (89.6°F). This finding is a positive deflection at the J point, seen between the QRS and ST segments.

FIGURE 3. Chest Radiograph of Child With Noncardiogenic Pulmonary Edema, With Progression to ARDS



Courtesy of *Critical Care*; used with permission.

CRITICAL DECISION

What is the pathophysiology of drowning?

Fatal and nonfatal drownings begin with primary respiratory impairment due to submersion in a liquid medium, followed by breath-holding and a struggle to stay above water, if concscious.[1,12] Eventual reflex inspiratory efforts lead to aspiration or laryngospasm. If laryngospasm occurs, it is often rapidly terminated by brain tissue hypoxia.[7] Regardless of freshwater or seawater aspiration, fluid in the alveoli causes surfactant dysfunction, which affects the osmotic gradient in the alveolar-capillary membrane. This leads to pulmonary edema, which decreases the exchange of oxygen and carbon dioxide.[7] If the patient is not rescued, aspiration leads to hypercapnea, hypoxia, and eventual respiratory arrest. This usually results in cardiac deterioration, starting with tachycardia, then bradycardia, PEA, and asystole.[7]

CRITICAL DECISION

What end-organ complications coincide with drowning?

Systemic hypoxemia can affect virtually all organs and lead to multisystem organ dysfunction or failure. In one study that reviewed multiorgan dysfunction after pediatric drowning, the respiratory system was most frequently affected, followed by the neurological, cardiovascular, hepatic, hematologic, and renal systems.[12] All children studied who experienced severe neurological impairment or died suffered cardiorespiratory arrest.[1]

Pulmonary injury results from fluid aspiration, which can lead to hypoxemia, noncardiogenic pulmonary edema, and acute respiratory distress syndrome (ARDS). The hallmarks of ARDS include diffuse alveolar injury leading to decreased permeability, inflammation, impaired gas exchange, and decreased pulmonary compliance. The classic chest x-ray for ARDS finds diffuse pulmonary opacities, consistent with noncardiogenic pulmonary edema. Patients have impaired oxygenation with high oxygen requirements, most often requiring intubation. Signs and symptoms of pulmonary insufficiency after drowning can present acutely or insidiously, and include dyspnea, tachypnea, hypoxia, crackles, and wheezing. Clinically significant pulmonary derangements can be seen with as little as 1 mL/kg to 3 mL/kg of fluid aspiration.[13]

Cardiac effects are usually secondary to hypoxemia or hypothermia. PEA and asystole are the most frequently encountered rhythms in drowning victims who are in cardiac arrest. Abnormal cardiac rhythms seen after drowning include tachycardia, bradycardia, atrial fibrillation, and even ventricular dysrhythmias.[1] In a hypothermic patient, notable ECG changes can include the Osborn wave, or J wave (*Figure 2*) — a positive deflection seen at the J point between the QRS and ST segments, which is best seen in the precordial leads. The Osborn wave is negative in leads aVR and V_1 and can occur when temperature falls below 30°C to 32°C (86°F to 89.6°F), though it is not pathognomonic for hypothermia.

Neurological impairment can occur due to cerebral edema and elevated intracranial pressure, or also as a result of hypoxemia and hypoxia.[1] Metabolic and respiratory acidosis are also seen, though less likely in nonfatal drowning victims.[1] Electrolyte abnormalities are not common. Renal failure can also occur, usually as a result of acute tubular necrosis, but it is rare.[1] Hepatic impairment and coagulopathies are also rare complications.[1]

CRITICAL DECISION

What is the appropriate disposition for a pediatric patient after drowning?

For a symptomatic, unstable, or critical drowning patient, the disposition is obvious — admission. Any symptomatic patient should receive an ECG, an arterial blood gas test, a basic or complete metabolic panel, a complete blood count, coagulation studies, drug and alcohol testing (when indicated), and a chest x-ray. All symptomatic patients should be admitted to a monitored bed. But what about the asymptomatic, stable patient?

In recent years, media have given a lot of attention to "delayed drowning" and "secondary drowning" cases, which has instilled fear in parents (and physicians) everywhere, even after minor submersion injuries. Historically, these patients

TABLE 1. Important Facts and Predictors of Outcome in Resuscitation of a Drowned Patient

Early basic life support and advanced life support improve outcomes.
During drowning, a reduction of brain temperature of 10°C decreases ATP consumption by approximately 50%, doubling the duration of time that the brain can survive.
Duration of submersion and risk of death or severe neurological impairment after hospital discharge **0-5 minutes:** 10% **6-10 minutes:** 56% **11-25 minutes:** 88% **>25 minutes:** nearly 100%
Signs of brain-stem injury predict death or severe neurologic sequelae.
Prognostic factors are important in the counseling of family members and are crucial in informing decisions regarding more aggressive cerebral resuscitation therapies.

Pearls

- Rescue breaths (ventilation) should be the first step to resuscitating a pediatric drowning patient ("ABC," not "CAB").
- Evaluate all drowning patients for hypothermia and initiate rewarming measures.
- Admit all symptomatic drowning patients.
- Consider discharge for an asymptomatic, stable patient after a period of 8 hours of observation in the emergency department.

were admitted due to the fear that they could later develop ARDS or respiratory arrest. Current literature suggests that emergency department monitoring or observation may be sufficient to safely discharge these patients.[14] A recent study, published in *The American Journal of Emergency Medicine*, focused on the safe discharge of pediatric drowning patients from the emergency department and showed that very few patients had clinical deterioration after a well-appearing presentation.[14]

Most of the patients who developed complications had abnormal age-adjusted vital signs on presentation. Only 34% of patients presented with normal age-adjusted vital signs. Despite the low number of patients with subsequent clinical deterioration, more than half were admitted to the hospital. Reasons included an abnormal temperature, respiratory rate, oxygen saturation, physical examination finding, or chest x-ray. The researchers concluded that initial age-adjusted vital signs and physical exam in stable, well-appearing drowning patients do not completely exclude the possibility of delayed complications. However, they are rare events.[14]

Another study, published in the *Society for Academic Emergency Medicine*, used a scoring system called the Pediatric Submersion Score to identify children at low risk of submersion-related injury who could be safely discharged from the emergency department after a period of observation. Five factors generated a safe discharge score at 8 hours: normal mentation, normal respiratory rate, absence of dyspnea, absence of need for airway support, and absence of hypotension (with a score of 0 to 5). A score of 4 or higher in the emergency department suggests a safe discharge from the emergency department at 8 hours. In this study, a total of 278 patients were ultimately reviewed, and 50% were deemed safe for discharge. None of the patients who were determined to be safe for discharge at 8 hours had abnormal vital signs requiring hospital admission at 24 hours. Outcomes were verified through fatality records and electronic health record review.[15]

In conclusion, the asymptomatic patient should be observed for 8 hours in the emergency department and admitted if there are any signs of deterioration. If the vital signs, exam, and all studies are normal, and remain normal, the patient can be safely discharged with clear discharge and follow-up instructions.[1]

CRITICAL DECISION

What factors indicate a poor prognosis for a pediatric drowning patient?

Factors associated with a poor prognosis for a pediatric drowning patient include submersion for longer than 5 minutes, time to basic life support longer than 10 minutes, a resuscitation duration greater than 25 minutes, an age older than 14 years, a Glasgow Coma Scale score below 5, persistent apnea and requirement of CPR in the emergency department, or an arterial blood pH below 7.1 on presentation.[1]

The survival outcome following pediatric cardiac arrest is poor. Survival to hospital discharge ranges from 0% to 38% when factoring for both out-of-hospital and in-hospital arrests, with up to half of the survivors having neurological impairment.[9] For children who do not need resuscitation or who recover quickly after basic life support, the neurological outcome is typically excellent. The prognosis is much worse in those children who require advanced life support.

In one retrospective study of children with cardiac arrest and hypothermia after drowning, absence of return of spontaneous circulation within 30 minutes was associated with an extremely poor outcome. Survival with good overall outcome or mild to moderate disability occurred in 11% of children with cardiac arrest who required advanced life support.[11] Induced therapeutic hypothermia has not been proven to improve outcomes following pediatric cardiac arrest, though case reports with good neurological outcomes do exist.[7]

Summary

Drowning is a leading cause of injury-related death in children, and is largely preventable. An adult should constantly supervise infants and toddlers during bath time and while swimming, and

Pitfalls

- Using the terms "near drowning," "delayed drowning," "secondary drowning," "wet drowning," or "dry drowning."
- Performing the Heimlich maneuver.
- Performing chest compressions before ventilation on a drowning cardiac arrest patient.
- Failing to recognize and treat hypothermia.
- Admitting every patient with a water-submersion injury.

CASE RESOLUTIONS

CASE ONE

The babysitter calls the parents, who arrive shortly after the arrival of the patient to the emergency department. An ECG, chest x-ray, and basic labs are obtained, all of which are normal. The emergency physician consults a social worker. After the social worker interviews both the parents and the babysitter, abuse is ruled out. The social worker then explains water-related safety precautions and reiterates the importance of supervision at all times when a child is in the bathtub. The child is observed for 8 hours in the emergency department. Her vital signs, respiratory status, and mental status remain unchanged and stable. She is discharged home with the parents with clear instructions and follow-up recommendations.

CASE TWO

On arrival, the child's condition is unchanged. She is unresponsive and apneic, and her pulses are weak. Her heart rate is 30 bpm. The respiratory therapist takes over bagging the child, and the technician resumes chest compressions.

The emergency physician prepares for intubation. The nurse is not able to establish a peripheral IV after two attempts, so she is instructed to place an intraosseous line in the child's right tibia. Once the line is established, the child is given atropine 0.4 mg IO. The physician intubates her using a 5.0-cuffed endotracheal tube. A 12-French nasogastric tube is also placed. A large amount of frothy pink sputum is suctioned from her airway, as well as fluid from her stomach. She continues to have weak pulses and is bradycardic; epinephrine 0.2 mg is given IO.

During the patient's next pulse and rhythm check, the physician finds that she has stronger pulses and a heart rate of 84 bpm, in sinus rhythm. Chest compressions are stopped, and a complete set of vitals show blood pressure 84/42, heart rate 84, respiratory rate 22 (with ventilator), rectal temperature 32°C (89.6°F), and oxygen saturation 88% on 100% FiO_2. An ECG reveals Osborn waves. The chest x-ray shows diffuse noncardiogenic pulmonary edema, and ARDS is suspected (*Figure 3*).

Laboratory tests show show normal electrolytes, renal function, blood counts, liver function, and coagulation studies. The arterial blood gas test shows mild metabolic acidosis. Active internal rewarming measures are started. She is admitted to the PICU, where she may require ECMO.

CASE THREE

On arrival, an assessment of the teenager's ABCs reveals he is still in full cardiac arrest. The monitor shows asystole. CPR is resumed, and cervical spine precautions are maintained. The physician intubates the patient using video laryngoscopy. Large volumes of pink, frothy fluid are suctioned from his airways. A size 7.0-cuffed endotracheal tube is placed and confirmed. An orogastric tube is then placed to decompress his stomach. Despite tube placement confirmation, breath sounds remain diminished bilaterally, and oxygen saturation is poor. Epinephrine 0.8 mg is given IV, and a second large bore IV is placed by the nurse. CPR is continued, and epinephrine is given every 3 minutes.

A low-reading thermometer shows a rectal temperature of 30°C (86°F). A brief secondary trauma exam is performed and shows a scalp hematoma to the right frontal-temporal region, facial abrasions, dilated and nonreactive pupils, and absent reflexes. No obvious trauma to the chest, abdomen, back, or extremities is found. Active external and internal rewarming measures are implemented.

An extended focused assessment with sonography for trauma is done and is negative for free fluid. A brief pause in chest compressions to perform bedside cardiac ultrasound shows a lack of cardiac activity after 45 minutes of high-quality CPR in the emergency department, with a total downtime estimated at 75 minutes. He remains in asystole, despite rewarming to 34°C (93.2°F), and is pronounced dead.

should not rely on floatation devices to substitute for supervision. Pools and other bodies of water around the home should have adequate childproof barriers. Buckets of water or other liquids should not be left unattended, as these also pose a drowning risk for children. In addition, public safety measures should be emphasized, such as using life jackets and avoiding risk-taking behavior, especially while under the influence of alcohol or drugs.

Early rescue and resuscitation are vital to a good outcome. The most important first step in resuscitation after rescue is ventilation by giving two rescue breaths. In most cases of early rescue, two rescue breaths are all that is needed. If a patient does not respond, CPR should be initiated. Medics and physicians should have a high suspicion for hypothermia in every drowning patient, and rewarming measures should be taken. The role of therapeutic hypothermia remains controversial in pediatric patients, so current recommendations are to continue prolonged resuscitative efforts until the patient is rewarmed to at least a core temperature of 32°C (89.6°F). Cervical spine injuries are rare in drowning cases, but should be considered if the mechanism suggests otherwise, such as diving. Prolonged submersion time, delay of rescue and resuscitation, and cardiac arrest are indicators of poor prognosis.

Stable, asymptomatic patients can potentially be discharged from the emergency department after a period of observation of 8 hours. Frequent assessment of vital signs and re-

examination are necessary, in addition to obtaining an ECG, a chest x-ray, and labs. All symptomatic patients should be admitted. Complications can include noncardiogenic pulmonary edema, ARDS, cardiac dysrhythmias, neurological impairment, and multisystem organ failure.

When referring to cases of drowning, only the terms nonfatal drowning and fatal drowning should be used. To be considered a drowning, respiratory impairment must have occurred after a period of submersion.[1,5] It is otherwise considered a water rescue. Do not use terms like "near drowning." Respiratory insufficiency can occur insidiously, but should not be referred to as a "delayed drowning" or "secondary drowning."

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CME QUESTIONS

Reviewed by **Lynn Roppolo, MD, FACEP**

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1 Which of the following strategies has failed to improve geriatric patient safety?

A. Bedside radiological studies
B. Fall-risk bracelets
C. Flat, even floors
D. Recliners or soft mattresses

2 What strategy can make the discharge process safer for older patients?

A. Ask the patient to schedule a follow-up appointment with a primary care provider within 1 month
B. Exclude family members from the process because their presence violates HIPAA
C. Present all instructions in simple language and personally review them with the patient
D. Streamline discharge instructions to one piece of paper

3 Which of the following presentations warrants assigning an older patient to a higher acuity level?

A. Blood pressure 130/90
B. Disorientation
C. Heart rate 85
D. Oral temperature 37.2°C (99°F)

4 Which of the following tactics could make the discharge process safer?

A. Discouraging the patient from seeing a primary care physician until next week
B. Excluding the patient's family from the process to protect the patient's privacy
C. Making a follow-up phone call in 2 weeks
D. Using large type for all discharge instructions

5 An 86-year-old woman presents after a fall. She reports a burning sensation while urinating. Her urinalysis is positive for leukocytes, >50 WBCs, large bacteria, and nitrates. What step should be taken prior to discharging her?

A. Arrange for the patient to be taken to her car in a wheelchair so that she doesn't have to walk and risk falling
B. Discuss the planned antibiotic therapy with the emergency department pharmacist or look at the Beers list for potentially harmful drug interactions
C. Explain to the patient that another antibiotic cannot be added to her medication regimen because it would be dangerous
D. Prescribe an antibiotic without checking the patient's home medication list

6 Which of the following interventions decreases the risk of delirium in susceptible patients?

A. Haloperidol
B. Regular meal times
C. Use of a cardiac monitor
D. Use of a clock

7 Which of the following is an inaccurate statement concerning the triage of elderly patients?

A. Even when triaged appropriately, geriatric patients wait longer to be seen than expected, given their assigned triage level
B. Heart rate is the most sensitive vital sign for the appropriate triage of elderly patients
C. Inappropriate field triage can direct elderly trauma patients away from level 1 trauma centers and put them at greater risk for delays in appropriate care
D. The ESI triage system is not always accurate when triaging elderly adults

8 Which of the following should be considered before prescribing opioids to a geriatric patient?

A. Acetaminophen and topical anesthetics should not be used in lieu of more effective opioids
B. Palliative care can help to create safe, effective pain management plans for elderly patients
C. Palliative care is appropriate for terminally ill patients
D. Regional nerve blocks should not be used routinely

9 A 70-year-old woman presents with new-onset gout. While waiting for her radiology results, her physician prescribes 6 mg of morphine. After receiving it, she becomes delirious. As she tries to get off the stretcher, she falls and sustains a femoral neck fracture. Which action might have prevented this series of events?

A. Application of a fall-risk bracelet
B. Consideration of alternatives to opioids
C. Evaluation of her vital signs and re-evaluation by the nurse
D. Placement of a Foley catheter

10 Which of the following tasks is outside the scope of practice for an emergency department pharmacist?

A. Completing a medication reconciliation
B. Confirming appropriate dosing for emergency department–prescribed medications
C. Identifying a potential medication-medication interaction
D. Modifying the patient's home medication dosages

11 What age group is at the highest risk for drowning?

A. 4 years of age and under
B. 5 to 8 years of age
C. 8 to 12 years of age
D. Over 15 years of age

12 Which of the following is an acceptable term to use when referring to drowning?

A. Dry drowning
B. Near drowning
C. Nonfatal drowning
D. Secondary drowning

13 An 11-month-old girl is left unattended in the bathtub. Her mother returns to find her submerged face down. What should the mother do first?

A. Get in the tub and start resuscitation
B. Pull the girl out of the tub, check for breathing, and give her two rescue breaths if she is not breathing
C. Pull the girl out of the tub and immediately start chest compressions
D. Pull the girl out of the tub and perform the Heimlich maneuver

14 Which of the following is associated with a poor prognosis after drowning?

A. Apnea and CPR required in the emergency department
B. Basic life support provided on scene
C. Duration of submersion of less than 5 minutes
D. Return of spontaneous circulation within 30 minutes

15 Which of the following should be considered when managing hypothermia in a drowning patient?

A. Active rewarming should be initiated in the emergency department
B. ECG changes include the "delta wave"
C. Induced or targeted therapeutic hypothermia should be performed, as it has been proven to improve survival and neurologic outcomes in pediatric patients
D. Patients should be rapidly rewarmed until they reach a core body temperature of 37°C (98.6°F)

16 Which of the following is a risk factor for drowning?

A. Constant adult supervision during bath time
B. Multiple adults hanging out around a pool socializing, while children are swimming in the pool
C. Using alcohol or drugs when in the water
D. Using life safety vests, while boating or swimming

17 Which of the following should be considered when performing diagnostic tests after a drowning?

A. Arterial blood gas, if abnormal, usually shows a respiratory alkalosis
B. Chest x-ray findings often include cardiomegaly and diffuse pulmonary edema
C. ECG is usually not necessary because drowning results primarily in pulmonary insufficiency and cardiac abnormalities are not common
D. Renal function is rarely affected

18 Which chest x-ray finding suggests ARDS?

A. Bilateral, patchy, perihilar opacities and peribronchial cuffing
B. Consolidation in the left lower lobe
C. Diffuse pulmonary edema with cardiomegaly
D. Diffuse pulmonary edema without cardiomegaly

19 A 3-year-old child has been rescued from drowning. He is unresponsive and apneic, has weak pulses, and has a heart rate of 40. What is the best approach?

A. Use a bag valve mask, give oxygen for ventilation, and administer a 20-mL/kg fluid bolus
B. Give two rescue breaths, followed by chest compressions if he does not respond; continue CPR and give atropine, as well as epinephrine; and intubate, if possible
C. Begin immediate chest compressions, followed by atropine every 3 to 5 minutes, and intubate, if possible
D. Since he is not pulseless and does not require chest compressions, perform the Heimlich maneuver, give two rescue breaths, and then intubate, if possible

20 Which of the following should be considered when managing a drowning patient?

A. All drowning patients should be admitted due to the risk of delayed respiratory distress, hypoxemia, ARDS, and respiratory arrest
B. Hypothermia associated with drowning should not be aggressively treated, as it has been shown to have neuroprotective effects and to improve the outcome in pediatric cardiac arrest patients
C. The most common rhythm in a drowning patient who has suffered cardiac arrest is ventricular fibrillation
D. Submersion or drowning injuries that result in pulmonary insufficiency and hypoxemia can potentially lead to multiorgan dysfunction

ANSWER KEY FOR AUGUST 2018, VOLUME 32, NUMBER 8

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
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OCTREOTIDE

By Anthony Kraus, MD; and Frank LoVecchio, DO, MPH, FACEP, Maricopa Medical Center, Phoenix, AZ

Octreotide is a broad polypeptide hormone that vasoconstricts vessels, reduces portal vessel pressure, and decreases insulin release. It provides more potent inhibition of growth hormone, glucagon, and insulin than endogenous somatostatin.

Mechanism of Action

The drug mimics natural somatostatin by inhibiting serotonin release and the secretion of gastrin, VIP, insulin, glucagon, secretin, motilin, and pancreatic polypeptide. In addition, it decreases growth hormone and IGF-1 in acromegaly, suppresses LH response to GnRH and the secretion of thyroid-stimulating hormone, and decreases splanchnic blood flow.

Emergent Indications

Bleeding esophageal varices — Decreases portal vessel pressure and may reduce the rate of upper-GI bleeding.
Sulfonylurea toxicity — Reduces the incidence of recurrent hypoglycemia versus therapy with dextrose alone.

Dosing

Bleeding esophageal varices (off label): (IVB) 25 to 100 mcg (usual bolus dose: 50 mcg) followed by continuous IV infusion of 25 to 50 mcg/hour for 2 to 5 days; may repeat bolus in first hour if hemorrhage is not controlled.

Sulfonylurea toxicity (off label): (SubQ) 50 mcg every 6 hours, when necessary. Subcutaneous administration is preferred; however, repeat dosing, dose escalation, or initiation of a continuous infusion may be required in cases of recurrent hypoglycemia. Treatment for >24 hours may be necessary; observation is recommended.

Precautions

Common adverse reactions include bradycardia arrhythmia (19%-25%), hyperglycemia (16%-27%), and fatigue (1%-10%). Patients should also be monitored for increased biliary disease due to decreased gallbladder motility and increased sludging.

Tox Box

BACLOFEN POISONING

By Tony Gao, MD; and Christian A. Tomaszewski, MD, MS, MBA, FACEP, University of California, San Diego

Baclofen is a centrally acting GABA-B receptor agonist prescribed to treat spasticity and chronic neuropathic pain syndromes. It is also used to treat alcohol withdrawal. There are oral and intrathecal formulations.

Presentation

Toxic dose

>150 mg — symptomatic
>300 mg — significant complications

Acute overdose

- CNS depression to coma
- Respiratory depression, resulting in coma and decreased muscle tone
- Hypotension with bradycardia
- Hypothermia

Seizures

- Seen in both baclofen overdose and withdrawal
- Inhibition of both presynaptic and postsynaptic receptors of GABA-B

Management

- Provide supportive care and maintain airway.
- The first-line treatment for seizures is benzodiazepines, which act on GABA-A receptors.
- Hemodialysis can be used in ill patients with end-stage renal disease or acute kidney injury.
- Consider EEG for persistent symptoms to rule out nonconvulsive status epilepticus.

Disposition

- Symptomatic patients should be admitted (effects can last 2-3 days).
- Asymptomatic patients can be discharged after brief (4-6 hours) observation (symptom-onset is quick).

Intrathecal Pumps

Because <10% of baclofen crosses the blood-brain barrier, intrathecal pumps are used to treat severe spasticity. Excess drug delivery or abrupt cessation can cause coma or status epilepticus. Pump interrogation may help distinguish the two, and benzodiazepines can treat both. In some cases of intrathecal overdose, the withdrawal of 30 mL of CSF has been advocated.