PEDIATRIC GASTROENTEROLOGY

FELLOWS' GUIDE

Stanford Children's Health | Lucile Packard Children's Hospital Stanford
# HOUSESTAFF DIRECTORY

<table>
<thead>
<tr>
<th>WARD TEAMS</th>
<th>INTERN</th>
<th>SENIOR</th>
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<td>Blue Hospitalist</td>
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<td>NFSUP</td>
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<tr>
<td>NICU</td>
<td>Red: 721-9688; Blue: 721-9585</td>
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<tr>
<td>PICN</td>
<td>721-9687</td>
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<td>PICN Hospitalist</td>
<td>721-3639; 721-3703</td>
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<td>PICU</td>
<td>A: 721-9749; B: 721-9595; Fellow A: 721-9748</td>
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<tr>
<td>HEME ONC</td>
<td>721-9574</td>
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<tr>
<td>Well Baby</td>
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## VALLEY (SCVMC)

<table>
<thead>
<tr>
<th>FLOOR</th>
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<tr>
<td>PICU</td>
<td>408-885-5260</td>
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# HOUSESTAFF DIRECTORY

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<tr>
<th>WARDS</th>
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<tr>
<td>1 NORTH</td>
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<td>497-8036</td>
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<tr>
<td>3 EAST (PCU 350)</td>
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<td>3 NORTH (PCU 360)</td>
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<td>3 SOUTH (PCU 380)</td>
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<td>3 WEST (PCU 374)</td>
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<td>BMT</td>
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<td>F2</td>
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<td>L&amp;D</td>
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<td>NICU</td>
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<td>PACU</td>
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<td>PICN 1</td>
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<td>497-8035</td>
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<tr>
<td>PICN 2/ WBN</td>
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<td>SSU</td>
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<td>Scheduling (Irma)</td>
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<td>Authorizations (Wil)</td>
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<td>SUH PEDS ED</td>
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## HOUSESTAFF DIRECTORY

<table>
<thead>
<tr>
<th>LABS (MAIN#S: 7-8613, 7-8614, 5-8243)</th>
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<td>Microbiology</td>
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<td>Mycology</td>
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<td>Send Out</td>
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<td>Virology</td>
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## PHARMACIES

<table>
<thead>
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<tr>
<td>Bass Center</td>
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<tr>
<td>Child Home</td>
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<tr>
<td>Inpatient</td>
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<tr>
<td>Outpatient</td>
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<td>SSU</td>
<td>721-1624</td>
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<td>TPN</td>
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## PROCEDURES

<table>
<thead>
<tr>
<th>Procedure</th>
<th>PHONE</th>
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<tbody>
<tr>
<td>APU</td>
<td>497-8912</td>
<td>721-6506</td>
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<tr>
<td>ECG/ECHO Lab</td>
<td>721-2121, 497-8678</td>
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<tr>
<td>OR Front Desk</td>
<td>723-7251</td>
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<tr>
<td>Peds Anesthesia</td>
<td>723-3176</td>
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<tr>
<td>PFT/EEG Lab</td>
<td>497-8709, 497-8655</td>
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<td>PREOP</td>
<td>497-8700</td>
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<tr>
<td>Vascular Access</td>
<td>47422 (pager)</td>
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# HOUSESTAFF DIRECTORY

## OFFICE/CLINIC

<table>
<thead>
<tr>
<th>Service</th>
<th>Phone</th>
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<tbody>
<tr>
<td>FRONT DESK</td>
<td>723-5070</td>
<td>498-5608</td>
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<td>BACK OFFICE</td>
<td>725-2531</td>
<td>723-4649</td>
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<tr>
<td>DARK SIDE</td>
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<td>724-3106</td>
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<td>RN (OFFICE)</td>
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<tr>
<td>RN (CLINIC)</td>
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<td>721-3822</td>
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<td>PROCEDURE SCH.</td>
<td>498-2669 (OUTPT ONLY)</td>
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<tr>
<td>LIVER OFFICE</td>
<td>725-8771</td>
<td>736-7857</td>
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## MISCELLANEOUS

<table>
<thead>
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<tr>
<td>ADMISSIONING</td>
<td>497-8224</td>
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<tr>
<td>BED CONTROL</td>
<td>725-8877</td>
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<tr>
<td>DICTATION</td>
<td>497-8278</td>
</tr>
<tr>
<td>INFECTION CONTROL</td>
<td>497-8447</td>
</tr>
<tr>
<td>INTERPRETER (@LPCH)</td>
<td>497-8371</td>
</tr>
</tbody>
</table>
| INTERPRETER (PHONE)          | 800-481-3293  
|                               | ACCOUNT# 501019480, PIN#9933 |
| IT SERVICE DESK              | LPCH: 498-7500  
|                               | SUH: 723-3333  
|                               | STANFORD: 725-HELP |
| PAGE OPERATOR                | 723-6661  |
| RONALD MC HOUSE              | 470-6000  |
| SURGICAL PATH                | 723-7211  |
| TRANSFER CENTER              | 723-7342  |
LPCH Fellows Guide

Phone prefixes
If 1, 3, 4, 5 then dial 72x-xxxx
If 6 then dial 73x-xxxx
If 7,8 then dial 49x-xxxx
*67 blocks your number for outgoing calls

Phone calls
1) From the Operator
   a. Ask who the GI attending is for the patient (ask them to call that MD if they are available)
   b. If during rounds, etc – ask if urgent. If not urgent, operator can page you the parent number to call back (the operator will inform the family that you will call them back)
   c. If outside MD, wanting to transfer the patient – try to reroute through the transfer center
2) From the Transfer Center (aka Dispatch)
   a. Calls will come from outside hospitals to Dispatch – sometimes they speak first with the attending, sometimes the call comes first to the fellow
   b. Use this line to contact outside hospitals, MDs, ERs etc if a transfer is at all possible
   c. They will connect you to bed control, figure out insurance, get nursing signout, etc
3) From parents
   a. Create Epic phone encounter (and route to the primary GI)
b. Call the ED to warn them a kid is coming (you can direct care, labs, etc)
c. Key Reasons for admission
   i. Fever with Central Line
      1. All patients must go to ER – local or LPCH
      2. CBCD, CRP, Blood +/- urine culture, Chem, procalcitonin
      3. Please see antibiotics per guideline in the back (check prior resistant bugs, fungal?), if our ED: look in http://www.curbsideup.com/path.asp?pathID=596
   ii. Fever with a transplant
      1. If <3months post transplant, likely admit
      2. If >3months and clear source, consider CBC, LFTs at PMD or local lab and follow closely
      3. If pretransplant (i.e. BA), likely admit re: cholangitis, remember to get glucose, ammonia and coag panel
   4) Foreign Body Calls
      a. Urgency
         i. EMERGENT for all esophageal batteries
         ii. Urgent procedures for esophageal foreign bodies and GI bleeders (severe bleeders need PICU stabilization first!)
            May try to schedule in APU/OR next day...but involve anesthesia early
      iii. Non urgent for foreign body in stomach
      b. Ask ER to repeat Xray if needed
c. Ask NPO STATUS, allergies, recent illness
d. Call OR front desk (given details of case, they create a pre-cert)
e. Call Anesthesia (OR front desk will give you pager)
f. Head to ER to get brief H&P and consent
g. Go to APU to set up tower, get supplies (emergency cart)

Admissions
1) From ER
   a. Tell ER who is the attending, green team, etc
   b. Sign-out to residents
2) Direct admission
   a. From Clinic or Home
      i. Call Bed Control – name, MR, DOB, attending, reason for admission, isolation??
      ii. (Try to dictate your clinic note as an H&P)
      iii. If stable, parent/child walk over to admitting
      iv. Sign-out to Green Team

Outpatient (or Follow-up) Appointments
1) Send Epic message including patient’s name, DOB, provider, urgency etc (the schedulers will contact family to confirm appointment)
   a. For regular open clinic slots- send to: P LPCH MEDICINE SPECIALTIES SCHEDULERS CAD [1170000008]
   b. For overbook slot that requires a room- send to: P LPCH MED SPEC ROOM REQUEST [2100000301];
If URGENT, CC Hope Gumagay, Jessica King, Megan Christofferson, Angelli Carmona

2) Call front desk (to add someone quickly to your clinic afternoon)

SSU – Short Stay Unit (Infusion Center)

1) What they do
   a. Lab draws from PICCs, central lines
   b. Meds – infliximab, pentamidine, cidofovir, alteplase, IVIG, transfusions

2) Calls
   a. OK to start
   b. Asking to place orders
      i. Ask who the attending is...if they are here they can write orders
      ii. Go to APU schedule in Epic and find patient
      iii. Add order set

Procedures

1) Pre-op H&P clinic visit, consent
2) Precertification
   a. Outpatients to Italo
   b. Inpatients case request order in Epic
   c. Remember complete medical history
   d. You will be given day of procedure (never tell patient TIME)
      i. Patients get call ~4pm day before procedure with details of NPO, place/time to arrive
ii. Cleanout instructions (GI nurses can do in clinic or they call family)

3) Pre op Orders (enter night before)
   a. “Pre op Admit (Outpatient)”
      i. Find correct CSN – can look at providers schedule
      ii. Check PIV care, ?Urine preg
   iii. Liver biopsy
      1. If Roux-limb – CIPRO Q12 x24 hours (first dose at start of procedure)
      2. Hold ASA/Dextran/Persantine
      3. If splenomegaly, check plts (give if on ASA or plts<50)
      4. Add Misc Test (write in EBV, CMV qualitative PCR)

4) H&P update (if clinic visit >24hr prior to procedure)

5) Procedure paperwork
   a. Path form (write GOLD, results by next day noon, if weekend write ULTRA for next day results)
   b. EGD/colo form (write down scope, LES, findings)
   c. Liver Bx form (write down pre HR, plt, INR, HCT)
      Needle - 18 G for babies. 16 G for bigger kids.
   d. Discharge Instructions

6) Post op Orders
   a. “Post Op Same Day Surgery”
   b. “Liver Biopsy Post Procedure”
      i. Choose Q 4hr HCT x2

PEG placement notes:
   1) No PEG in patients with prior abdominal surgery
   2) Sizing: little 1-2y/o 18Fr
3) Pre-op and post-op Abx (Ancef)
4) Pre-op labs
5) Admit orders
   a. Open to gravity x 3hrs → Clamp x 4hrs
   b. Pedialyte to full rate → home formula
   c. Tylenol ATC x 24 hours then PRN
<table>
<thead>
<tr>
<th>Extent of disease</th>
<th>Specific disease location- esophagus, stomach, duodenum, jejunum, ileum, right colon, transverse colon, left colon, rectum, perineum</th>
</tr>
</thead>
<tbody>
<tr>
<td>If Crohn’s (Based on Paris classification)</td>
<td>Age at diagnosis, disease above the distal ileum; non-stenosing, non-penetrating; penetrating; or stenosing</td>
</tr>
<tr>
<td>Severity (Physician Global Assessment)</td>
<td>Quiescent, Mild, Moderate, Severe short Pediatric Crohn’s Disease Activity Index (sPCDAI); Pediatric Ulcerative Colitis Activity Index (PUCAI)</td>
</tr>
<tr>
<td>Visit frequency</td>
<td>Recommended every 6month at least</td>
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<tr>
<td>Monitoring with fecal calprotectin</td>
<td>Consider testing periodically, at the time of and after a treatment change</td>
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**Pharmacologic options**

<table>
<thead>
<tr>
<th>Prednisone</th>
<th>Induction of remission</th>
<th>1 mg/kg/d (max 40-60mg/d) For 1-4 weeks then taper off (total time 16 weeks since start)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>▪ Resistance: inadequate improvement after 2-4 wks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Dependence: initially improves but recurs when taper or within 6months after discontinued.</td>
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<tr>
<td>5- ASA</td>
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<tr>
<td>● Mesalamine</td>
<td>Induction</td>
<td>80 (60-100) mg/kg/d (max 4.8g/d)</td>
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<tr>
<td></td>
<td>Maintenance</td>
<td>30 (30-100) mg/kg/d (max 4.8g/d)</td>
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<tr>
<td>Drug</td>
<td>Induction</td>
<td>Maintenance</td>
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<tr>
<td>---------------</td>
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<tr>
<td>Sulfasalazine</td>
<td>70 (50-80) mg/kg/d (max 4g/d)</td>
<td>25 (25-80) mg/kg/d (max 4g/d)</td>
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**Thiopurines (need TPMT genotype/ phenotype prior to start)**

Need monitoring: CBC (BM suppression), ALT (transaminitis) and levels (thiopurine metabolites)

Starting dose base on TPMT labs; maintenance dose base on these dose or levels

- Normal/high TPMT activity
  - Azathioprine 2-3mg/kg/d
  - 6MP 1-1.5 mg/kg/d

- Intermediate activity
  - Azathioprine 1-1.5 mg/kg/d
  - 6MP 0.5-0.75 mg/kg/d

- Absent/ very low activity
  - Do not use

Reduce 6-MP dose by 25% if used w/allopurinol. Allopurinol will decrease metabolism of 6-MP.

**Methotrexate**

Need Folic acid 800-1200mg/d supplement. Monitor for CBC and ALT.

<table>
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<tr>
<th></th>
<th>induction</th>
<th>maintenance</th>
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<tbody>
<tr>
<td>induction</td>
<td>15 mg/m² (max 25mg) Q week (IM/PO/SQ)</td>
<td>10-15 mg/m² (max 15-25mg) Q week (IM/PO/SQ)</td>
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**Infliximab**

Need PPD and/or quantiferon prior to initiation

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<th></th>
<th>Induction</th>
<th>Maintenance</th>
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<tbody>
<tr>
<td>induction</td>
<td>5 mg/kg at 0, 2, 6 weeks (some cases get up to 10mg/kg or shorter interval- depend on severity)</td>
<td>5 mg/kg Q 4-8 weeks. Adjust per symptoms and trough level</td>
</tr>
<tr>
<td>Treatment</td>
<td>Details</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
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</tr>
</tbody>
</table>
| **Recommend:** trough level prior to first maintenance dose (@14wk)  
For poorly respond case: trough and antibody to infliximab  
If lose response prior to next infusion: consider dose adjustment followed by measurement of infliximab trough and antibody  
**The target Infliximab trough level:** 3 to 5 µg/mL at the lower limit & 7 to 10 µg/mL at the upper limit. |
| **Humira** | Need PPD and/or quantiferon prior to initiation  
**induction**  
<40 kg: 80 mg on week 0 followed by 40 mg on week 2  
≥ 40 kg: 160 mg on week 0 followed by 80 mg on week 2  
**maintenance**  
Start on week 4  
<40 kg: 20 mg every other week, if needed dose may be ↑ by Δ weekly dosing  
≥ 40 kg: 40 mg every other week, if needed dose may be ↑ by Δ weekly dosing  
If disease is active: get trough and antibody level  
**The target Humira trough level** is ≥ 6 to 8 µg/mL (to date, an upper limit has not been established) |
Note: Types of 5 ASA

Pentasa – released in small bowel

Asacol, Lialda, sulfazalasine, colazal – released in colon

Note: Rectal meds for distal disease

- Cortifoam 10%: steroids: 1-2times/day x 2-3weeks
- Rowasa (enema), Canasa (suppository): rectal ASA

Post-resection monitoring and treatment:

1. It is recommended that post-operative medical therapy be started or continued in Crohn’s disease patients, particularly those with high risk factors for disease recurrence, including prior resection, presence of colonic and/or extensive disease at the time of resection, penetrating or perforating disease or tobacco usage.

2. Consider monitoring patients with Crohn’s disease who have undergone resection for post-operative assessment of disease activity with ileocolonoscopy beginning at 3-6 months following resection. Other methods of post-resection monitoring may include MR Enterography and fecal calprotectin.
### Nutritional and Growth Assessment

<table>
<thead>
<tr>
<th>Status</th>
<th>Definition</th>
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</thead>
</table>
| **Nutritional status at risk** | Weight percentile changed lower by one isobar *or*  
Weight stable (no gain) or 1% to 9% loss (involuntary)  
Body mass index <10\textsuperscript{th} percentile for age  
(Adjust for prednisone treatment) |
| **Nutritional failure**  | Weight percentile changed lower by two isobars *or*  
Weight loss ≥ 10%  
Body mass index <3\textsuperscript{rd} percentile for age  
(Adjust for prednisone treatment) |
| **Nutritional status satisfactory** | Not at risk or failure                                                                                                           |
| **Growth status at risk** | Height percentile changed lower by one isobar *or*  
Height percentile <10\textsuperscript{th} percentile for age *or*  
Height velocity <10\textsuperscript{th} percentile for age |
| **Growth failure**       | Height percentile changed lower by two isobars *or*  
Height percentile <3\textsuperscript{rd} percentile for age *or*  
Height velocity <3\textsuperscript{rd} percentile for age |
| **Growth satisfactory**  | Not at risk or failure                                                                                                           |
Model IBD Care—a Guideline for Consistent Reliable Care: diagnostic and therapeutic interventions that are appropriate and recommended for a very large percentage of children and adolescents with Crohn’s disease and ulcerative colitis.¹

Complete diagnostic and initial evaluation:

- CBC, ESR, and serum albumin
- Esophagogastroduodenoscopy with biopsy and colonoscopy with biopsy
- Imaging of the small intestine (upper GI and small bowel series; or CT scan with oral and IV contrast; or MRI enterography; or capsule endoscopy). Minimizing or avoiding exposure to ionizing radiation is recommended.
- Consider fecal calprotectin to establish a baseline level
- Other studies as indicated, including stool samples to rule out enteric infection

¹The guidance in this document does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.
Pediatric Acute Liver Failure (PALF)

**Definition:** (1) no known evidence of chronic liver disease, (2) biochemical evidence of acute liver injury (elevated AST/ALT), and (3) hepatic-based coagulopathy defined as INR ≥ 1.5 not corrected by vitamin K with hepatic encephalopathy or INR ≥ 2.0

50% of children with PALF either die or need liver transplant! If listed, highest priority of status 1A.

**Physical exam:** Hepatic encephalopathy grades: I – altered sleep/wake cycle; II – confusion, asterixis; III – unresponsive to verbal, hyperreflexia; IV – coma

**Signs of chronic liver disease:** big spleen, palmar erythema; Big tender liver suggests acute process; small, nodular liver suggests cirrhosis

**Labs:** Need HIV and 2 documented blood types for stat transplant listing
- Glucose, Chem-22, CBC, ammonia, INR, Factors V, VII, VIII before FFP if possible. Factors helpful in distinguishing DIC from ALF.
- V, VII made in liver, VIII made in endothelial cells,
- In DIC ALL will be low, in ALF only V/VII will be low.

**Etiology:** 50% indeterminate, acetaminophen toxicity (14%), metabolic (10%), autoimmune (6%), infectious (6%), drug toxicity (5%), and other (11%)

**Drug history:** acetaminophen level, urine toxicology screen, herbals
• **Tylenol**: one time toxic dose: 250 mg/kg child, 7.5-12 grams adult; chronic use: 150 mg/kg over 2 days
  o NAC protocol for Tylenol: 140 mg/kg load, 17 doses of 70 mg/kg Q4 PO/IV

**Ischemic**: ECHO, US with Doppler for hepatic vein issues

**Metabolic**: older children: ceruloplasmin for Wilson’s, alpha-1 antitrypsin phenotype; younger children: urine succinylacetone for tyrosinemia, ferritin for neonatal hemochromatosis/hemophagocytic lymphohistiocytosis, serum amino acids, urine reducing substances for galactosemia, acylcarnitine profile for fatty acid oxidation defects, lactate/pyruvate ratio for mitochondriopathies

• **Wilson’s disease**: high bilirubin (>20) and mixed direct/indirect due to hemolysis, low alkaline phosphatase and phosphorus due to renal injury from Cu. Dx: Kaiser-Fleisher rings, low ceruloplasmin, high 24 hour Cu urine content

• **Neonatal hemochromatosis**: at least 2nd pregnancy, low glucose and high INR at birth with normal AST/ALT. Dx: high ferritin (>1000), excess Fe in extrahepatic organs (pancreas/heart on MRI or salivary glands on buccal biopsy). Tx: exchange transfusion, IVIG but often need liver transplantation

**Infection**: Hepatitis A/B/C, EBV, CMV, consider herpes/HHV, enterovirus, parvovirus, myco, adeno, TORCH

**Autoimmune**: ANA, anti-smooth muscle antibody, anti-liver kidney microsomal antibody. Tx: 2 mg/kg IV
Management:

**FEN/Renal:** Need access for glucose, blood products, so central line is key. Q2-4 gluoses. Aim for GIR 5-7 mg/kg/min [%D x cc/hr ÷ 6 x wt (kg)]. Watch for Na/ammonia/fluid overload from FFP. Consider CVVH early if urine output dropping off, will help with ICP issues and ammonia.

**Liver/Heme:** Goal to keep INF < 2.5-3.0 to reduce risk of bleeding, FFP dose 10 ml/kg Q4. IV vitamin K for 3 days. Falling enzymes in a child with low glucose of high INR is a sign of liver death and not recovery! NAC shown in adults to help in early ALF for ALL etiologies of ALF, so use it! 150 mg/kg/day IV drip. Often too coagulopathic to perform liver bx safely.

**Neuro:** Watch ammonia and treat with either lactulose (~1 ml/kg/dose up to QID, must stool out to work) or neomycin/rifaximin (400 mg PO Q8). NO benzodiazepines (ativan/versed/Benadryl) because they are metabolized by the liver and they won’t wake up! Use fentanyl/remifentanyl/propofol for sedation. Watch for cerebral edema and consider head CT with big changes in mental status or look for bleeding, edema. Herniation is how most children die.

**ID:** Broad spectrum antibiotics with the first sign of fever.
Pediatric Liver/Intestinal Transplant

Baseline questions for parents: type of tx, underlying diagnosis, sick contacts, viral symptoms, appearance of child, trustworthiness of the family, immunosuppression, presence of spleen, recent hospitalizations.

Fever: ≥ 100.4 or 38 – worry about infection, rejection, drug effect.
- If have central line: needs admission for 48 hour rule out. Draw CBC, CRP, blood culture from each port, chem-23, EBV/CMV PCR. Consider viral DFA, CXR, urine culture, stool studies based on symptoms, age. Tx: broad spectrum antibiotics (Vancomycin, cephalosporin).
- If no central line: ask about sick contacts, viral symptoms, appearance of child, trustworthiness of the family, immunosuppression, presence of spleen, past history of bad infections. When in doubt, send them to the ED for evaluation.

Vomiting/Diarrhea – worry about infection, rejection, obstruction, feeding intolerance.
- If intestinal transplant, likely will need to go to ED because they get into trouble quickly. If has stoma, ask about output and how compares to baseline (normal is 40 cc/kg/day). Draw CBC, CRP, chem-23, EBV/CMV PCR, stool studies (bacterial cx, viral cx, C. diff, cryptosporidium, rotavirus, ova/parasite,
isospora/cyclospora). If has low albumin, send alpha-1 antitrypsin of stool for protein losing enteropathy. Consider AXR/abdominal CT for signs of obstruction. Tx: consider NS bolus, 5% albumin, correcting electrolytes (K, Mg, HCO₃), admission.

- If liver transplant, basic pediatric guidelines for dehydration, but watch immunosuppression levels as they can go either low or high.

**GI/stomal bleeding**

- See GI bleeding sheet for stabilization, if localized stoma bleeding, apply pressure, consider Surgicel, silver nitrate, but call surgery for stitch.

**Hyperkalemia** – seen with tacrolimus toxicity, acidosis, renal insufficiency, spironolactone

- **Level 5-5.9:** stop K in IVF’s/TPN, give NS bolus, EKG, if HCO₃ < 20, give HCO₃
- **Level 6-6.5:** above plus IV lasix 1mg/kg
- **Level ≥ 6.5:** above plus EKG changes (peaked T waves), kayexalate, insulin/glucose, NaHCO₃, calcium gluconate

**Hypertension** – seen with tacrolimus, steroids, volume overload, pain, renal insufficiency

- Lower immunosuppression if tolerated, treat volume overload with diuretics, manage pain
- Amlodipine: > 6 years of age start at 2.5 mg, < 6 years, consult renal
Common medications used in transplant

- **Tacrolimus/cyclosporine** (calcineurin inhibitors CCI): 1\(^{st}\) line maintenance immunosuppression. Side effects: hemolytic anemia, headache, hypertension, tremors, low Mg, high K, high glucose
  - **Cyclosporine** – not used as much. Side effects: same as with tacro + hirsutism. Should be on low dose prednisone if cyclosporine is only immunosuppression.

- **Sirolimus**: used as 2\(^{nd}\) line immunosuppressive agent, has some EBV activity. Side effects: mouth sores, hypertension.

- **Cellcept**: used as 2\(^{nd}\) line immunosuppressive agent. Side effect: diarrhea, abdominal pain, pancytopenia.

- **Valganciclovir**: used as EBV prophylaxis 1\(^{st}\) year out, Qday (15 mg/kg, max 450 mg) for prophylaxis, BID if have + EBV PCR. Side effects: pancytopenia.

- **Septra**: used as PCP prophylaxis 1\(^{st}\) year out. Side effects: may increase LFT’s → may switch to inhaled/IV pentamidine which is Qmonth.

- **Cytogram**: proven to treat CMV but we also use for EBV. 100 mg/kg/dose IV qweek. Side effects: infusion reaction, but don’t need to pre-treat.

- **Antithymocyte globulin**: used in induction when CCI cannot or to treat bad rejection. 1.5 mg/kg/day for 7-14 days. Watch for infusion reaction, pre-treat with Tylenol (10 mg/kg), Benadryl (1 mg/kg), methylprednisolone (2 mg/kg). Side effects: leucopenia (reduce dose by 50% or hold), pancreatitis, increased liver enzymes. Need monitoring panel.
• **Methylprednisolone**: used in induction and rejection. "Recycle" = Day 1: 10 mg/kg up to 1 gram, then each day one dose of 5 mg/kg, 4 mg/kg, 3 mg/kg, 2 mg/kg, 1 mg/kg (hold). Side effects: hypertension, high glucose, mood swings. Give acid blockade and nystatin.

• **OKT3**: for severe steroid resistant rejection. < 30 kg = 2.5 mg IV for 14 days, > 30 kg = 5 mg. Pre-treat with Tylenol (10 mg/kg), Benadryl (1 mg/kg), methylprednisolone (2 mg/kg). First dose in PICU due to anaphylaxis.

---

**Antibiotic choices for cholangitis**

<table>
<thead>
<tr>
<th>Mild</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1st gen Ceph.</td>
<td>Cefazolin</td>
</tr>
<tr>
<td>Pen/β-lactamase inh</td>
<td>Ampicillin/sulbactam</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Mod-Severe</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First options</strong></td>
<td></td>
</tr>
<tr>
<td>Wide spectrum pen/β-lactamase inh</td>
<td>Ampicillin/sulbactam, Piperacillin/tazobactam</td>
</tr>
<tr>
<td>3rd &amp; 4th gen Ceph.</td>
<td>ceftriaxone, ceftazidime, cefepime</td>
</tr>
<tr>
<td>Monobactams</td>
<td>Aztreonam</td>
</tr>
<tr>
<td></td>
<td>One of the above + metronidazole</td>
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</table>

<table>
<thead>
<tr>
<th><strong>Second options</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoroquinolones</td>
<td>Ciprofloxacin, levofloxacin</td>
</tr>
<tr>
<td></td>
<td>One of above + metronidazole</td>
</tr>
<tr>
<td>Carbapenems</td>
<td>Meropenem, imipenem/cilastatin</td>
</tr>
</tbody>
</table>
Pediatric and Adult Intestinal Transplant Protocol  
(June 2012)

I. PRE TRANSPLANT
   A. No donor pretreatment
   B. Draw pre-transplant blood culture (all lumens)
   C. HLA Antibody Screen with T-Cell/B-Cell flow cytometry to be sent at listing then 1 month after blood transfusions if >1yo in pre-transplant patients

II. IMMUNOSUPPRESSION
   A. Induction- Timing of induction agent to be at surgeon’s discretion
      1. Isolated
         CAMPATH 0.4 mg/kg given over 2 hrs (max dose 30 mg) with pre medications:
            i. Solu-Cortef 5mg/kg (max 100mg)
            ii. Tylenol 15 mg/kg (Adults: 500 mg)
            iii. Benadryl 1 mg/kg (Adults: 50 mg)
      2. Combined/Multi-visceral
         Thymoglobulin 1.5-2mg/kg
            i. Solu-Cortef 5mg/kg (max 100mg)
            ii. Tylenol 15mg/kg (Adults: 500mg)
            iii. Benadryl 1mg/kg (Adults: 50mg)
   B. Post-Transplant
      1. Prograf: 0.05 mg/kg IV over 24hrs
         **DESIGNATE 1 LUMEN TO BE USED FOR IV PROGRAF AND REMAIN UNUSED FOR LAB DRAWS THROUGHOUT ADMISSION, ENSURE CLEARLY LABELED FOR NURSING STAFF TO PREVENT FK LEVEL ERRORS**
            a. Start Prograf within 72 hours of the transplant at the surgeons' discretion.
            b. Goal level 12-15 mg/ml
            c. When appropriate, start oral/enteral at 0.2-0.4 mg/kg BID-Adjust to maintain target level 10-12 for 3 month then 8-10 until 1 year post op
      2. FOR ISOLATED ONLY: Prednisone/Solumedrol: 1mg/kg/day (max 20 mg/day)
3. **FOR COMBINED ONLY**: Thymoglobulin 1.5-2mg/kg x 2-3 doses depending on response and patient status
4. Consider starting second agent at three weeks post op if isolated or if episode of rejection within first 3 months of transplant.
5. Please send DSA on POD 1 then yearly/PRN rejection
6. Cylex studies weekly in initial post op period

### III. ANTIBIOTICS/ANTIVIRALS

A. **Zosyn** x 1-2 weeks (If previously infected and treated with Zosyn, use Meropenem)

B. **Anidulafungin**
   1. Peds: 3mg/kg IV one time first dose, then 1.5 mg/kg IV daily.
   2. Adults: 200mg IV first dose, then 100mg qdx14d

C. **Gancyclovir** (DHPG):
   1. Peds: 5 mg/kg q12h until diet advanced, then switch to oral Valgancyclovir 15mg/kg po BID
   2. Adult: DHPG 5mg/kg until diet advanced, then switch to Valgancyclovir 900mg daily
   **Monitor WBCs-may need to be decreased to 450mg daily

D. **Cytogam** (Peds only): First dose within first week; 150 mg/kg/dose weeks 0/ 2/4/6/8 then 100mg/kg/dose weeks 12/16

E. **PCP Prophylaxis**:
   1. Peds: Pentamidine monthly x 2-3 months then transition to Septra 5mg/kg(max 80mg or SS tab) daily Mon/Wed/Fri.
   2. Adults: Septra 1 SS tablet Mon/Wed/Fri

### IV. ANTICOAGULANTS

A. Peds: None

B. Adults: Case by case

### V. GI MEDS/ENTERAL FEEDS

A. Pediatrics:
   1. Protonix 1 mg/kg BID IV; follow gastric pH daily (goal 6-8); start Protonix drip if unable to reach within 24hrs.
   2. Feed initiation:
      a. Pedialyte: start POD 3-evaluate tolerance before advance to formula
b. Pediatric Vivonex x 4wks. Start with dilute strength (1/2 to start).

c. Continue TPN until enteral/oral feeds provide 50% nutritional goal

3. Imodium 0.5-2 mg/ kg/d (capsules added to feed) started once ostomy output 35-50ml/kg/day AND no rejection

B. Adults:
   1. Protonix 40 mg/d IV, or PPI PO
   2. Feed initiation: Tolerex 1/4-1/2 strength x 2 weeks
   3. Imodium – Start with 4mg TID added to feeds once ostomy output >1L/day AND no rejection

VI. SURVEILLANCE

A. Close monitoring of ostomy output-typically 30-50ml/kg/day or 1 liter for adults; increased output concerning for rejection vs infection; if >20ml/kg in 8hrs consider holding feeds, assess fluid status

B. Enteric biopsies SEND ULTRASTAT
   1. 2-3x week x 1st month, 1x week x 2 months then PRN thereafter

C. Stool pH and stool reducing substances daily to monitor absorption

D. EBV-PCR / CMV – PCR q 2 weeks first month, then q month x 1yr

E. Immune function test (Cylex) as needed when concern for infection/rejection

V. REJECTION

A. Mild: Solu-Medrol bolus 10mg/kg (max 1 gm) 1-3 boluses

B. Moderate:
   Solu-Medrol bolus 10 mg/kg (max 1 gm) then,
   Steroid recycle: (max 1gm) 5-4-3-2-1 mg/kg/day and continue this dose until appropriate to wean

C. Severe: Thymoglobulin 2mg/kg/dose x 2-5 doses (Duration to depend upon clinical response)
   1. PreMed with Tylenol/Benadryl and Solu-Cortef
   2. Solu-Cortef dosing:
a. Peds: 5mg/kg(max 100mg) first dose then 3mg/kg(max 75mg) for subsequent doses
b. Adult: 125mg per dose

D. For all grades of rejection:
1. increase Prograf dose (Target level 10-12)
2. re-biopsy at 48 hrs to assess treatment efficacy
3. consider biopsies of the PROXIMAL graft if clinical picture suggests rejection but ileal biopsies are negative
4. for Thymo-resistant rejection, consider REMICADE
   5mg/kg/wk x 4 wks
### INITIATING AND ADVANCING ENTERAL NUTRITION

<table>
<thead>
<tr>
<th>TYPE</th>
<th>AGE</th>
<th>INITIAL INFUSION</th>
<th>ADVANCEMENT</th>
<th>GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous</td>
<td>0-12 mos</td>
<td>1-2 mL/kg/hr</td>
<td>1-2 mL/kg every 2-8 hr</td>
<td>6 mL/kg/hr</td>
</tr>
<tr>
<td></td>
<td>1-6 yrs</td>
<td>1 mL/kg/hr</td>
<td>1 mL/kg every 2-8 hr</td>
<td>4-5 mL/kg/hr</td>
</tr>
<tr>
<td></td>
<td>&gt; 6 yrs</td>
<td>25 mL/hr</td>
<td>25 mL every 2-8 hr</td>
<td>100-150 mL/hr</td>
</tr>
<tr>
<td>Bolus</td>
<td>0-12 mos</td>
<td>10-60 mL/2-3 hr</td>
<td>10-60 mL/feeding</td>
<td>90-180 mL/4-5 hr</td>
</tr>
<tr>
<td></td>
<td>1-6 yrs</td>
<td>30-90 mL/2-3 hr</td>
<td>30-90 mL/feeding</td>
<td>150-300 mL/4-5 hr</td>
</tr>
<tr>
<td></td>
<td>&gt; 6 yrs</td>
<td>60-120 mL/2-3 hr</td>
<td>60-90 mL/feeding</td>
<td>240-480 mL/4-5 hr</td>
</tr>
<tr>
<td>Cyclic</td>
<td>0-12 mos</td>
<td>1-2 mL/kg/hr</td>
<td>1-2 mL/kg/2 hr</td>
<td>60-90 mL/hr 12-18 hr/d</td>
</tr>
<tr>
<td></td>
<td>1-6 yrs</td>
<td>1 mL/kg/hr</td>
<td>1 mL/kg/2 hr</td>
<td>75-125 mL/hr 8-16 hr/d</td>
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<tr>
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<td>&gt; 6 yrs</td>
<td>25 mL/hr</td>
<td>25 mL/kg/2 hr</td>
<td>100-175 mL/hr 8-16 hr/d</td>
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</tbody>
</table>

Adapted from Davis A. Pediatrics. *In Contemporary Nutrition Support Practice*; 1998; Ch 26; 358.

### GROWTH VELOCITY

<table>
<thead>
<tr>
<th>AGE</th>
<th>WEIGHT (g/day)</th>
<th>LENGTH (cm/mo)</th>
</tr>
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<tbody>
<tr>
<td>&lt; 3 mo</td>
<td>25-35</td>
<td>2.6-3.5</td>
</tr>
<tr>
<td>3-6 mo</td>
<td>15-21</td>
<td>1.6-2.5</td>
</tr>
<tr>
<td>6-12 mo</td>
<td>10-13</td>
<td>1.2-1.7</td>
</tr>
<tr>
<td>1-3 yr</td>
<td>4-10</td>
<td>0.7-1.1</td>
</tr>
<tr>
<td>4-6 yr</td>
<td>5-8</td>
<td>0.5-0.8</td>
</tr>
<tr>
<td>7-10 yr</td>
<td>5-12</td>
<td>0.4-0.6</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>CLINICAL CONDITION</th>
<th>CALORIE REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebral Palsy (age 5-11 yrs)</td>
<td>13.9 kcal/cm height with mild to moderate activity</td>
</tr>
<tr>
<td></td>
<td>11.1 kcal/cm height with severe physical restrictions</td>
</tr>
<tr>
<td>Athetoid Cerebral Palsy</td>
<td>Up to 6000 kcal/d (adolescence)</td>
</tr>
<tr>
<td>Down Syndrome</td>
<td></td>
</tr>
<tr>
<td>Boys (age 5-12 yrs)</td>
<td>16.1 kcal/cm height</td>
</tr>
<tr>
<td>Girls (age 5-12 yrs)</td>
<td>14.3 kcal/cm height</td>
</tr>
<tr>
<td>Myelomeningocele (Spina Bifida)</td>
<td>9-11 kcal/cm height for maintenance</td>
</tr>
<tr>
<td></td>
<td>7 kcal/cm for weight loss</td>
</tr>
<tr>
<td></td>
<td>Approximately 50% RDA for age after infancy</td>
</tr>
<tr>
<td>Prader-Willi Syndrome</td>
<td>10-11 kcal/cm height for maintenance</td>
</tr>
<tr>
<td></td>
<td>8.5 kcal/cm height for weight loss</td>
</tr>
</tbody>
</table>

1. Protein requirements – May be met by providing RDA for age
2. Fluid requirements – Attention to fluid needs is crucial in these patients because many do not have, or cannot express, a thirst sensation
3. Formula choice guideline – If weight age is ≤ 10 years, use pediatric formula; if weight age is > 10 years, may use adult formula

CATCH-UP GROWTH REQUIREMENTS

<table>
<thead>
<tr>
<th>Equation</th>
<th>RDA Calories for Age (kcal/kg/d)</th>
<th>Ideal Weight for Height (kg)</th>
<th>Actual Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catch-Up Growth Requirement (kcal/kg/d)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein Requirement (g/kg/d)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Plot the child’s height and weight on the NCHS growth charts
2. Determine the child’s recommended calories per kg for this child’s age
3. Determine the ideal weight (50th percentile) for this child’s height
4. Multiply the value obtained in (2) by the value obtained in (3)
5. Divide the value obtained in (4) by actual weight

For the protein equation, follow the same steps, but in (2), substitute protein for calories

Guidelines for Omegaven for LPCH patients
Updated 6/14

1-Consult Intestinal Rehab/GI- GI fellow on service will do initial consult. If Dr. Kerner, Dr. Castillo or Dr. Berquist is on service, they do consult with the fellow. If another GI attending is on service, Dr. Castillo will work with the GI fellow on service to gather information and present to the Nutrition Support Team rounds (Wed 10-12)

2-Insurance Authorization must have patient’s case manager contact Colleen pg 28058 or office 6-8097 prior to discharge to ensure approval from insurance.

3-Labs  SERUM
Chemistry Panel
Liver Function Panel
CBC w/diff
C-reactive Protein
Essential Fatty Acid Profile
Free Fatty Acids
Lipid Profile/Panel
PT/PTT/INR
Vitamin A level
Retinol Binding Protein
Vitamin E level
Vitamin D level (25-hydroxy-VitD)
Alpha-1-Antitrypsin level and phenotype

URINE
Urine Glucose, Ketones
4-Criteria

INCLUSION CRITERIA:
- TPN dependent
- Must have parenteral nutrition associated liver disease. Other causes of liver disease should be excluded. A liver bx is not needed.
- Direct bilirubin > 3.0 mg/dL.

The patient must have failed standard therapies to prevent the progression of his/her liver disease including:
- Surgical treatment
- Cyclic PN
- Avoiding overfeeding
- Reduction/removal of copper and manganese from PN
- Advancement of enteral feeding
- Use of ursodiol (i.e., Actigall)
- Lipid minimization

EXCLUSION CRITERIA:
- Pregnancy.
- Other causes of chronic liver disease (Hepatitis C, cystic fibrosis, biliary atresia, and alpha-1-antitrypsin deficiency,).
- Signs of advanced liver disease, including cirrhosis on biopsy, varices, ascites.
- The patient is enrolled in any other clinical trial involving an investigational agent (unless approved
by the designated physicians on the multidisciplinary team).

- The parent or guardian or child is unwilling to provide consent or assent.

5-Consent- Attending gastroenterologist who did consult will obtain consent from parents, send one copy to medical records and forward one copy to Colleen for data collection. Available in English and Spanish.

6-Begin Omegaven

ADMINISTRATION

- Begin at 0.5 g/kg/d over 12-24 hrs, for 2 days.
- Increase dose to 1 g/kg/d after 2 days.
- Given through central or peripheral line.
- Compatible to “Y-in” with TPN.
- Consider dose reduction by 25% if hypertriglyceridemia develops (TG > 200, checked 4 hrs after stopping infusion; no confounding reason for TG elevation such as drugs or renal disease).
- If additional fat needed, give enterally. OK to give additional conventional Intralipid® if enteral not tolerate
- Pt will require GI follow up for up to 3 months after stopping Omegaven™.
- Omegaven will be administered over 12-24 hours. If over 24 hours, syringes must be changed out after 12 hours for infection control.
• If patient becomes an inpatient after being home with Omegaven they will use ‘home supply’ for hospital administration.

CONTRAINDICATIONS
• Impaired lipid metabolism
• Severe hemorrhagic disorders
• Unstable diabetes mellitus
• Collapse and shock
• Stroke/Embolism
• Recent cardiac infarction
• Undefined coma status

SIDE EFFECTS
• Prolonged bleeding time
• Inhibition of platelet aggregation
• Fishy taste (rare)
• Hyperglycemia (reduce or stop infusion)
• Otherwise same as Intralipid®

MONITORING LABS (weekly)
• Essential Fatty Acid Profile
• Liver Function Panel
Portosystemic shunts

Types of Biliary Atresia

Most common
Treatment of choledochal cyst according to types:
I, IV: complete removal + roux-en-Y
II: cyst removal
III: only if symptomatic - sphincterotomy
V: supportive, may need transplant

Carol disease

<table>
<thead>
<tr>
<th>PFIC 1</th>
<th>PFIC 2</th>
<th>PFIC 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Functional deficiency</strong></td>
<td>FIC1</td>
<td>BSEP</td>
</tr>
<tr>
<td><strong>Gene mutation</strong></td>
<td>ATP8B1</td>
<td>ABCB11</td>
</tr>
<tr>
<td><strong>Age of onset</strong></td>
<td>Neonatal period</td>
<td>Neonatal period</td>
</tr>
<tr>
<td><strong>Serum GGT</strong></td>
<td>Normal or low</td>
<td>Normal or low</td>
</tr>
<tr>
<td><strong>Expression in others organs</strong></td>
<td>Cholangiocytes, intestine, pancreas</td>
<td>None</td>
</tr>
<tr>
<td><strong>Clinical characteristics</strong></td>
<td>Cirrhosis. BRIC 1</td>
<td>Cirrhosis. BRIC 2</td>
</tr>
<tr>
<td><strong>Extrahepatic features:</strong></td>
<td>Malabsorption, pancreatitis</td>
<td>Bile stones</td>
</tr>
<tr>
<td><strong>Functional defect</strong></td>
<td>Aminophospholipid translocase</td>
<td>Bile acid transport</td>
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<table>
<thead>
<tr>
<th>Disease</th>
<th>Diagnostic workup</th>
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<tbody>
<tr>
<td>Sepsis</td>
<td>*History/Physical and cultures</td>
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<tr>
<td>Neonatal hemochromatosis/ HLH</td>
<td>*Serum ferritin</td>
</tr>
<tr>
<td>TORCHs</td>
<td>*Urine CMV/blood CMV PCR, *HSV PCR, titers</td>
</tr>
<tr>
<td>Inborn Error of Metabolism</td>
<td>*Urine for succinylacetone</td>
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<tr>
<td>Genetic/metabolic</td>
<td>*Urine reducing substance</td>
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<tr>
<td></td>
<td>Newborn screen/ serum amino acids/ urine organic acids/ serum lactate, pyruvate/ acylcarnitine profile</td>
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<tr>
<td>Biliary atresia</td>
<td>Abd US, liver biopsy, cholangiogram</td>
</tr>
<tr>
<td>Choledochal cyst</td>
<td>Abd US</td>
</tr>
<tr>
<td>A1AT deficiency</td>
<td>A1AT level/phenotype (MM- normal, ZZ- high risk)</td>
</tr>
<tr>
<td>UTI</td>
<td>Urine culture</td>
</tr>
<tr>
<td>Alagille syndrome</td>
<td>Echocardiogram (if murmur present), spine film, ophthalmology exam, liver biopsy</td>
</tr>
<tr>
<td>BASD</td>
<td>Total serum bile acids, urine bile acid FAB</td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td>Newborn screen, TSH, total and free T4</td>
</tr>
<tr>
<td>Panhypopituitarism</td>
<td>TSH, total and free T4, early am cortisol, glucose, brain MRI</td>
</tr>
<tr>
<td>Cystic fibrosis</td>
<td>Newborn screen, sweat chloride test</td>
</tr>
</tbody>
</table>

*sick patients

Types of surgery for Hirschprung’s disease
The bold lines in each drawing indicate the retained aganglionic rectum.
(a) End stoma, maturation (inset). (b) Double-barrel stoma. (c) Bishop–Koop: distal stoma with proximal end-to-side anastomosis. (d) Santulli: proximal stoma with side-to-end distal anastomosis. (e) Loop ostomy. (f) End stoma with Hartmann’s closure and rodless end-loop variation (inset).

Table 57.1  Function and types of ileostomy and colostomy

<table>
<thead>
<tr>
<th>Stomas for intestinal diversion and decompression</th>
</tr>
</thead>
<tbody>
<tr>
<td>End ostomy</td>
</tr>
<tr>
<td>Loop ostomy and variants (rodless end-loop stoma)</td>
</tr>
<tr>
<td>Double-barrel ostomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stomas for irrigation and evacuation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appendicostomy</td>
</tr>
<tr>
<td>Catherizable cecal conduit</td>
</tr>
<tr>
<td>Tube cecostomy or sigmoidostomy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stomas for both diversion and irrigation/evacuation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distal venting ileostomy with end-to-side anastomosis (Bishop–Koop)</td>
</tr>
<tr>
<td>Proximal venting ileostomy with side-to-end anastomosis (Santulli)</td>
</tr>
<tr>
<td>Divided descending sigmoid colostomy for high imperforate anus</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Esophageal Atresia</th>
<th>Esophageal Atresia + proximal TE Fistula</th>
<th>Esophageal Atresia + Distal TE Fistula</th>
<th>Esophageal Atresia + Proximal and Distal TE Fistula</th>
<th>TE Fistula without Esophageal Atresia</th>
</tr>
</thead>
<tbody>
<tr>
<td>8%</td>
<td>1%</td>
<td>86%</td>
<td>1%</td>
<td>4%</td>
</tr>
</tbody>
</table>
TPN is a medication with potential for harm if ordered or used incorrectly. This resource should serve as a guide for the initiation and adjustment of TPN. It is not all encompassing and should be used in conjunction with ongoing assessment of the patient’s status and with input from the LPCH Nutrition Support Team.

### LPCH Non-NICU TPN GUIDE

<table>
<thead>
<tr>
<th>Age</th>
<th>Goal Weight Gain</th>
<th>Energy Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3 mo</td>
<td>30 g/day</td>
<td>90-110 kcal/kg/day</td>
</tr>
<tr>
<td>3-6 mo</td>
<td>20 g/day</td>
<td>90-110 kcal/kg/day</td>
</tr>
<tr>
<td>6-12 mo</td>
<td>12 g/day</td>
<td>90-100 kcal/kg/day</td>
</tr>
<tr>
<td>1-6 yr</td>
<td>8 g/day</td>
<td>60-90 kcal/kg/day</td>
</tr>
<tr>
<td>7-10 yr</td>
<td>5-12 g/day</td>
<td>45-70 kcal/kg/day</td>
</tr>
<tr>
<td>11-18 yr</td>
<td>5-12 g/day</td>
<td>30-55 kcal/kg/day</td>
</tr>
</tbody>
</table>

RDs may use sedentary Dietary Reference Index (DRI) for critically ill patients = lower range for kcal

### Daily Carbohydrate Requirement

<table>
<thead>
<tr>
<th>Age</th>
<th>Initial</th>
<th>Advance</th>
<th>Goal (GIR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants (&lt;1 yr)</td>
<td>D10</td>
<td>D 2.5</td>
<td>12 mg/kg/min</td>
</tr>
<tr>
<td>Children (1-10 yrs)</td>
<td>D10</td>
<td>D 2.5-5</td>
<td>8-10 mg/kg/min</td>
</tr>
<tr>
<td>Adolescent (11-18 yrs)</td>
<td>D10</td>
<td>D 2.5-5</td>
<td>5-6 mg/kg/min</td>
</tr>
</tbody>
</table>

*If Dbili elevated >2mg/dL, decrease IL to 1 gm/kg/day
*Lipids should be <60% of daily calories
*Lipids run for same length of time as other TPN components

### Daily Protein Requirement

<table>
<thead>
<tr>
<th>Age</th>
<th>Initial</th>
<th>Advance</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1 yr</td>
<td>1.5 g/kg/d</td>
<td>1 g/kg/d</td>
<td>2-3.0 g/kg/d</td>
</tr>
<tr>
<td>1-10 yrs</td>
<td>1-2 g/kg/d</td>
<td>1 g/kg/d</td>
<td>1.5-3 g/kg/d</td>
</tr>
<tr>
<td>11-18 yrs</td>
<td>1-1.5 g/kg/d</td>
<td>1 g/kg/d</td>
<td>1-2.5 g/kg/d</td>
</tr>
</tbody>
</table>

*Trophamine for patients < 6mo or on long term TPN
*Aminosyn for patients > 6mo

### Electrolytes

<table>
<thead>
<tr>
<th>Electrolyte</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>2-4 mEq/kg/d</td>
</tr>
<tr>
<td>Potassium</td>
<td>2-3 mEq/kg/d</td>
</tr>
<tr>
<td>Chloride</td>
<td>2-4 mEq/kg/d</td>
</tr>
<tr>
<td>Acetate (Bicarb)</td>
<td>1-4 mEq/kg/d</td>
</tr>
<tr>
<td>Phosphate</td>
<td>0.5-2.0 mM/kg/d</td>
</tr>
<tr>
<td>Calcium Gluconate</td>
<td>&lt;6mo: 300-400 mg/kg/d</td>
</tr>
<tr>
<td></td>
<td>6mo-10yrs: 100-200 mg/kg/d</td>
</tr>
<tr>
<td></td>
<td>&gt;10yrs: 50-100 mg/kg/d</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.25-1 mEq/kg/d</td>
</tr>
</tbody>
</table>

*Small adjustments (10-20%) based on labs
*Pt with ileostomy (no colon) will have higher NA and fluid needs

### Daily Lipid Requirement

<table>
<thead>
<tr>
<th>Age</th>
<th>Initial</th>
<th>Advance</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1 yr</td>
<td>1-2 g/kg/d</td>
<td>0.5-1 g/kg/d</td>
<td>3 g/kg/d</td>
</tr>
<tr>
<td>1-10 yrs</td>
<td>1-2 g/kg/d</td>
<td>0.5-1 g/kg/d</td>
<td>1-2 g/kg/d</td>
</tr>
<tr>
<td>11-18 yrs</td>
<td>1 g/kg/d</td>
<td>1 g/kg/d</td>
<td>1-2 g/kg/d</td>
</tr>
</tbody>
</table>

*If Dbili elevated >2mg/dL, decrease IL to 1 gm/kg/day

### Trace Elements
- **Zinc:**
  - Newborn term infant: 250 mcg/kg/day; 3-10 kg: 200 mcg/kg/day
  - Children: 10-40 kg may require less (e.g., 100 mcg/kg/day)
  - Adolescent > 40 kg: 3-5 mg/day
  - Greater zince requirements if high volume stool loss, wounds, or burns
- **Copper:** 20 mcg/kg/day or 10 mcg/kg if cholestasis and monitor serum copper and possibley ceruloplasmin and adjust; adults: 0.3-0.5 mg/d*
- **Selenium:** routine add at 2 mcg/kg/d; in adults add 60 mcg/day*

*ASPEN Novel NUtrient Task Force
**Fluid Goals**

- Based on 4-2-1 rule
  - Note TPN order entry program asks for fluid as ml/kg/day
- TPN order entry allows entry of non TPN fluid volumes (i.e. drips, meds or enteral feeds). If these are entered, the program will take these into consideration to insure patient does not exceed entered fluid goal when making TPN.

**Infusion Time**

- Initially start with 24 hour infusions
- For patients that will be on long term TPN, it can be cycled to run for 12-18 hours
  - Decrease cycle length 2 hours/day for 0-6 yrs and by 4 hrs/day for >6 yrs
  - Ramp up and down infusion rate over 2 hours when using D12.5% or higher
  - Check glucose one hour into maximum rate and one hour after infusion when adjusting cycle lengths
  - When outside of LPCH, cycle length calculator available at [www.peds.stanford.edu](http://www.peds.stanford.edu) under “Links” and “Patient Care Tools”

**Monitoring**

1. Initiate “TPN Monitoring” lab order set in Epic
   - Prior to ordering TPN = CBC, MetC, Mg, Phos, triglyceride, D-bili, GGT, Coags, UA
     - CXR to insure proper placement of central line
     - Do NOT order a Chem 23
   - TPN days 1-4 = Daily renal function panel, Mg, triglyceride, and UA
   - Long Term inpatient monitoring
     - qMonday = CBC, MetC, Mg, PO4, D-bili, GGT, triglyceride
     - qThursday = Renal function panel, magnesium, triglyceride
2. Change in status of patient/care
   - If patient status, medications, or care plan changes with potential impacts to electrolytes or liver function, consider more frequent labs
3. Nutrition Support Service is automatically consulted for patients on TPN. Their notes are in Epic.

**Peripheral Lines**

Maximums: Dextrose D12.5%, Protein 3.5%, Potassium 40 mEq/L, Calcium 3 g/L, Osmolarity 900-950 mOsm

**Long Term TPN Patients**

Attempt to obtain home recipe (from their pharmacy or on their home bag of TPN). If no recipe is available prior to LPCH TPN pharmacy closing for the day, consult with the fellow to determine an appropriate dextrose and electrolyte solution until TPN can be made.

- Please do not change DCW from Home TPN Rx unless this is an intentional adjustment to TPN
- For discharge, do not include feed volume in TPN Rx

TPN is a medication with potential for harm if ordered or used incorrectly. This resource should serve as a guide for the initiation and adjustment of TPN. It is not all encompassing and should be used in conjunction with ongoing assessment of the patient’s status and with input from the LPCH Nutrition Support Team.
TPN is a medication with potential for harm if ordered or used incorrectly. This resource should serve as a guide for the initiation and adjustment of TPN. It is not all encompassing and should be used in conjunction with ongoing assessment of the patient’s status and with input from the LPCH Nutrition Support Team.

### Monitoring for Intestinal Rehabilitation Patients

<table>
<thead>
<tr>
<th></th>
<th>On TPN</th>
<th>On TPN &lt;5 d/wk</th>
<th>&lt;12 mo off TPN</th>
<th>&gt;12 mo off TPN</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBC</td>
<td>3 mo</td>
<td>3 mo</td>
<td>3 mo</td>
<td>6-12 mo</td>
</tr>
<tr>
<td>Chem 23</td>
<td>Q draw</td>
<td>Q draw</td>
<td>Q draw</td>
<td>Q draw</td>
</tr>
<tr>
<td>PT/INR</td>
<td>3 mo</td>
<td>3 mo</td>
<td>3 mo</td>
<td>12 mo</td>
</tr>
<tr>
<td>Fe studies</td>
<td>@3mo then 6 mo</td>
<td>6 mo</td>
<td>6 mo</td>
<td>6-12 mo</td>
</tr>
<tr>
<td>Prealbumin</td>
<td>3 mo</td>
<td>3 mo</td>
<td>3 mo</td>
<td>Prn</td>
</tr>
<tr>
<td>VitA, retinol binding prot</td>
<td>6 mo</td>
<td>6 mo</td>
<td>3 mo</td>
<td>6-12 mo</td>
</tr>
<tr>
<td>Thiamine (WB)</td>
<td>3 mo</td>
<td>3 mo</td>
<td>6-12 mo</td>
<td></td>
</tr>
<tr>
<td>RBC folate</td>
<td>6 mo</td>
<td>6 mo</td>
<td>3 mo</td>
<td>6-12 mo</td>
</tr>
<tr>
<td>Vit B12</td>
<td>6 mo</td>
<td>6 mo</td>
<td>3 mo</td>
<td>12 mo MMA/homocystein</td>
</tr>
<tr>
<td>Vit D25OH</td>
<td>6 mo</td>
<td>6 mo</td>
<td>3 mo</td>
<td>6 mo then 12 mo</td>
</tr>
<tr>
<td>Vit E</td>
<td>6 mo</td>
<td>6 mo</td>
<td>3 mo</td>
<td>6 mo then 12 mo</td>
</tr>
<tr>
<td>CRP</td>
<td>Q draw</td>
<td>Q draw</td>
<td>Q draw</td>
<td>Q draw w/ micronutrients</td>
</tr>
<tr>
<td>Copper</td>
<td>@1mo, 3mo then 6 mo</td>
<td>6 mo</td>
<td>3 mo</td>
<td>6 mo then 12 mo</td>
</tr>
<tr>
<td>Zinc</td>
<td>@1mo, 3mo then 6 mo</td>
<td>6 mo</td>
<td>3 mo</td>
<td>6 mo then 12 mo</td>
</tr>
<tr>
<td>Selenium</td>
<td>@1mo, 3mo then 6 mo</td>
<td>6 mo</td>
<td>3 mo</td>
<td>6 mo then 12 mo</td>
</tr>
<tr>
<td>EFAP</td>
<td>12 mo</td>
<td>6 mo</td>
<td>6 mo</td>
<td>6-12 mo PRn &lt;0.5g/kg/d</td>
</tr>
<tr>
<td>Citrulline</td>
<td>12 mo</td>
<td>12 mo</td>
<td>12 mo</td>
<td>12 mo x1</td>
</tr>
<tr>
<td>Chromium</td>
<td>3 mo</td>
<td>6-12 mo</td>
<td>12 mo</td>
<td>12 mo</td>
</tr>
<tr>
<td>Manganese</td>
<td>3 mo</td>
<td>6-12 mo</td>
<td>12 mo</td>
<td>12 mo</td>
</tr>
<tr>
<td>CXR</td>
<td>12 mo</td>
<td>12 mo</td>
<td>12 mo</td>
<td>12 mo Check line placement</td>
</tr>
<tr>
<td>DEXA</td>
<td>12 mo</td>
<td>12 mo</td>
<td>12 mo</td>
<td>12 mo</td>
</tr>
<tr>
<td>US gallbladder</td>
<td>12 mo</td>
<td>12 mo</td>
<td>12 mo</td>
<td>r/o gallstone</td>
</tr>
</tbody>
</table>
# GI and Transplant Medication Cheat Sheet

## Reflux

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zantac</td>
<td>2-4mg/kg/day divided BID (suspension 15mg/ml)</td>
</tr>
<tr>
<td>Prilosec (omeprazole)</td>
<td>1mg/kg/dose daily or BID (suspension 2mg/ml)</td>
</tr>
<tr>
<td>Prevacid (lansoprazole)</td>
<td>1mg/kg/dose daily or BID (solutab 15mg and 30mg)</td>
</tr>
<tr>
<td>Protonix (pantoprazole)</td>
<td>1-2mg/kg/day IV daily or BID Continuous drip 2mg/kg/day divided over 24hours or 0.1mg/kg/hour</td>
</tr>
<tr>
<td>Nexium (esomeprazole)</td>
<td>&lt;20kg 10mg daily, &gt;20kg 10-20mg daily</td>
</tr>
<tr>
<td>Reglan</td>
<td>0.1-0.2 mg/kg/dose up to QID</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>20mg/kg/day divided TID, low dose 3-5mg/kg/dose TID</td>
</tr>
</tbody>
</table>

## Miscellaneous

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periactin</td>
<td>0.25mg/kg/day divided BID (suspension 2mg/5ml)</td>
</tr>
<tr>
<td></td>
<td>Start with first dose at bedtime, titrate up</td>
</tr>
<tr>
<td></td>
<td>2-6 years 2mg at bedtime, then BID</td>
</tr>
<tr>
<td></td>
<td>7-14 years 4mg at bedtime, then BID</td>
</tr>
<tr>
<td>Loperamide</td>
<td>1-3mg/kg/day (higher doses in short gut) – up to 2 cap TID - QID</td>
</tr>
<tr>
<td>Glutamine</td>
<td>0.4-0.5mg/kg/day divided TID</td>
</tr>
<tr>
<td>Imodium</td>
<td>0.5-2mg/kg/day</td>
</tr>
</tbody>
</table>

## Liver Failure

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Octreotide</td>
<td>1-2mcg/kg/hour gtt (max 50 mcg/hr) or 1 mcg/kg/dose IV/subQ BID</td>
</tr>
<tr>
<td>Rifaximin</td>
<td>10mg/kg/dose bid (up to TID) (max 400 mg/dose) Adults 550 mg PO BID</td>
</tr>
<tr>
<td>Lactulose</td>
<td>1-3ml/kg/day divided BID</td>
</tr>
</tbody>
</table>
### NAC (for Tylenol ingestion)

<table>
<thead>
<tr>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>150mg/kg (max 15gm) IV over 60 minutes</td>
</tr>
<tr>
<td>50mg/kg (max 5gm) IV over 4 hours</td>
</tr>
<tr>
<td>100mg/kg (max 10gm) over 16 hours, cont till normal coags</td>
</tr>
</tbody>
</table>

### Cholestasis

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosage/Dosage Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actigall</td>
<td>10mg/kg/dose PO BID or TID</td>
</tr>
<tr>
<td>Phenobarbital</td>
<td>5mg/kg/day divided BID x 3-5 days before HIDA</td>
</tr>
<tr>
<td>Rifampin (for pruritis)</td>
<td>5 mg/kg/dose BID up to max 10 mg/kg/dose BID (max 300 mg/day or 600 mg/day)</td>
</tr>
<tr>
<td>Cholestyramine</td>
<td>240 mg/kg/day divided TID</td>
</tr>
<tr>
<td></td>
<td>≤ 10 yrs: max 4 gm/day</td>
</tr>
<tr>
<td></td>
<td>&gt; 10 yrs: 8 gm/day</td>
</tr>
<tr>
<td>AquADEK</td>
<td>Vit A 5751 IU, Vit D 400 IU, Vit E 50 IU, Vit K 0.1mg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fat soluble Vitamins in Cholestatic Kids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A</td>
</tr>
<tr>
<td>Vitamin E (Aqua-E or Liqui-E)</td>
</tr>
<tr>
<td>Vitamin D (goal level 30)</td>
</tr>
<tr>
<td>Vitamin K</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
### Endoscopic injection of epinephrine for esophageal varices

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>Dose (mg)</th>
<th>Dilution instruction (0.01mg/ml)</th>
<th>Volume to draw up for ONE dose* (max:5 doses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.001</td>
<td>Add 1 ml of 1:10,000 (=0.1mg/ml) Epinephrine</td>
<td>0.1 ml</td>
</tr>
<tr>
<td>2</td>
<td>0.002</td>
<td></td>
<td>0.2 ml</td>
</tr>
<tr>
<td>3</td>
<td>0.003</td>
<td></td>
<td>0.3 ml</td>
</tr>
<tr>
<td>4</td>
<td>0.004</td>
<td></td>
<td>0.4 ml</td>
</tr>
<tr>
<td>5</td>
<td>0.005</td>
<td></td>
<td>0.5 ml</td>
</tr>
<tr>
<td>6</td>
<td>0.006</td>
<td></td>
<td>0.6 ml</td>
</tr>
<tr>
<td>7</td>
<td>0.007</td>
<td></td>
<td>0.7 ml</td>
</tr>
<tr>
<td>8</td>
<td>0.008</td>
<td></td>
<td>0.8 ml</td>
</tr>
<tr>
<td>9</td>
<td>0.009</td>
<td></td>
<td>0.9 ml</td>
</tr>
<tr>
<td>10</td>
<td>0.01</td>
<td></td>
<td>1 ml</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>Dose (mg)</th>
<th>NO need for dilution</th>
<th>Volume to draw up for ONE dose* (max:5 doses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>0.015</td>
<td>Use 1:10,000 (0.1mg/ml) Epinephrine</td>
<td>0.15 ml</td>
</tr>
<tr>
<td>20</td>
<td>0.02</td>
<td></td>
<td>0.2 ml</td>
</tr>
<tr>
<td>25</td>
<td>0.025</td>
<td></td>
<td>0.25 ml</td>
</tr>
<tr>
<td>30</td>
<td>0.03</td>
<td></td>
<td>0.3 ml</td>
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<tr>
<td>35</td>
<td>0.035</td>
<td></td>
<td>0.35 ml</td>
</tr>
<tr>
<td>40</td>
<td>0.04</td>
<td></td>
<td>0.4 ml</td>
</tr>
<tr>
<td>45</td>
<td>0.045</td>
<td></td>
<td>0.45 ml</td>
</tr>
<tr>
<td>50-100</td>
<td>0.5</td>
<td></td>
<td>0.5 ml</td>
</tr>
</tbody>
</table>

*If volume is <0.5ml, add NS up to 0.5ml before injection

Dose = 0.001 mg/kg/dose
Max total dose - 0.005 mg/kg
**Endoscopic injection of Ethanolamine for esophageal varices**

0.5-1ml per varix

Max dose: >50kg : 20 ml

<50kg : 0.4ml/kg

**Oral antibiotics used (7 to 10 days) to treat small intestinal bacterial overgrowth (SBBO)**

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trimethoprim/sulfamethoxazole</td>
<td>2–10 mg/kg/dose bid</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>10 mg/kg/dose bid</td>
</tr>
<tr>
<td><strong>Broad-spectrum antibiotics</strong></td>
<td></td>
</tr>
<tr>
<td>Amoxicillin-clavulanic acid</td>
<td>15 mg/kg/dose bid</td>
</tr>
<tr>
<td>Rifaximin</td>
<td>10–15 mg/kg/dose bid</td>
</tr>
<tr>
<td><em>Tetracycline</em></td>
<td>10–15 mg/kg/dose tid</td>
</tr>
<tr>
<td><strong>Fluoroquinolones</strong></td>
<td></td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>10–20 mg/kg/dose bid</td>
</tr>
<tr>
<td><strong>Aminoglycoside</strong></td>
<td></td>
</tr>
<tr>
<td>Gentamicin</td>
<td>5 mg/kg/dose bid</td>
</tr>
<tr>
<td>Neomycin</td>
<td>2.5 mg/kg/dose qid</td>
</tr>
</tbody>
</table>

*Recommended for children ≥ 8 years of age*
## Classification and Dosing of Laxatives

<table>
<thead>
<tr>
<th>Laxative</th>
<th>FDA Indication</th>
<th>Pediatric Dosing</th>
<th>Adult Dosing</th>
<th>Mechanism of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psyllium (Metamucil®)</td>
<td>Treatment of occasional constipation</td>
<td><strong>Oral:</strong> Ages 6-11: 1.25-15g daily in divided doses</td>
<td><strong>Oral:</strong> 2.5-30g daily in divided doses</td>
<td>Holds water in stool, mechanical distention stimulates peristalsis</td>
</tr>
<tr>
<td>Methylcellulose (Citrucel®)</td>
<td>Adjunct in treatment of constipation</td>
<td><strong>Oral:</strong> Caplets (500mg): Ages 6-12: 1 caplet up to 6 times/day w/8 oz of water</td>
<td><strong>Oral:</strong> Caplets (500 mg): 2-4 caplets up to 1-3x/day w/8oz of water</td>
<td><strong>Powder:</strong> Ages 6-12: 1 gm in 4 oz water 1-3x/day</td>
</tr>
<tr>
<td>Calcium polycarbophil (FiberCon®)</td>
<td>Treatment of constipation or diarrhea</td>
<td><strong>Oral:</strong> Ages 6-12: 625 mg 1-4x/day</td>
<td><strong>Oral:</strong> 1250 mg 1-4x/day</td>
<td></td>
</tr>
<tr>
<td><strong>HYPEROSMOTIC</strong></td>
<td><strong>Treatment of constipation</strong></td>
<td><strong>Osmotic effect draws water into intestines stimulating peristalsis and/or bowel movement</strong></td>
<td></td>
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<tr>
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<td>-----------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glycerin (Fleet® Suppository)</td>
<td>Treatment of constipation</td>
<td>Rectal (suppository): Age &lt; 6: 1 infant suppository, 1-2x/day as needed Rectal (suppository): 1 adult suppository 1-2x/day as needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lactulose (Kristalose®, Constulose®, Generlac®)</td>
<td>Treatment of chronic constipation</td>
<td>Oral: 1-3 mL/kg/d Oral: 10-20 g/day (15-30 ml) increased to 60 ml/day in 1-2 divided doses if needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polyethylene glycol (Miralax®, Glycolax®)</td>
<td>Treatment of occasional constipation in adults <em>(Unlabeled use in children)</em></td>
<td>Oral: Age &gt; 6 months: 0.5-1.5 g/kg Oral: 17 g dissolved in 4-8 oz beverage daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnesium Citrate (Citroma®)</td>
<td>Evacuation of bowel prior to certain surgical and diagnostic procedures or overdose situations</td>
<td><strong>Oral:</strong> Age &lt; 6: 2-4 ml/kg as single dose Age 6-12: 100-150 ml as single dose</td>
<td><strong>Oral:</strong> 150-300 ml as single dose</td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>Magnesium Hydroxide (Phillips’® Milk of Magnesia)</td>
<td>Short-term treatment of occasional constipation</td>
<td><strong>Oral:</strong> Liquid (400 mg/5 mL): Ages 2-5: 5-15 ml at bedtime or in divided doses Ages 6-11: 15-30 ml at bedtime or in divided doses</td>
<td><strong>Oral:</strong> Liquid (400 mg/5 mL): 30-60 ml at bedtime or in divided doses</td>
<td></td>
</tr>
<tr>
<td><strong>LUBRICANTS</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Mineral oil</td>
<td>Temporary relief of occasional constipation, relief of fecal impaction</td>
<td><strong>Oral:</strong> Ages 1-18: 1-3 mL/kg/day 1-2x/d <strong>Rectal (enema):</strong> Ages 2-11: 30-60 mL once/day</td>
<td><strong>Oral:</strong> 15-45 mL/day <strong>Rectal (enema):</strong> ½ - 1 bottle (66.5 -133 mL) as single dose</td>
<td>Lubricates the intestine and coats and softens stool</td>
</tr>
<tr>
<td><strong>SALINE</strong></td>
<td></td>
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<tr>
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<td>-----------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Sodium Phosphates (Fleet® Enema)</td>
<td>Short-term treatment of constipation and to evacuate the colon for rectal and bowel exams</td>
<td><strong>Rectal:</strong> Ages 2-4: ½ contents of 2.25 oz pediatric enema Ages 5-12: 2.25 oz pediatric enema, may repeat</td>
<td><strong>Rectal:</strong> 4.5 oz enema as single dose, may repeat</td>
<td></td>
</tr>
<tr>
<td>NaCl enema</td>
<td><strong>Neonate</strong> &lt;1kg : 5mL &gt;1 kg : 10 mL Age &gt;1 y/o : 6 mL/kg 1-2x/day</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **EMOLLIENTS** |
|-----------------|------------------------------------------|---------------------------------|-----------------------------------------------|
| Docusate Sodium (Colace®) | Treatment of constipation and constipation care | **Oral:** <3y: 10-40 mg/day 3-6y: 20-60 mg/day 6-12y: 40-120 mg/day **Rectal:** <12y: 100-283mg x1 | **Oral:** 50-300 mg/day **Rectal:** 283mg 1-3x/d Prevents hardening of the stool by adding moisture |


## STIMULANT

<table>
<thead>
<tr>
<th>Drug</th>
<th>Treatment of constipation or used as bowel prep for procedure</th>
<th>Oral: Syrup (8.8 mg/5 mL):</th>
<th>Oral: Tablet (8.6 mg):</th>
<th>Rectal (suppository):</th>
<th>Oral: 10-15 mL (max 30 mL) at bedtime</th>
<th>Rectal: 10 mg/day</th>
<th>Direct action on intestinal mucosa; stimulates contraction of colon muscles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senna (Senokot®)</td>
<td>Special instructions for ages and dosages.</td>
<td>Ages 2-6: ½ - ¾ tsp/day (max ¾ tsp 2x/day)</td>
<td>Ages 2-5: ½ tab/day (max 1 tab 2x/day)</td>
<td>Ages 2-10: 5 mg/day</td>
<td>2 tabs/day, (max 4 tabs 2x/day)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oral: Syrup (8.8 mg/5 mL):</td>
<td>Ages 6-12: 1-1 ½ tsp/day (max 1 ½ tsp 2x/day)</td>
<td>Ages 6-12: 1-2 tabs/day (max 2 tabs 2x/day)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oral: Tablet (8.6 mg):</td>
<td>Ages 3-10: 5 mg/day</td>
<td>Ages 2-10: 5 mg/day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rectal (suppository):</td>
<td>Rectal: 10 mg/day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bisacodyl (Dulcolax®)</td>
<td>Treatment of constipation or used as bowel prep for procedure</td>
<td>Oral: 5-15 mg/day (max 30 mg/day)</td>
<td>Oral: 15-60 mL single dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rectal: 10 mg/day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Castor oil</td>
<td>Treatment of constipation or used as bowel prep for procedure</td>
<td>Oral: 15-60 mL single dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oral: Syrup (8.8 mg/5 mL):</td>
<td>Oral: 10-15 mL (max 30 mL) at bedtime</td>
<td>Direct action on intestinal mucosa; stimulates contraction of small and large intestine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**H. pylori treatment**

duration of triple therapy be 10-14 days. Reliable tests to monitor successful eradication include the 13C-UBT and a monoclonal ELISA for detection of H pylori antigen in stool and should be done 4-8week post treatment.

<table>
<thead>
<tr>
<th>Body weight (kg)</th>
<th>(Es) Omeprazole (mg)</th>
<th>Amoxicillin (mg)</th>
<th>Clarithromycin (mg)</th>
<th>Metronidazole (mg)</th>
<th>Bismuth salts (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;15-25</td>
<td>20-0-10</td>
<td>750-0-750</td>
<td>250-0-250</td>
<td>250-0-250</td>
<td>120-0-60</td>
</tr>
<tr>
<td>&gt;25-35</td>
<td>20-0-20</td>
<td>1000-0-1000</td>
<td>500-0-250</td>
<td>500-0-250</td>
<td>120-0-120</td>
</tr>
<tr>
<td>&gt;35</td>
<td>40-0-20</td>
<td>1500-0-1500</td>
<td>500-0-500</td>
<td>500-0-500</td>
<td>180-0-180</td>
</tr>
<tr>
<td>&gt;45</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>240-0-240</td>
</tr>
</tbody>
</table>

Duration: 10 days
Cases: (1) CLA & MET S or (2) MET R or (3) unknown susceptibility and MET used before: PPI+AMO+CLA
Cases: (1) CLA S & MET S or (2) CLA R or (3) unknown susceptibility and CLA used before: PPI+AMO+MET
Cases: (1) unknown susceptibility and (2) treatment naïve: Quadruple (ST) PPI+AMO+CLA+MET
Cases: (1) Children>14 year-old and (2) CLA R & MET R: PPI+AMO+DOXY 100mg BID or LEVO 500mg BID+BIS

Duration: 14 days
Cases: (1) CLA R & MET R or (2) unknown susceptibility: PPI+AMO+MET
Cases: (1) CLA R & MET R : PPI+AMO+MET+BIS

CLA, clarithromycin; AMO, amoxicillin; MET, metronidazole; PPI, proton pump inhibitor (Es) Omeprazole; BIS, bismuth salts; DOXY, doxycycline; LEVO, levofloxacin

---

**Special situation**

<table>
<thead>
<tr>
<th>Sequential therapy</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; : 5-7 day</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; : 5-7 day</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPI +AMO</td>
<td></td>
<td>PPI+ CLA + metronidazole/tinidazole</td>
</tr>
</tbody>
</table>

Penicillin allergy (not as good)

Quadruple Tx : PPI+MET+BIS+ Tetracycline
PPI + MET + Moxifloxacin/ levofloxacin
Has treatment been sufficient?

Optimize treatment

Alarm signs/symptoms?

Tailor testing for differential diagnosis

Consider hypoallergenic formula for 2-4 wks

Reconsider organic disease

Continue treatment

Algorithm for the evaluation and treatment of infants < 6 months.

Cystic fibrosis
- Resp problem/ FTT
- Celiac disease/ hypothyroidism
- Family hx, growth delay, dev. Delay
- Protein allergy
  - Personal, family history of allergy, eczema
- Anatomic malformations
  - Anal stenosis: ribbons stools tight anal canal
  - Abnormal anal position
- Spinal cord anomalies
  - Weakness in legs, locomotor delay
  - Pilonidal dimple covered by tuft of hair
  - Gluteal cleft deviation
  - Absent anal/ cremasteric reflex
  - Decreased lower ext tone/strength
  - Abnormal deep tendon reflexes of lower extremity

Hirschsprung’s disease
- Onset of symptoms <1mo, passage of meconium >48hr
- Bloody diarrhea, bilious vomiting
- Failure to thrive
- Abdominal distension
- Tight empty rectum in presence of palpable abdominal fecal mass
- Explosive stool/air from rectum upon withdrawal of examining finger
- Sacral teratoma
- Sacral agenesis
- Pseudo obstruction
  - Failure to thrive
  - Abdominal distension and bilious vomiting
  - Urinary bladder distension
  - Prune belly, gastroschisis, Down syndrome
  - Abnormal abdominal musculature
Algorithm for the evaluation and treatment of infants ≥ 6 months of age. ACE = antegrade continence enema.
Presence of other symptoms associated with diarrhea?

- **NO**
  - alb, TG, Chol
  - stool pH, ions, reducing substances
  - Normal labs

- **YES**
  - See Panel B

Abnormal labs

- Fecal pH <5 and +reducing substance
  - Biopsy
  - specific breath test / Molecular analysis
  - lactase def
  - sucrase-isomaltase def
  - Maltase-glucoamylase def
  - Fructose malabsorption
  - Glucose-galactose malabsorption
  - Lymphangiectasia
    - distorted, obstructed lymphatic vessels containing macrophages
  - Hypoalbuminemia
  - fecal Na >145
  - Fecal Cl >90
  - TG <10 Chol<40
  - Biopsy
  - Molecular analysis
    - congenital sodium diarrhea
    - Congenital chloride diarrhea
    - Abetalipoproteinemia /hypolipoproteinemia Chylomicron retention disease

Abnormal

- Steatorrhea
  - Molecular analysis
    - Shwachman-Diamond syndrome
    - Cystic fibrosis

Abnormal

- presence of inflammation
  - Possible secretory diarrhea
  - Enteric anendocrinosis/dysendocrinosis

Normal

- Sweat test, steatocrit
  - normal
  - biopsy
  - absence of enteroendocrine cells
Presence of other symptoms associated with diarrhea?

See panel A

**NO**

- Skeletal abn., recurrent infections, failure to thrive
  - CBC, serum Ig levels, steatocrit, lipase / amylase, skeletal xray
  - Anemia, neutropenia, thrombocytopenia, ↓lipase, ↓amylase, ↑steatocrit, metaphysis anomalies

**YES**

- edema
  - Serum albumin
  - Hypoalbumin
  - Improve after trial with amino acid-based formula
- Nephropathy
  - edema
  - Tubular nephropathy, Fasting hypoglycemia
  - ↓Zn in plasma and urine, anemia
- Organomegaly
- Dermatitis, alopecia, conjunctivitis
  - Zn in urine/plasma, CBC
  - ↓Zn in plasma and urine, anemia
- Failure to thrive, vomiting, enlarged liver/spleen, osteoporosis, spont protein aversion, seizures and coma
  - Ammonemia, aminoacidemia, aminoaciduria
  - ↑Lysine, arginine, orotic acid and ornithine in urine, ↓lysine in plasma, hyperammonemia

**Panel B**

- OSMOTIC DIARRHEA

Molecular analysis

- Shwachman-Diamond synd
- Enterokinase def/ trypsinogen
- Fanconi-Bickel synd
- Acrodermatitis enteropathica
- Lysinuric protein intolerance
Early onset and dependence on total parenteral nutrition

Specific symptoms?
- Dermatitis, diabetes, arthritis, thyroiditis, hematologic disorder, mucus and blood in the stool

Low birth weight, dimorphisms (facial abnormalities), liver cirrhosis

Pruritus, icterus

Serum metabolites of bile acid

SeHCAT, quantification of excreted bile acid

Disorders of intestinal motility

Presence of vomiting, abdominal distension and pain

X-ray, functional study, endoscopy

Biopsy / molecular analysis

Bile acid malabsorption

Pruritus, icterus

↓ Alb, ↓ plt, ↓ FT4, ↓ BUN, ↑ TSH, ↑ Cr, ↓ α1AT

Biopsy / molecular analysis

Disorganization of surface enterocytes with focal crowding resembling tufts

Intestinal epithelial dysplasia (tufting enteropathy)

Biopsy

No inflammation

Syndromic diarrhea

Inflammation autoantibodies

IPEX / autoimmune enteropathy

SECRETORY DIARRHEA
Evaluation of child/adolescent with symptoms suggestive of EoE (otherwise unexplained feeding difficulty, vomiting, dysphagia, hx. of food impaction)

**On PPI treatment?**

- **No**
  - **EGD with biopsies of proximal and distal parts of esophagus**
  - **≥ 15 eos/hpf**
    - Trial of PPI's for 8 weeks (*). Monitor for symptoms
    - **EGD with biopsies on PPIs (independent of symptoms)**
      - **EOE**
        - **≥ 15 eos/hpf**
        - **< 15 eos/hpf**
          - Consider GERD/NERD/PPI-REE or other diagnosis

- **Yes**

(*) PPI trial may be stopped earlier if no improvement occurs in young children and infants with clinically significant symptoms (eg, frequent vomiting and/or feeding refusal with failure to thrive) to avoid delay in making diagnosis and commencing treatment.
Confirmed diagnosis of EoE

Consider allergy history +/- food allergy testing

Discuss therapeutic options (diet and/or steroids)

- Diet
  - Empiric elimination diet
  - Targeted elimination diet
  - Amino acid formula

- Steroids
  - Off-label topical swallowed steroids
  - Rarely - systemic oral steroids
    (see main text)

Monitor for symptoms!
Repeat EGD and biopsies in 4–12 weeks

Follow-up endoscopy
- If symptoms reoccur
- If asymptomatic — consider on individual basis

Poor adherence? Adapt treatment

- No resolution of inflammation
- Resolution of inflammation

Drug titration and/or stepwise food reintroduction
Celiac disease?

Check TTG IgA

Positive

EGD with small bowel biopsy

- Normal
  - Check HLA DQ2 and HLA DQ8
    - Negative: CD unlikely
    - Positive: Possible CD
      - Consider repeat EGD after gluten challenge
      - Consider follow-up EGD in 1–2 yr

- Marsh I/II
  - Confirmed diagnosis of CD
  - Refer to dietitian to start GFD
  - Check for nutritional deficiencies*

- Marsh III

Negative

Check IgA level

Deficient IgA

- Check TTG IgG and deamidated gliadin antibody
  - Positive: Small bowel biopsy
  - Negative: CD unlikely

Normal IgA

- Check HLA DQ2 and HLA DQ8
  - Positive: Small bowel biopsy
  - Negative: CD unlikely
Unresponsive CD?

Verify initial diagnosis of CD was correct

- Review serology and small bowel biopsy pathology (obtained prior to starting GFD)
- Perform HLA typing

Positive

Refer to dietician to rule out continued gluten exposure

Not compliant

- Re-educate regarding GFD
- Assess barriers (ie: financial, depression, anxiety, availability, etc)

Compliant

CD unlikely; consider alternate diagnosis

EGD with small bowel biopsy – send for
- Histology
- Flow cytometry
- TCR δ rearrangement to test for RCD, UJ, EATL

EGD with small bowel aspirate to rule out bacterial overgrowth

If all negative

Trial of pancreatic enzyme supplements

If no change

Consider other diagnoses (ie: fructose intolerance, lactose intolerance, IBS, protein-losing enteropathy, etc)

Colonoscopy with random biopsies to rule out CC and LC

If symptoms improve with enzyme supplement

Pancreatic insufficiency

CC – Collagenous colitis
LC – Lymphocytic colitis
UJ – Ulcerative jejunitis
EATL – Enteropathy associated T-cell lymphoma
TCR – T-cell receptor
Evaluation of cyclic vomiting pattern in children > 2y.


<table>
<thead>
<tr>
<th>Prophylactic or preventive medications* in CVS</th>
</tr>
</thead>
</table>

**Children 5 y or younger**

- **Antihistamines:** cyproheptadine (first choice) and pizotifen (available in UK, Canada)
  - Cyproheptadine $0.25–0.5 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{day}^{-1}$ divided bid or tid
  - Side effects: increased appetite, weight gain, sedation
  - Alternatives: pizotifen (available in UK, Canada)

- **β-Blockers:** propranolol (second choice)
  - Propranolol $0.25–1.0 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{day}^{-1}$, most often $10 \text{ mg}$ bid or tid
  - Monitor: resting heart rate maintain $\geq 60 \text{ bpm}$
  - Side effects: lethargy, reduced exercise intolerance
  - Contraindications: asthma, diabetes, heart disease, depression
  - Discontinuation: tapered for 1–2 wk

**Children older than 5 y**

- **Tricyclic antidepressants:** amitriptyline (first choice)
  - Amitriptyline begin at $0.25–0.5 \text{ mg/kgqhs}$, increase weekly by $5–10 \text{ mg}$, until $1.0–1.5 \text{ mg/kg}$
  - Monitor: $\sqrt[3]{\text{EKG QTc}}$ interval before starting and 10 days after peak dose
  - Side effects: constipation, sedation, arrhythmia, behavioral changes (especially in young children)
  - Alternatives: nortriptyline (available in liquid)

- **β-Blockers:** propranolol (second choice)—see above

**Other agents**

- **Anticonvulsants:** phenobarbital
  - Phenobarbital $2 \text{ mg/kgqhs}$
  - Side effects: sedation, cognitive impairment
  - Alternatives: topiramate, valproic acid, gabapentin, levetiracetam—consult Neurology Dept

**Supplements**

- $L$-carnitine $50–100 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{day}^{-1}$ divided bid or tid (max $1 \text{ g tid}$)
- Coenzyme $Q_{10}$ $10 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{day}^{-1}$ divided bid or tid (max $100 \text{ mg tid}$)
  - Side effects: diarrhea, fishy body odor (for $L$-carnitine)

---

* All medication recommendations are made for off-label use.
Management of Patients with Suspected Ingestion of Radiopaque Foreign Bodies

Suspected radiopaque foreign body ingestion

Radiograph

Object is in esophagus

Endoscopic removal. Consider 24-hour observation, Foley technique, or bougienage in selected patients.

Object is distal to esophagus

Asymptomatic

Removal

Small, blunt object

Day 1: Weekly radiographs (every 3 to 4 days for button batteries); check stool.

Remove if not past pylorus in 3 to 4 weeks (48 hours for button batteries) or if no progress for one week once object is beyond stomach.

Large object

≥ 2 cm to 3 cm (0.79 to 1.18 inches) in children younger than 1 year

≥ 3 cm to 5 cm (1.18 to 1.97 inches) in children older than 1 year

Before duodenal sweep

Weekly radiographs (every 3 to 4 days for button batteries); check stool.

Remove if no progress for one week.

Beyond duodenal sweep

Endoscopic removal

Sharp object

Before duodenal sweep

Before duodenal sweep

Endoscopic removal

Beyond duodenal sweep

Daily radiographs, check stool.

Remove if no progress for 3 days.

Figure 1. Algorithm for management of suspected ingestion of radiopaque foreign bodies.
Fever in this population is an emergency
Patients with intestinal failure, including short gut syndrome, are at increased risk for bacteremia and sepsis. There is increased risk of infection with gram positive skin flora due to indwelling lines and infection with gram negative rods due to translocation from abnormal gut anatomy & small bowel bacterial overgrowth.

**Inclusion Criteria** (all criteria are present)
- GI patient with indwelling central venous catheter (i.e. Broviac, Hickman, port, PICC)
- Fever (≥ 38.0°C [100.4°F] in the past 24 hours)

**Exclusion Criteria**
- Positive blood culture that has not been fully treated

**Population specific information**
- Blood cultures should always be drawn directly from the central line.
- Consider additional intravenous access if aggressive fluid resuscitation is indicated, however, **ANTIBIOTICS SHOULD ALWAYS BE GIVEN THROUGH THE CENTRAL VENOUS CATHETER**.
- Some short gut patients take no significant PO. Because of this, they are at high risk for hypoglycemia and dehydration should their TPN be stopped. Continue to run either their TPN or D10 containing fluids during their typical TPN run-time.
- Keep in mind that many oral medications will not be adequately absorbed in short gut patients and intravenous administration is preferred.

**Fever in short gut patients with a central venous line (<18 years)**

**Contact a pediatric gastroenterologist**

**Inspect all CVCs for integrity as line breaks/cracks are risk factors for infection, then obtain labs.**
- Blood culture from central venous catheter
- Complete metabolic panel, Mg, Phos
- Procalcitonin & CRP
- CBC with differential
- Coagulation panel
- VGB with lactate
**SIRS criteria (≥ 2 criteria, one of which must be abnormal temperature or WBC)**
- Abnormal core temperature >38.5°C (101.3°F) or < 36°C (96.8°F)
  - Rectal, bladder, oral, or central probe
- Tachycardia for age, or if < 1 year, bradycardia
- Tachypnea for age or mechanical ventilation for an acute pulmonary process
- WBC elevated or depressed for age, or > 10 percent bands

**High-risk blood-stream isolates**
- *Enterobacter cloacae* (specifically *cloacae* NOT aerogenes)
- *Citrobacter* species
- *Acinetobacter* species
- *Pseudomonas* species

**Admit to floor**
- Respiratory PCR swab
- Contact/Droplet Isolation
- Defer initiation of antibiotics and monitor vital signs and I/O closely

**Note regarding observation without antibiotics:**
To be observed without antibiotics, the patient must continue to meet ALL of the following criteria:
- Remains non-toxic appearing
- Temperature no higher than 38.5°C (101.3°F)
- No leukocytosis
- Normal procalcitonin (<0.3)
- Potential fever source identified

*Should any of the above criteria NOT be met, pursue usual management with empiric antibiotic therapy.*

**POC blood glucose, start D10 NS at a maintenance rate**

**TPN dependent, but stopped or unavailable?**

**Viral URI AND Tmax < 38.5°C?**

**Meets SIRS criteria?**

**Grown high risk isolate in past 3 months?**
Administer empiric antibiotics via central venous catheter within 1 hour of presentation.

- If NO allergy
  - Ceftriaxone 50 mg/kg/dose IV q24hr (max 1 gm)
  - Vancomycin 15 mg/kg/dose IV q8hr (max 1 gm)

- If cephalosporin allergy
  - Meropenem 20 mg/kg/dose q8hr (max 1 gm)
  - Vancomycin 15 mg/kg/dose IV q8hr (max 1 gm)

Severe sepsis?

- Yes
  - Admit to floor, Green Team
  - Reassessment
    - Adequate response?
      - Yes
      - Admit to ICU
      - No
      - Aggressive resuscitation
        - Obtain further IV access
        - Fluid resuscitation as needed
        - Vasopressors as needed

- No
  - Admit to floor, Green Team
  - 20 mL/kg NS bolus with repeat if needed
  - Reassessment
  - Adequate response?
    - Yes
    - Admit to ICU
    - No
Inpatient management includes:

- Close monitoring for signs if SIRS/Sepsis, including clinical appearance, vital signs, urine output
- Ongoing fluid resuscitation
- Empiric antibiotic therapy administered through the central venous catheter until culture isolate is identified or culture is negative x48h
- Daily blood cultures via central venous catheter
- If any isolate grows on culture, initiate daily ethanol lock therapy x5 days (if appropriate for line type)
- Given the high frequency of antibiotic use in this population, aim toward as narrow, targeted coverage as much as possible to avoid fostering antibiotic resistance.
  - If an isolate grows on culture, antibiotic coverage should be narrowed promptly upon receipt of isolate sensitivities.
  - If a Gram+ isolate grows on culture, narrow antibiotic coverage once mecA testing results is available (before full sensitivities). For *Staph aureus* – convert Vancomycin to Cefazolin immediately if not MRSA.
  - If the patient has an unclear allergy to a cephalosporin, consider allergy & immunology consultation for allergy testing and possible desensitization.
Acute Pancreatitis (<18 years)

**Inclusion Criteria** (all criteria are present)
- Abdominal pain concerning for pancreatitis

**Exclusion Criteria**
- Complex history of abdominal surgery

**Serum Labs:** Amylase, Lipase, complete metabolic panel, GGT, CRP, CBC, Triglyceride.

**Imaging:** Abdominal US. If US concerning for pancreatic complications, consider further imaging with CT or MRI.

Evaluate the following criteria:
- Abdominal pain consistent with acute pancreatitis
- Serum lipase or amylase \( \geq 3 \times \) upper limit of normal
- Characteristic findings of acute pancreatitis on transabdominal ultrasonography, MRI or contrast-enhanced CT if obtained.

Caution patients with pre-existing organ failure: watch for signs of pulmonary edema (tachypnea, hypoxia, increased work of breathing)

2-3 criteria

20 mL/kg bolus 0.9% NS
**Pediatric SIRS Criteria:** ≥ 2 criteria (one of which must be *abnormal temperature* or *leukocyte count*):
- Core Temp >38.5°C or < 36°C
- Tachycardia
- Tachypnea or mechanical ventilation
- Leukocyte count elevated or depressed for age (not secondary to chemotherapy-induced leukopenia) or > 10% immature

**Clinical Signs of Organ Dysfunction:**
- CV: hypotension (less than 5th percentile for age), capillary refill > 5 seconds, oliguria, unexplained metabolic acidosis
- Renal: Cr ≥ 2x upper limit for age or 2-fold increase in baseline
- Hepatic: total bilirubin ≥ 4 mg/dL or ALT 2x upper limit for age
- Heme: platelets < 80,000/mm3 or INR >2

**Evidence of Local Complications of Acute Pancreatitis:**
- Acute peripancreatic fluid collection
- Pancreatic pseudocyst
- Acute necrotic collection
- Walled-off necrosis
- Gastric outlet dysfunction
- Splenic and portal vein thrombosis
- Colonic necrosis

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**Admission for moderate/severe pancreatitis**

**SIRS/Organ Failure/Local Complications?**

**Responsive to initial fluid bolus?**

**Admission for mild pancreatitis**

**Fluids Pathway**

**Yes**

**Analgesia Pathway**

**No**

**Nutrition Pathway** (mild pancreatitis only)

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Yes

No

Yes

No
Fluids Pathway

D5 NS @ 1.5x maintenance, reassessment #1 in 6 hours

Patient evaluation #1 (Fluid responsiveness): any of the following present?
- UOP < 1 mg/kg/hr or 30 mL in older children
- Persistent tachycardia, hypotension, prolonged capillary refill, poor skin turgor

- Yes
  - NS bolus 20 mL/kg x1
  - Yes
  - Patient evaluation #2 (12 hours after eval #1): any of the following present?
    - UOP < 1 mg/kg/hr or 30 mL in older children
    - Persistent tachycardia, hypotension, prolonged capillary refill, poor skin turgor
    - Yes
      - NS bolus 20 mL/kg x1
    - No
      - No

- No
  - Change fluids to 1x maintenance and add potassium
**Analgesia Pathway**

- Acetaminophen PO/IV q6h
- Ibuprofen PO or Ketorolac IV q6h (NSAID should not be added until Cr has normalized and/or there are no signs of AKI)
- Morphine/Dilaudid IV PRN

**Pain well-controlled?**

- Yes
  - Transition to PRN acetaminophen or NSAID
- No
  - Morphine/Dilaudid IV scheduled or PCA
  - Bowel regimen (Miralax or Colace)
  - Consider other causes of pain
    - Local complications
    - Psychosocial causes
    - Other etiologies

**Patient evaluation #3 (12 hours after eval #2):**

- Obtain renal function panel and CBC

*Any of the following present?*

- BUN unchanged or increased from admission
- Hematocrit > 44
- UOP < 1 mg/kg/hr or 30 mL in older children
- Persistent tachycardia, hypotension, prolonged capillary refill, poor skin turgor

**Fluids Pathway (cont)**

- Yes
  - Reassess for SIRS/Organ Failure/Local complications and consider ICU consult if not already in ICU
- No
  - Change fluids to IV + PO = 1x maintenance OR discontinue fluids
**Nutrition Pathway**  
(mild pancreatitis only)

**Goal:** Start enteral nutrition within 48 hours of admission.

**Diet advancement criteria (assess Q6 hours):**
- Desire to eat
- No vomiting
- Positive bowel sounds

Pain should NOT be a reason to limit diet.

**Clear Liquid Diet**

- **Meet advancement criteria?**
  - Yes ➔ Advance to regular, age-appropriate diet, no–fat restriction
  - No ➔ Reassessment

**Reassess advancement criteria**

- Successful ➔ Parenteral nutrition (last resort)
- Successful ➔ Parenteral nutrition (last resort)
- Successful ➔ Parenteral nutrition (last resort)
- Unsuccessful ➔ NG/NJ feeds (start with clears – pedialyte)

**Address the following and reassess advancement criteria:**
- Pain: is it well controlled?
- Nausea: consider Zofran scheduled or PRN
- Local complications: has disease progressed/worsened?
- Etiology: have you treated the underlying cause?
### Potential etiologies of pediatric pancreatitis

#### Biliary/Obstructive Factors
- Gallstones
- Biliary Sludge
- Pancreas divisum
- Choledochal cyst
- Sphincter of Oddi dysfunction
- Annular pancreas

#### Medications
- L-Aspariginase
- Steroids
- Valproic Acid
- 6-MP/Azathioprine
- Mesalamine
- TMP-SMX
- Furosemide
- Tacrolimus

#### Systemic Disease
- Sepsis
- Shock
- Inflammatory Bowel Disease
- Hemolytic Uremic Syndrome
- Henoch-Schönlein Purpura

#### Trauma
- Blunt Injury
- ERCP

#### Infection
- Mumps
- Measles
- Coxsackie
- Echo
- Iota
- Influenza
- Epstein-Barr virus
- Mycoplasma
- Salmonella
- Other Gram-Negative bacteria

#### Metabolic Diseases
- DKA
- Hyperlipoproteinemia
- Inborn Errors of Metabolism
- Hypercalcemia

#### Idiopathic

#### Autoimmune

#### Genetic (CFTR, SPINK1, PRSS1, and CTRC mutations)
**Fecal Microbiota Transplant (FMT)**

**What is the purpose of FMT?**
To treat disease and restore the normal gut microbiota via administration of fecal material from a healthy donor

**Indications for FMT**
- Recurrent or relapsing *C. Difficile* Infection (CDI)
- Moderate CDI with no response to standard therapy for at least 1 week
- Severe (even fulminant) CDI with no response to standard therapy for 48 hours

**Pre-Transplant**
- Begin PPI 72-hours prior to scheduled transplant and continue for 1 dose after completed transplant
- Stop antibiotics 72-hours prior to transplant
- One dose of Immodium (1-2mg) is given at the start and at the end of the transplant
- Patient may remain on probiotics
- Patient can receive water only for 4 hours preceding transplant if receiving nutrition via PO or NG/GT & can receive water for only 2 hours preceding transplant if receiving nutrition via G-tube

**Post-Transplant**
- Avoid giving antibiotics for 6 weeks following transplant
- Stool will be rechecked for C.diff & Qual Real Time PCR 6 weeks after transplant
Administration Routes—Colonoscopy, NG/GT, or GJ

Preparing FMT

• Material may be stored locally for up to 6 months in a standard -20°C laboratory freezer or up to 12 months in a -80°C laboratory freezer.

• Thaw prior to administration using one of the following:
  o 1 hour in a warm water bath
  o 4 hours at room temperature
  o 16 hours in a refrigerator (preferred method)

• Once thawed, the material is ready for immediate administration. After thawing, material may remain at room temperature for up to 4 hours (or refrigerated/on ice for up to 8 hours).

• Samples should never be re-frozen. If thawed and not used within 8 hours, the material should be disposed of, as freeze thaw cycles may compromise viability.
190 series GI Tower Set-up Guide

1. Connect scope - White dot up (New Scopes) – Use Pigtail (Old Scopes)
2. Do Power up sequence – takes 1.6 min
   A. Turn Cart **Main Power** On – green when ON
   B. Turn **Processor** On
   C. Turn **Light Source** On
   D. Turn **nStream Computer** (blue light when on) On
   E. Turn **Printer** ON

**NStream Set-up**
- Use keyboard labeled - NStream –Port B

1. Log on – ID (lpchapu) and Password (lpchapu*)
2. Click “Capture”
3. Choose “Register New Patient”
4. Enter Patient info.
   a. First and Last Name
   b. MRN
   c. Gender
   d. DOB
   e. MD
   f. Procedure
5. Click “Register Now”
Live Screen Set-up
- Use keyboard labeled – Port A

1. Press Display Button at lower right hand side of the monitor to display Port buttons
2. Press “Port A” on the monitor for Live Image
3. To start on a new patient Press the button on the top right of the keyboard the picture that looks like a book with arrow
4. Press “Add Data” button found on the top left hand side of the keyboard
5. Enter Patient info. – MRN, Last and First, DOB, MD using the second keyboard to view on the Live Image – Press “Enter” in between entering each line item. Use the “Arrow buttons”
6. White Balance
7. Test Scope – Air/Water/Suction – READY to start

To PRINT

1. Press “Port B” when ready to PRINT – not automatic. Delete unwanted images (uncheck the check mark by the image or click the trash bin) before printing
2. Click “PRINT”
3. Number of pictures per page – defaulted to 2x4
4. Number of Prints – defaulted to 2
5. Click “PRINT”
6. Click “Finish” – it can be press while still printing
7. **Click SAVE!!!**
8. Do you want to Archive? – **Click SAVE!!!**

**Power Off Sequence:**

A. Turn Off **nStream Computer**
B. Turn Off **Printer**
C. Turn Off **Main Power** - wait for the nStream Computer to shut down completely before turning off the main power

**Note:**

**Port A** – Live Image – to see the actual image  
**Port B** – nStream

**Functions:**

1. Patient Profile
2. Video access – manually turn on and off per MD’s request
3. Print
4. Edit pictures
5. Change number of prints and sizes
6. Access previous cases in Library