JOHNS HOPKINS ALL CHILDREN'S HOSPITAL

Pyloric Stenosis Clinical Pathway

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Rationale

This clinical pathway was developed by a consensus group of JHACH physicians, advanced practice providers, nurses and pharmacists to standardize the management of children hospitalized for Pyloric Stenosis. It addresses the following clinical questions or problems:

1. When to evaluate for pyloric stenosis
2. When to consider admission for further evaluation
3. When to consult surgery
4. When to consider resuscitation and other disease processes

Background

Pyloric stenosis is one of the more common causes of persistent vomiting in the first weeks of life and one of the most common surgical conditions of the newborn. The usual age at presentation ranges from 2-8 weeks, with occasional late appearance up to 12 weeks of age. The cause remains unknown, though it is thought to have a genetic predisposition with some environmental influence. Occurs more commonly in males than females. Classically, the presentation is one of projectile, **non-bilious** vomiting. If bile is present in the emesis, it is **NOT** due to pyloric stenosis.

Definition: Hypertrophic pyloric stenosis (HPS) occurs from hypertrophy of the circular and longitudinal muscularis of the pylorus and the distal antrum of the stomach with progressive narrowing of the pyloric canal. It is the most common surgical cause of vomiting in infants.
Age Range: HPS typically presents in the first 2-8 weeks of life, with occasional late appearance up to 12 weeks of age.
Symptoms: The classic symptom is progressively worsening projectile vomiting after feeding. The vomiting is usually non-bilious. A mass in the upper abdomen/gastric wave may or may not be palpable. Ongoing emesis left untreated leads to dehydration, including hypochloremia, hypokalemia metabolic alkalosis.
Epidemiology: The incidence of HPS occurs more commonly in males than females, along with firstborn children. There is also lower risk in African and Asian populations.
Differential Diagnosis: overfeeding, gastroesophageal reflux, malrotation, duodenal stenosis, intracranial lesions

Diagnosis

Pyloric stenosis suspected:

1. Obtain basic metabolic panel (BMP)
2. NPO
3. Place IV
4. Initiate Normal Saline bolus 20ml/kg
5. Obtain pyloric ultrasound-positive measurements include a pyloric muscle thickness greater than 3mm and a pyloric canal length of 15mm or greater, and no fluid moving through pyloric canal
   If pyloric US equivocal-recommend observation, repeat pyloric US in 48 hrs, and consider upper GI contrast study if pyloric US remains equivocal

Pyloric stenosis confirmed:

1. Consult pediatric surgery or transfer to JHACH for pediatric surgery consult
2. Assess serum electrolyte results
3. Nasogastric tube to be placed at surgical team's discretion
4. Place infant on apnea monitor and admit

Clinical Management

Preoperative Resuscitation Management

Cl < 85 or HCO2 >/= 40	1. Admit to PICU 2. 20ml/kg NS bolus x3, each bolus over 30 minutes, each bolus to be given 1 hour apart 3. Recheck BMP 1 hour after last bolus
Cl 85-97 or HCO2 33-39	1. Admit to floor, unless infant with tachycardia, hypotension, or deemed necessary by surgical team 2. 20ml/kg NS bolus x2, each bolus over 30 minutes, each bolus to be given 1 hour apart 3. Recheck BMP 1 hour after last bolus
Cl 98-99 or HCO2 31-32	1. Admit to floor 2. 20ml/kg NS bolus x1 3. Recheck BMP 1 hour after bolus
Cl >/= 100, HCO2 </=30, K < 5	1. Infant is cleared for OR

Multiple boluses should be given 1 hour apart

All patients should have BMP drawn 1 hour after the last ordered bolus

All patients should be put on 1.5 MIVF (D5 0.45 NS + 20mEq/L KCl) also. K should be included in the MIVF if the patient has adequate UOP (ok to use parent history)

All patients should be placed on apnea monitor while on the med/surg unit

Patient should proceed to pyloromyotomy once meets institutional anesthesia requirements-CO2</=30, K<5, Cl>/=100

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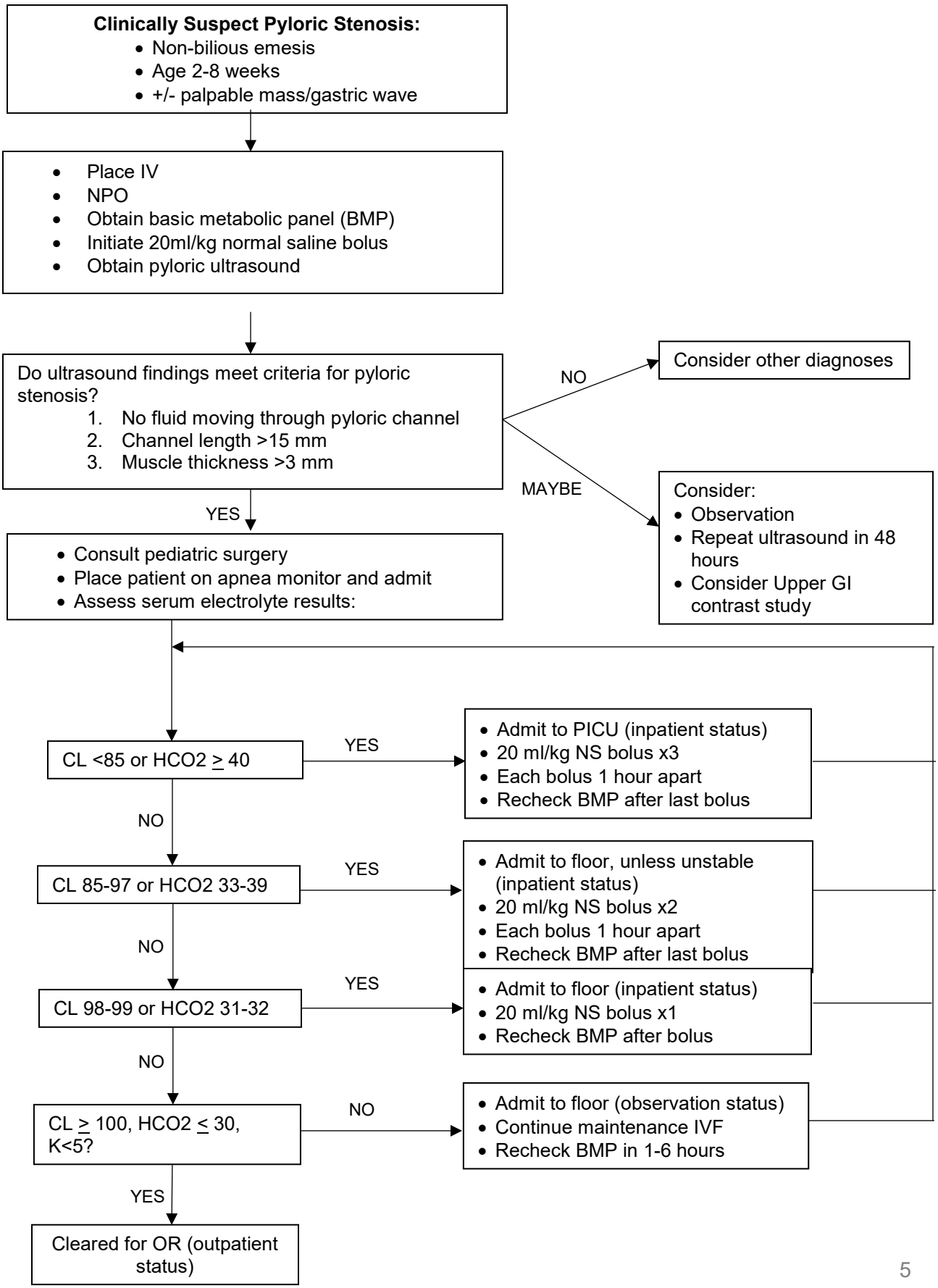

Admission and Rehydration

Pyloric stenosis is a medical, not a surgical emergency!

- The classic metabolic derangement is a hypokalemic, hypochloremic metabolic alkalosis (from gastric HCI losses). This will be evident by the results of the electrolyte panel.

- Rehydration is determined by the patient's clinical status. Dehydrated patients should receive a normal saline bolus (20mL/kg over an hour) in addition to maintenance fluids (D5 0.45 NS + 20mEq/L KCI) at 1.5x rate. Adequate urine output should be ensured (2mL/kg/hr).

- Surgery will not be performed until the electrolytes are corrected (K<5, Cl >/=100, HC02 </=30).

Additional Considerations

Postop feeding management:

1. NPO for 2 hours from the end of the procedure
2. Start formula/Breast milk ad lib frequency up to 2 ounces
3. All patients should be placed on an apnea monitor
4. Patient may be discharged when tolerating 2 ounces for 2 feedings without emesis and meets institutional postoperative monitoring requirements.

Inpatient Management

- Once the patient is fully hydrated and the electrolytes are corrected, surgical intervention is indicated. The surgical procedure is a pyloromyotomy, which can be performed open or laparoscopically.
- Postoperatively, the feeds can be resumed within two hours.
- Tylenol only for pain management
- The feeding regimen is per the Attending's discretion. The formula of choice is that provided by the parents preoperatively, which is usually breastmilk or Enfamil. It is not unusual for vomiting to occur with the first few feedings; continue the proposed feeding regimen and reassure the parents, unless otherwise specified by the Pediatric Surgery Fellow or Attending.

Discharge

- Anticipate discharge on post operative day (POD) 1 or 2.

Documentation Recommendations

- Providers should be sure to capture any electrolyte or acid-base abnormalities in their assessment and plan (ex. hypokalemia, metabolic alkalosis).
- Document if dehydration was present on admission, and if so, the degree/severity.
- Document if shock was present on admission.

Patient Class Recommendations

- Patients with stable volume status and electrolytes after evaluation and fluid resuscitation in the EC who will proceed to the OR without delay for clinical indications should be placed in observation status.
- Patients admitted to the PICU and/or patients requiring ongoing fluid resuscitation and electrolyte monitoring beyond what is performed in the EC should be admitted to inpatient status.

References

1. Jobson M, Hall N, Bchir MB, Contemporary management of pyloric stenosis. Seminars in Pediatric Surgery 2016 Aug; 25(4):219-224.
2. Dalton BG, Gonzalez KW, Boda SR, Thomas PG, Sherman AK, St Peter SD, Optimizing fluid resuscitation in hypertrophic pyloric stenosis. J Pediatr Surg. 2016 Aug; 51(8):1279-82.
3. Markel TA, Scott MR, Stokes SM, Ladd AP, A randomized trial to assess advancement of enteral feedings following surgery for hypertrophic pyloric stenosis. J Pediatr Surg. 2017 Apr;52(4):534-539.

Outcome Measures

1.Time to OR
2.Time to first feed post op
3.Post-op length of stay

Clinical Pathway Team

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Disclaimer

Clinical Pathways are intended to assist physicians, physician assistants, nurse practitioners and other health care providers in clinical decision-making by describing a range of generally acceptable approaches for the diagnosis, management, or prevention of specific diseases or conditions. The ultimate judgment regarding care of a particular patient must be made by the physician in light of the individual circumstances presented by the patient.

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