Patients’ Plastic Pieces
Common Technology in Children with Medical Complexity
Pediatric Hospital Medicine
July 2017

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Disclosures

• We have no financial relationships or commercial interests to disclose
• We have received no financial incentives from any corporations involved in the manufacture or development of products employed in this presentation
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Learning Objectives

1. Manipulate and learn the basics of common medical technology including:
   ✓ Ventricular shunts
   ✓ Tracheostomies
   ✓ Chest tubes
   ✓ Long term central venous access
   ✓ Enteral tubes
2. Learn to troubleshoot common problems and concerns related to the above technology
3. Explore ways to lead discussions with families about the above procedures and subsequent care, including the more philosophical challenges of caring for a technology-dependent children

Introduction

- Nationwide, children with medical complexity account for 0.5% of the population, yet 25% of healthcare costs.
- Hospitalists are involved in critically important episodes during these patients’ lives, and we are often asked to assist in decisions involving the placement and subsequent care of medical technology.
- We are expected to be familiar with our patients’ medical technology, empathize with the day-to-day challenges these patients and their families face, and troubleshoot and advise on problems that inevitably arise.

- This workshop is designed to suit the more advanced understanding of the target PHM audience, and it will include thought- and discussion-provoking topics relevant to the care of medically complex and technology dependent children across the continuum.
Workshop Design

- 0815-0830 Introduction
- 0830-1030 Concurrent small groups (next slide)
- 1030-1100 Closing discussion
  ✓ Cases
  ✓ Goals of care and thoughtful considerations
  ✓ Advance care planning

4 concurrent small groups

30 minutes per group

A. Enteral tubes with Dr. Samuel Flores
B. Ventricular shunts with Dr. Brittany Wold
C. Long-term central venous access with Dr. Sarjita Shukla
D. Tracheostomies and chest tubes with Dr. Dustin Rayhorn

- Explore physical items and electronic visual aids
- Discussion points including:
  ✓ Patient/family education regarding the surgical procedure
  ✓ Troubleshooting problems
  ✓ Expectations of care
  ✓ Impact on everyday life
RECONVENE AT 1030

Ventricular Shunts

By
Brittany Wold, MD
Most common shunt placement
VA shunts are relatively uncommon in younger children, mostly because they do not allow for linear growth. They are more common in teenagers or after most of the patient’s growth potential has been achieved. The benefit of VP shunts is the extra tubing left in the abdomen allows the shunt to remain in place for a much longer time barring any malfunctions or infections. There are also VPl (V-Pleural) and LP shunts - worth an honorable mention.

Wendy Hamura Arafiles, 6/13/2016

Also - most often placed on the R side as majority of population is R handed, hopefully minimizing impact on dexterity. Also, many patients with VPS also have GTs which are or need to be located on the L abdomen.

Wendy Hamura Arafiles, 6/13/2016

Codman vs Medtronic programmable valves both have the same basic valve construct: spring-loaded ball-in-cone design that can be adjusted noninvasively to allow more or less CSF flow out of the catheter.

Wendy Hamura Arafiles, 6/13/2016

In general, the higher the setting, the more resistance to CSF flow therefore the more slowly CSF will flow out of the catheter.

Wendy Hamura Arafiles, 6/13/2016

Wendy Hamura Arafiles, 6/13/2016
CODMAN CERTAS® Plus Programmable Valve Components

- Reservoir
- Right Hand Side (RHS) Marker
- Valve Construct
- Inlet
- Outlet
- Suture Holes (4x)
- Direction of flow indicator
- New ruby bushing
- SIPHONGUARD® Anti-Siphon Device (Optional)

Medtronic Strata® II Valve

View on X-ray

Medtronic Shunt Valves
http://www.medtronic.com/neurosurgery/shunts.html

Medtronic Strata II Valve (a programmable valve, different settings are depicted; “P/L” stands for Performance Level; see Medtronic website for pressure/flow information)
Important to mention that this illustrates the basic design parts of ALL programmable valves: inlet, reservoir, valve mechanism, and outlet (usually with some sort of anti-siphon device to prevent large drops in ICP when going from lying to sitting/standing).

Wendy Hamura Arafiles, 6/13/2016
CODMAN CERTAS® Plus Valve View on X-Ray

The valve setting is determined by the Setting Indicator [ ], relative to the Right Hand Side X-ray Marker [ ].

Medtronic Strata® Valve Reprogrammer
CODMAN CERTAS® Tool Kit

- Low Profile Locator Tool
- Adjustable Height Locator Tool
- Indicator Tool
- Adjustment Tool
- X-Ray Overlay Tool

Adjustment with CODMAN CERTAS® Toolkit

- Things to learn with adjustment....
  - Alignment is critical
  - Height is critical - need to use the Adjustable Height Locator Tool appropriately
  - Horizontal use (like a compass)
  - The indicator tool: if you drop it, request a replacement.
Maybe not necessary to get into a lot of detail with this.

Wendy Hamura Arafiles, 6/13/2016
CODMAN CERTAS® Tool Kit

Indicator Tool

- The position of the number in the window helps confirm that the tools are properly aligned with the valve

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Important Questions/Resident Teaching Points

- When shunt placed?
- Type of shunt (e.g. VP vs VA) and is it programmable?
- Do you have a pocket or wallet card that goes with your device?
- What was the most recent shunt setting?
- Date of last revision and reason for revision?
- Any history of infections?
Also maybe too much detail.
Wendy Hamura Arafiles, 6/13/2016

What type of shunt, what brand, and is it programmable? If programmable, what was the setting? Do you have a pocket card that goes with your device?
Wendy Hamura Arafiles, 6/13/2016
Common Scenario

• 3 yr old male with Codman programmable VPS shunt placed in 2013 for hydrocephalus (status post revision 6 months ago) presents with a 1 day history of headache and vomiting.
  – X-ray Shunt series: intact shunt tubing
  – 1-bang MRI brain (or CT hydro): no increased intracranial pressure, ventricle size stable
  – Neurosurgery consult: Admit and observe overnight

For the Hospitalist

– Check valve type and setting on Xray and ask NSGY if it needs to be re-programmed
  • Could (should) hospitalists have access to these tools to reprogram shunts themselves?
– When is it necessary to “tap the shunt”?
– Observe for Increased ICP
  • Cushing Triad: Hypertension, bradycardia, and abnormal breathing
– What to do next if patient decompensates?
  • Transfer to ICU
  • Hyperventilate
  • Consider Hypertonic saline vs mannitol
A little basic - I adjusted to suit our audience.

Wendy Hamura Arafiles, 6/13/2016
Resources

• Hydrocephalus Association
  http://www.hydroassoc.org/docs/FactSheets/FactsheetShuntSystems.pdf

• Codman Neuro:
  http://www.depuysynthes.com/hcp/codman-neuro

• Medtronic:

Tracheostomy Tubes
Chest Tubes

by
Dustin Rayhorn, MD
Tracheostomy Tubes

Anatomy of a Trach

This diagram illustrates how the proximal, radial and distal measurements are determined for proper sizing.
Trachs: Cuffed and Uncuffed

Obturator: facilitates trach replacement (like a stylet)

Pilot balloon: indicates cuff inflation, can palpate cuff tension

Cuff: facilitates airleak management

Trachs: Shiley™

Cuffed and Uncuffed, Neonatal and Pediatric sizes, firmer plastic material
Trachs: Bivona®

Silicone material = more flexible

Uncuffed

Cuffed

Bivona® Flextend™ Tight-to-Shaft (TTS)™
- Extended length proximal shaft is flexible and allows for more neck soft tissue, providing more distance between the patient and connected devices (e.g. ventilator)
- Wire embedded in tube maintains tube integrity despite the extended length and is non-ferrous (less distortion on XR imaging and MR-conditional)
- Deflated cuff rests “Tight-to-Shaft”

Flextend™

Trachs: Other

Fenestrated:
Allows air to escape through vocal cords = vocalization

Inner cannula:
- Outer cannula stays in place up to 30 days, inner cannula removed and cleaned daily.
- Fenestrated and non-fenestrated

Metal
Trachs: Accessories

**PMV:** Passy-Muir® Valve
- Allows inspiration but blocks expiration = forces air up through vocal cords
- aka “speaking valve”

**HME:** Heat Moisture Exchanger
- Single or Double barrel
- aka “nose”

**Cap:** Blocks all air passage (for weaning)

**Ties:**
- Foam with velcro
- Metal chain

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Trach Placement

- Placed in OR with ENT or general surgeon
- New trach anchored in place by sutures
- 5-7 day postoperative stay in ICU – allow new trach stoma to heal before 1st trach change
- 1st trach change performed by surgeon due to risk of false-tracking upon replacement and need for advanced airway support during procedure
- Ideally, after ICU stay, patient will be cared for on a specialized airway unit for trach-specific caregiver education and discharge planning
Life after the Trach

- Notify local power company if patient has a ventilator
- Notify local Fire Station/EMS of patient with a trach (+/- ventilator)
- Leaving the house becomes much more complicated!
  - Trip reduction
- Access to emergency services
- Access to home health nursing and DME services

Trach Troubles

- Common problems for the hospitalist
  - Clogging with mucus
  - Dislodgement or accidental removal
- Be prepared
  - Know how far you can suction → standard lengths
  - Have extra trachs available → same size, one size smaller
  - Know how you may bag the patient → by trach, by mouth?
Chest Tubes

Chest tubes: Pigtail catheter

- Placed in IR under fluoroscopy (or ED, ICU)
- Smaller caliber than surgical chest tubes therefore less painful
- BUT easily becomes clogged with purulent or fibrinous material
- TPA is safe and oftentimes effective (but not always)
- 3-way stopcock facilitates delivery of TPA doses (up to 3 doses, 24 hours apart)
- Removal at bedside – remember to release the locking mechanism that keeps the proximal end curled
Chest tubes: Drainage system

Chest tubes: Atrium drainage system
Atrium drainage system

A: Suction regulator
B: Water seal chamber
C: Air leak monitor – oscillating ball and bubble window
D: Fluid collection chambers
E: Suction bellows

Home chest tube drainage systems

**Passive drains**
- To drain intrapleural fluid at home
- Limited volume capacity

**Active drains**
- To drain intrapleural fluid at home
- Larger volume capacity
- Atrium product requires suction source
Home chest tube drainage systems

Heimlich or “Flutter” Valve
- One-way valve to let intrapleural air escape the thorax
- E.g. persistent air leak in bronchopleural fistula
- Meant for very stable patients with ~90% re-expansion to use at home

Chest tube problems

- Poor output despite imaging noting persistent effusion
  - Clogged tube → TPA (0.1mg/kg, max 8mg), can repeat daily for up to 2 days
  - Non-communicating fluid collections
    - Chest US or CT to diagnose
    - Consider TPA or additional tube

- Air Leak
  - Is your system connected appropriately
  - CXR → is there a pneumothorax?
  - Try to brace the tubing at entrance to chest
Indwelling Central Venous Catheters

By

Sarjita Shukla, MD
Central Venous Catheters

<table>
<thead>
<tr>
<th></th>
<th>PICC</th>
<th>Broviac®/Hickman®</th>
<th>Port-a-Cath®/MediPort®</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Catheter</td>
<td>Tunneled</td>
<td>Not externally visible</td>
<td></td>
</tr>
<tr>
<td>Can be tunneled</td>
<td>Externally visible</td>
<td>Flush monthly</td>
<td></td>
</tr>
<tr>
<td>Power option for contrast</td>
<td>Cuffed to grow into skin</td>
<td>Externally accessed</td>
<td></td>
</tr>
<tr>
<td>Requires frequent flushing</td>
<td>Open ended</td>
<td>Intermittent use</td>
<td></td>
</tr>
<tr>
<td>Easily displaced</td>
<td>Daily, long term use</td>
<td>Less mechanical damage</td>
<td></td>
</tr>
<tr>
<td>Can be used up 6 months</td>
<td></td>
<td>Durable, withstands punctures best of 3</td>
<td></td>
</tr>
<tr>
<td>Highest risk of infection</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CVCs: Complications

<table>
<thead>
<tr>
<th>Immediate</th>
<th>Delayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleeding</td>
<td>Infection</td>
</tr>
<tr>
<td>Arterial Puncture</td>
<td>Thrombosis</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>Catheter migration</td>
</tr>
<tr>
<td>Air embolism</td>
<td>Catheter embolization</td>
</tr>
<tr>
<td>Thoracic duct injury</td>
<td>Myocardial perforation</td>
</tr>
<tr>
<td>Catheter malposition</td>
<td>Nerve injury</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td></td>
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</tbody>
</table>

Smaller diameter catheter & fewer lumens should be used to reduce the risk of thrombosis.
CVCs: PICC

- Often placed in IR, +/- sedation
- Can be performed at bedside with sterile field, +/- anxiolysis with midazolam
- Tip placement confirmed with bedside ultrasound, by measurement and post-placement CXR, or direct image guidance
- **Upper extremity PICC**: usually inserted into the cephalic, basilic, or brachial vein, advanced to cavoatrial junction
- **Lower extremity PICC**: usually inserted into the greater saphenous vein, advanced to the IVC, level of L1-4

**Tunneled CVC**:
- Placed in IR under GA with fluoroscopy guidance
- Inserted peripherally, tunneled subcutaneously to vessel access point
- Usually used in patients with more difficult central access

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**CVCs: PICC**

**Groshong® catheters**:
- Use of a heparin lock is not necessary
- No clamps on the external length
- Flush with NS weekly
- Less risk of air embolus
- Black tip with three-way valve formed by slit in the sidewall of the catheter tip.
  - Valve opens outward during infusion
  - Inward during blood aspiration
  - Closed when not accessed

**PowerPICC®**:
- Single-, Double-, or Triple-lumen
- Used for “power flush” of IV contrast for imaging
CVCs: **Broviac® & Hickman®**

- Placed in the OR under GA
- Proximal catheter inserted directly into a central vein
- Distal catheter is tunneled under the skin and brought out on the chest or thigh away from the site where it enters the vein
- Tunneling prevents bacteria from gaining access to the central portion of the catheter
- Single- or Double-lumen available

Contain a "cuff" of Dacron material which is buried under the skin
- Within a month, subQ fat tissue grows into this "cuff"
- Stabilizes the catheter in the skin
- Acts as a barrier to infection
*This is essentially what differentiates a Broviac from a tunneled PICC*

CVCs: **Port-a-Cath® or MediPort®**

- Placed in the OR under GA
- Embedded under the skin and catheter is tunneled subcutaneously then inserted into a central vein
- Port is the size of a nickel or quarter, circular (or oblong or triangle) in shape, palpable under the skin
- Port has a raised septum of self-sealing rubber material in the center through which the access needle is inserted
- Meant for long-term intermittent access (septum has a limited lifespan = # of "pokes")
- Less risk of complication when not accessed compared to Broviac®
- Requires heparin flush every month
CVCs: Dressings

**Biopatch®**
Chlorhexidine impregnated sponge with 360 degree contact around the catheter at skin insertion site

**StatLock®**
Locking device that adheres to skin and holds distal portion of the catheter in place to minimize movement at skin entry point

**Tegaderm™, Sorbaview®**
Clear adhesive layer that covers entire apparatus optimizing visibility at insertion site
Removing a PICC

1. CLEAN PROCEDURE = wear mask, gown, gloves; tie hair back
2. Note the length of indwelling catheter from insertion records
3. Using non-sterile gloves: place a glob of vaseline on middle 1/3 of one edge of a 4x4 gauze – set aside; loosen all peripheral tape and dressings beforehand, but keep Tegaderm™ and Biopatch® securely in place directly over skin insertion site
4. Using a sterile glove, keep a finger over the catheter at insertion site and remove Biopatch® and remainder of dressing (prevent catheter from receding further into vessel)
5. Place gauze with vaseline directly under catheter where it enters the skin, loosely fold two sides over the catheter
6. Holding slight pressure over the vaseline/gauze over catheter, slowly and steadily slide the catheter out through the vaseline/gauze
7. Once entire catheter is removed, keep holding the gauze over the insertion site and inspect the tip and length of catheter removed – ensure catheter is intact
8. Once inspection is complete, without removing vaseline gauze from insertion site, fold distal portion of gauze up to create a small pressure dressing – cover securely with Telfa™ dressing

CVCs: Troubleshooting

- Phlebitis: can occur within 24 hours of placement
  - Warm compresses and increased movement of extremity
- Fibrin sheath vs thrombosis
  - Difficulty with draw but not flush = fibrin sheath
  - Difficulty with both draw and flush = thrombosis
- Do not flush through it: pressure can tear the lumen leading to a leak
- Alteplase for 30 minutes in catheter. If not improved, then try 2 hours. May require second dose.
- Alteplase will not work if crystallization has occurred due to incompatibility of infusions or if thrombosis has formed
CVCs: Troubleshooting

• Malposition or migration:
  – Usually PICC, often occurs during dressing changes
  – Suspect if:
    • Mechanical problems with the line
    • Concerns about discomfort of the extremity
    • Observation of color/temperature/size change of the extremity
  – When in doubt, check an x-ray to confirm proper tip location
  – If tip has “flipped up”, line may be “power-flushed” to attempt redirection of tip into inferior direction
  – May need to be “re-wired” in IR

Tunneled CVCs: Pinch off syndrome

• Tunneled catheter (subclavian vessel placement) passing through tissue just outside the vessel lumen becomes compressed between the clavicle and rib.
• Intermittent pain and occlusion.
• As the patient raises and lowers the shoulder, repeated compression and shearing forces put pressure on the catheter.
• Repositioning helps but if recurs, line needs to be replaced.
PICC and Tunneled CVC: Troubleshooting

PICC
- Risk of phlebitis:
  - Chemical
  - Mechanical: due to presence of foreign body or wire irritation on lumen.
- Kinked dressing can occlude line
- Trial warm pack and range of motion q 2 hours to help
- If not flushing, change end cap or dressing.

Port
- Check position with X-ray, PA and Lateral
- Sometimes needle is not accessing due to short length
- If there is a leak, skin may develop swelling.
- Redness or blistering can occur if infusion is a vesicant.
- During a prolonged infusion, check needle position as it can be displaced.

Broviac®
- Families should keep plastic clamps handy.
- For any break, leak, or hole, clamp should be applied above damaged area and close to patient to prevent bleeding or air emboli.

Enteral Tubes

By
Sam Flores, MD
Nasogastric (NG) & Nasojunal (NJ) Tubes
**NG/NJ Tube: Placement**

**NGT**
- Determine length (distance nose to ear lobe, then to xiphoid process)
- Confirm placement with AP CXR with upper abdomen
- ND can also be placed at bedside.

**NJT**
- Requires fluoroscopy to place tube tip distal to ligament of Treitz

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**NGT/NJT: Complications**

*Especially with long-term use*

- GER/Aspiration +/- pneumonia
- Pharyngitis, Esophagitis, Otitis Media, Sinusitis
- Bleed, Perforations, Mucosal tears
- Nasal ulceration or pressure necrosis
- Dislodgement
- Obstruction
  - Flush with warm H2O +/- enzymes
  - If does not work, then *carbonated diet soda*
Re checking placement: the RNs now use an equation and litmus paper to check pH...would like to include this as well as what we tell parents to do at home.

Wendy Hamura Arafiles, 6/13/2016
AMT Bridle™:
NG/NJ tube securement device

- Secures NG/NJ tubes via umbilical tape anchor to vomer bone (nasal septum)
- Reduces risks of inadequately secured tubes (i.e. displacement and feeds aspiration, pressure necrosis, skin breakdown from adhesives)
- Reduces costs of frequent replacements (i.e. nutrition interruption, tube replacement procedures and risks therein, xrays for confirmation of placement)
- With increased pressure on tube, tube diameter will narrow and slip through the clamp to release before damaging the vomer bone
- Recent article:
Gastrostomy Tubes

Anatomy of a Feeding Tube

External portion visible on or outside the skin
- Traditional tube projecting out of skin
- Skin level device (button)

External bolster
- Sliding ring
- Flaps on valve (button)

Internal portion within stomach (retention tip)
- Balloon
- Mushroom/cupped
- Pigtail
Ports
• Feeding port
• +/- Side port for fluids/meds
• +/- Balloon inflation port

Long GT or PEG Tube

- Simplified tube, easy to use, less mechanical failures.
- Protrudes from abdomen, requires securement device in active patients.
- Can be pulled into distal GI tract.
**Button GT: Measurements**

French size = diameter of tube (stoma)
1 French = 1/3 mm

Length in cm = thickness of abdominal wall

**Button GT: obturated**

- No balloon, but obturated or mushroom-shaped tip prevents dislodgement.
- Obturated tip is firm and usually painful upon removal – usually requires sedation for planned removal.
- Extension does not lock into place – detaches often with active patients.
Button GT: balloon

- Balloon keeps button in place
- Silicone material of the balloon can break
- Low profile – close to surface of skin
- Extensions lock into place

Gastrojejunostomy (GJ) Tubes
GJ Tubes

- Placed in IR
- Usually does not need sedation if converting from GT to GJT
- Run continuous feeds in “Jejunal” or “J” port
- Vent stomach from or give medications in “Gastric” or “G” port
- Inflate balloon via separate side port (“BAL”)
- J portion of tube has radiopaque maker to allow visualization during placement in IR
- J portion of tube can clog – small diameter, tube can kink
Jejunostomy (J) Tubes

- Usually placed by surgeon in OR
- Direct stoma through skin into loop of jejunum via enterotomy
- Usually a long tube is placed first, then can be changed to button tube once stoma has epithelialized
- Increased risk of bowel obstruction and stricture, peritonitis in immediate postoperative period
- Avoids gastric outlet obstruction with tube through pylorus (as in GJT)

Enteral Tube Placement

- Gastrostomy
  - Percutaneous endoscopic: GI for visualization with endoscopy, surgeon for tube placement
  - Surgical: open vs laparoscopic
  - IR: fluoroscopic imaging
- Direct jejunostomy
  - Primary surgical placement of tube into loop of jejunum (laparoscopic vs open)
- Gastrojejunostomy
  - GT to GJT exchange in IR after stoma epithelializes (4-6 weeks after initial GT placement)
  - Primary GJT placement (less common) – surgical vs IR
GT/GJT/JT Care

- Know type & size of tube, balloon volume
- Postoperatively:
  - 24 hours prophylactic IV cephalosporin
  - Begin early feedings, sometimes starting with Pedialyte vs straight to formula – usually continuous feeds first
  - May place G portion of GJ tube to intermittent suction for post-op gastroparesis
  - Provide Foley catheter (same F size as tube and one size smaller) to place in new stoma immediately after an accidental pull-out
- Maintenance:
  - Clean daily with soap and water, avoid hydrogen peroxide
  - Tube should be able to move up and down 1 cm and rotate 180°
  - Check balloon volume and change tube monthly (may depend on health plan and # tubes provided to patient per month)

G-Tube Dislodgement

- If within 6 weeks of initial placement:
  - Foley one size smaller, do not inflate balloon or feed
  - Fluoroscopy to replace ASAP
- If after 6 weeks:
  - Can replace at bedside
  - Foley of similar diameter, secure with tape on skin
  - Check for gastric secretions then can restart feeds
- If not noticed for several hours:
  - Place NG, intermittent suction
  - Broad spectrum IV antibiotics
  - Can replace new GT in approx. 7-10 days
The Pedialyte step is often skipped - usually now meds-only through 1st night post-op, then continuous feeds the next morning with slow advance to goal rate, bolus feeds to begin at a later point if GT. This is so surgeon-dependent that it may be better to generalize this slide.

Wendy Hamura Arafiles, 6/13/2016
Replacing an established GT

- Equipment: Lubricant gel, new device, NS, 10 ml syringe
- Prep new tube
  - Check size and balloon integrity
  - Deflate and lubricate
- Remove old tube
  - Deflate balloon fully with syringe
  - Pull out firmly, usually has some resistance
- Insert new tube into stoma
  - Inflate balloon fully, tug to check if secure
  - Firmly pull up, push external bolster down with 2-5 mm slack
- Confirm placement
  - Aspirate tube for gastric contents
  - Consider GT contrast study

Discontinuing a GT

- Most fistulas spontaneously close in 48-72 hours
- Persistent (gastric drainage > 2 months)
  - Prolonged placement (> 8-12 mo), large diameter (14 Fr)
  - Malnutrition, obesity, straining cough, debilitating dz
- Non-operative closure: 2-octylcyanoacrylate (2OC)
  - Tissue adhesive: stimulates tissue inflammation and fibrosis
  - Cost effective, non-invasive, no anesthesia, outpatient setting
- Surgical excision and closure of fistula
Clogged tube

• Prevention
  – Flush tube with water after feeds and medications
  – Use liquid form of meds (except ciprofloxacin liquid)
  – Consider flush volumes in total daily fluid intake

• Management
  – Allow 1-3 ml of warm H2O to dwell for 20 minutes, then gently push and pull
    • carbonated soda, pancreatic enzyme, or papain have been shown to be ineffective
  – Use 60mL syringe for smaller French tubes (NG, JT) to avoid rupture with excess pressure (30mL syringe is safe for GT)
  – No stylet - breaks valves
  – Last resort is to replace tube

Cecostomy Tubes (C tubes)
C-tube: Indications & Placement

- Chronic refractory constipation and fecal incontinence
- Placed by IR or laparoscopically by surgery
  - 2 days bowel prep
  - Perioperative IV antibiotics
  - Initial tube long, change to low-profile after 2 months
- Risks
  - Peritonitis
  - Abscess
  - Bleeding
  - Injury to other structures

C-tube: Management

- Daily care
  - Clean daily with soap and water
  - Keep tubing secure
- Enema regimen (begin 1-2 weeks after initial placement)
  - Have patient sit on toilet
  - Flush enema regimen as prescribed
  - Have activities for patient (DVD, books, etc), can take up to 1 hour to complete stooling
  - Clean site and equipment after completed
- Tube change
  - Every 6 to 12 months after initial long tube changed to low-profile
C-tube: Complications

- Infection
- Leakage
- Granulation tissue
- Dislodgement
  - Place foley catheter, do not inflate balloon
  - Replace in IR

References

CLOSING DISCUSSION

Yes, we can...
...but should we?

Closing Discussion

ILLUSTRATIVE CASES
Case #1

- 6 week old baby girl admitted directly by her PCP for acute-on-chronic poor feeding and poor weight gain with concurrent URI symptoms
- She is accompanied by her teenage mother
- Exam reveals a young infant with RR 50, minimal accessory muscle use but obvious central hypotonia, and poor air movement to bibasilar lungs

Case #1

- CXR reveals bibasilar atelectasis and poor lung volumes, CBG reveals pH 7.1 and PCO2 50, respiratory PCR + for rhinovirus
- She is transferred to the PICU for acute respiratory failure where she spends 3 days on high-flow nasal cannula and requires an NG tube for feeds
- She returns to the general pediatrics floor with nasal cannula O2 1L, NG for majority of nutritional needs, and a new diagnosis of SMA type 1
Case #1: Discussion

- What will this baby need for discharge?
  - NG tube feeds (and caregiver education)
  - Home oxygen, oximeter, suction (and caregiver education)
  - Neurology, GI, Genetics, Pulmonology outpatient visits
  - PCP who can coordinate all of the above
  - Community resources, support groups, patient information
  - Early Intervention, DDD/DES, Long term care, Medicaid
  - Caregiver at home
  - PALLIATIVE CARE CONSULTATION

*High risk for anesthesia, but muscle bx can be taken from the rectus abdominus during GT surgery

Case #1: Discussion

- What will this baby need in the future?
  - Muscle biopsy*
  - G tube*
  - BiPAP vs Tracheostomy & Ventilator
  - PCP who can coordinate progressive DME and referral needs
  - Caregivers who understand that even a mild URI warrants a visit to a medical provider
  - Advance care planning
  - Home Palliative Care team services
Case #2

• 17 year old boy with **HIE** due to drowning event at 2yo, GERD and dysphagia s/p GT and Nissen, **severe malnutrition** due to chronic feeding intolerance, significant **upper airway obstruction**, severe neuromuscular **scoliosis** with significant **contractures**, and **pressure ulcers** over multiple bony prominences

• Admitted for viral respiratory illness requiring near-constant suction and up to 3L O2 via NC at home

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Case #2

• **CXR** shows the same multifocal atelectasis noted on all CXRs over the last 2 years

• **Multiple admissions over the last 2 years** for respiratory infections (twice to PICU) despite aggressive airway clearance with bronchodilators, hypertonic saline, vest, and nocturnal BiPAP

• His GI provider has been **struggling to find a feeding regimen he will tolerate**; meanwhile he has become severely malnourished
Case #2

• Mom expresses concern because she and the orthopedic surgeon have been trying to coordinate *spinal fusion* surgery
• Mom has, in the past, refused tracheostomy, and she *does not have an advance directive* at the moment

Case #2: Discussion

• What are the *risks of spinal fusion* in the patient’s current state?
  – Inability to extubate
  – Prolonged recovery period requiring inpatient care
  – Poor wound healing
  – Worsening feeding intolerance and SMA syndrome
  – Potential need for TPN (and thus a central line)
  – Worsening pressure ulcer disease
  – Minimal improvement in respiratory mechanics
Case #2: Discussion

- Assuming immediate medical needs are met, how do you approach this situation?
  - Immediate inpatient needs only
  - Talk with mom alone
  - Call a Care Conference
  - PALLIATIVE CARE

Closing Discussion

ADVANCE CARE PLANNING
Goals of Care: Considerations

- Caregiver’s overall goals
- Planning ahead
- Advance care planning
- Medical power of attorney
- PALLIATIVE CARE services
- Decision-making capacity of caregivers
- Access to emergency and home care services
- Access to hospice services
- Care transitions for aging patients and caregivers

Advance Care Planning: TIPS

- **Start early**, preferably *before* starting down the medical technology road
  - Involve Palliative Care team (if available)
  - Introduce the idea of Advance Care Planning
- **Involve the PCP** in discussions when possible
- **KEY:**
  - Dedicate time to sit and just listen to the caregiver(s) and walk through whatever doors are opened
  - Slow and steady progress, avoid hasty or pressured decisions
Advance Care Planning:
STARTING THE DISCUSSION

• Recognition of a recent decline or of the life-limiting nature of the child’s condition
  – difficult to move forward without this piece
• “If this [decline] continues, what would be important to you for your child?”
• “If the end is close, where would you want your child to be? What would you want us to prioritize?”
  – offer examples of hospital/ICU interventions vs comfort care in context of the child’s illness and prognosis

Advance Care Planning:
STARTING THE DISCUSSION

• Preparing a “back-up plan”
  – Avoid making decisions in crisis mode
  – Allow provider(s) to advocate for patient and family
  – Restore some of patient’s/family’s control in an uncontrollable situation
Advance Care Planning: Resources

• Local Hospice services
  • [www.NHPCO.org/pediatrics](http://www.NHPCO.org/pediatrics)
    - National Hospice and Palliative Care Organization
    - “Advance Planning in Pediatric Hospice/Palliative Care, Parts 1 and 2”
  • [www.polst.org](http://www.polst.org)
    - “Physician Orders for Life Sustaining Treatment” Paradigm

• No standardized forms for pediatrics
• State-dependent DNR forms or advance directives (may be found on state attorney general office site)
• Institution-dependent internal DNR policy and procedures

Educational Resources

• Radiopaedia.org
  • [http://pediatrics.ucsf.edu/blog](http://pediatrics.ucsf.edu/blog)
  • [http://dontforgetthebubbles.com](http://dontforgetthebubbles.com)
  • [http://lifeinthefastlane.com](http://lifeinthefastlane.com)
Thank you!!!

From Dustin, Wendy, Sam, Sarjita, and Brittany

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