

Foundations of Emergency Medicine

Foundations III: Guided Small Group Experience

Session 28: “Care of the Special Needs Child”

Unit: Special Populations

❖ Agenda and Learning Objectives

○ Case Part I – Care of the Autistic Child (20 min)

- Basic child life/analgesia (10 min)
 - Explain the specific role of a certified child life specialist in the ED
 - Discuss non-pharmacological methods of addressing pain and anxiety in children in the ED
 - Describe the general approach to medication administration when pharmacological methods are needed
- Care for autistic children or those with developmental delay (10 min)
 - Describe the specific challenges of caring for children with autism or developmental delay in the ED
 - List specific tips for approaching a painful procedure or difficult examination in an autistic or developmentally delayed child

○ Case Part II — Care of the child with chronic medical conditions (20 min)

- Discuss how ED care of the technology-assisted child differs from that of children without chronic medical conditions.
- List possible complications of a CSF shunt, along with appropriate ED testing strategies.
- Describe ED evaluation and management of tracheostomies.
- Name the steps for replacement of a dislodged gastrostomy tube and demonstrate proper technique.

○ Session Conclusion (10 min)

- Review Session Teaching Points

❖ Case Part I– Child life, analgesia and Care of the Autistic Child (20 min)

- *It is a busy day in the pediatric emergency department, and the next patient to be roomed in your zone is Ricky, a six-year-old autistic male, who presents with a large laceration to his forearm after falling onto a glass coffee table. The wound is bandaged and there is no active bleeding. He is visibly agitated and pacing the room. You ask yourself, “How can I best approach this patient? What resources do I have that can make the exam and laceration repair go more smoothly?”*

❖ Discussion Questions with Teaching Points

- **What is a certified child life specialist (CCLS) and how might he or she be helpful to you in the emergency department?**
 - A CCLS is a professional whose role is to work with children and families in a healthcare setting and help them cope with illness, treatment, and hospitalization

- They have specific training that includes: a bachelor's degree in child development or a similar area of study, completion of an internship proctored by a child life specialist, and the completion of a certifying examination (1)
 - In the ED, they help with psychosocial preparation for procedures, providing comfort and distraction during a procedure, and educating staff on appropriate approaches to non-pharmacological methods of pain control
 - They help to prepare for examinations and procedures using these main principles:
 - Providing developmentally appropriate preparation/explanation
 - Encouraging emotional expression
 - Creating trusting relationships with healthcare professionals
- **You ask the CCLS in your emergency department to assist you in repair of Ricky's laceration. What are some non-pharmacological methods often employed by CCLS that address pain and anxiety in children in the emergency department?**
- Distraction-Visual (toys, books, iPad, guided imagery, singing, listening to music)
 - Children ages 3-11 undergoing IV placement were randomized to standard procedure vs. listening to music during placement. For children who reported any distress during the procedure, music had distress-reducing effect (median changes in distress scores from before to immediately after procedure were 2.2 (ICR 1.7-8.7) and 1.1 (ICR 0.1-2.4) for standard care and music groups respectively) (2)
 - Counterstimulation: using tactile stimulation near site of pain (gate theory of pain control) ex: Buzzy™ near site of IV cannulation or venipuncture
 - "Buzzy™" is a vibrating plastic device shaped like a bee (see Figure 1 below)
 - 91.4% of kids undergoing venipuncture had none or mild procedural pain when using the Buzzy vs. 61.1% in the non intervention group (3)
 - Patients had a decrease in self-reported pain scores when Buzzy and/or distraction cards were used during blood draws. The most effective was the combined use of Buzzy with distraction cards. (4)
 - Consider "comfort holds" (i.e. allowing caregivers to hold patients for painful procedures instead of using restraints)



Figure 1. Buzzy™ with frozen ice “wings” attached

- **What are some general approaches to medication administration with pharmacological methods are needed to address pain and/or anxiety?**
 - Consider the injury and the patient when choosing specific medications and routes of administration:
 - Is it likely that this injury is going to cause ongoing and significant pain?
 - If there is likely to be a procedure needed, will the procedure be particularly painful, and when will you be prepared to perform the procedure?
 - How long will the procedure last, and what is the likelihood that the patient will require procedural sedation?
 - Early application of topical anesthetics should be considered in any patient likely to require non-emergent procedures such as venipuncture, lumbar puncture, or wound closure, as they may lessen the need for additional analgesics
 - Consider early administration of analgesics and/or anxiolytics for painful injuries
 - Intranasal (IN) fentanyl has been shown to be an effective analgesic and equivalent to IV morphine, IV fentanyl and oral morphine pain control
 - 2014 Cochrane Review showed IN Fentanyl was an effective analgesic in children three years and older
 - Intranasal midazolam has been shown to be a fast, effective anxiolytic prior to procedures (7)
 - RCT comparing aerosolized intranasal, aerosolized buccal and oral midazolam in children undergoing laceration repair demonstrated faster

onset, greater proportion of patients receiving adequate sedation and better parent satisfaction with intranasal route

- Consider IN medication administration in children without IV access with moderate to severe pain, anxiety, or in those who would otherwise not require an IV for medication administration
 - IN fentanyl dosing: 2 mcg/kg to max 100 mcg
 - IN midazolam dosing: 0.2-0.4 mg/kg to max 10 mg
 - When larger volumes are required, providers can split the dose into two syringes and administer sequentially or simultaneously in bilateral nares
 - Always administer with a nasal atomizer!
- **After examining Ricky's laceration, you determine that it will require closure with sutures. What are some specific challenges to performing this procedure on an autistic child?**
 - Characteristics of autism spectrum disorder: problems with communication and social interaction and restrictive, repetitive patterns of behavior, interests or activities
 - Difficulty expressing needs; he may not be able to communicate fear, pain and anxiety
 - He may not be able to express whether he understands what is about to happen in the same way another child his age could
 - Repetitive behaviors or activities may be misinterpreted as agitation-this is where discussing with the family may help (see below)
 - Children who are developmentally delayed, and in particular children with ASD, often are "triggered" by certain sensory stimuli that are present in the ED: large number of people, loud noises, bright lights, chaotic environment
- **You are planning for the laceration repair and are aware of the specific challenges that accompany performing this procedure. What are some specific tips and tricks you can use to make this procedure go more smoothly?**
 - Discuss the procedure with the child's caregiver. They are your best resource! Some specific questions to ask:
 - Has your child ever had a similar procedure in the past? If so, what did or didn't work?
 - Are there specific things that "trigger" your child? (i.e. lights, noises, etc.)
 - What are some things that typically soothe your child or help de-escalate him when he is agitated?
 - Engage your child life specialist (see above). He or she is a great resource and can help with coordination with the family, appropriate preparation for the procedure and distraction during the procedure.
 - When explaining things to a child with ASD or DD, visual cues, pictures, social stories or role play may be helpful. Visual roadmaps or "if/then" cards (which display two images, one of an action and the other of a reward if the action is completed) may also help them understand potential choices and outcomes.
 - Modify the child's environment to avoid excess stimuli (dim the lights, minimize noises, and keep a minimum amount of providers in the room during the procedure)
 - Exercise caution when employing the use of restraints or seclusion with children with ASD or DD, and consider anxiolysis when needed.

❖ **Case Part I Concludes**

- *After consulting with your CCLS and Ricky's mom, you decide to apply LET gel to his laceration, then give him intranasal midazolam. During the procedure, you dim the room lights, turn on a soothing light machine, and Ricky wears his noise-cancelling headphones, listening to his favorite music. You're able to repair the laceration in under 10 minutes and Ricky and his mom leave happily 30 minutes later.*

❖ **Case Part II – Care of the child with chronic medical conditions (20 min)**

- *A triage nurse comes to you and says, "I've just roomed an 8-year-old with lots of chronic medical problems, and he doesn't look very good. Can you come see him?" You rush to the room and find a small 8-year-old boy with multiple contractures laying on the gurney, with an oxygen saturation of 88% with a good waveform. His home health nurse is vigorously suctioning out his tracheostomy while mom holds his hand. She tells you, "Yeah, I'm actually not worried about Andrew from a respiratory standpoint. He's just been **off** today." What're you going to do to evaluate this child?*

❖ **Discussion Questions with Teaching Points**

- **How are evaluation and management of a child with chronic medical issues different from a previously well child? What are important questions to ask Andrew's mom?**
 - Three main ways management of these children differs from those of previously well children:
 - Parents/caregivers are very medically savvy, and frequently understand the child's underlying condition better than providers
 - Children with chronic medical conditions may have access to services at home (such as nursing, suction, and oxygen) that other children may not have—this may assist with discharging a patient that might otherwise have been admitted
 - May have a care plan already in place, rendering their care more algorithmic; also, providers will likely need to reach out to subspecialists more commonly than in other children
 - Important questions to ask Andrew's mom:
 - When was the last time Andrew was admitted to the hospital? For what? How long did he stay? How does he look today compared with that time?
 - How does Andrew usually show that he is sick?
 - What did Andrew look like when he was the sickest you've ever seen?
 - What are you most worried about today?
 - Do you have a preference on being admitted versus going home, if we end up having a choice?
 - ACEP and the AAP recommend use of an emergency information form to facilitate and expedite evaluation and management of children with chronic medical conditions (example included in Appendix)(1)
 - Providers may dramatically alter their typical ED evaluation, management, and disposition for these children, including decreased labs and imaging, increased

involvement of subspecialists, and decreased admission, all predicated on caregiver comfort

- **Andrew has a tracheostomy in place for respiratory dysfunction related to perinatal neurologic injury; he usually is on room air during the day and on a ventilator to 30% FiO₂ at night. Discuss your leading diagnosis and what you would do for the following situations:**
 - **He presents in respiratory distress, with an oxygen saturation of 69% with good waveform.**
Diagnosis: likely mucus plug, though can't rule out decannulation or infection
Management:
 - Immediately suction the trach, using saline as needed
 - Apply humidified oxygen to the trach, and listen for breath sounds in lung fields
 - Palpate the neck for crepitus (suggestive of dislodgement/decannulation).
 - If decannulation can't be ruled out, then you may have to change the trach (best done as a two-person job)
 - If the trach appears to be in the correct position and isn't obstructed, then increase the FiO₂, consider ventilator support, and evaluate for tracheal or pulmonary infection along with other causes of hypoxia
 - **He presents with purulent secretions, fever, and respiratory distress. He has no other findings on exam.**
Diagnosis: Infection, most likely tracheitis
Management:
 - Respiratory support as above
 - Obtain gram stain and culture of secretions, as well as viral testing
 - Probable chest X-ray
 - Admit for IV antibiotics (most common organisms are *Staph aureus* and *epidermidis*, *Strep pneumoniae*, alpha and beta hemolytic *Strep*, *Klebsiella*, *Haemophilus influenza*, and even *Pseudomonas*), pulmonary toilet, and close observation
 - Recommended antibiotics cover for these organisms: vancomycin (45 mg/kg/day in 3 divided doses) and either ceftriaxone 100 mg/kg/day in 1-2 divided doses) or ampicillin-sulbactam (200 mg ampicillin/kg/day in 4 divided doses); may consider aztreonam (120 mg/kg/day in 3 divided doses) in penicillin allergy
 - **Check your patient's previous cultures and amend coverage accordingly** (e.g. may need to add in anti-pseudomonal coverage)
 - **He presents with bright red bleeding from his tracheostomy and respiratory distress.**
Diagnosis: Bleeding from trauma vs. granuloma vs. erosion into brachiocephalic artery
Management:
 - Try to keep tube in place (this may be the only airway you have!) and suction frequently
 - Respiratory support as above; may also need IV access and circulatory support
 - Apply direct pressure to visible sources of bleeding; you can also overinflate the cuff to tamponade more internal bleeding

- If you see a granuloma, you may treat with topical antibiotics (once the bleeding has stopped) and/or silver nitrate cautery
- Likely need a scope from ENT or surgery to rule out a serious cause of bleeding
- **Andrew also has a ventriculoperitoneal (VP) shunt, which was placed when he was six months old for hydrocephalus. It was last revised two years ago. Are you worried about a VP shunt infection? Why or why not? Name the steps for obtaining CSF from a VP shunt.**
 - Low chance of shunt infection— most are perioperative (within the first 2 months of placement or revision)
 - Younger children are at higher risk for infection
 - Compared with kids who have an uninfected VPS, kids with a VPS infection are more likely to have fever (58.6% vs. 17.4%), abdominal pain, and irritability, and are less likely to have headache (3)
 - On multivariable analysis, shunt revision in the last 90 days (adjusted odds ratio 2.4) and WBC > 15,000 (adjusted odds ratio 3.2) are suggestive of infection (3)
 - “Tapping” a VPS is typically performed by neurosurgery at tertiary and quaternary centers, but should be within an EM physician’s skillset. (see Figure 1 below)
 1. Consider application of a local anesthetic cream (LMX, EMLA) to the reservoir site if time allows
 2. Position the supine patient with the face turned toward the contralateral shoulder and the reservoir facing up
 3. Shave hair directly overlying the reservoir
 4. Prep the site with alcohol, then with providone-iodine solution x 3, allowing to dry each time
 5. Using sterile technique, obliquely puncture the skin and enter the reservoir with a 23 or 25 gauge butterfly needle, with the tubing perpendicular to the floor
 6. Measure intracranial pressure by measuring the height to which CSF rises in the tubing above the ventricles
 7. Continue to drain CSF until the pressure is just under 20 cm H₂O
 - a. Do not apply suction to remove CSF—this can inadvertently aspirate choroid plexus into the system
 - b. You may need to apply very gentle negative pressure in the case of proximal obstruction, but do not pull very hard

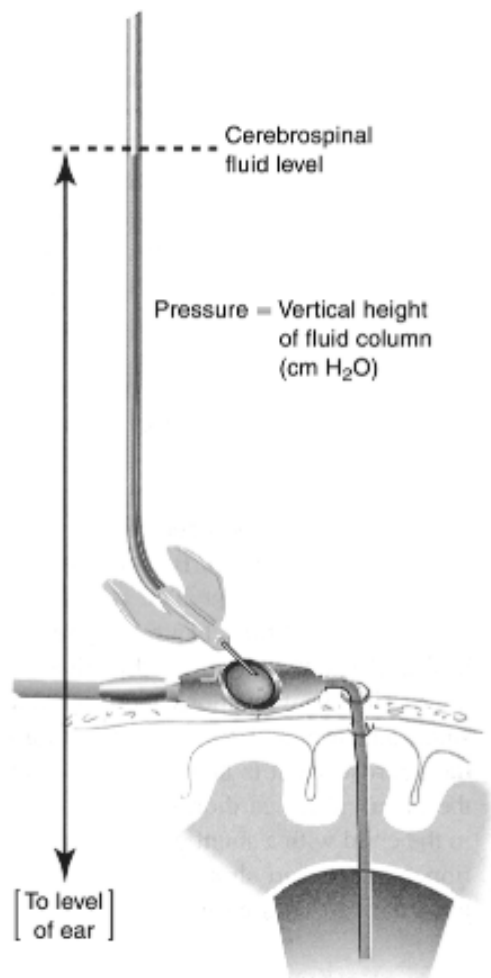


Figure 1
From Source 2

❖ **Case Part II Continues:**

After deep suction by his home health nurse, Andrew's vital signs are: BP 100/70 HR 120 RR 22 T 36.8 O2 sat 96% on room air. His mom and home health nurse report that he's been "off" for approximately 24 hours, without fever, changes in secretions, increased oxygen requirement, feeding intolerance, seizures, or other focal symptoms. Likewise, his exam is nonfocal. What's your differential diagnosis? What would you like to do to evaluate and manage him?

- Differential diagnosis:
 - VP shunt malfunction (from obstruction more likely than infection for reasons listed above)
 - Viral or bacterial infection (though less likely without fever or focal signs/symptoms)
 - Electrolyte abnormality (though no reason for this)
 - Status epilepticus or increased seizures (less likely given no witnessed seizure activity)

- Medication effect (dosing error, polypharmacy, etc.)
 - Innumerable other causes
 - Evaluation and management:
 - Of course, this varies by provider, but the authors' management would include:
 - Detailed head-to-toe exam (cannot be overemphasized)
 - Asking caregivers what they think is happening today
 - XR shunt series
 - Brain CT or rapid MRI (institution-dependent)
 - May consider CXR → labs likely to be low-yield though you may want to consider urine especially if they have a history of urinary tract infection or retention
 - Of note, the diagnosis of shunt malfunction cannot be made or excluded on the basis of imaging alone—history and physical exam also contribute dramatically
 - Lethargy (OR 2.2) and shunt site swelling (OR 3.1) significantly associated with shunt malfunction (and seizure almost significant); headache and vomiting were *not* significantly associated with malfunction (4)
 - Sensitivity and specificity in detecting shunt malfunction: (5,6)
 - CT: 53-92% sensitive, 76-96% specific
 - Rapid MRI: 59% sensitive, 93% specific
 - XR “shunt series”: 4-26% sensitive, 92-98% specific
 - Parental report: 89% sensitive, 62% specific
- **After you put in all of your orders for Andrew, another nurse comes running up to you and says, “We’ve got a 3-year-old whose G-tube is out! You gotta come put it in!” What questions are important to ask the parent? Describe the steps of replacing a G-tube.**
- Questions:
 - **When was the G-tube placed and by whom** (institution, specialty [may be placed by surgery, GI, or radiology])?
 - If the tube was placed within the last 6 weeks, the stoma and tract are likely both still fresh and the provider who placed the tube should evaluate the patient prior to ED replacement.
 - **Is this a G-tube, or a G-J tube** (ports in stomach and jejunum)?
 - G-J tubes need to be replaced by interventional radiology.
 - **What type and size is it?**
 - Most common type is a balloon tip (Mic-Key; designed similarly to a Foley catheter), may also have a mushroom tip (see Figure 2 below)
 - Two sizes of concern: length (in cm) and diameter (in Fr)
 - **How long has it been out?**
 - This is an emergent procedure!
 - In less than two hours, the stoma can start to close—if the tube replacement will be delayed at all, and/or if the tube has been out for more than 2 hours, place the largest size Foley catheter that will fit inside the stoma to keep it patent
 - If the catheter has been out for > 6 hours, may consider speaking with the placing provider before attempting tube replacement
 - **Any tips and tricks on replacing your child’s G-tube** (if it’s been dislodged before)?

- As mentioned above, caregivers here are key team members. They will offer advice on procedural adjuncts (toys, songs, movies, positions, etc.) to optimize success
- Steps of G-tube replacement:
 1. Confirm date of placement, type, and size
 2. Position child supine on bed, with arms and legs restrained
 3. Test the balloon (in balloon tip tubes) for competency, then deflate
 4. Insert the shaft of a cotton swab (balloon tip) or the obturator (mushroom tip) to maintain stiffness and generously coat the tube in lubricant
 5. Holding steady, firm pressure, insert the tube perpendicular to the skin until you feel yourself pop into stomach
 - a. Take care not to slide off obliquely or force the tube—these maneuvers could create a false tract
 - b. Especially if the tube has been dislodged for a while, the patient may require serial dilations with sequentially larger Foley catheters before a G-tube can be inserted; alternatively, you can place a smaller tube, but this may be associated with leakage of feeds and gastric contents
 6. Inflate the balloon (if present) and remove the cotton swab or obturator
 7. Aspirate gastric contents and attempt to flush the tube
 8. Some institutions and providers may still require contrast-enhanced X-ray confirmation of tube placement, even with aspiration of gastric contents (not perfectly specific)
 9. Can use point-of-care ultrasound (POCUS) to assist with G-tube replacement (7)
 - a. Place the linear or curvilinear transversely on the patient, with the stoma at the center of the probe (see Figure 3 below)
 - b. Identify abdominal wall (Ab in Figure 4 below), peritoneum (P), stomach wall (Sw), and stomach (St), and then visualize your G-tube within the gastric cavity
 - c. May also directly visualize flush with bubbles entering the gastric cavity

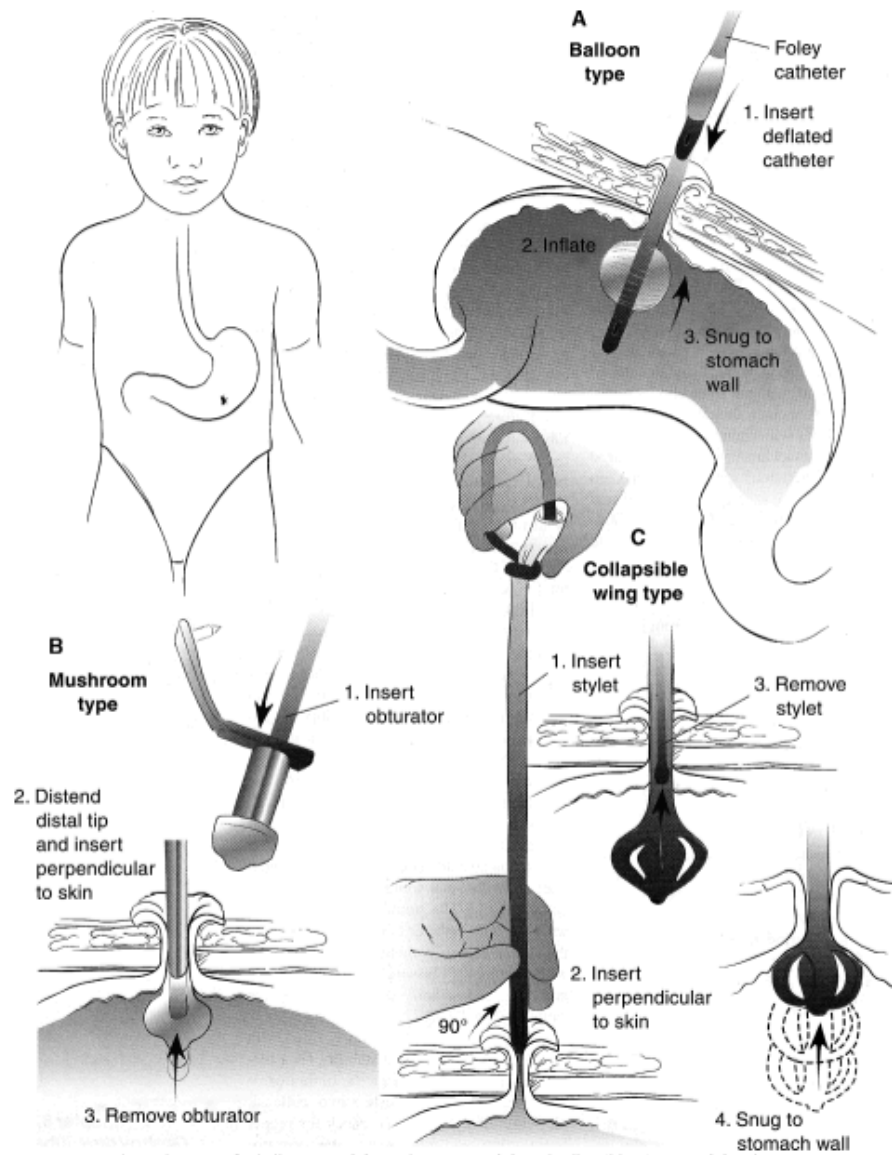


Figure 2
From Source 2



Figure 3
From Source 7

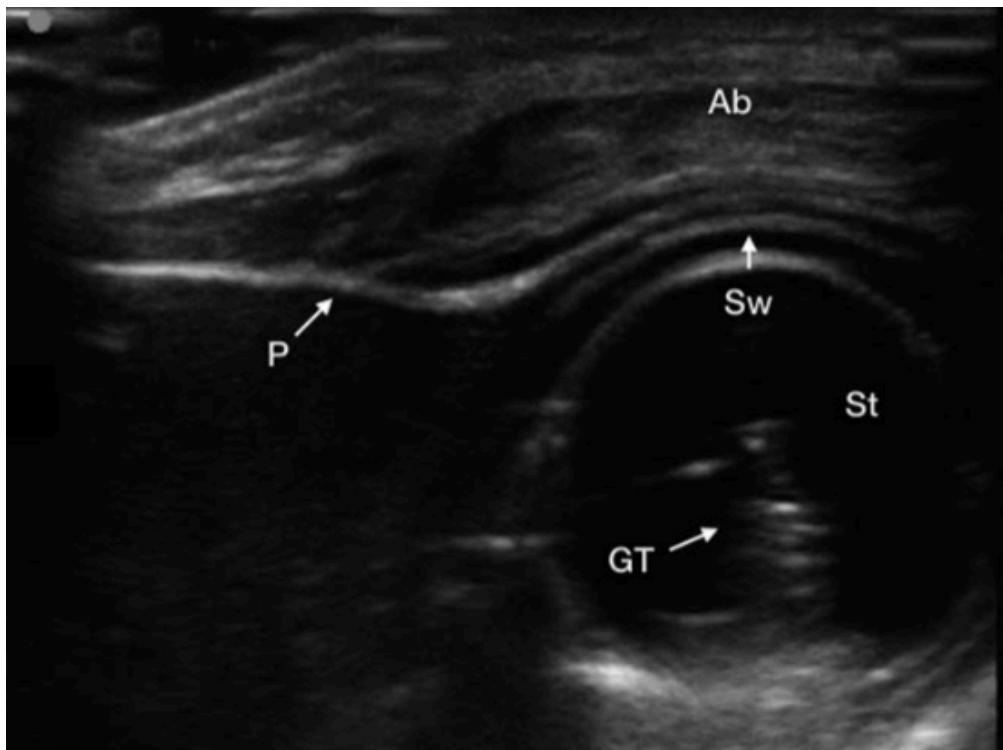


Figure 4
From Source 7

❖ Case Concludes

- *You were most concerned about a shunt malfunction in Andrew. You ordered an XR shunt series and a rapid MRI of his brain—the shunt series was normal, without any breaks or kinks in the catheter tubing, but the MRI demonstrated bilateral ventriculomegaly, concerning for recurrence of his hydrocephalus. You call neurosurgery, and, after they come by to reset his shunt post MRI, they admit him to the hospital for shunt revision in the morning.*

❖ Case Teaching Points Summary

- Child Life Specialists and Symptom Management
 - Certified child life specialists can assist with many aspects of emergency department care: preparation for procedures, comfort and distraction during procedures and exams, education of staff on non-pharmacological methods of pain and anxiety control.
 - Preparation for procedures includes:
 - Age- or developmentally appropriate preparation for the procedure
 - Allowing for emotional expression
 - Creating trusting relationships with the healthcare team
 - Non-pharmacological methods of pain control that are often employed by CCLS to address pain and anxiety in the emergency department include:
 - Distraction
 - Counterstimulation
 - Comfort holds
 - Several things should be considered when choosing appropriate medication and medication administration for pain control and anxiolysis. Things to consider:
 - Is this an injury likely to cause significant or ongoing pain?
 - Will there likely be a procedure required? If so, how long will the procedure take and how long until you are prepared to perform the procedure?
 - Is it likely that procedural sedation will be required?
 - Would the method of administration (i.e. placement of an IV for administration) cause significant and potentially unnecessary fear, pain, and anxiety for the child?
- Intranasal medication administration should be considered:
 - Intranasal fentanyl is effective analgesia in children three years and older and has been shown to be equivalent to other oral and IV forms of pain control
 - An alternative to IV medication in children in whom IV placement would cause significant distress or would otherwise be unnecessary
- **Care of the Autistic Child**
 - Children with autism spectrum disorder and developmental delay have difficulty with communication when compared to their peers. The characteristics of children with ASD include difficulty with communication and social interaction and restrictive, repetitive patterns of behavior, interests or activities
 - Caregivers are great resources when caring for children with ASD and DD. They can often help you plan for the best way to approach the child and prepare for any examinations and procedures
 - Some specific questions to ask:

- Has your child visited the ED in the past? If so, what did or didn't work on a previous visit? Similarly, have they every required a painful procedure? What did or did not work in that instance?
 - Are there specific things that "trigger" your child? (i.e. lights, noises, etc.)
 - What are some things that typically soothe your child or help de-escalate him when he is agitated?
 - When explaining things to a child with ASD or DD, visual cues, pictures, social stories or role play may be helpful
 - Modify the child's environment to avoid excess stimuli (ex. dim lights, minimize noises, and minimize the amount of people in the room)
 - Exercise caution when employing the use of restraints or seclusion with children with ASD or DD and consider anxiolysis when needed
- **Care of the child with chronic medical conditions**
- Caregivers of children with chronic medical conditions are invaluable members of the care team, and typically have a very good understanding of their child's acute and chronic issues. Rely on caregiver history and assessment.
 - Providers may alter their admission criteria for children with chronic medical conditions, for a multitude of reasons:
 - Caregivers tend to be medically savvy and very reliable (see above)
 - The child may have access to supplies, equipment, and personnel at home (oxygen, suction, ventilator, home health nursing, etc.) that other children don't have
 - These children are frequently in and out of the hospital, and saving one admission may have significant ramifications for that child and family
 - Children with tracheostomy tubes may present in respiratory distress or with concerns for infection or bleeding around the tube. Resuscitate the patient with suction, humidified oxygen, and potentially ventilation while determining the underlying etiology of the patient's acute presentation.
 - Children with ventriculoperitoneal shunts may present to the ED with subtle symptoms (behavior changes, headache, vomiting, increased seizures, fever) related to shunt malfunction from over- or under-drainage (broken or kinked catheter, proximal or distal obstruction, catheter malposition) or infection. Assume the patient's symptoms are from the shunt unless proven otherwise.
 - Children with gastrostomy tubes frequently present to the ED with dislodgement of the tube; this is a relatively easy but time sensitive procedure that can be performed by any EM physician.

❖ Facilitator Background Information

Child Life Specialist and Pediatric Symptom Control in the ED

Certified child life specialists (CCLSs) are health professionals who work with children and families in a healthcare setting and help them to cope with the difficulties of illness, medical treatment, and hospitalization. The credentials of a CCLS include a bachelor's degree in child development or a related field, completion of supervised internship, and the successful passing of a certification exam. CCLSs play an integral role in the care of pediatric patients in the emergency department by addressing the psychosocial concerns that can accompany an ED visit. CCLSs can help with psychological preparation for procedures, providing comfort and distraction during the procedure, and educating staff on appropriate ways to approach patients in these situations. A recent study by Hall et al. showed that child life specialist involvement was associated in less emotional distress for children undergoing laceration repair in a pediatric emergency department. Another study by Ortiz et al. showed that child life involvement during intravenous catheter in a pediatric emergency department helped to minimize stress associated with the procedure. In a 2014 consensus statement, the AAP concluded that the use of CCLSs should be used as a quality indicator, and that providers should strive to have them be an integrated part of family-centered care.

Preparing patients for procedures is one way that CCLSs aid in the care of pediatric patients. In an evidence based practice statement, the Child Life Council outlines three essential components to successful preparation for medical procedures. These components include: the provision of developmentally appropriate information, encouraging emotional expression, and forming trusting relationships with health-care professionals^(EBP statement). When assessing a child's development and providing developmentally appropriate information about the procedure, CCLSs often provide physical demonstration with the use of diagrams, patient models, and/or models of medical equipment. This allows the child to actively engage in the procedure process. While helping to prepare for a procedure, CCLSs may anticipate certain fears and misconceptions about the particular procedure and allow children to ask questions and express concerns. Additionally, CCLSs help to build rapport with a child and can therefore facilitate a more trusting relationship between the child, the caregiver, and the medical team.^(ebp)

In addition to preparation for procedures, CCLSs aid in pain management by incorporating nonpharmacological strategies. These methods can be used alone or can be used in conjunction with sedation and analgesia. CCLSs often employ one method, distraction, during procedures. This can include visual distraction with toys and books, and may also include guided imagery, controlled breathing, singing, or listening to music. One study by Hartling, et al. showed that children who listened to music during IV placement reported less procedural distress than those undergoing IV placement without music.

Counterstimulation is a technique that requires someone to touch or rub an area of the body near where the painful procedure is being performed. This technique is based upon the "gate theory" of pain. This theory posits that pain is transmitted through a "gate" which is opened in response to signals from affected small pain fibers. The "gate" can be closed when surrounding large neurons are stimulated by non-painful touch^(F&L). An example of this includes the use of a Buzzy[®] (a modality which provides external thermomechanical stimulation) which is placed proximal to an IV site during cannulation and works by conducting cold and vibrations in the area. A study conducted by Inal and Kelleci looked at the effect of thermomechanical stimulation (using the Buzzy) and distraction cards

used alone or in combination on pain during blood draws and found a significant difference in pain scores between those who had no intervention and the use of the Buzzy, distraction cards or both. A study by Schreiber et al. looking at the use of the Buzzy for children with cognitive delays undergoing venipuncture found that for those children randomized to have the Buzzy for venipuncture, 91.4% had no or only mild pain as reported on a checklist when compared to 61.1% the non-Buzzy group ($p=0.003$).

Specific positioning techniques during procedures may also lessen fear and anxiety. CCLSs may help to facilitate “comfort holds,” such as allowing the child to remain in a caregiver’s lap during a procedure, thereby reducing the need for restraining techniques.

Finally, CCLSs are essential in providing family and caregiver support. When caregivers are anxious about the emergency department visit or any procedures required, this anxiety is easily sensed and transmitted to the child. CCLSs can help families understand their child’s developmental response to medical procedures. They may also discuss with parents certain coping strategies that may be employed during the painful parts of the procedure.

While non-pharmacological methods play an important role in reducing anxiety and pain associated with the emergency department experience, pharmacological analgesics and sedation are often necessary. Several things should be considered when choosing appropriate medication and medication administration. Questions to consider include:

- Is this an injury likely to cause significant or ongoing pain?
- Will there likely be a procedure required? If so, how long will the procedure take and how long until you are prepared to perform the procedure?
- Is it likely that procedural sedation will be required?

Early application of topical anesthetics is essential for any patient who is expected to require a painful procedure such as venipuncture, wound closure, or lumbar puncture. Early administration of pain medication for moderately-severely painful injuries can help lessen the overall pain, fear and anxiety in the ED. In cases when IV access is not established, intranasal (IN) medication administration should be considered. A 2014 Cochrane review of IN fentanyl administration concluded that it was an effective analgesic for children three years and older with moderate to severe pain. Additional studies have shown IN fentanyl to have equivalent pain control when compared to IV administration of morphine and fentanyl and oral administration of morphine. IN medication administration for pain or anxiolysis may also be considered in cases when the placement of an IV catheter is likely to cause significant additional distress and would otherwise be unnecessary.

Care of the Autistic Child

Autism spectrum disorder (ASD) is a term that encompasses a range of neurodevelopmental disorders that include autism, Aspergers syndrome, childhood disintegrative disorder, and pervasive developmental disability. The incidence of ASD is estimated at 1:90 live births. The main characteristics of ASD are problems with communication and social interaction and restricted, repetitive patterns of behavior, interests or activities. It is also estimated that about 72% of children with autism also have additional psychiatric comorbidities^{Sharif et al}. Children with ASD or other developmental disorders have a wide range of severity and levels of functioning. Therefore, they also have a wide range of levels of understanding and communication. Caring for a child with ASD or developmental delay (DD) in the ED

can be particularly challenging for a variety of reasons. The ED can be a difficult environment for patients with ASD or DD since they are often very sensitive to environmental stimuli such as sounds, noises, and crowds of people. These children will often struggle with verbal communication and many will be non-verbal. Additionally, many children with ASD or DD will have unique behaviors, and it can be difficult to understand the meaning behind these behaviors and find the optimal way of communicating with each patient.

Parents or caregivers are typically the optimal resource as they are familiar with their child's specific communication and healthcare needs. Caregivers of children with autism should be encouraged to create "essential information" cards that include diagnoses, medications, behaviors, communication styles, what to do to reduce undesired behaviors, tips on how to increase compliance, and how to manage catastrophic reactions^{sharif}. An initial interview with the caregiver or parent may help to facilitate a smooth ED experience. It is important to ask about previous ED experiences, including any strategies that worked well in the past. Address any potential triggers and ways of de-escalating any episodes of undesired behavior. Ask if a child has every required a painful procedure in the past and engage the parent/caregiver in creating a strategy for approaching the procedure if one is required.

In addition to caregivers, CCLSs can be especially helpful when caring for patients with ASD or DD. Several strategies can be used to help improve the ED experience. One strategy, transition planning, includes preparing the child for what is about to happen. Ideally, caregivers will begin to prepare their children for the visit prior to arrival. However, the nature of emergency presentations can make this difficult. Additionally, this strategy can include scheduling in breaks with planned distractions. They may also need a method for signaling transitions or a change in activity^{chun et al}. When explaining things to a child with ASD or DD, visual cues, pictures, social stories, and/or role play may be helpful. Visual roadmaps or "if/then" cards (which display two images-one of an action and the other of a reward if the action is completed) may also help them understand potential choices and outcomes. Again, it is helpful to engage the caregiver as some children may use specific picture systems at home^(sharif and fleisher/ludwig).

Careful consideration of the child's environment is also essential when caring for a patient with ASD or DD in the ED. Children with ASD are particularly sensitive to environmental stimuli and can have difficulty processing auditory, visual, oral, and touch sensations^{et al}. When children with ASD are in a new, unusual environment, they may express fear or frustrations with repetitive behaviors, self-injury, or aggression. Because the ED is an intense, unpredictable environment, it can trigger an adverse response in these patients, making it difficult for them to participate with an examination or procedure. Modifications made to the child's environment may be helpful for creating a better ED experience. For example, turning off or dimming the lights in a room is helpful for children sensitive to lights. Placing a child in a single room away from other patients or allowing them to wait in a designated quiet space outside of the main waiting room may be helpful for children sensitive to loud sounds.

Caution should be used considering the use of restraint or seclusion in patients with ASD or DD unless the patient is presenting an imminent risk to himself or others or his or her behavior is interfering with life-sustaining treatments^(mcgonigle). It may be helpful to engage the caregiver in a discussion regarding restraints if it is deemed that restraints may be required.

Care of the Child with Chronic Medical Conditions

Children with chronic medical conditions can present to any ED, anywhere, any time, and EM physicians need to be prepared to care for them; 11.2 million children in the US have chronic medical conditions (8)

and nearly one quarter of pediatric ED visits are for complaints related to chronic illness (2). Approximately 50% of children with chronic conditions are publicly insured, and are two times more likely to incur out-of-pocket medical costs than children without chronic conditions; these children are also two times more likely to experience a delay in care, especially if they have autism or if their caregiver has struggled to pay bills in the past. (8) In addition to the underlying medical diagnoses themselves, which can include conditions such as hydrocephalus, seizure disorder, cerebral palsy, developmental delay, and chronic lung disease, these children also frequently have medical equipment in place, such as ventricular shunts, tracheostomy tubes, and gastrostomy tubes—all of these are addressed in this session.

Care for children with chronic medical conditions differs from care of other children in several important ways. First, parents and caregivers of these children tend to be relatively medically savvy, and may come with specific requests of ED providers. Especially in the instance of non-verbal children or those with intellectual disability, the history from these caregivers is vital; their gestalt is also typically accurate (if a parent tells you that their child is sick, they're probably right). Secondly, these children may have more resources at home (such as oxygen, suction, and home nursing) that children without chronic medical problems may not have; these resources may help facilitate discharge from the ED. Lastly, these children may come to the ED with a specific care plan delineated by their specialists, rendering ED management more algorithmic than other children and mandating involvement of other specialties.

Children with chronic medical conditions develop common childhood illnesses that baseline well children also acquire, such as viral upper respiratory and gastrointestinal infections, and their management for these processes might not differ much from that of other children. Children with an acute process superimposed upon a chronic medical conditions also may appear quite ill to new providers, at times provoking a broader workup than may be indicated. In addition to standard historical questions asked of any patient, important questions to ask the caregivers of children with chronic medical conditions include:

- When was the last time your child was admitted to the hospital? How long did he/she stay? How does he/she look today compared with that time?
- How does your child usually show that he/she is sick?
- What did your child look like when he/she was the sickest you've ever seen?
- What are you most worried about today?
- Do you have a preference on being admitted versus going home, if we end up having a choice?

Children with chronic medical conditions also frequently have external hardware in place, and may seek care related to those devices. Three very commonly encountered indwelling devices are cerebrospinal fluid shunts, tracheostomy tubes, and gastrostomy tubes.

Cerebrospinal fluid shunts

Cerebrospinal fluid (CSF) shunts are commonly encountered devices in this population, with the most common being a ventriculoperitoneal shunt (VPS, more than 90% of pediatric CSF shunts); other less common options include ventriculoatrial, ventriculopleural, and ventriculovenous (see Figure 1 below). The shunt consists of a proximal catheter with its tip in the lateral ventricles of the brain, a reservoir that allows measurement of intracranial pressure and sampling of CSF, and a distal catheter that drains into one of the above sites.

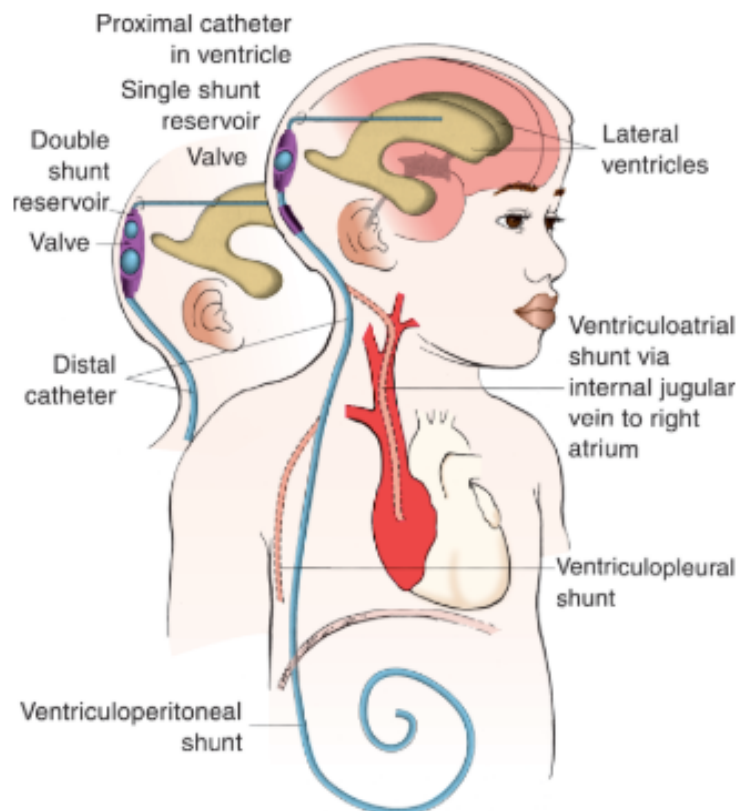


Figure 1
From Source 2

Up to 40% of pediatric VPSs will need revision in the first year after placement, with 80% needing revision in the first ten years. (5) Potential VPS complications include infection and malfunction; VPS complications can present in a variety of ways, including increased seizure frequency, increased somnolence or irritability, vomiting/retching, fever, and subtle changes in behavior. Physical exam findings associated with increased intracranial pressure, such as a bulging fontanel, increased head circumference, and papilledema, may not reliably be present. It cannot be overemphasized how critical caregiver history is with these patients—if the caregiver reports that the child's behavior today is identical to the last time she had a shunt malfunction, this must be taken seriously! Management of all of these children can be assisted by neurosurgery consult; if one's institution doesn't have access to pediatric neurosurgery, one may consider calling neurosurgery at the center where the shunt was placed.

VPS malfunction leading to over- or underdrainage may occur, from obstruction, kinking, or fracture at any point along the catheter's course as well as infection. To evaluate for a mechanical problem, providers should obtain a conventional radiology "shunt series" (AP and lateral X-rays of the entire course of the shunt), as well as rapid MRI or CT to evaluate ventricle size; programmable shunts may need to be reset after exposure to the magnet in MRI. Furthermore, MRI may not reliably show catheter position or intracranial hemorrhage, so CT may be indicated when suspicious of catheter malposition or intracranial hemorrhage. Determination of shunt malfunction cannot be made on the basis of imaging alone—the history and physical are vital contributors to this diagnosis. CT has a sensitivity from 53-92% in detecting shunt malfunction and a specificity of 76-93%, rapid MRI is 59%

sensitive and 93% specific, “shunt series” has 4-26% sensitivity and 92-98% specificity, and caregiver report 89% sensitivity and 62% specificity (5,6). On multivariable analysis, lethargy (odds ratio 2.2) and shunt site swelling (odds ratio 3.1) are significantly associated with shunt malfunction, and seizure neared significance; of note, headache and vomiting were *not* associated with malfunction. (4)

VPS infections are relatively uncommon, and are extremely rare outside of 6 months post VPS placement or revision. Erythema or tenderness to palpation at the site of the VPS reservoir may be present, but the absence of these symptoms does not rule out a VPS infection. Compared with kids who have an uninfected VPS, kids with a VPS infection are more likely to have fever (58.6% vs. 17.4%), abdominal pain, and irritability, and are less likely to have headache; on multivariable analysis, shunt revision in the last 90 days (adjusted odds ratio 2.4) and WBC > 15,000 (adjusted odds ratio 3.2) are suggestive of infection. (3) If a VPS infection is high on the differential, EM physicians may be asked to “tap the shunt,” or obtain a sample of CSF from the reservoir. The exact steps for this procedure are discussed in the answer to the third discussion question. While awaiting results from the CSF, providers should resuscitate the child accordingly, including antibiotics (most common to start empirically with vancomycin and cefotaxime, with *Pseudomonas* coverage if the child is critically ill) when appropriate.

Tracheostomy tubes

Tracheostomy tubes (“trachs”) may be placed for a variety of reasons, including neurological or neuromuscular problems leading to disordered respiration (most common) and chronic lung disease. Tracheostomy tubes can be cuffed or uncuffed, and have three associated dimensions: length, inner diameter, and outer diameter. Complications of tracheostomies include decannulation, obstruction, and infection, all of which can present with respiratory distress and/or respiratory failure. Decannulation is most likely in younger children, because they have smaller necks, less subcutaneous tissue, and a shorter tube. Obstruction, which is also more common in smaller tubes, most frequently occurs from a mucus plug. Viral upper and lower respiratory tract infections can cause increased secretions, though the most concerning infection is bacterial tracheitis, which can present as a change in secretions, fever, and ill appearance.

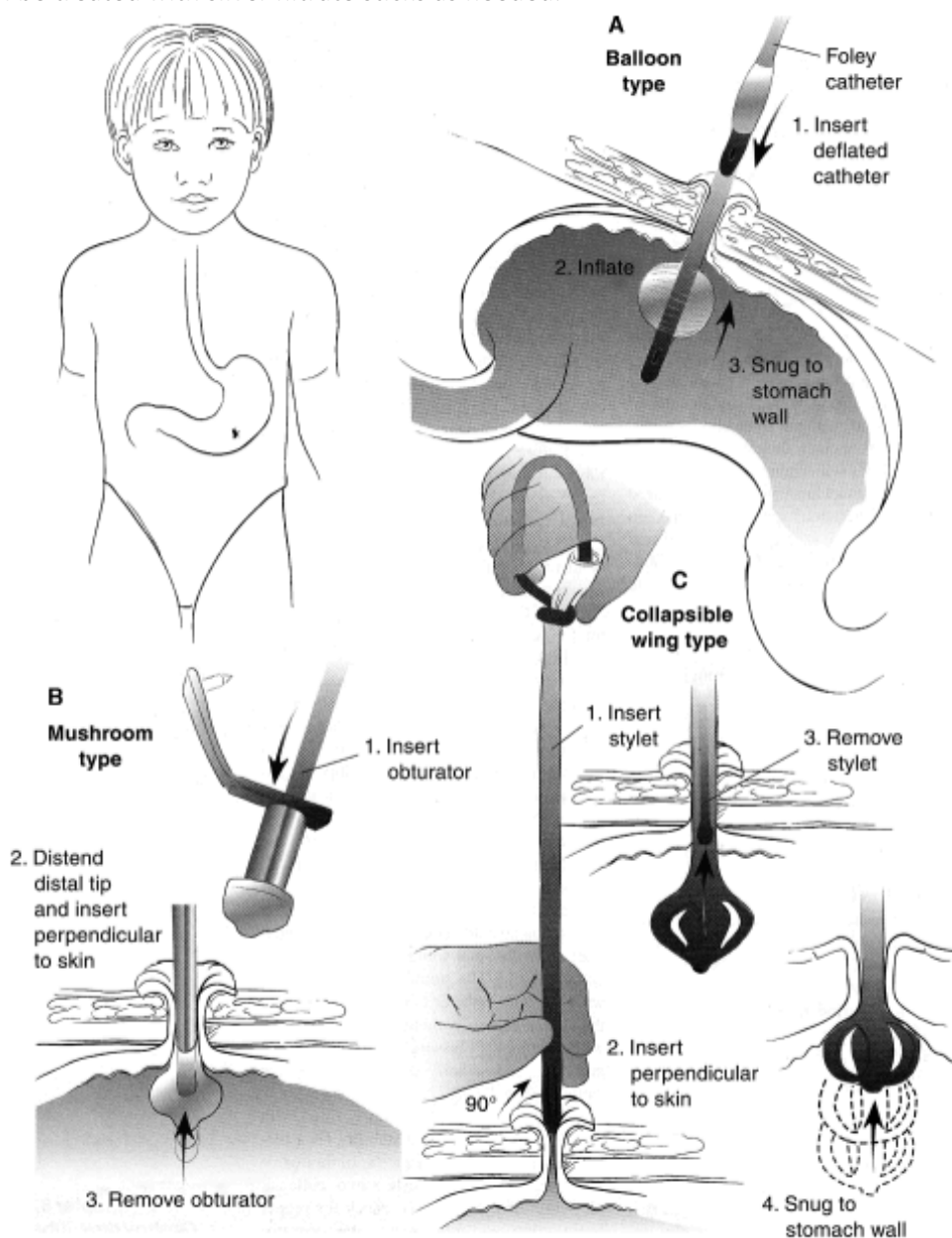
When a child with a tracheostomy presents in respiratory distress or failure, assume decannulation or obstruction until proven otherwise, since these are two potentially life-threatening and relatively easy to treat. First, give the child humidified 100% oxygen and suction the tracheostomy the best you can; auscultate in all lung fields, and palpate and listen to the neck to evaluate for malposition. If suction and humidified oxygen don’t improve the child’s status, then attempt bag-valve-mask positive pressure ventilation through the tracheostomy. If the patient’s status is still unchanged, and/or if you suspect decannulation, then remove and replace the tracheostomy.

Gastrostomy tubes

Lastly, many of these children will have gastrostomy tubes (G-tube) in place, most commonly inserted percutaneously (PEG tube), and may present for issues with the tube. Sixty-two percent of G-tube related ED visits are for dislodgement (7), with nearly one-third of children having dislodgement at some point over the lifetime of the G-tube. Displacement or dislodgement of a G-tube is an emergency, since the tract can start to close after hours. Typically parents will have a replacement G-tube with them or will know the type of tube their child has, and there are again three important details one needs to know: type of tube (balloon or mushroom), length, and diameter (see Figure 2 below). Specific steps for replacement of a G-tube are reviewed in the fifth discussion question. In one study (9), 74% of dislodged G-tubes were successfully replaced by the ED physician without surgeon involvement. The

tube may also get clogged, in which case it can be flushed with warm water after aspirating any intraluminal material.

The patient might also present with concern for peri-tube infection. Leaking formula or gastric fluid can irritate the skin around the G-tube site, causing erythematous contact dermatitis or even candidal skin infection; true bacterial cellulitis is less common. The dermatitis and/or infection should be treated, and a leaking G-tube likely needs to be replaced or upsized, after discussion with the specialists (usually surgery or interventional radiology) who placed it to prevent future leakage. Granulomas around the tube can be treated with silver nitrate sticks as needed.



From Source 2

In summary, children with chronic medical conditions can present with issues specific to indwelling devices, and also present with common pediatric complaints such as viral upper respiratory infections

and gastroenteritis. Relying on parental history, assessment, and preference is even more vital in these kids than in other patients.

❖ Annotated bibliography

Care of the Child with Chronic Medical Conditions

1. Donley T, King DM, Nyathi N, Okafor A, Mbizo J. Socioeconomic Status, Family Functioning and Delayed Care Among Children With Special Needs. *Soc Work Public Health*. 2018;00(00):1-16. doi:10.1080/19371918.2018.1504703.

More than 50% of the 11.2 million US children with special healthcare needs (CSHCN) are publicly insured, and are 2 times more likely to experience unmet healthcare needs; this rate is even higher in autistic children and in children whose caregiver has recently struggled to pay bills. In addition to financial concerns, caregivers of CSHCN frequently report other frustrations related to the care of these children. This article is a prospective survey study of caregivers of children across the US and establishes a useful framework for providing patient- and family-centered care in the ED.

2. Rogers EA, Kimia A, Madsen JR, Nigrovic LE, Neuman MI. Predictors of ventricular shunt infection among children presenting to a pediatric emergency department. *Pediatr Emerg Care*. 2012;28(5):405-409. doi:10.1097/PEC.0b013e318252c23c.

This is a retrospective cohort study of children with CSF shunts who presented to a single pediatric ED over the study period, and who had CSF cultures obtained within 24 hours of that visit. The authors then derive predictors of shunt infection. Compared with children who did not have shunt infections, children with shunt infections were more likely to have fever, abdominal pain, and irritability, and were less likely to have headache. On multivariable analysis, shunt revision within the last 90 days (adjusted odds ratio 2.4) and WBC > 15,000 (adjusted odds ratio 3.2) were the only significant predictors of shunt infection.

3. Kim TY, Stewart G, Voth M, Moynihan JA, Brown L. Signs and symptoms of cerebrospinal fluid shunt malfunction in the pediatric emergency department. *Pediatr Emerg Care*. 2006;22(1):28-34. doi:10.1097/01.pec.0000195764.50565.8c.

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4. Boyle TP, Nigrovic LE. Radiographic evaluation of pediatric cerebrospinal fluid shunt malfunction in the emergency setting. *Pediatr Emerg Care*. 2015;31(6):435-440. doi:10.1097/PEC.0000000000000462.

This is a succinct review article describing test characteristics of CT, rapid MRI, conventional radiography "shunt series," and nuclear medicine shuntograms for evaluation of pediatric CSF shunt malfunction in the ED.

5. Myatt TC, Medak AJ, Lam SHF. Use of Point-of-Care Ultrasound to Guide Pediatric Gastrostomy Tube Replacement in the Emergency Department. *Pediatr Emerg Care*. 2018;34(2):141-144. doi:10.1097/PEC.0000000000001400.

This is a report of 3 cases where point-of-care ultrasound (POCUS) was utilized in the replacement of dislodged gastrostomy tubes (G-tubes) in the pediatric ED. The authors describe the technique for utilizing POCUS for this purpose, and also provide a literature review on the topic.

6. Saavedra H, Losek JD, Shanley L, Titus MO. Gastrostomy tube-related complaints in the pediatric emergency department: Identifying opportunities for improvement. *Pediatr Emerg Care*. 2009;25(11):728-732. doi:10.1097/PEC.0b013e3181bec847.

Approximately 75% of children with G-tubes will have minor complications with their tubes, and 5% will have major complications-- caregivers of these children will typically present to the ED for evaluation and management of these complications. This article is a retrospective descriptive study of visits to one center's pediatric ED for G-tube-related complaints, outlining frequency of visits, chief complaints, and outcomes. The authors also offer some best practices for ED providers, who will most certainly care for these children in the future.

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- **Authors:** Dr. Courtney Brennan and Dr. Dina Wallin

- **Editors:** Dr. Natasha Wheaton

- **Annotated References:**

Case Part I

1. Percelay JM, Betts JM, Chitkara MA, et al. Child life Services. Committee on Hospital and Child Life. *Pediatrics*. 2014;11(5): 1471-1478 doi: 10.1542/peds.2014-0556

This is a review article describing child life services programs and the role of child life specialists in pediatric hospitals. It describes the background of child life services programs, the training and qualifications of child life specialists as well as specific methods used by child life specialists when they work with children and families to improve the healthcare experience.

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This is a randomized clinical trial comparing music with standard care to manage pain and distress among children undergoing IV placement in the ED. When removing patients who reported no distress with the procedure, the immediate change in distress scores (measured on standard scale) from before to immediately after the procedure were 2.2 (IQR 1.7-8.) and 1.1 (IQR 0.1-2.4) for the music and standard care groups, respectively (p<0.05). Pain scores increased by 2 points in the standard care group but stayed the same in the music group. (p=0.04).

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This section of the chapter on procedural sedation in the emergency department reviews the topic of nonpharmacologic methods of pain control and addresses the topics of distraction, counterstimulation and restraint.

4. Schreiber S, Cozzi G, Rutigliano R, Assandro P, Tubaro M, Cortellazzo WL, et al. Analgesia by cooling vibration during venipuncture in children with cognitive impairment. *Acta Paediatrica*. 2016; 105(1). e12-e16. doi: 10.1111/apa.13224. Epub 2015 Nov 4.

The Buzzy is a device that uses cold temperature and high frequency vibration to reduce pain during painful procedures. This study is a randomized clinical trial comparing the use of a Buzzy device vs no intervention during IV placement in children cognitive impairment. 70 children using standardized pain checklist and found that 91.4% had none or mild procedural pain when undergoing venipuncture when using the Buzzy vs 61.1% in the non intervention group (p=0.003)

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This is a randomized clinical trial investigating the sole and combined effects of external thermomechanical stimulation (using the Buzzy device) and distraction on pain relief of children undergoing blood draw. When comparing the three groups (Buzzy alone, distraction alone, Buzzy and distraction combined) when compared to control, all three groups had significantly lower pain scores than control group ($p < 0.001$). The lowest pain scores were seen in the combined group.

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7. Klein EJ, Brown JC, Kobayashi A, Osincup D, Seidel K. A randomized clinical trial comparing oral , aerosolized intranasal, and aerosolized buccal midazolam. 2011; 58(4). 323-329. Doi: 10.1016/j.annemergmed. 2011. 05. 016

This is a randomized clinical trial that compares oral, intranasal and buccal midazolam to determine which best reduces the distress of pediatric laceration repair. The study found less distress in the buccal midazolam group. However, the intranasal midazolam group had a greater proportion of patients with an optimal activity score, a greater proportion of parents wanting the sedation in the future and a faster sedation onset.

8. Al Sharif S, Ratnapalan S. Managing Children with Autism Spectrum Disorders in Emergency Departments. *Pediatric Emergency Care*. 2016; 32(2). 101-103. doi: 10.1097/PEC.0000000000000705.

This review article presents information about autism and provides general principles to help manage these patients when they present to the emergency department or other acute care settings.

9. Chun TH, Katz ER, Duffy SJ, Gerson RS. Challenges of managing pediatric mental health crises in the emergency department. *Child and Adolescent Psychiatry Clinics of North America*. 2015; 24(1). 21-40. doi: 10.1016/j.chc.2014.09.003

Children with mental health crises are often evaluated and treated in the emergency department setting. This review focuses on the emergency department evaluation and management of two common mental health emergencies; children presenting with suicidal or homicidal ideation and children with autism or developmental disabilities.

10. Hall JE, Patel DP, Thomas JW, et al. Certified Child Life Specialists Lessen Emotional Distress of Children Undergoing Laceration Repair in the Pediatric Emergency Department. *Pediatric Emergency Care*. Epub 2018 Aug 25. doi: 10.1097/PEC.0000000000001559

This is a prospective observational study of children undergoing laceration repair by suturing in a pediatric emergency department. They compared children who had child life specialists present during the procedure to those children who did not have a child life specialist present. Fifty-one percent of patients had child life present during the procedure. The median emotional score for patients with child life services was 7 (interquartile range, 6–9) versus 9 (interquartile range, 7.5–12) for those without ($P < 0.0005$).

11. Ortiz GS, O'Connor T, Carey J, Vella A, Paul A, Rode D, Weinberg A. Impact of Child Life and Music Therapy Procedural Support Intervention on Parental Perception of Their Child's Distress During Intravenous Placement. *Pediatric Emergency Care* 2017 Feb 21. Epub. doi: 10.1097/PEC.0000000000001065

This is a prospective study looking at the impact of child life and music therapy services on children ages 4-11 requiring IV placement in a pediatric emergency department. Parents were asked to evaluate how they thought their child would respond to IV placement and then asked to perceive how well their child responded after the procedure was complete. Significant differences were found in all questions pre and post IV placement as a result of child life and music therapy intervention ($p < 0.05$).

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This review article describes the challenges that individuals with ASD face when receiving treatment in crisis and emergency settings. It provides information and guidance for how the emergency department team should approach and treat a child with ASD who presents to the emergency department with acute agitation.

Care of the child with chronic medical conditions

- 1. Donley T, King DM, Nyathi N, Okafor A, Mbizo J. Socioeconomic Status, Family Functioning and Delayed Care Among Children With Special Needs. *Soc Work Public Health*. 2018;00(00):1-16. doi:10.1080/19371918.2018.1504703.**

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