Pyloric Stenosis v.2.0: Emergency Department

Executive Summary

Citation Information

Explanation of Evidence Ratings

Summary of Version Changes

Inclusion Criteria
- Infants < 6 months old with progressive nonbilious emesis

Exclusion Criteria
- Concern for sepsis
- Bilious emesis

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Bilious Emesis: Consider bowel obstruction and emergent need for UGI

Evaluation by ED fellow or attending
Assess Volume Status and NPO

Euvolemic / Mildly Dehydrated Infants

Abdominal U/S
Results confirmed by fellow or attending radiologist

Positive ultrasound

- Check electrolytes, glucose
- Consider bilirubin if infant appears jaundiced
- Bolus with NS @ 20ml/kg
- Following bolus – start D5 ½ NS + 20mEqKCl/L @ 150ml/kg/day (add K+ only after urine output established)

Negative Ultrasound

Off Pathway

Moderately / Severely Dehydrated Infants

- Check electrolytes, glucose
- Consider bilirubin if infant appears jaundiced
- Bolus with NS @ 20ml/kg
- Following bolus – start D5 ½ NS + 20mEqKCl/L @ 150ml/kg/day (add K+ only after urine output established)

D_{10} W 5ml/kg

Glucose <60

Glucose >60

If glucose still <60

15 minutes after bolus, recheck glocuse

Abdominal U/S
Results confirmed by fellow or attending radiologist

Negative Ultrasound

Positive Ultrasound

Positive Abdominal U/S
- Surgical consult
- NG tube placement of 10 French Replogle

Admit to Surgery Service

To Inpatient Management

Last Updated: January 2015
Next Expected Revision: July 2017

Pyloric Stenosis v.2.0: Inpatient Management

Preoperative Management

- Continue D5 ½ NS with 20 mEq KCl/L @ 150 ml/kg/day (add K+ only after urine output established)
- If **bicarbonate is GREATER THAN OR EQUAL TO 30 mEq/L, K < 3mEq/L, Cl < 90mEq/L** continue resuscitation and repeat electrolytes in 8 hours
- Consider bilirubin if infant appears jaundiced.

Perioperative Management

- Gastric decompression by anesthesiologist with large bore orogastric tube in OR prior to induction
- **Give pre-op dose of IV Cefazolin** unless allergies exist
- Repair as per surgeon preference (supra-umbilical, RUQ incision, laparoscopic)
- If duodenotomy, NPO x 24 hours advance directly to pyloric feeding regimen

Postoperative Management: ad-lib feeding

- NPO X 4 hours.
- IV + PO fluids: D10 1/2 NS with 20 mEq KCl/L at 100ml/kg/day
- Initiate ad lib bottle feeds of full-strength breast milk or formula 4 hours following pyloromyotomy for pyloric stenosis
- If clinically significant emesis*, wait 2 hours followed by ad lib bottle feeds of full-strength breast milk or formula
- If ad lib feeding fails twice, due to repeat emesis, follow pyloric feeding regimen

Tolerating ad lib feeds

Failed ad lib feeds

Discharge Criteria

- No incision redness or pain
- Temp less than 38 C for last 12 hours
- Pain controlled without IV meds > 4 hours
- Pain score < 3 for 4 hours
- Maintaining hydration orally/enterally
- Tolerates diet without emesis for 4 hours
- Urine output 1ml/kg/h

Postoperative Management: Pyloric feeding regimen

- Start with clears (glucose water or Pedialyte) 30 ml q2h X 2
- Full strength formula or breast milk 30 ml q2h X 2
- Full strength formula 45 ml q2h X 2. May start breast feeding
- Full strength formula ad lib, breast milk, or breast-feeding. Advance as tolerated to ad lib feeds.
- If clinically significant emesis, withhold feeds one cycle and restart at previously

Persistent clinically significant emesis vomiting (half of the estimated volume of previous feeds)

Discharge Instructions

Pyloric Stenosis Care

Off Pathway

Last Updated: January 2015
Next Expected Revision: July 2017

Pyloric Stenosis - ED

Inclusion Criteria:

- Infants < 6 months old with progressive nonbilious emesis

Exclusion Criteria:

- Febrile / Septic appearing
- Bilious emesis

Evaluation by ED Fellow and Attending

Physical Examination

- Negative: No palpable olive
- Non-diagnostic: Difficult examination
- Classic: Palpable olive

Lab Findings

- Hypokalemia, hypochloremia, metabolic alkalosis, paradoxic aciduria, hyperbilirubinemia

Clinical Suspicion by History

- High (2 of 4): Projectile, non-bilious emesis, progressive, persistent
- Low: 1 of 4 or clinical h/o not c/w pyloric stenosis

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Ultrasound

Positive Ultrasound

- Pyloric muscle thickness ≥ 3.5 mm

Pyloric Stenosis Recommendation

Clinical Question: *What anesthesia practices, specifically NG tube placement and perioperative antibiotics, used in infants with pyloric stenosis may result in better outcomes?*

Patients with pyloric stenosis awaiting surgery should have a 10 French Repogle NG tube placed in the ED phase. [✪○○○ Very low quality] (Local consensus opinion)

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Pyloric Stenosis Recommendation

Clinical Question: *What anesthesia practices, specifically NG tube placement and perioperative antibiotics, used in infants with pyloric stenosis may result in better outcomes?*

Antibiotic prophylaxis should be given to patients undergoing surgery for pyloric stenosis. [✪○○○ Very low quality] (Local consensus opinion)

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Pyloric Stenosis - Inpatient

Inclusion Criteria:

- Infants < 6 months old with progressive nonbilious emesis

Exclusion Criteria:

- Febrile / Septic appearing
- Bilious emesis

Pyloric Stenosis Recommendation

Clinical Question: *What preoperative readiness conditions, specifically metabolic alkalosis and hypochloremia, affect surgical outcomes in infants?*

For patients with pyloric stenosis, surgery should be postponed until serum electrolytes meet the following criteria:

- Potassium > 3mEq/L
- Bicarbonate < 30mEq/L
- Chloride > 90mEq/L [○○○○ No evidence] (Local consensus opinion)

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Pyloric Stenosis Recommendation

Clinical Question: *What is the optimal feeding regimen in infants post-op from pyloric stenosis?*

Initiate ad lib bottle feeds of full-strength breast milk or formula 4 hours following pyloromyotomy for pyloric stenosis.

- If clinically significant emesis (≥ half of the estimated volume of previous feed) wait 2 hours followed by ad-lib bottle feeds of full-strength breast milk or formula.

- If ad-lib feeding fails twice, due to repeat clinically significant emesis, follow pyloric feeding regimen.

[✪✪○○ Low quality] (Carpenter, 1999; Obbina, 2007)

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Executive Summary

Objective

To standardize the pre-operative and post-operative care of infants with pyloric stenosis.

Recommendations

1. Initiate ad-lib bottle feeds of full-strength breast milk or formula 4 hours following pyloromyotomy for pyloric stenosis.
    - If clinically significant emesis (≥ half of the estimated volume of previous feed) wait 2 hours followed by ad-lib bottle feeds of full-strength breast milk or formula.
    - If ad-lib feeding fails twice, due to repeat emesis, follow pyloric feeding regimen.
2. Patients with pyloric stenosis awaiting surgery should have a 10 French repogle NG tube placed in the perioperative management phase.
3. For patients with pyloric stenosis, surgery should be postponed until serum electrolytes meet the following criteria:
    - Potassium > 3mEq/L
    - Bicarbonate < 30mEq/L
    - Chloride > 90mEq/L

Rationale

- Safety is anticipated to be improved by the development of the above recommendations aimed at promoting pre-operative and post-operative standardization.
- Quality of care will be improved by reducing variability with standardization, the use of the best available evidence and consensus.
- Delivery of care will be anticipated to be more efficient with the transition to powerplans.
- Engagement is grounded in the fact that the pathway has been developed, reviewed, and vetted by all members of the medical team.
- Patient/Family Satisfaction will be addressed by implementing clinical standard work that will assure the highest quality of care.
- Costs will be monitored and presumed to be more predictable with standardization.

Evidence

The division of general surgery has previously reached and practiced a consensus driven model of the standardized care of infants with pyloric stenosis.

We have supplemented this approach with the querying of evidence to augment the clinical practices of pre-operative readiness, anesthesia practices, and post-operative feeding. A literature search was conducted by our librarian services in attempt to answer these clinical questions with the highest level of evidence. These references were further reviewed and

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their applicability to these questions summarized and documented to inform recommendations. (Please see the Evidence and Recommendations document for specific details.)

Implementation Items

- The development of an algorithm to promote the standardized care of infants with pyloric stenosis.
- The conversion of pre-existing pyloric pre-operative and post-operative order sets to powerplans.
- The development, training and use of a pre-operative readiness checklist (discontinued in February 2015).
- The revision of nursing care guidelines and parent education materials to reflect the new post-operative feeding recommendations.

Metrics Plan

1. Count of inpatient/observed discharges
2. Median length of stay
    a) ED length of stay
    b) Pre-operative length of stay
    c) Post-operative length of stay
3. Percentage of patients with any of the specified orderset (pre-op and post-op)
4. Average charges per case
5. Readmission
6. Percentage of patients started on ad lib feeds post-operatively
7. Percentage of patients on pyloric feeding regimen post-operatively

PDCA Plan

The CSW owner and committee will follow metrics, continue to review medical literature, and make alterations to the pathway as needed.

Revision History

Date Approved: **June 2012**
Next Review Date: **June 2015**

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Executive Summary

Approved by the CSW Pyloric Stenosis Team on 2012

CSW Pyloric Stenosis Team:

Pediatric Surgery, Owner:	Jeffrey Avansino, MD
Emergency Medicine:	Russ Migita, MD
Dietician:	Jennifer Stevens
Anesthesia:	Alan Tingley, MD
Emergency Department CNS:	Elaine Beardsley, RN MN, ED CNS
Surgical Department CNS:	Wendy Murchie, RN MN, CNS

Clinical Effectiveness Team:

Consultant:	Jeff Foti, MD
Project Leader:	Devra Densmore
KM Analyst:	Suzanne Spencer, MBA, MHA
CIS Informatician:	Michael Leu, MD, MS, MHS
CIS Analyst:	Heather Marshall
Librarian:	Susan Klawansky, MLS

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Pyloric Stenosis Citation

Title: Pyloric Stenosis Pathway

Authors:
- Seattle Children's Hospital
- Jeffrey Avansino
- Elaine Beardsley
- Kate Drummond
- Jeffrey Foti
- Michael Leu
- John Meehan
- Russ Migita
- Wendy Murchie

Date: July 2012

Retrieval Website: http://www.seattlechildrens.org/pdf/pyloric-stenosis-pathway.pdf

Example:
Seattle Children's Hospital, Avansino J, Beardsley E, Drummond K, Foti J, Leu MG, Meehan M, Migita R, Murchie W. 2012 July. Pyloric stenosis Pathway. Available from: http://www.seattlechildrens.org/pdf/pyloric-stenosis-pathway.pdf

Evidence Ratings

This pathway was developed through local consensus based on published evidence and expert opinion as part of Clinical Standard Work at Seattle Children's. Pathway teams include representatives from Medical, Subspecialty, and/or Surgical Services, Nursing, Pharmacy, Clinical Effectiveness, and other services as appropriate.

When possible, we used the GRADE method of rating evidence quality. Evidence is first assessed as to whether it is from randomized trial or cohort studies. The rating is then adjusted in the following manner (from: Guyatt G et al. J Clin Epidemiol. 2011;4:383-94.):

Quality ratings are *downgraded* if studies:

- Have serious limitations
- Have inconsistent results
- If evidence does not directly address clinical questions
- If estimates are imprecise OR
- If it is felt that there is substantial publication bias

Quality ratings are *upgraded* if it is felt that:

- The effect size is large
- If studies are designed in a way that confounding would likely underreport the magnitude of the effect OR
- If a dose-response gradient is evident

Guideline – Recommendation is from a published guideline that used methodology deemed acceptable by the team.

Expert Opinion – Our expert opinion is based on available evidence that does not meet GRADE criteria (for example, case-control studies).

Quality of Evidence:

✪✪✪✪ High quality
✪✪✪○ Moderate quality
✪✪○○ Low quality
✪○○○ Very low quality
Guideline
Expert Opinion

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Summary of Version Changes

Version 1.0 (07/26/12: Go live
Version 1.1 (8/13/2014): Changed bicarbonate to greater than or equal to 30; added citation information
Version 2.0 (1/08/2015): Changes to reflect the discontinuation of a pre-operative readiness checklist

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Medical Disclaimer

Medicine is an ever-changing science. As new research and clinical experience broaden our knowledge, changes in treatment and drug therapy are required.

The authors have checked with sources believed to be reliable in their efforts to provide information that is complete and generally in accord with the standards accepted at the time of publication.

However, in view of the possibility of human error or changes in medical sciences, neither the authors nor Seattle Children's Healthcare System nor any other party who has been involved in the preparation or publication of this work warrants that the information contained herein is in every respect accurate or complete, and they are not responsible for any errors or omissions or for the results obtained from the use of such information.

Readers should confirm the information contained herein with other sources and are encouraged to consult with their health care provider before making any health care decision.

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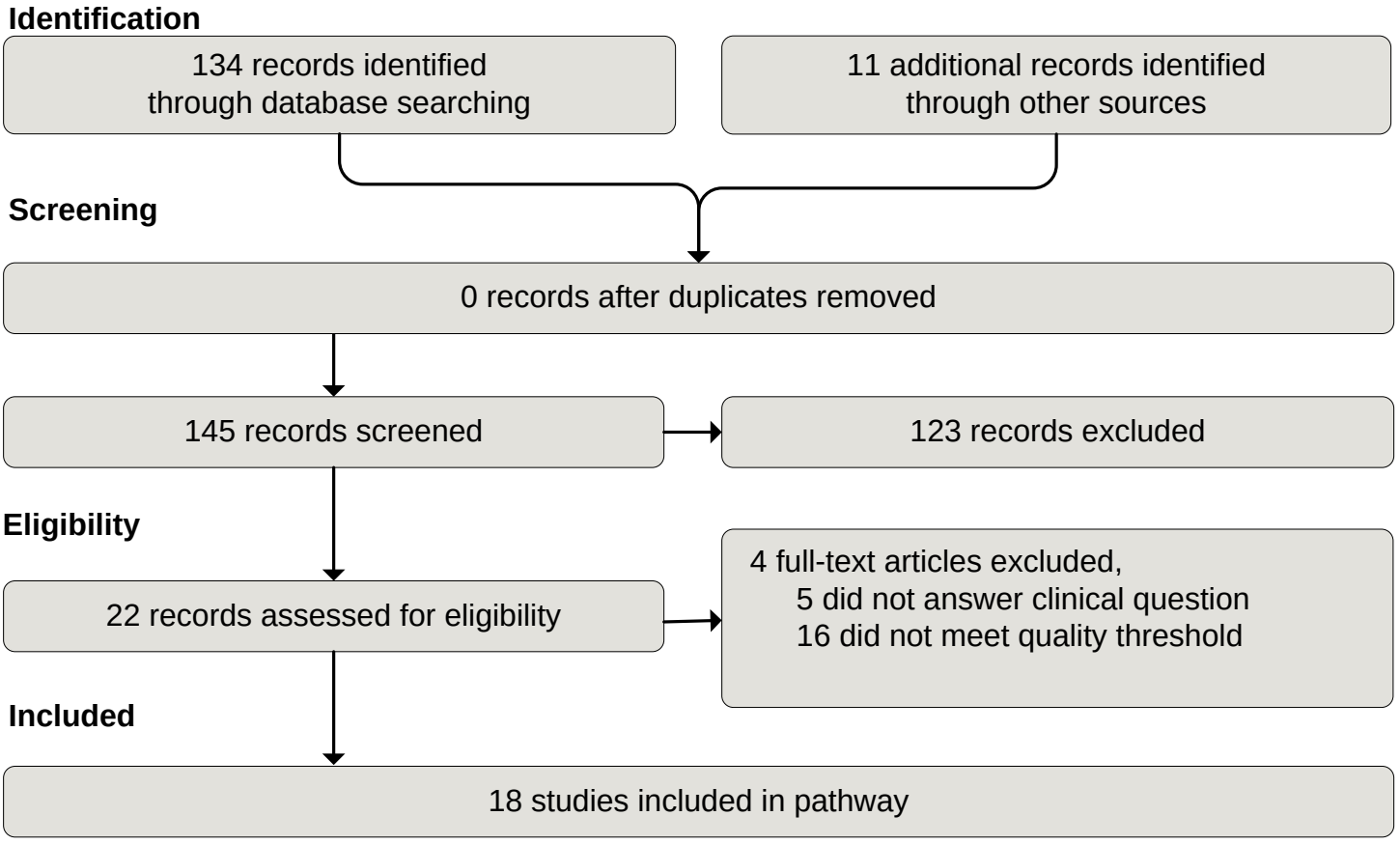
Bibliography

Search Methods, Pyloric Stenosis, Clinical Standard Work

Studies were identified by searching electronic databases using search strategies developed and executed by a medical librarian, Susan Klawansky. Searches were performed in February (on the general topic, high level evidence only, 1996 to date) and April (on specific clinical questions, broader levels of evidence, 2006 [year prior to Cincinnati Children's guideline] to date), 2012. The following databases were searched – on the Ovid platform: Medline, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials; elsewhere – Embase, Clinical Evidence, National Guideline Clearinghouse, TRIP and Cincinnati Children's Evidence-Based Care Guidelines. Retrieval was limited to ages 0 – 2 and English language. In Medline and Embase, appropriate Medical Subject Headings (MeSH) and Emtree headings were used respectively, along with text words, and the search strategy was adapted for other databases using their controlled vocabularies, where available, along with text words. Concepts searched were pyloric stenosis (including hypertrophic) and any of the following: pre- or postoperative care, feeding issues, surgical wound infection, antibiotic prophylaxis, metabolic alkalosis, hypochloremia, water-electrolyte imbalance and anesthesia. All retrieval was further limited to certain evidence categories, such as relevant publication types, Clinical Queries, index terms for study types and other similar limits.

Susan Klawansky, MLS, AHIP
May 16, 2012



Flow diagram adapted from Moher D et al. BMJ 2009;339:bmj.b2535

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