




Medical Technologies in the Pediatric Patient

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Goals & Objectives

- Understand and recognize the various tubes, drains, and vascular access that may be found in/on a pediatric patient
- Learn to systematically recognize malfunctions and troubleshoot these technologies

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Technology Dependent Children

- Term used to describe children who need one or more medical technologies/devices to compensate for failure of a vital function
- Medical devices in a child can range from a single device to > 10 devices.

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Hardships with medical technology dependent children



- Lack of availability of appropriate respite care both away from the home and inside the home, especially in the evening and overnight
- Difficulties combining caring and working
- Sleep disruption
- Social isolation
- Children's and siblings' relatively limited or disrupted participation at school and in social activities.

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Tracheostomy



- What is it?
 - an incision in the windpipe made to relieve an obstruction to breathing.



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Initial assessment of the patient with a tracheostomy



- How mature is the stoma?
- What size is the current tracheostomy?
- Why was the tracheostomy placed?

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Types of tracheostomies

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Theme for troubleshooting:

- DOPE
 - D-displaced, dislodged or damaged
 - O-obstructed (mucus, food, blood, secretions)
 - P-pulmonary problems
 - E-equipment failure (bent tubing, ventilator malfunction, depleted oxygen supply)

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DOPE

- a. Is the tube in place?
- b. Has the obturator (stylet) been removed?
- c. In a double lumen trach tube, is the inner cannula in place?
- d. Has a decannulation plug or speaking valve been removed

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Pediatric tracheostomy tubes: approximate sizes

	Shiley	Holinger	Portex	Bivona	Berdeem	ETT	Suction
Premature	00	00	3.0	2.5-3.0	---	2.5-3.0	6 Fr
Newborn	0	0	3.0	3.0-3.5	3.5	3.0-3.5	6 Fr
0-6 mo	0-1	1-2	3.5	3.5-4.0	3.5-4.0	3.5-4.0	6-8 Fr
6-12 mo	1-2	2-3	4.0	4.0-4.5	4.0-4.5	4.0-4.5	8 Fr
12-24 mo	3	3	4.5	4.5-5.0	5.0	4.5-5.0	8 Fr
3-6 yr	4	4	5.0	5.0	5.0	5.0	8-10 Fr
7-10 yr	4	5	5.0	5.0-6.0	6.0	6.0	10 Fr
10-12 yr	6	6	6.0	6.0-7.0	6.0	7.0	10 Fr
12-14 yr	6	6	7.0	7.0	7.0	7.5	10 Fr

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Mechanical Ventilators


- In some case, a tracheostomy patient is not too far from a ventilator
- Many different manufacturers and types of home use ventilators
- Some children are on a vent continuously, others are for night time or intermittent use
- Some require the additional use of oxygen

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- Ventilators are set with
 - Respiratory rate
 - Tidal volume
 - Oxygen
 - Pressure settings
- 2 main types of settings
 - Pressure
 - Volume


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- Modes:
 - Intermittent: IMV
 - Continuous : CMV

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DOPE



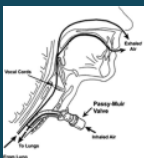
- Dislodgement of tracheostomy, tubing
- Obstruction of the tubing, circuit
- Equipment failure - battery

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Adjuncts to the artificial airways



- Passy-Muir valve: Apparatus placed on the hub of a tracheostomy.
- Redirects air flow through the vocal folds, mouth and nose enabling voice and improved communication.



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Cerebral Shunts



- A shunt is a medical device that relieves pressure on the **brain** caused by fluid accumulation.
- Placed via a surgical procedure that primarily treats a condition called hydrocephalus.

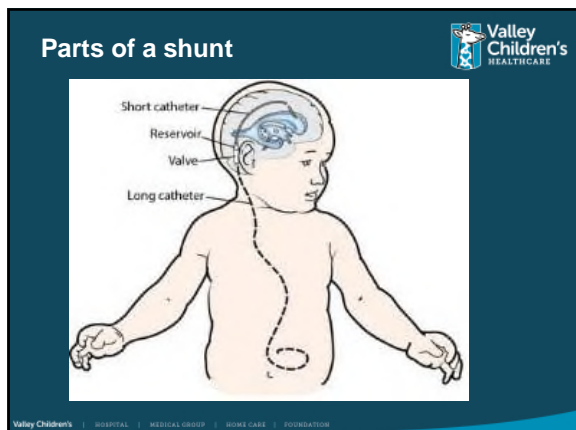
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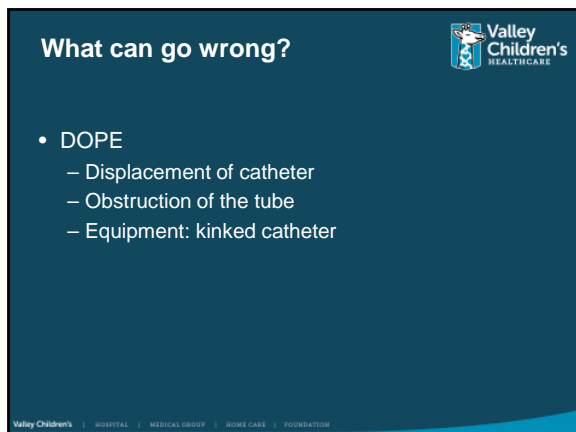
Types of shunts

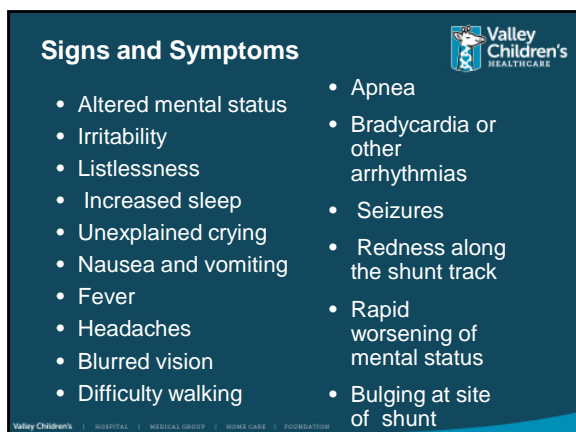


- Ventriculoperitoneal – VP - conduit from the CSF in the cerebral ventricle into the peritoneal cavity
- Ventriculoatrial – VA – conduit from the CSF in the cerebral ventricle into the right atrium of the heart
- Ventriculopleural – conduit from the CSF in the cerebral ventricle into the pleural cavity

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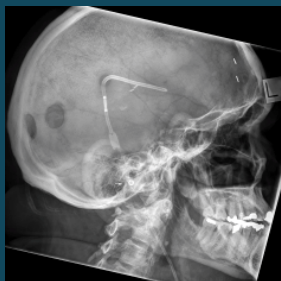


Manage ABCs



- You cannot externalize the shunt or really do anything with it
- Neurosurgery is the keeper of shunts.
- Can Image upon arrival –
 - Shunt Series – assess integrity of the tubing and connections
 - MRI or CT – assess ventricle status – dilated vs collapsed
 - For VP shunt patient presenting with abdominal pain – ultrasound of the abdomen – there may be a cyst or seroma at the end of the shunt tubing

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Definitive care



- Obstruction –
 - Temporizing measures
 - Tape shunt valve – when infection suspected
 - Checking shunt settings – if programmable magnetic shunt
 - Operating room for replacement of shunt
- Infection – externalizing the shunt, antibiotics, and then shunt revision once infection improves

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Jejunostomy



Ileostomy **Gastrostomy**


Ostomies!

Cecostomy **Urostomy**

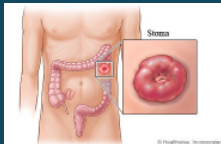
Colostomy

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Ostomy vs Stoma



- **Ostomy** – Surgically created opening in the body for the discharge of body wastes
- **Stoma** - The actual end of the ureter or small or large bowel that can be seen protruding through the abdominal wall.

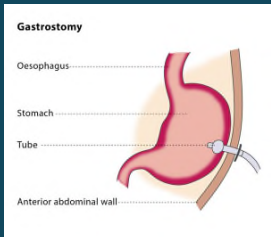


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Gastrostomy



- What is it?
 - An opening into the stomach from the abdominal wall, made surgically for the introduction of food



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Placement and Types of Gastrostomy Tubes



- Stamm Gastrostomy - open
- Janeway Gastrostomy -laparoscopic
- Percutaneous endoscopic gastrostomy - endoscopic

- Mic-Key button
- PEG tube
- Gastro-Jejunal – tube
- Malecot or Pezzer
- J tubes

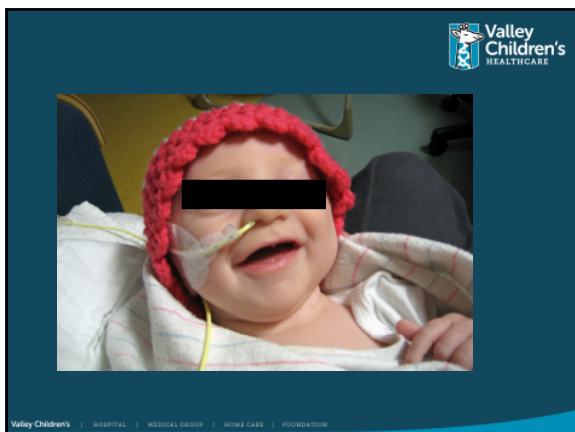
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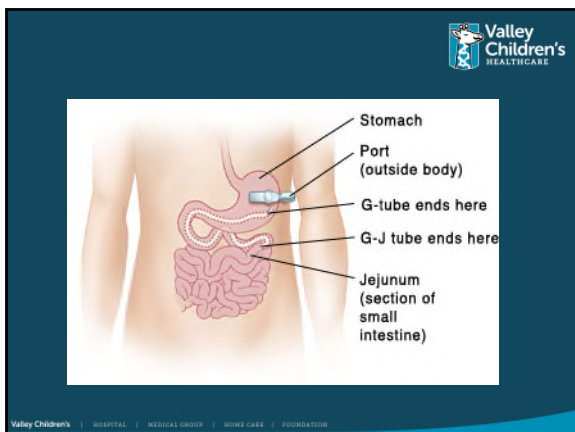
First step – Naso-gastric Tube

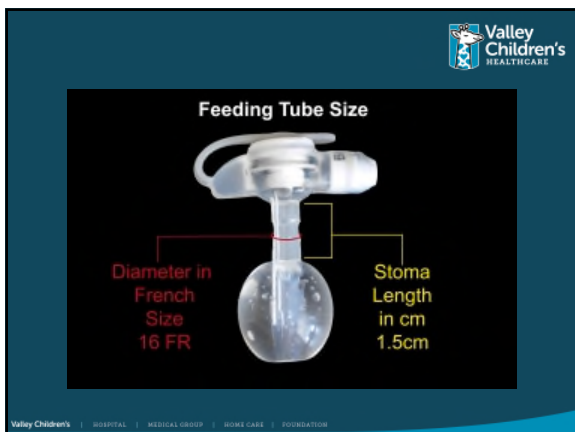


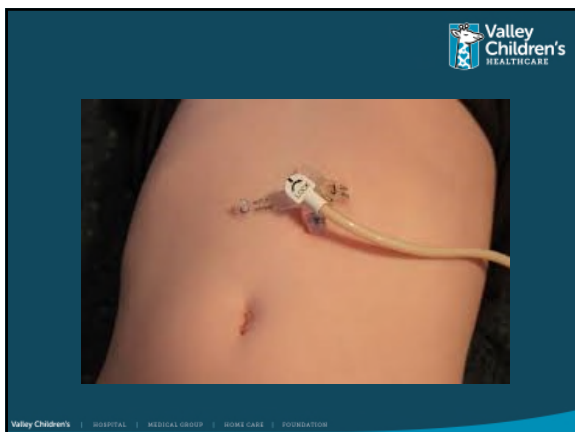
- Often this is the step before placement of a percutaneous gastrostomy tube
- NGT can be placed by parents as they are taught how to measure and listen.
- A pulled NGT is not life threatening.
- If family uncomfortable with placement, this can be easily done in the ED with audio confirmation or radiographic confirmation

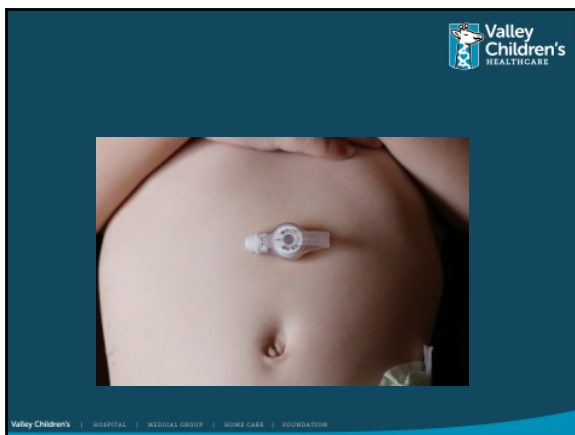
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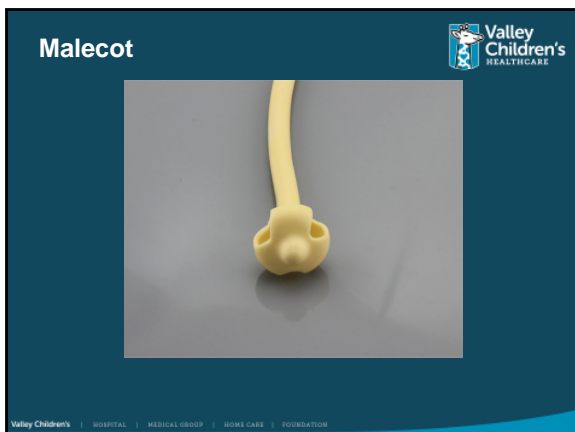














Complications

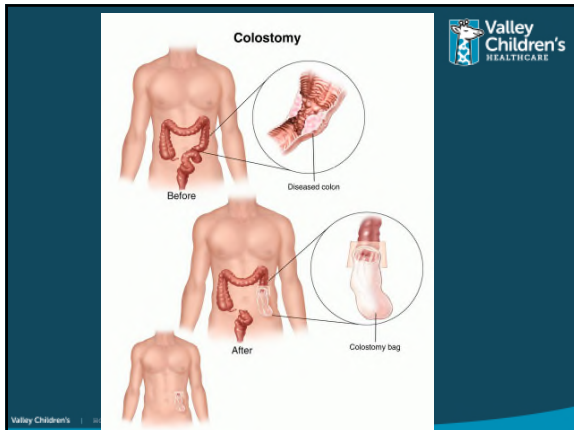
- DOPE
- Peritonitis
- GI bleeding
- Tube Dislodgement
- Skin irritation
- Granuloma formation

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Colostomy/Ileostomy

- What is it?
 - A surgically created hole in the abdominal wall that leads to the desired portion of the GI tract
 - Colostomy - health colon is brought up to the abdominal wall
 - Ileostomy - healthy ileus is brought up to the abdominal wall

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DOPE

- Usually complications with ostomies in the abdomen have to do with infection or obstruction
- These patients need to remain as comfortable as they can until assessment and definitive care can be achieved
- Often times a 2 view xray of the abdomen will be ordered, followed by sometime of therapeutic intervention
- Sometimes the reason for transport is simply local irritation or lack of supplies to change the ostomy site

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Urinary conduits

- Foley Catheter
- Nephrostomy: From skin directly into kidney
- Suprapubic (Urostomy/Vesicostomy): From skin directly into bladder
- Ureterostomy: From skin into ureter

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Urinary Conduits

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Urostomy

- What is it?
 - Stoma in the lower abdomen
 - Requires formation of a pouch to be worn outside the body or a continent diversion (neo-bladder) is formed inside the body
 - The ileal conduit is made from a short segment of the small intestines and removing the bladder
 - Urostomies are often done as temporizing measures. They help relieve bladder obstruction

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Vesicostomy



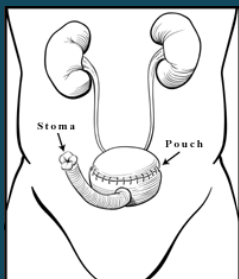
- Communicating channel between the bladder and the lower abdominal wall
- Bladder usually empties directly through the abdominal wall into a diaper

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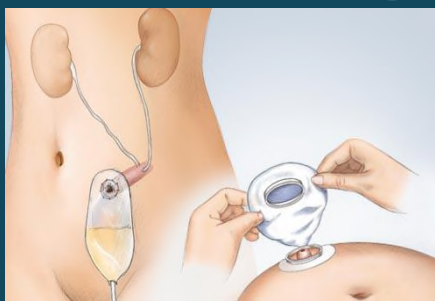
Mitrofanoff



- Also known as "appendicovesicostomy"
- Appendix is used to create a conduit between the surface of the skin and the urinary bladder
-



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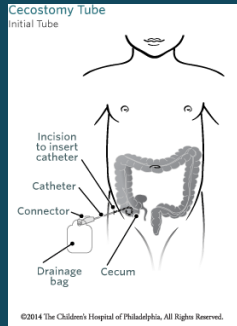


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Cecostomy



- What is it?



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Chait



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Central Lines



- What is it?
 - This is a central venous catheter placed into a large vein
- Types
 - Tunneled catheter: Broviac
 - Implanted Port: Meidport
 - PICC (Peripherally inserted Central Catheter)

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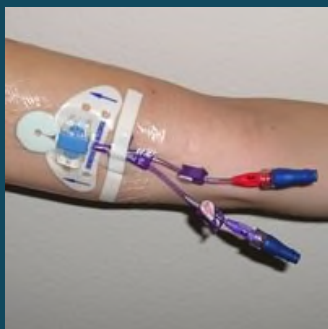
Why do kids have these?



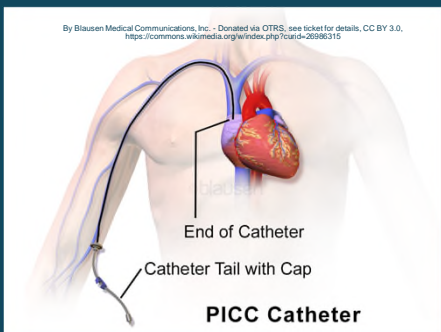
- Long term antibiotic administration
- Difficulty venous access
- Long term medication use (Chemotherapy)
- Metabolic disorders (weekly/monthly enzyme infusions)
- Poor GI absorption of foods or medications (short gut syndrome, bowel resection)
- Supplemental nutrition (TPN)

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PICC Line



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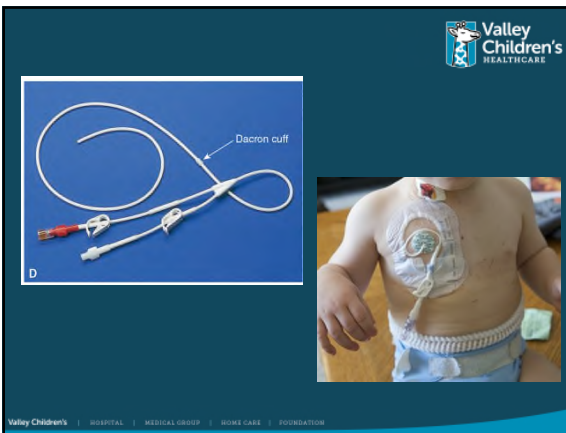
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Broviac/Hickman



- Very similar to PICC but directly inserted into the neck or chest wall
- Tunneled under the skin
 - Theoretically should reduce the risk of infection
- The doctor makes a small opening in the mid-chest area. Another opening is made where the catheter will enter the vein. A tunnel is formed under the skin between the two openings.
- The catheter is passed through this tunnel and then gently threaded into the vein. Your child will get a chest X-ray to make sure the catheter is in the proper location.

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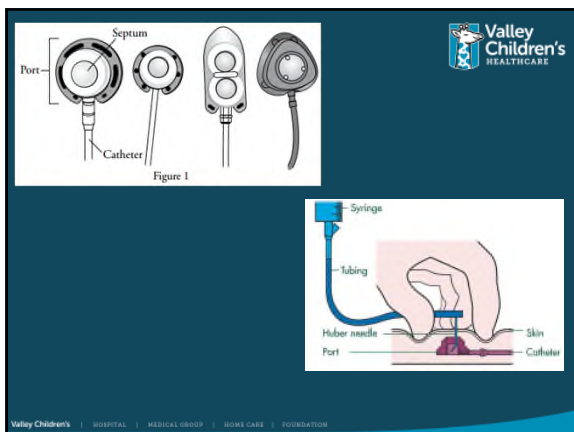


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Mediport



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DOPE

- Bleeding from CVL
- Broken CVL
- Clotted CVL
- Pain
- Infection around site
- Bacteremia

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- ALWAYS listen to the caregiver
- They know their child best

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