Disclaimer

- Information is for educational purposes only
- The alternative view presented has not been established as standard care or practice
- Clinical trials have not yet been conducted
- Not to be taken as specific medical advice
- All medical decisions regarding your child’s health issues should be discussed with your health care provider
SIBO- What is it?

- SIBO: Small Intestinal Bacterial Overgrowth
- “Abnormally large numbers of bacteria present in the small intestine, leading to impairment of digestion and absorption”.
- Dr. Mark Pimentel of Cedars-Sinai: A New IBS Solution
- Should be called “Small Gut Dyskinesia Syndrome”
IBS can be SIBO

- 60% of IBS (Irritable Bowel Syndrome) can be due to SIBO
- 15% of the population have IBS
- Over 27 million people have SIBO
- The patients diagnosed may not be treated properly in a step-by-step fashion
Bacteria found in SIBO patients:

- **Hydrogen Bacteria:** E. Coli, Klebsiella, Proteus, Aeromonas
  - Produces Hydrogen gas; Diarrhea

- **Methane Archaea:** Methaneobrevibacteria smithii
  - Converts Hydrogen to Methane; Constipation-stops segmental contractions of gut→ slows gut movements by 60%. More methane→ worse constipation with hard, dry stools; Uses 4 Hydrogen to feed methane organism

- **Hydrogen Sulfide:** Proetobacteria-Desulfovibrio piger/ species
  - Uses 5 H to produce H2S
  - Tends to diarrhea
  - May be associated w/ UC/ ASD children
  - Egg/ Sulphur smelling breath or flatus
SIBO Causes

- Most common way is a prior Food Poisoning incident.
  - More likely to develop IBS following food poisoning if susceptible.
- The bacterial infection can cause antibodies that attack the intestinal lining
  - Bacteria produce Cytolethal Distending Toxin (CDT)b
  - Body produces antibodies against CDT
  - CDT Abs auto-immune attack against Vinculin in ICC cells: “cytoskeletal protein”
  - Damage/Reduction to/of Interstitial Cells of Cajal (ICC): interrupts normal neural control of GI contractions
- Muscle + Nerve damage=
  - Lack of MMC (Migrating Motor Complex)
  - SIBO
  - Lack of Disaccharidase absorption
    - (Disaccharides: sucrose, lactose, maltose)
SIBO: Causes

- SIBO gasses consume vitamin B12, iron, magnesium & other nutrients
- Destroys flavonoids; hydrogenates polyunsaturated oils, promotes systemic inflammation, produces nitrosamines.
  - Malabsorption, Inflammation, Leaky gut(50%), Gas production
- This will cause a disruption in the neuronal control of Gastrointestinal contractions which will slow down the intestines.
- This will allow bacterial to accumulate and even cause yeast overgrowth.
- Biofilms may develop around organisms
SIBO Pathophysiology II

SI Bacterial Overgrowth

Bacterial Growth

Hydrogen, Methane Gas

GI Sx’s: Bloating, Constipation/Diarrhea, Pain

Fermentation of Unabsorbed Carbohydrate

↓ Disaccharidases
- Carb Transporters, Blunted Villi, Increased Crypt Depth, Intestinal Permeability

Bacterial Actions

Glycosidase & Protease

Bile Deconjugation

↑ Inflammatory cytokines

Vit A, D, E, Ω 3 deficiency

→ Steatorrhea

Damage the Brush Border

Systemic Sx’s

Dr. Allison Siebecker
Pathophysiology of SIBO

- Cause: Slowing of Migrating Motor Complex (MMC)
  - MMC empties stomach and movement through gut
- Interstitial Cells of Cajal
- Vinculin
- Colonic Peristalsis
Migrating Motor Complex

- Begins in stomach
- Proximal stomach to pylorus
- Pacemaker nerve cells regulate contractile activity of peristaltic waves:
  - Proximal, middle to terminal antrum
  - Opening of pylorus valve
  - Inhibition of duodenal contractions \(\rightarrow\) chyme emptied into duodenum
- Acetylcholine opens calcium channels to initiate smooth muscle cells (Acetyl-l-carnitine is precursor)
Migrating Motor Complex

- **Small Intestine**
  - Duodenal peristaltic waves occur more frequently than stomach waves:
  - 3-4 waves for one stomach wave.
  - Pacemaker cells initiate slow intestinal waves: longer waves going faster proximal intestine and shorter waves going slower at the distal gut.
Eating and MMC

- Begins 90 minutes after eating
- Turned OFF during eating: DO NOT GRAZE
  - Kicks in ~ two hours after eating
- Eat three meals at least 4-5 hours apart
- Do a long fast from dinner to breakfast
  - Cleansing Wave: Waves from stomach through small intestine
- During night: 3-4 waves so have clean SI when waking
- MMC 68% SLOWER in SIBO patients
Microbiota and MMC

- Bacteria can affect MMC
  - Release of bacterial substances/end-products of fermentation
  - Intestinal neuroendocrine factors
  - Indirectly through effects of mediators released by gut immune response

- Bacterial components
  - Promote Motility: SCFA and deconjugated bile salts
  - Interfere with Motility: Nitric oxide production, toxic gasses

- [http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3093005/](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3093005/)
Interstitial Cells of Cajal

- Intestinal intrinsic cell-pacemaker
  - Found in esophagus, stomach, Small intestine, Large intestine, pancreas, upper urinary tract, urethra, myometrium, myocardium, uterus, Fallopian tube, human placenta
  - Stimulates slow wave causing contraction of smooth muscle in gut.
  - Forms networks in submucosa, intra-mucosa and inter-muscular layers of gut
  - Drives spontaneous rhythmic motility - they are electrically coupled to smooth muscle

- ICC Pacemaker
  - 3 per minute in stomach
  - 12 per minute in duodenum
  - 10 per minute in ileum
  - 3 per minute in colon
Vinculin

- Cytoskeletal protein-Protein on ICC: found at junctions between cells and extracellular matrix
  - Helps anchor protein called “F-actin”, which helps muscles contract
  - Helps control cell’s motility
  - Helps fight off pathogenic bacteria

- Loss of vinculin:
  - Prevents cell adhesion and spreading
  - Reduced stress fiber formation
  - Fewer focal adhesions
  - Slows gut movement
  - Muscles cannot contract.
Vinculin

http://www.thno.org/v01/p0154/thnov01p0154g03.jpg
SIBO damage to microvilli

- Epithelial lining inflammation
  - Anaerobes: endotoxin formation, direct adherence cause injury
  - Aerobes: enzymes and metabolic products cause injury
- Blunting of villi
- Increase in inflammatory cytokines/mediators
- Reduced intestinal absorptive area
- Decreases in enterocyte disaccharidase and brush-border hydrolase activity.
- Development of intestinal permeability
- [http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2852716/](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2852716/)
- Next Slides:
Microvilli of Intestines

INTESTINAL EPITHELIAL CELL

- Microvilli
- Nucleus
- Mitochondrion
- Nerve
- Artery
- Vein
- Lymph vessel

INTESTINAL VILLI

- Mucosa
- Submucosa
- Muscularis

NORMAL SMALL INTESTINE

- enterocytes
- villi
- crypts

Base of intestinal lining
Blunting of Villi

http://photos1.blogger.com/blogger2/3301/4292/1600/Villous%20blunting%20and%20crypt%20hyperplasia.0.jpg

http://www.thefooddoc.com/yahoo_site_admin1/assets/images/celiacendophotoatrophy.39181311_large.jpg
Inhibitors of MMC

- Gastrin/CCK—eating
- Psychological stress
- Atropine, Epinephrine
- Gastroparesis
- Hydrochloric Acid and Achlorhydria
- Nitric Oxide
- Morphine/Opiates
- A mixed meal
- Pathogenic bacterial toxins
SIBO: how do you know if you have it?

- More than 60% of people with IBS (Irritable Bowel Syndrome) have SIBO.
- Patient reports Gastrointestinal symptoms are temporarily alleviated after taking Antibiotics.
- Probiotics & fiber make Gastrointestinal symptoms are worse.
- Celiac patient that is not better on GF diet.
- Candida symptoms - not better after treatment.
- PPI can cause IBS - more eructation symptoms.
- Chronic constipation after opiates.
- Low Ferritin/ Iron without any other known cause (suspect H. pylori).
Symptoms of SIBO

- Bloating, abdominal gas, eructations, flatulence
- Upper gut gas worse after eating
- Start day out with flat abdomen and progressively distends out, looks “pregnant” by end of day
- Gas that can’t be passed
- Diarrhea (Hydrogen) or constipation (Methane) or alternating
Testing for SIBO

- Comprehensive Stool Analysis- GI Effects Genova Diagnostics
  - Identifies any overgrowth of bacteria, yeast
  - Identifies any malabsorption, low bile acids, low pancreatic enzymes
  - Identifies quantities of good bacteria and diversity of bacteria

- SIBO breath test- Aero Diagnostics
  - Identifies which kind of bacteria is present
    - Hydrogen
    - Methane
BACTERIAL OVERGROWTH REPORT SHEET 10 TUBE KIT

Patient Name: McCracken, Sylvie
Date of Birth: [Redacted]
Physician: [Redacted]
Address: [Redacted]
Date Specimen Collected: 3/19/2014
Date Received: 3/25/2014
Date Reported: 3/25/2014

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<th>ppm CH₄</th>
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SUMMARY OF 2 HOUR RESULTS:

Peak Hydrogen Production: 3 ppm  Normal <20 ppm
Peak Methane Production: 35 ppm  Normal <20 ppm
Peak Combined H₂ and CH₄ Production: 38 ppm  Normal <20 ppm

BASED ON THIS STUDY BACTERIAL OVERGROWTH IS SUSPECTED.*
Treatment Options

- Prescription Antibiotics
  - Anti-candida if needed
- Antimicrobial Herbs
- Diet
- Prokinetics
Rifaximin (Xifaximin)

- Used to treat both Hydrogen and Methane + SIBO
  - May need to be combined with other prescriptives
- Does not affect Colonic microbiome too much
- Not water soluble
- Can increase Bifido bacteria and enhances Short Chain Fatty Acids
- Can be safely used for Pediatrics
- Typically prescribed for 14 days, then SIBO breath test retested 5-10 days later
- If bacteria not clear, will have to repeat another course before moving onto the next phase.
Botanicals: Antimicrobial herbs

- Berberine Complex by Integrative Therapeutics
- Neem Plus by Ayush herbs
- Allimed drops
- Typical course is 30 days, retest SIBO breath test 5-10 days later.
Diet to heal the gut

Specific Carbohydrate Diet

- Grain-free, starchy veggie free, lower fiber
- Clover honey (monosaccharide okay, allows high fermentable veggies/fruit
- Main Avoidances:
  - Disaccharides, Oligosaccharides: FOS (fructo), GOS (Galacto), MOS (mannan), Polysaccharides: Starch/fiber—soluble and insoluble, Polyols—Sugar alcohols
- Allison Siebecker on SIBOINFO.com
SCD: 5 Phases to heal the gut

Intro diet 2-3 days: no raw fruits or veggies, no nuts/seeds/ beans; Add in Bone Broth; Typical veggie: Carrots (peeled and cooked); Fruits: grape juice, apple cider; Sweeteners: honey, pure stevia, glucose/dextrose;

- **Phase 1 x 1 week**: Protein powders: Pea, rice, whey, egg; Veggies: carrot, acorn squash, buttercup squash, butternut squash, Spinach, zucchini; Fruits: grape & apple cider, pear sauce, apple sauce; Homemade milks only!

- **Phase 2 for 2-4 weeks w/o arising any sx with good bowel habits**: add in nuts; veggies: garlic, asparagus, green beans, mushrooms, pumpkins, artichoke, cucumber; Fruits: peach, pineapple, plum, tomato, apricot

- **Phase 3-for 2-4 weeks**: adding in more veggies; Can add in Quinoa & Flax

- **Phase 4 for 1-3 weeks- for a few weeks**: adding in more foods

- **Phase 5 for 1-3 weeks- education on good fats, websites on how to go forward w/ diet**: Pecan bread; cookbooks

- Then live off legal/ illegal food lists.

- Symptoms might return if go off the SCD diet if there are issues w/ MMC-will have to stay on Prokinetics.

- Gut can heal within 1 month. If Villi damage, may take 3-6 months to heal.
Prokinetics

- Low Dose Naltrexone
  - endorphin receptor blocker
  - Modulates the immune system

- Iberogast
  - 5 HT4 agonist & 5 HT3 antagonist
  - Iberis amara, Angelica, Chamomile, Caraway Fruit, St. Mary’s Thistle, Balm Leaves, Peppermint Leaves, Celandine, and Liquorice Root.
    - Iberis amara: It increases the tone of smooth gastro-intestinal muscles and accelerates gastro-intestinal peristalsis.
  - Can be used in combinations

- 5-HTP
  - Stimulates Colonic migrating motor complex
Other supplements

- Probiotics - repopulate microbiome
- Acetyl-L-Carnitine - heal nerves
- Hericium Erinaceus (Lion’s Mane) - Mushroom - heal nerves
- Alpha Lipoic Acid - heal nerves
- Digestive and pancreatic enzymes - improve absorption
- L-Glutamine - heal gut lining
- Biofilm Defense
  - Lactoferrin - prevents formation
  - Disodium EDTA - disrupts biofilm
  - Curcumin
How can we prevent SIBO?

- Ensure proper Gastric Acidity and Digestive enzymes
- Ensure proper function of liver for Bile acids which help to digest fats
- Maintain Healthy microbiota with probiotics, fiber
- Healthy intestinal lining
- Keep a healthy immune system
- Maintain healthy Small intestine motility