

Gastroparesis in Children							
Definition	Gastric motility disorder characterized by delayed gastric emptying (GE) in the absence of mechanical obstruction (liquid GE is often preserved)						
Prevalence	<ul style="list-style-type: none"> ▪ No data available on prevalence of gastroparesis in children ▪ M = F in 1 large retrospective study 						
Causes	<p>Idiopathic 70%</p> <p>Drug-induced 18%</p> <ul style="list-style-type: none"> - Common drugs causing gastroparesis: α-2 adrenergic agonists, TCA, PPI, antacids, H2 receptor agonists, sucralfate, octreotide, β-adrenergic agonists, calcium channel blockers and diphenhydramine <p>Post-surgical 12.5%</p> <ul style="list-style-type: none"> - Common surgeries causing gastroparesis: Upper GI surgery and heart/lung transplantation <p>Post-viral 5%</p> <ul style="list-style-type: none"> - Common viruses causing gastroparesis: Rotavirus, EBV and CMV - Usually self-limited and resolves within 24 months <p>Diabetic 4%</p>						
Comorbidities	<p>Common comorbidities including seizure disorders, CP, DD, prematurity as well as behavioral problems such as ADHD, anxiety, and bipolar disorder</p> <p>GERD is a COMMON complication of gastroparesis.</p>						
Clinical	<ul style="list-style-type: none"> ▪ Vomiting 68% ▪ Abdominal pain 51% ▪ Nausea 28% ▪ Weight loss 27% ▪ Early satiety 25% ▪ Postprandial fullness 7% <div style="border: 1px solid black; padding: 5px; margin-left: 20px;"> <p><i>Correlation between the severity of symptoms and the degree of delayed GE is poorly defined.</i></p> </div>						
DDx	Esophagitis/gastritis, peptic ulcer disease, SIBO, intestinal obstruction, functional dyspepsia, cyclical vomiting syndrome, rumination syndrome and medications (e.g., anti-neoplastic medications)						
Investigations	<p>Initial investigation: Upper gastrointestinal contrast study or upper GI scope to rule out mechanical obstruction</p> <p>Subsequent investigation: GE scintigraphy (gold standard) or breath test to confirm delayed GE</p> <ul style="list-style-type: none"> - Breath test's advantage is that it does not exposure the patient to radiation, but it can be inaccurate in patients with specific conditions such as celiac disease and liver cirrhosis. <p>Other methods that measure GE time: Transabdominal ultrasonography, MRI and antroduodenal manometry</p>						
Treatment	<table border="0" style="width: 100%;"> <tr> <td style="vertical-align: top; width: 15%;">General</td> <td> <ul style="list-style-type: none"> ▪ Treatment of underlying disease ▪ Correction of fluid and electrolyte imbalances ▪ Alleviation of symptoms ▪ Optimizing nutritional status ▪ Hospitalization for severe symptoms (e.g., intractable vomiting) </td> </tr> <tr> <td style="vertical-align: top;">Diet & lifestyle changes</td> <td> <ul style="list-style-type: none"> ▪ Small-volume and frequent meals with low content in fat and non-digestible fibers ▪ Avoidance of carbonated beverages and lying down for 1-2 h following meals ▪ Referral to a RD ▪ In severe/persistent cases: <ul style="list-style-type: none"> ○ Strict liquid diet ○ Enteral nutrition via naso-jejunal tube or jejunostomy ○ TPN – if enteral nutrition fails </td> </tr> <tr> <td style="vertical-align: top;">Meds</td> <td> <p>Prokinetics:</p> <p>(1) <u>Metoclopramide:</u></p> <ul style="list-style-type: none"> - Dopamine antagonist, central antiemetic and peripheral prokinetic effects, side-effects (galactorrhea, extrapyramidal symptoms) <p>(2) <u>Domperidone:</u></p> <ul style="list-style-type: none"> - Dopamine antagonist, peripheral prokinetic effect - does not cross the BBB, side effects (galactorrhea, prolonged QTc) <p>(3) <u>Erythromycin:</u></p> <ul style="list-style-type: none"> - Subtherapeutic dose (less than Abx dose) for its prokinetic agent, side-effects (pyloric stenosis in neonates, risk of prolonged QTc unclear) </td> </tr> </table>	General	<ul style="list-style-type: none"> ▪ Treatment of underlying disease ▪ Correction of fluid and electrolyte imbalances ▪ Alleviation of symptoms ▪ Optimizing nutritional status ▪ Hospitalization for severe symptoms (e.g., intractable vomiting) 	Diet & lifestyle changes	<ul style="list-style-type: none"> ▪ Small-volume and frequent meals with low content in fat and non-digestible fibers ▪ Avoidance of carbonated beverages and lying down for 1-2 h following meals ▪ Referral to a RD ▪ In severe/persistent cases: <ul style="list-style-type: none"> ○ Strict liquid diet ○ Enteral nutrition via naso-jejunal tube or jejunostomy ○ TPN – if enteral nutrition fails 	Meds	<p>Prokinetics:</p> <p>(1) <u>Metoclopramide:</u></p> <ul style="list-style-type: none"> - Dopamine antagonist, central antiemetic and peripheral prokinetic effects, side-effects (galactorrhea, extrapyramidal symptoms) <p>(2) <u>Domperidone:</u></p> <ul style="list-style-type: none"> - Dopamine antagonist, peripheral prokinetic effect - does not cross the BBB, side effects (galactorrhea, prolonged QTc) <p>(3) <u>Erythromycin:</u></p> <ul style="list-style-type: none"> - Subtherapeutic dose (less than Abx dose) for its prokinetic agent, side-effects (pyloric stenosis in neonates, risk of prolonged QTc unclear)
General	<ul style="list-style-type: none"> ▪ Treatment of underlying disease ▪ Correction of fluid and electrolyte imbalances ▪ Alleviation of symptoms ▪ Optimizing nutritional status ▪ Hospitalization for severe symptoms (e.g., intractable vomiting) 						
Diet & lifestyle changes	<ul style="list-style-type: none"> ▪ Small-volume and frequent meals with low content in fat and non-digestible fibers ▪ Avoidance of carbonated beverages and lying down for 1-2 h following meals ▪ Referral to a RD ▪ In severe/persistent cases: <ul style="list-style-type: none"> ○ Strict liquid diet ○ Enteral nutrition via naso-jejunal tube or jejunostomy ○ TPN – if enteral nutrition fails 						
Meds	<p>Prokinetics:</p> <p>(1) <u>Metoclopramide:</u></p> <ul style="list-style-type: none"> - Dopamine antagonist, central antiemetic and peripheral prokinetic effects, side-effects (galactorrhea, extrapyramidal symptoms) <p>(2) <u>Domperidone:</u></p> <ul style="list-style-type: none"> - Dopamine antagonist, peripheral prokinetic effect - does not cross the BBB, side effects (galactorrhea, prolonged QTc) <p>(3) <u>Erythromycin:</u></p> <ul style="list-style-type: none"> - Subtherapeutic dose (less than Abx dose) for its prokinetic agent, side-effects (pyloric stenosis in neonates, risk of prolonged QTc unclear) 						

		<p>(4) Cisapride: - Serotonin 5-HT4 receptor agonist and parasympathomimetic, side-effect (prolonged QTc)</p> <p>(5) Prucalopride: Serotonin 5-HT4 receptor agonist, side-effects (headache, GI symptoms such as abdominal pain, diarrhea, N/V)</p> <p>Antiemetics: Phenothiazines (e.g., prochlorperazine), 5-HT3 antagonists (e.g., ondasetron), dopamine antagonists (e.g., metoclopramide), histamine H1 antagonists (e.g., diphenhydramine), and benzodiazepines (e.g., lorazepam)</p> <p>PPI: Lansoprazole, omeprazole, esomeprazole, and pantoprazole to address associated GERD</p>
	Botox injection	<ul style="list-style-type: none"> ▪ Botulinum toxin type A ▪ Endoscopically injected into the pylorus ▪ Blocks the release of acetylcholine from cholinergic nerve endings and as a result promotes GE ▪ Occasionally used in children with refractory gastroparesis
	Gastric stimulator	<ul style="list-style-type: none"> ▪ Laparoscopic implantation of two electrodes into the seromuscular layer of the stomach connected to a pacemaker ▪ Long-term efficacy and safety to be established
	Surgery	<p>Gastrostomy tube insertion:</p> <ul style="list-style-type: none"> ▪ To facilitate gastric ventilation and symptomatic relief ▪ To place a jejunostomy tube for nutrition ▪ Reserved for refractory cases that fail medical treatment
Stepwise approach in the diagnosis and treatment of gastroparesis	<pre> graph TD A["Baseline assessment of the patient (detailed medical history, thorough physical examination)"] --> No identifiable cause of the symptoms B["Exclusion of mechanical obstruction (esophagogastroduodenoscopy, upper gastrointestinal barium series)"] B --> No pathology identified C["Assesment of gastric emptying time (scintigraphy, breath testing)"] C --> Gastroparesis confirmed D["Medical treatment (dietary modifications, prokinetics, anti-emetics)"] D --> Symptoms unremitting despite appropriate modification of the initial approach E["Botulinum toxin injection or Surgical treatment (jejunostomy, gastric electrical stimulator)"] E --> F["Total parenteral nutrition in the extreme case where all the above fail"] </pre>	
References	<p>(1) Efstratios Saliakellis, Maria Fotoulaki; Gastroparesis in children, Annals of Gastroenterology (2013) 26, 204-211</p> <p>(2) Parkman HP, Hasler WL, Fisher RS. American Gastroenterological Association technical review on the diagnosis and treatment of gastroparesis. Gastroenterology 2004;127:1592-1622</p> <p>(3) Tougas G, Eaker EY, Abell TL, et al. Assessment of gastric emptying using a low fat meal: establishment of international control values. Am J Gastroenterol 2000;95:1456-1462</p>	