Clinical Pathways

Post-Operative Tethered Cord Patients

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What is a Clinical Pathway?

• An evidence-based guideline that decreases unnecessary variation and helps promote safe, effective and consistent patient care.
Objectives of Pathway

- To improve and standardize post-operative care of the patient undergoing tethered cord surgery
- To eliminate variability and establish a standard of care for these patients
Why do we need this pathway?

• To change practice for post operative care of these select group of patients
• To guide care for these children
• To ensure standard of care is successfully implemented for the safety of the patient
What is Tethered Cord?

Tethered cord occurs when the spinal cord is attached to tissues around the spine, most commonly at the base of the spine. The attached tissue limits the movement of the spinal cord within the spinal column and causes an abnormal stretching of the spinal cord and impairment of blood flow to the nerve tissue. Can be closely associated with spina bifida OR can occur as an independent entity related to disorders of secondary neurulation and some tumors.

Image courtesy of: https://www.seattlechildrens.org/conditions/brain-nervous-system-mental-conditions/tethered-spinal-cord/
What is Tethered Cord?

- The lower tip of the spinal cord (conus medullaris) is normally located opposite the disc between the first and second lumbar vertebrae.
- With tethered cord, the conus medullaris may be located below the interspace between the second and third lumbar vertebrae, and/or there may be radiographic evidence of abnormal points of attachment (i.e. thickened filum terminale, intraspinal mass, spinal cord adjacent to thecal sack in a fixed position).
This is the Post Operative Tethered Cord Clinical Pathway.

We will be reviewing each component in the following slides.
Patients need to be flat in bed for 24 hours post procedure.

- Some patients will require PICU admission for sedation with precedex during this initial period of recovery.
- Most children can then transfer to the Med/Surg unit after 24 hours.

### Inclusion Criteria:
Post-operative care for any patient diagnosed by Neurosurgery to have tethered cord syndrome requiring surgical correction

### Exclusion Criteria:
- None

### Post-operative Care:
- **Admit to Neurosurgery service**
  - Transfer to Med/Surg if no sedation required, or
  - Transfer to PICU if requiring sedation x 24 hours to maintain flat in bed
    - Care per PICU for precedex infusion
    - HR, RR, and BP q2hr; temperature q4hr

### Activities
- Temperature, HR, RR, and BP q2hr for 24 hours, then daily

### Infection Care:
- Treat liberally and provide Med/Surg dressing placed in operating room
- Change and transport site daily

### Other
- Strict intake & output
- Check post-tap bladder sounds (KUB) — new “Marches" check, straight insertion
- Blood pressure + pulse + JVP
- Neurosurgical vs Med/Surg

### Tethered Neuromuscular vs Tethered Bladder
- Venous monitoring x 3 or 4 times during intubation
- Temp 93-100°F, HR 60-100 bpm, RR 16-30, SpO2 > 94%
- Skirt patient gait if possible
- Follow up in 2-3 weeks after discharge

### Discharge Criteria:
- Baseline neurologic examination, can walk without aid and not on medication, ambulates 4-24 hours, bowel movement, taking oral fluids if no sedation needed. Cleaned & DF, at skill level or with appropriate assistive movement plan

### Discharge Medications:
- **Reflux:** PO 2 mg/kg/day after each dose or PO 2 mg/kg/day after each dose + PO 75 mg/day PRN for mild/moderate pain
- **Anticonvulsant:** PO 2 mg/kg/day after each dose + PO 75 mg/day PRN for mild/moderate pain
- **Neurotrophic Factors:** PO or IV as prescribed

### Discharge Instructions:
- Call Neurosurgery for follow-up at 1-2 weeks, early infection if delay in discharge, severe instability, consistent change in pain.
- Notify the NICU team to be changed daily after background had been noted
- Follow up in 2 weeks, 2-3 weeks after discharge
- Followed post-operative care, may need to be assessed prior to discharge.
Standardized care for these patients includes five different categories.

- **Antibiotics**
- **Pain Control**
- **Nursing & Monitoring**
- **Activity**
- **Fluids, Electrolytes, Nutrition**

**Diagnosis Criteria**
- Baseline neurologic/urologic evaluation, with well-circumscribed voiding/voiding dysfunction; 24-hour blood pressure, bowel movements, taking adequate fluids and intake and output,.logged by PRN, TF, or at every clinical visit or with appropriate urological management plan.

**Discharge Instructions**
- Follow-up appointment is required. This will be arranged prior to discharge.

**Diabetes Medications**
- Metformin PO: 500 mg daily; Prandial glinides PO: 1 mg tid.

**Diabetes Infections**
- Call 911 for severe ketoacidosis, vomiting, or dehydration, severe hypoglycemia or hypokalemia.

**Diabetes Interventions**
- Follow-up appointment is required. Avoid hypoglycemia or dehydration, severe hypokalemia, or severe hypoglycemia, as necessary. Follow-up appointment is required. Avoid hypoglycemia or dehydration, severe hypokalemia, or severe hypoglycemia, as necessary. Follow-up appointment is required. Avoid hypoglycemia or dehydration, severe hypokalemia, or severe hypoglycemia, as necessary.
All children will receive antibiotics for the first 24 hours post procedure.

- There is no indication for routine administration of antibiotics beyond 24 hours.

**Antibiotics**

Antibiotics to be given for only 24 hours post-operatively unless otherwise indicated.

**Cefazolin**

100 mg/kg/day div q8hr (max 2,000 mg/dose) OR 200 mg/kg/day div q6hr (max 12 g/day); adult dose 2g q6hr

**Nafcillin**

200 mg/kg/day div q6hr (max 12 g/day); adult dose 2g q6hr

If β-Lactam allergy:

**Vancomycin IV**

- <2 weeks PMA: about <3 mo old: 15 mg/kg q8hr or as determined by pharmacy based on estimated AUC
- ≥2 weeks PMA: about ≥3 months old – 11 years old: 70 mg/kg/day div q6hr
- ≥12 yrs old: 60 mg/kg/day div q8hr

PMA (Post-Menstrual Age) = gestational age + postnatal age

**Discharge Instructions**

- Continue NG tube feed for nutrition, feed until stools return
- Continue stool softener as needed
- Continue cefazolin 2g q6hr until discharge
- NPO status until discharged

**Discharge Medications**

- Oral antibiotics
- Stool softeners
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**Discharge Instructions**

- NG tube feed to be discontinued upon discharge
- Stool softeners to be discontinued upon discharge
- Continue oral antibiotics as prescribed
NSAIDs, such as Toradol, are an important part of post operative pain management.

- Children with known renal impairment should only get NSAIDs after discussion with Nephrology

**If acute kidney injury**: Avoid NSAIDs or discuss with Nephrology for approval.

- **Toradol IV** 0.5 mg/kg/dose q6hr x 6 doses (max 30 mg/dose)
  - 6 hours after last toradol dose, start ibuprofen PO: 10 mg/kg/ dose q6hr PRN (max 40 mg/kg/day or 2,400 mg/day, whichever is less)
  - Acetaminophen IV 15 mg/kg/dose q6hr around the clock for 24 hours (max 1,000 mg/dose)
  - After 24 hours of IV acetaminophen, switch to PO acetaminophen: 15 mg/kg/dose q6hr PRN pain (max 75 mg/kg/day or 4,000 mg/day) for mild/moderate pain; may use PR acetaminophen for infants.
  - Morphine 0.05 – 0.1 mg/kg IV q4hr PRN severe pain (max 5 mg/dose)

**Consider Acute Kidney Injury (AKI) based on the following criteria:**

- Increase in serum creatinine by 1.5-1.9 times baseline within the prior seven days, or
- Increase in serum creatinine by ≥0.3 mg/dL from baseline (≥22.5 mcM/L) within 48 hours, or
- For those with unknown creatinine, an eGFR <90 ml/min/1.73m²
Nursing care includes both routine vital sign monitoring, incentive spirometry, and venous thrombo-embolism (VTE) prevention. The surgical incision should be closely monitored.

**Neurosurgery should be notified of any fluid leakage from the incision**
Patients will be on bedrest with the bed flat for the first 24 hours after surgery.
- Once patient is allowed to sit up, RN should evaluate for headaches. If a patient experiences a severe headache, they should return to having the head of bed (HOB) flat then gradually increase the HOB over several hours.

Early PT and OT consults are important to help reduce the risk of complications that may result from immobility.
Children will come out of the OR with a foley catheter in place. Once the foley catheter is removed, post void residuals (PVR) need to be checked and documented in the medical record.

- Patients with PVR greater than 10% of their estimated bladder capacity will need a urology consult
- Urology is also consulted for patients with preexisting bladder dysfunction

Other things to note related to Fluids, Nutrition, and Electrolytes:

- Bowel regimen is initiated immediately post op
Children criteria, medications and instructions (including when to call neurosurgery once discharged) are clearly outlined.

**Discharge Criteria:**
- Baseline neurological examination, pain well-controlled on oral medication, bowel movement, taking adequate fluid and nutrition orally, cleared by PT & OT, at urologic baseline or with appropriate outpatient management plan

**Discharge Medications:**
- **Ibuprofen PO**: 10 mg/kg/dose q6hr PRN (max 40 mg/kg/day or 2,400 mg/day, whichever is less) for mild/moderate pain
- **Acetaminophen PO**: 15 mg/kg/dose q6hr PRN pain (max 75 mg/kg/day or 4,000 mg/day) for mild/moderate pain
- **Polyethylene glycol PO** and/or **Docusate** to prevent constipation

**Discharge Instructions:**
- Call Neurosurgery for fever >101.5°F, vomiting >3x in 12 hr period, excessive irritability or sleepiness, severe headache, consistent change in gait
- Tegaderm & telfa dressing to be changed daily after bathing and when soiled
- Follow up outpatient 2-3 weeks after discharge
- If sedated suture removal is required, this will be arranged prior to discharge

**Discharge Medications:**
- **Ibuprofen PO**: 10 mg/kg/dose q6hr PRN (max 40 mg/kg/day or 2,400 mg/day, whichever is less) for mild/moderate pain
- **Acetaminophen PO**: 15 mg/kg/dose q6hr PRN pain (max 75 mg/kg/day or 4,000 mg/day) for mild/moderate pain
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Review of Key Points

- If patient requires Precedex then patient requires admission to PICU
- No BLOOD WORK required for patient post operatively unless unstable
- Pain Control
- Antibiotics x 24 hours
- Notify NS attending for any bleeding, instability or wound drainage immediately
- PVR are essential once foley is out
- If PVR are significant (see algorithm in pathway) Urology consult is indicated
Use of Order Set

The Post-Op Tethered Cord Order set should be used for all patients who are post procedure. It will help ensure that all pathway elements are ordered correctly.

Order sets also help track pathway usage and pathway metrics.

*NOTE: This order set is not to be used for PICU patients. Patients going to the PICU post operatively should use the PICU – Neurosurgery Order Set instead.
Quality Metrics

- Percentage of patients with pathway order set usage
- Percentage of patients with deep wound infections
- Percentage of patients with superficial skin infections (SSI)
- Number of patients with organ space infection within 30 days of principal operative procedure
- Readmission within 30 days
- Return to the OR within 30 days
Pathway Contacts

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References


About Connecticut Children’s Pathways Program

Clinical pathways guide the management of patients to optimize consistent use of evidence-based practice. Clinical pathways have been shown to improve guideline adherence and quality outcomes, while decreasing length of stay and cost. Here at Connecticut Children’s, our Clinical Pathways Program aims to deliver evidence-based, high value care to the greatest number of children in a diversity of patient settings. These pathways serve as a guide for providers and do not replace clinical judgment.