بسم الله الرحمـٰن الرحيم

{وَإِذَا مَرِضْتُ فَهُوَ يَشْفِينِ}

GIS PBL Clinical | FINAL 3

Pediatrics

Written by : Noor Saif

Pediatric Chronic Diarrhea and Malabsorption

Salam Alkayed
Pediatric Gastroenterology fellow

Learning Objectives

- Define chronic diarrhea and malabsorption in pediatric patients
- Learn how to Develop a differential diagnosis based on age and presentation
- Recognize key features of pediatric celiac disease
- Understand the pathophysiology of malabsorption
- Apply clinical reasoning to pediatric cases

Starting our session with a pediatric case, to see how understanding the pathophysiology of malabsorption & chronic diarrhea will affect our clinical duties

Pediatric Case Discussion

- A 4-year-old boy presents with chronic loose stools for 6 months
- His Parents report abdominal distension, irritability, and poor weight gain
- Symptoms began after transition to a wheat-rich diet
- Physical exam showed: pallor, muscle wasting, decreased growth velocity
- How can basic science guide the diagnosis? Most likely it's celiac disease

Clinical Reasoning from Basic Knowledge

- Chronic diarrhea suggests prolonged intestinal dysfunction
- Failure to thrive indicates impaired nutrient absorption
- Iron deficiency anemia may explain the pallor
- (pallor: unusual paleness of skin)
- Temporal relationship with gluten exposure suggests celiac disease
- Combining physiology and history narrows the differential diagnosis

Definition of Chronic Diarrhea in Children

- **Definition of chronic diarrhea:** Diarrhea lasting longer than 2–4 weeks
- **Characteristics of diarrhea:** Characterized by increased stool frequency, liquidity, or volume. **having AT LEAST one of these (not necessarily all) can indicate diarrhea**
- May affect growth, hydration, and nutrition
- Etiology varies by age group and nutritional status

Definition of Malabsorption

- Defective digestion or absorption of nutrients
- Can involve fats, carbohydrates, proteins, vitamins, or minerals
- Results in poor growth and nutritional deficiencies
- Common pediatric manifestations include steatorrhea and failure to thrive
- **Steatorrhea: Presence of fat in the stool**
- **Failure to thrive: weight is below normal in the growth chart**

Classification of Chronic Diarrhea

- Osmotic diarrhea: improves with fasting

Let the patient be NPO (nothing by mouth, or in Latin: nil per os) and see if the patient's chronic diarrhea is improving or not, if it does; osmotic diarrhea.

- If it's not osmotic, it's Secretory diarrhea: persists during fasting
- If neither, it's Inflammatory diarrhea: blood/mucus and systemic symptoms
- Or Malabsorptive diarrhea: bulky, greasy stools with poor growth

Differential Diagnosis of Pediatric Chronic Diarrhea

- Infectious: Giardia, chronic enteric infections
- Malabsorptive: celiac disease, lactose intolerance, cystic fibrosis
- Inflammatory: inflammatory bowel disease
- Functional: toddler's diarrhea
- Immune and congenital enteropathies

Differential Diagnosis of Pediatric Malabsorption

- Mucosal disease: celiac disease like in the case of our session
- Pancreatic insufficiency: cystic fibrosis
- Disaccharidase deficiency: lactose intolerance
- Bile acid disorders and cholestatic liver disease
- Short bowel syndrome and lymphatic disorders

Approach to the Pediatric Patient

- Assess growth charts carefully

Assessment of the child's growth by plotting his circumflex length and weight according to his age

- Evaluate stool characteristics and dietary history

Analyze stool to evaluate characteristics & look for WBC or RBC in the stool

- Look for extraintestinal manifestations
- Family history may reveal autoimmune disease. We should take a detailed family history, like in the case of celiac which can involve family history, or inflammatory bowel disease.
- Consider age-specific causes of diarrhea especially toddlers' diarrhea because can be caused by what they eat or drink

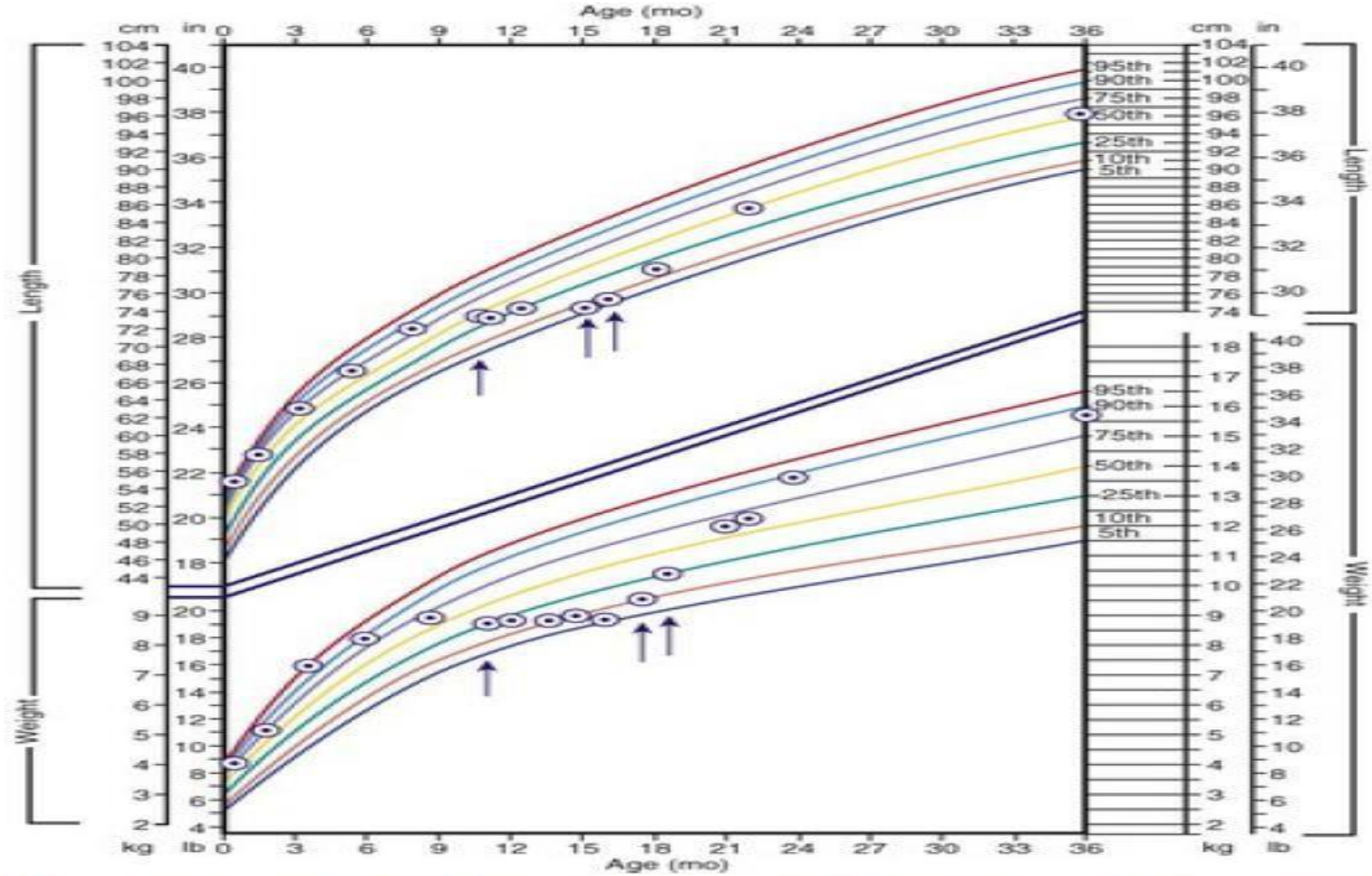
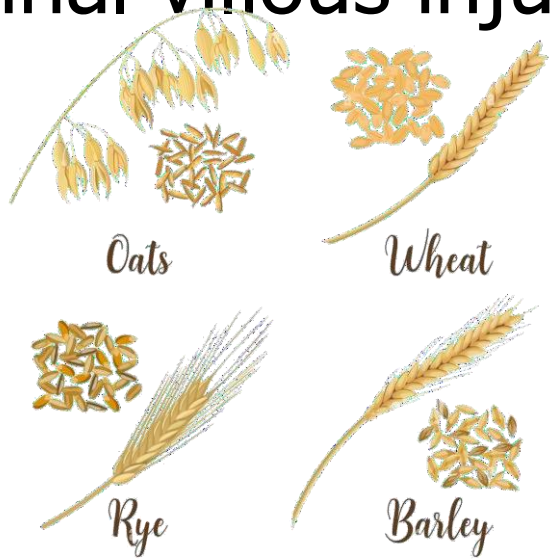


FIG. 364.3 Gluten-sensitive enteropathy. Growth curve demonstrates initial normal growth from 0 to 9 mo, followed by onset of poor appetite with intermittent vomiting and diarrhea after initiation of gluten-containing diet *(single arrow)* . After biopsy conformed diagnosis and treatment with gluten-free diet *(double arrow)* , growth improves.

- In the previous slide we can see the growth chart, we plot his age according to his weight.
- Ideally, the patient should stick to a single line (centile) during his growth. If the patient is crossing centiles, then the patient is having an issue called failure to thrive. *centiles are the colored curves seen on the graph.
- One of the differential diagnoses of failure to thrive is malabsorption or celiac disease.
- On the previous chart we can see the kid was growing normally then at 6 months of age he started to have decrease in weight, why? Because he started to eat food instead of breast or formula milk.
- So, when the patient starts to eat food containing wheat, oat, rye the celiac disease manifestations will start to show

Introduction to Pediatric Celiac Disease

- Immune-mediated enteropathy triggered by gluten
- Occurs in genetically susceptible children
- Gluten is found in wheat, barley, and rye, Oats
- Leads to small intestinal villous injury and malabsorption



Epidemiology

- Prevalence approximately 1% worldwide
- Can present after gluten introduction in infancy or childhood
- Associated with HLA-DQ2 and HLA-DQ8 (genetically susceptible patients)
- Higher prevalence in type 1 diabetes and Down syndrome

So, type 1 Diabetes Mellitus patients should be screened for celiac because they have higher probability to have celiac. As well as patients with down syndrome, even if they are asymptomatic, they should be screened regularly in regular follow ups

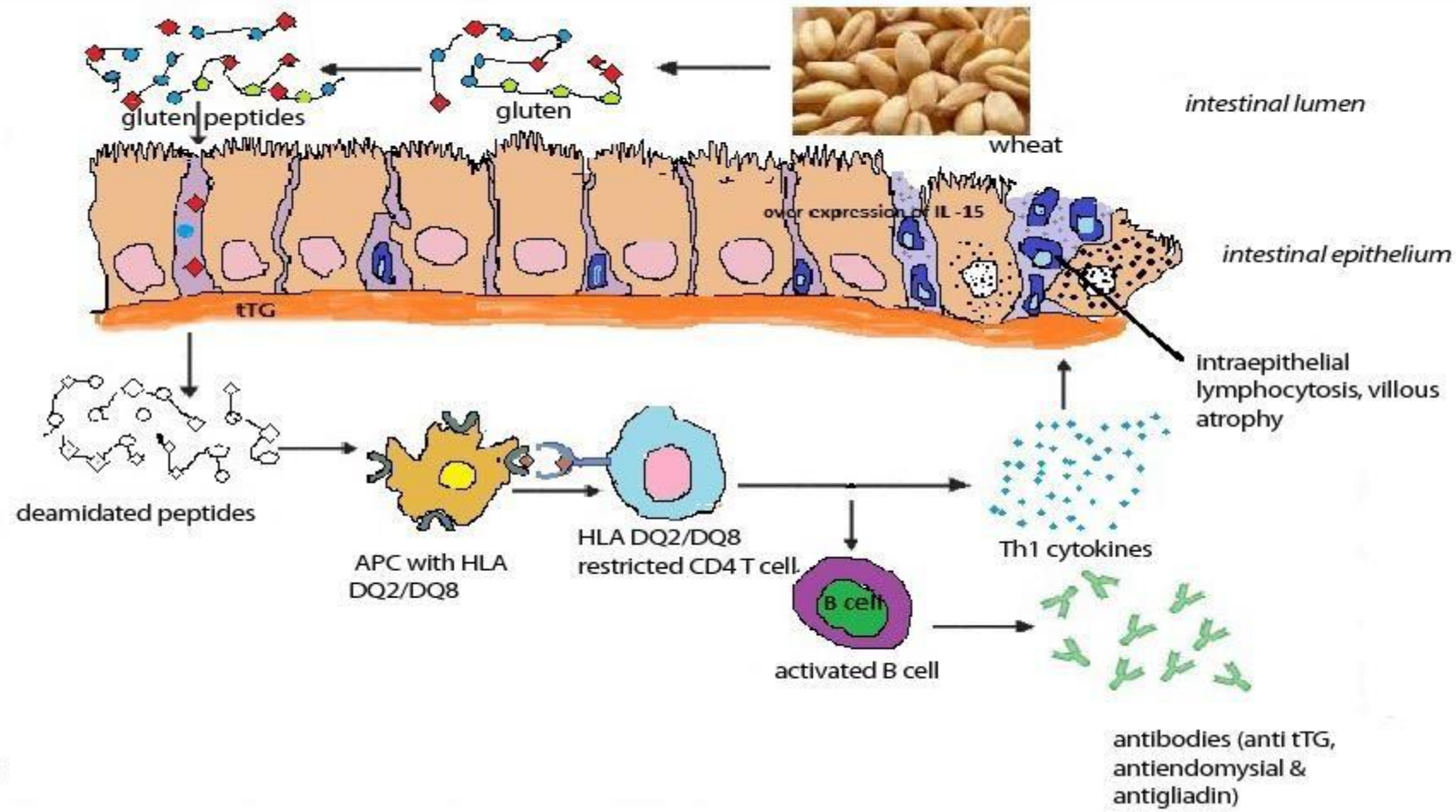
Pathophysiology of Celiac Disease

- Gliadin peptides trigger immune activation
- Tissue transglutaminase modifies gluten peptides
- Activated T cells damage intestinal mucosa
- Villous atrophy reduces absorptive surface area

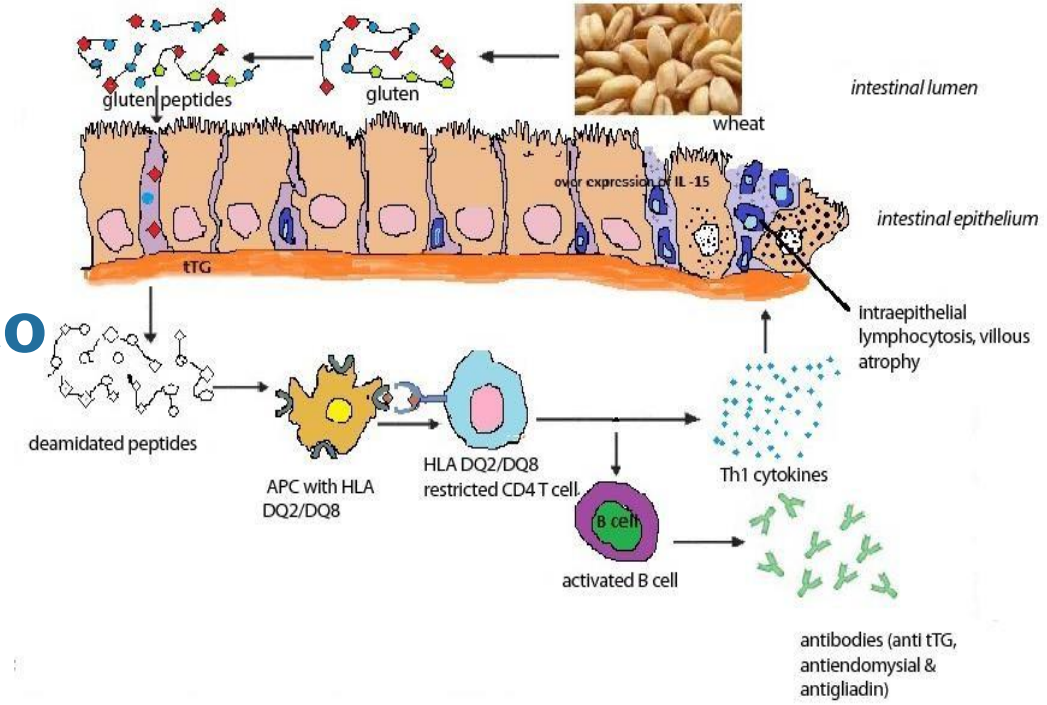
It's an autoimmune disease caused by gluten.

In the next slides the doctor explains...

Genetics and Pathogenesis



In celiac patients, there are crypts, villi, epithelium and the patient eats wheat product which has gluten peptides that are normally absorbed in the gut to the blood stream, there it will breakdown into deaminated peptides which activate HLADQ2/DQ8, T cells, B cells. T helper-1 will produce cytokines & B-cells will produce antibodies like anti-tissue transglutaminase, anti-endomysial antibodies, anti-gliadin antibodies. These antibodies will attack the intestinal epithelium, what will happen there?
Check slide 27



Why Do Children Become Malnourished?

- Flattened villi impair nutrient absorption
- Fat malabsorption leads to energy deficiency
- Iron and folate deficiency cause anemia
- Calcium and vitamin D deficiency affect bone growth

Clinical Manifestations in Children

- Chronic diarrhea or constipation

10% of patients can have constipation, so it's not just diarrhea

- Abdominal bloating and pain
- Failure to thrive and weight loss
- Irritability and fatigue
- Short stature and delayed puberty

So if a patient has constipation & iron deficiency and is not improving after taking iron supplements we should keep in mind celiac disease.

Remember that children are growing in their heights & lengths so their heights should be checked and plotted, at first the weight will be affected then with long-term disease height will be affected as well

Sometimes patients can have silent celiac disease so the only symptom might be iron deficiency not corrected by iron supplements so screening should be done

Extraintestinal Manifestations

- Iron deficiency anemia(most common)
- Dental enamel defects
- Dermatitis herpetiformis
- Low bone mineral density
- Behavioral or neurologic symptoms (depression, anger, anxiety, attacks called celiac attacks, ADHD)

Diagnostic Evaluation

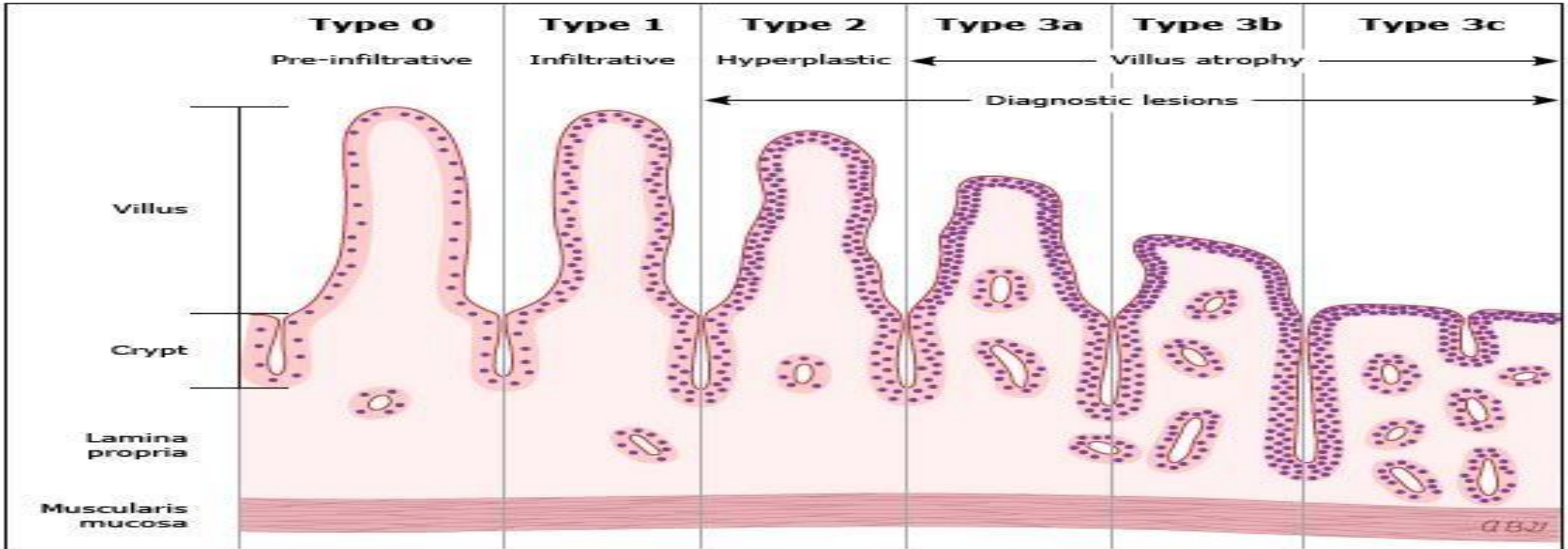
- First-line test: anti-tTG IgA
- Measure total serum IgA level
- Endoscopy with small bowel biopsy confirms diagnosis
- Children should remain on gluten-containing diet before testing

Anti-tissue transglutaminase IgA (anti-TTG IgA) is the main screening test for celiac disease. However, some patients have IgA deficiency. In these patients, the body cannot produce enough IgA antibodies, so the anti-TTG IgA test may appear falsely negative even if the patient actually has celiac disease. Therefore, if a patient has symptoms suggestive of celiac disease but a negative anti-TTG IgA result, total serum IgA should also be measured to check for IgA deficiency. If total IgA is low or absent, IgA-based tests cannot be relied upon, and IgG-based tests should be used instead. If the patient has normal IgA levels and negative anti-TTG antibodies, celiac disease becomes less likely. But we still cannot tell, in order to diagnose celiac we need further investigations so we perform endoscopy with small bower biopsy. Before the test the child must eat gluten-containing food in order to trigger the immune reaction.

Histologic Findings

- Villous atrophy
- Crypt hyperplasia
- Increased intraepithelial lymphocytes
- Histologic improvement occurs after gluten-free diet

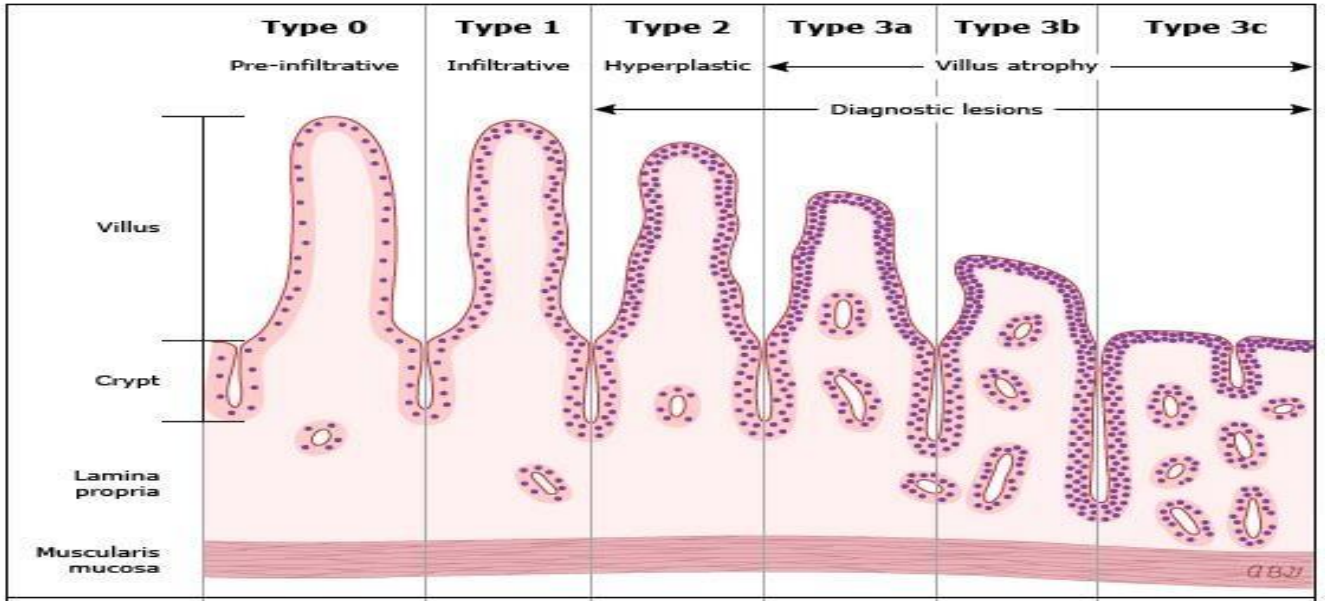
Marsh classification



Villus	Normal	Normal	Normal	Mild atrophy	Moderate atrophy	Severe atrophy
Crypt	Normal	Normal	Hyperplasia	Hyperplasia	Hyperplasia	Hyperplasia
Ratio, villus height: crypt depth	3:1	3:1	<3:1	<2:1	1:1	<1:1
IEL/ 100 EC	<40	>40	>40	>40	>40	>40

Normally there should be villi & crypts

And ideally the ratio between the villi & the crypts should be 3:1, villi should be much more in height. In celiac, villi is atrophied, the crypts will be hypertrophied and the ratio will be decreased because the villi will decrease in height and the crypts will increase in depth and the inflammatory lymphocytes will increase. Normally there should be less than 4 inflammatory cells per 100 cells, in severe cases it will be more than 40



	Type 0	Type 1	Type 2	Type 3a	Type 3b	Type 3c
Villus	Normal	Normal	Normal	Mild atrophy	Moderate atrophy	Severe atrophy
Crypt	Normal	Normal	Hyperplasia	Hyperplasia	Hyperplasia	Hyperplasia
Ratio, villus height: crypt depth	3:1	3:1	<3:1	<2:1	1:1	<1:1
IEL/ 100 EC	<40	>40	>40	>40	>40	>40

Inflammatory cells. In severe cases there will be no villi, this villus atrophy will cause malabsorption of nutrients, chronic diarrhea, malnutrition, deficiencies & symptoms

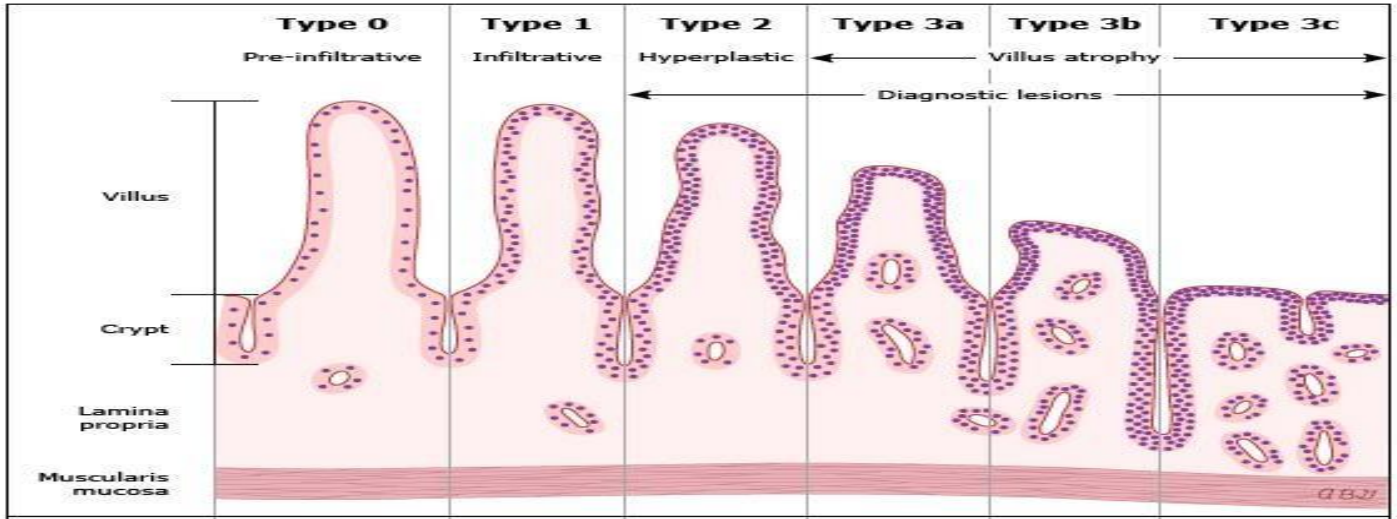
Marsh classification

Histological improvements occur when the patient is on gluten free diet. Marsh classification is from type 0 to type 3 (type 3 has A,B ,C) the higher the marsh classification:

1- The greater the villous atrophy and hyperplasia of crypts

2- The ratio of villous height to depth of crypts will decrease

3- The number of intra-epithelial lymphocytes will increase



	Type 0	Type 1	Type 2	Type 3a	Type 3b	Type 3c
Villus	Normal	Normal	Normal	Mild atrophy	Moderate atrophy	Severe atrophy
Crypt	Normal	Normal	Hyperplasia	Hyperplasia	Hyperplasia	Hyperplasia
Ratio, villus height: crypt depth	3:1	3:1	<3:1	<2:1	1:1	<1:1
IEL/ 100 EC	<40	>40	>40	>40	>40	>40

Management

- **Strict** lifelong gluten-free diet
- Avoid wheat, barley, and rye & oats
- Correct nutritional deficiencies, like calcium, iron, Vit.D and protein deficiencies
- Multidisciplinary care including **dietitian support**

Treatment

- The only treatment for CD is lifelong strict adherence to a gluten-free diet.

In this era, they are discovering stem-cell therapy and genetic therapy

Follow-Up in Pediatric Patients

- Monitor growth velocity and BMI & height
- Repeat serology to assess compliance

If there is negative serology after treatment then the patient is compliant (responding to treatment)

- Evaluate symptom resolution
- Monitor for micronutrient deficiencies

If patient has negative serology, better growth, less deficiencies, no anemia, distention, irritability then there is no need to repeat endoscopy

Complications of Untreated Celiac Disease

- Persistent growth failure **starts with weight, then with long-term disease height is affected as well.**
- Delayed puberty
- Osteopenia and fractures
- Psychosocial difficulties
- Long-term malignancy risk in adults **such as Non-Hodgkin lymphoma, it is the leading cause of death of adults with celiac disease**

So patient should stick with gluten free diet

Key Take-Home Messages

- Chronic diarrhea in children requires systematic evaluation
- Growth failure is a major clue to malabsorption
- Celiac disease is common and treatable
- Basic science knowledge improves pediatric diagnosis
- Early recognition prevents long-term complications


Thank you!

رسالة من الفريق العلمي:

الله أكبر الله أكبر الله أكبر، لا إله إلا الله
الله أكبر الله أكبر، ولله الحمد

الله أكبر كبيرا، والحمد لله كثيرا
وسبحان الله بكرةً وأصيلا

أعمال العشرمن ذو الحجة

الصلاة في وقتها	صلاة النوافل	صلاة الضحى
قيام الليل	ختم القرآن	كثرة الذكر
الصيام	الصدقة	الدعاء
أذكار الصباح والمساء	بر الوالدين	إحياء سنة التكبير

اغتنم واظفر بالربح العظيم
فإن للّه مواسم فيها الأجور مضاعفة

- عشر ذي الحجة -

ستبدأ افضل الأيام واحبها إلى الله، فمن مضى عامه وقد اودعه الكثير فليزد، ومن مضى عنه وهو مقصر فليستدرك فخير أيام الدنيا بين يديه ، هي عشرة أيام ستمرُ عليك بِلمح البصر، فهنيئاً لمن ادركها واغتنمها ذكّر بها وفرغ قلبك لخير ايام الدنيا

For any feedback, scan the code or click on it.

Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			