

Viewing Time

The program will take up to one hour to complete.

Target Audience

This program is designed for primary care physicians.

Other health care professionals working with patients and their families may also find this program of interest.

Faculty Disclosure

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Faculty Disclosure

Jared Austin, MD has disclosed no actual or potential conflict of interest in relation to this educational activity.

During this educational activity **Dr. Austin** will not be discussing the use of any commercial or investigational product not approved for any purpose by the FDA.

An Infant With Poor Weight Gain

Jared Austin, MD
Pediatric Chief Resident
University of Minnesota Medical School

An Infant With Poor Weight Gain

A lecture presenting a case that was seen in a local primary care clinic, discussing the workup and diagnosis of the case and reviewing the literature pertinent to the discussion.

Program Objectives

Upon completion of this program, participants should be able to:

- Inform participants of unusual presentations of common pediatric problems.
- Identify specific difficulties in the diagnosis of specific problems.
- Discuss potential difficulties in the management of pediatric problems.

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Accreditation

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Receiving CME Credit

To receive CME credit you must view the entire program and complete the evaluation form at the end.

An infant with poor weight gain

Jared Austin, M.D.
April 1 and 3, 2008
Children's Hospitals and Clinics-MN

Objectives

- Present a case of an infant with poor weight gain
- Recognize the importance of growth curves in the evaluation of an infant with FTT
- Discuss an important cause of FTT

Primary care clinic- Day of life #3

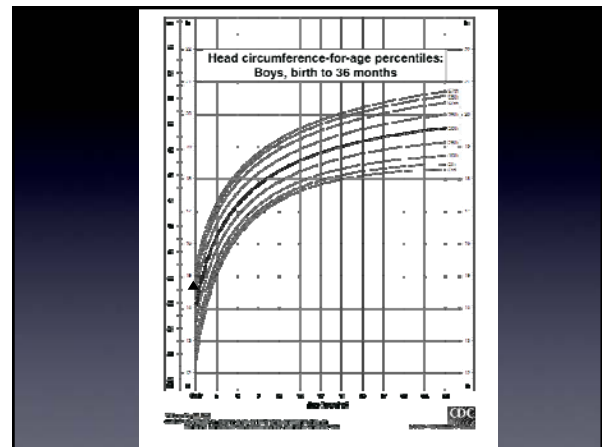
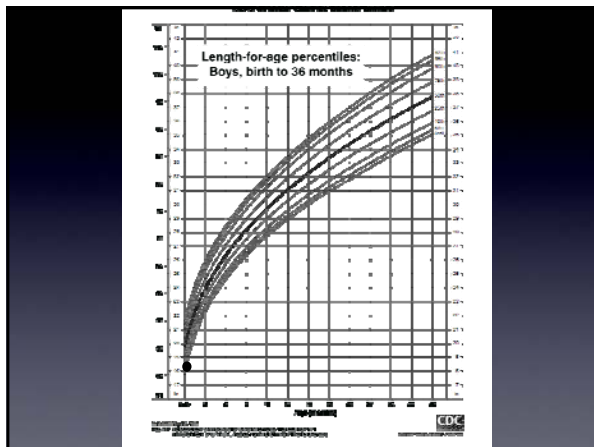
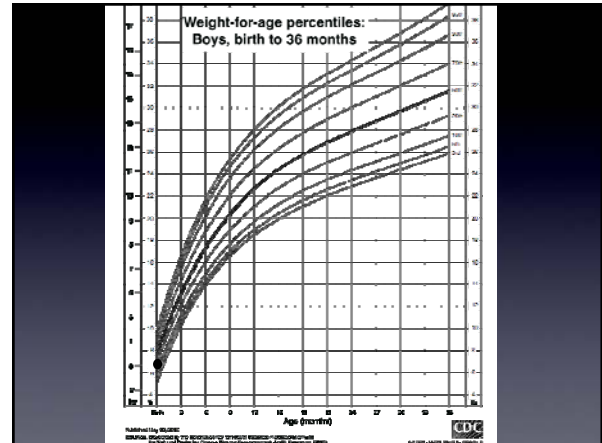
- CC: 3 day old male here for weight and color check.
- Mom breastfed for first 2 days, but stopped 24 hours ago after he refused to breastfeed.
- He is now taking Similac formula 1-1.5 oz every 2-3 hours.
- He has had adequate wet diapers, and normal stools
- He has been awakening to feed

DOL#3 Visit cont.

- PMHx:
 - NSVD at 37 2/7 weeks
 - APGARS 9,9
 - Failed hearing screen on the right
 - Mom had no problems during pregnancy with negative prenatal labs
- Immunizations: received Hep B vaccine at birth
- No medications
- Fam hx: positive for depression, otherwise neg
- Soc hx: lives with mother and maternal grandparents. Father is not involved.

DOL#3 visit cont.

- ROS: negative
- P.E.: wt: **5 lb 11 oz**, BW 6 lb 8 oz, DW 6 lb, 3 oz
- Gen: **appears dry**, but NAD
- HEENT: **sunken fontanel**, **dry lips and tongue**, PERRL, nl TM and oropharynx
- CV: RRR without g/r/m, ext warm, well perfused
- PULM: cta bilaterally
- ABD: s/nt/nd, no hsm
- GU: normal male genitalia, testes descended
- SKIN: **moderate jaundice**



A/P

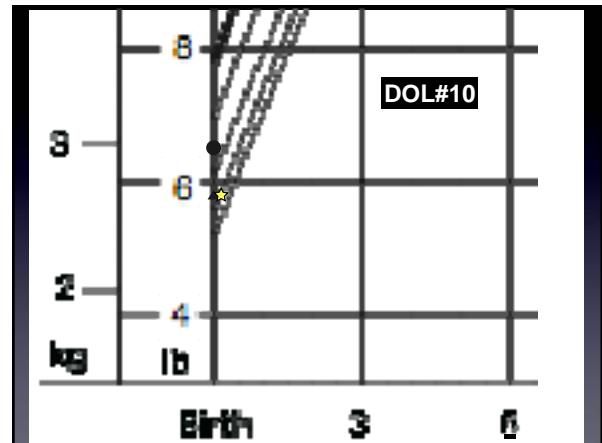
- A: 3 day old male with excessive weight loss (12% below BW), jaundice and dehydration.
- P: Admit to hospital.
- Give 20ml/kg NS bolus, then start maintenance IVF
- Obtain CBC, BMP, bilirubin
- Continue feeding with Similac q3hours
- OT consult to evaluate swallowing mechanism

Hospitalization DOL #3-5

- CBC, BMP were normal
- Bilirubin was mildly elevated but came down to normal with phototherapy and IVF
- Had an upper GI and swallow study, which showed mild GERD, but was otherwise normal
- Zantac was started
- His weight increased from 5 lb 11 oz at admit to 5 lb 15 oz the next day to 5 lb 12 oz at discharge.
- F/u in clinic in 5 days.

Clinic follow up- DOL#10

- HPI: Here for weight recheck
- Mom feels things are going very well
- He is taking Similac Advance 3 oz every 3 hours
- Also on Zantac
- PE: weight 5 lb 13.1 oz
- HEENT, CV, PULM and ABD exam documented and normal

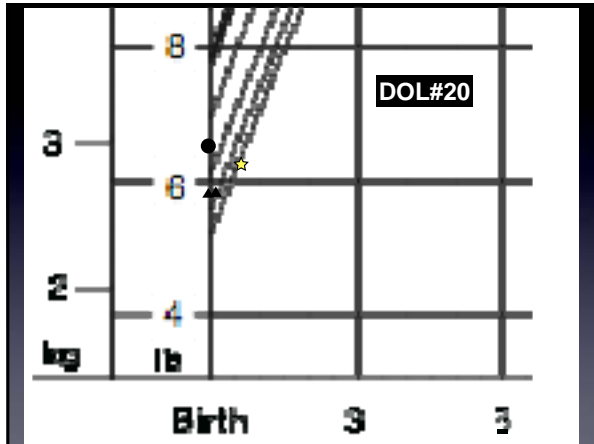


A/P DOL#10

- A: 10 day old male with GERD and weight concerns
- Still has not regained BW of 6 lb 8 oz
- P: Recheck wt in 1 week.
- Consider fortifying formula to 22kcal if no improvement

Clinic visit- DOL#20

- CC: weight recheck
- Was switched to prilosec from zantac last week
- Feeding regimen is: Similac Advance 3.5 oz q 3 hours
- Mom feels that he is feeding well except that he is gassy and spits up frequently
- NI stooling and wet diapers
- PE: weight 6 lbs 6 oz, up from 5 lb 13 oz 10 days ago.
- HEENT, CV, ABD exam documented and normal



A/P DOL#20

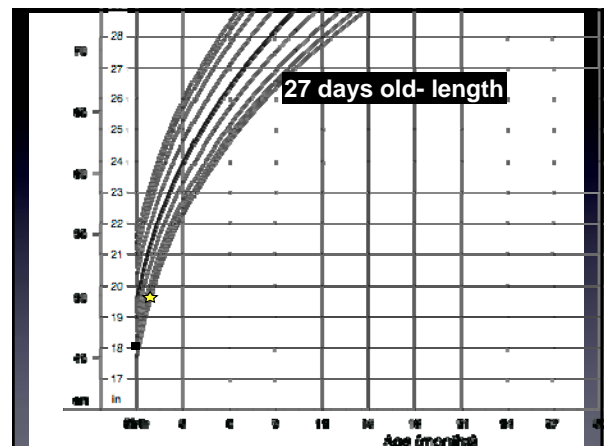
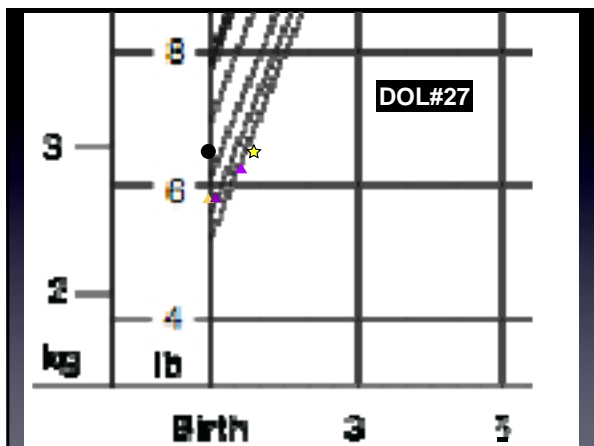
- A: Weight concerns (has not regained birth weight)
- P: Switch to soy formula
- Return for weight recheck in 1 week

Clinic visit- DOL#27

- On soy formula and taking 3-4 oz every 4 hours.
- Still spitting up frequently
- Mom is mixing 1.5 scoops of powder with 3.5 oz of water
- Soc hx: mom has returned to work
- Fam hx: negative for cystic fibrosis

Clinic visit-DOL#27 cont

- P.E. weight 6 lbs, 8 oz (still below 5th percentile), height 19.5 inches
- General: appears very thin, NAD
- HEENT, CV, PULM, ABD, EXT, SKIN: documented and normal
- A: 27 day old male with failure to thrive
- P: Obtain CXR, sweat chloride, CBC, BMP, TSH, free T4, liver enzymes, UA and Ucx
- Switch formula to Nutramigen



Labs: DOL#27

13.3 < 17.1 < 497

21% PMNs
 46% lymphs
 28% Monos
 Moderate reactive lymphocytes

- UA negative except for trace albumin
- Sweat chloride: 33 (<40) Alb 2.1
- NI TSH and free T4 ALT 55
- NI BMP AST 72

Peds GI contacted

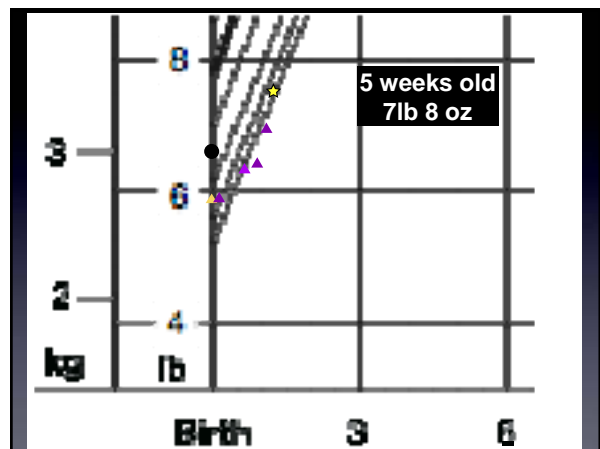
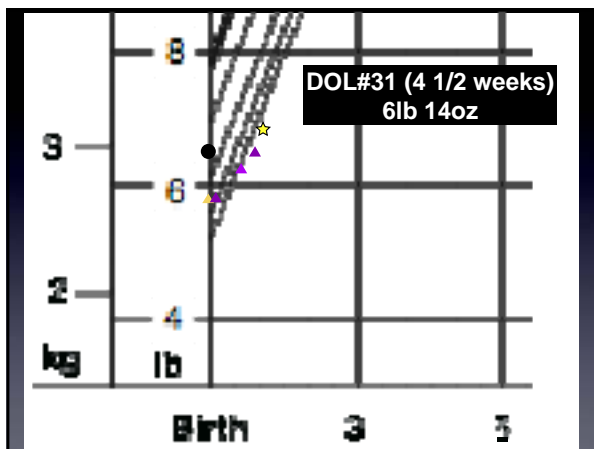
- Recommended supplementing formula to 24 kcal/oz
- Send stool for occult blood and alpha-1 antitrypsin
- Hospitalize if he continues to have poor weight gain

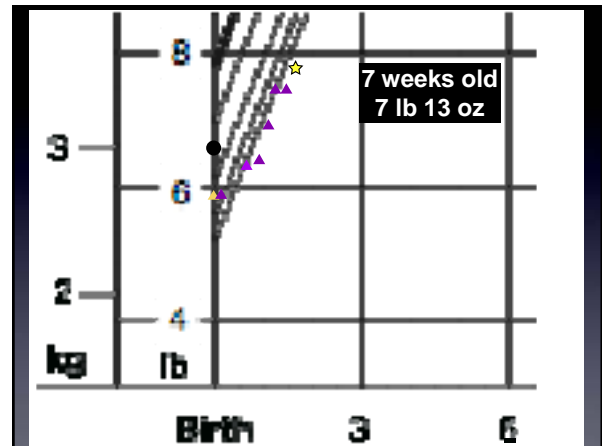
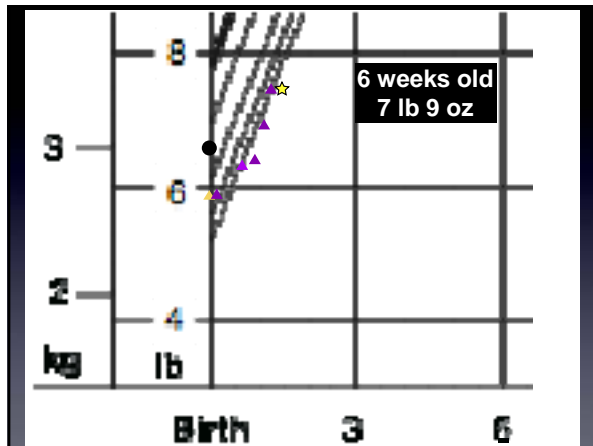
Clinic visit- DOL#31

- Mom switched formula to Nutramigen and pt immediately had 4-5 episodes of projectile emesis, and was unable to keep it down
- Mom then tried Alimentum, which he refused to take
- Mom then switched back to soy formula 2 days ago
- He has been taking 4 oz every 4 hours
- He has been constipated, having small, hard stools
- No blood in stool. No fevers.

Clinic visit-DOL#31

- Weight: 6 lbs 14 oz
- Gen: continues to look very thin, but NAD
- Rest of exam documented and normal
- A: Failure to thrive
- P: Send stool for occult blood and alpha-1 antitrypsin
- May need further GI workup
- Followup in 3-4 days for weight recheck





Clinic visit-7 weeks old

- Spitting up with every feed
- Mom reports that a cousin was diagnosed with pyloric stenosis, and wondered if this could be the cause of vomiting in her infant
- Alpha-1 antitrypsin and stool guiac came back negative
- Pyloric ultrasound performed, and normal

Plan- 7 weeks old

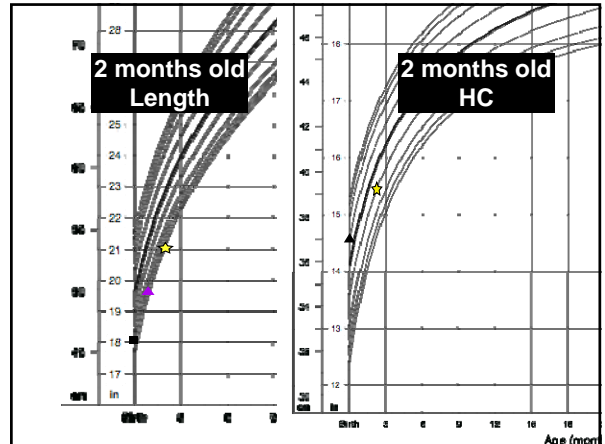
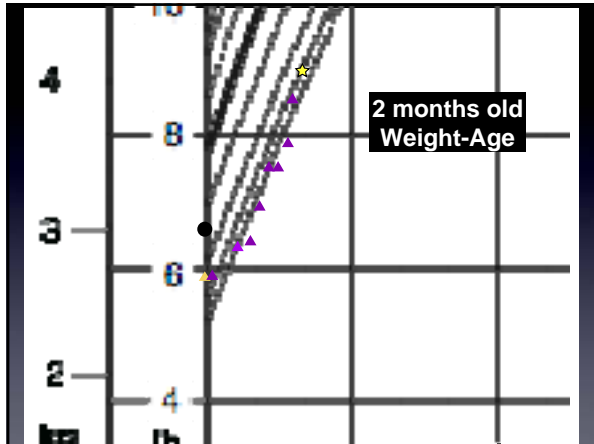
- Continue to fortify feeds to 24 kcal/oz
- Awaken in night to get in one more feed
- Start erythromycin for promotility
- Referral made to Peds GI

Peds GI clinic- 8 weeks old

- Reviewed history and growth curve
- Identified bilateral inguinal hernias on exam
- Did an upper GI with SB follow through-- normal
- A: Failure to thrive from insufficient calorie intake
- P: Send to surgery for inguinal hernia repair, and will do endoscopy with bx at the same time
- Continue to fortify soy formula to 24kcal/oz
- Weekly weight checks
- cont prilosec and erythromycin

Summary 8-10 weeks old

- Visited ED once for vomiting, not admitted
- Visited PMD twice, weight increased from 8 lbs 10 oz to 9 lbs at 2 month WCC
- Head circum: 38.5 cm at WCC
- Length: 21 inches at WCC
- Got 2 month immunizations
- Bilateral inguinal hernias were repaired, and a nl EGD was performed at the same time



How does the growth curve inform us on the potential causes of failure to thrive?

The Rosetta Stone for Failure to Thrive...

3 Main Patterns of Failure to Thrive

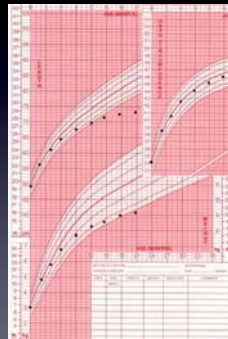
- Pattern #1: HC and Length preserved while weight falls off--Most common type, and usually due to insufficient caloric intake
- Pattern #2: Length and weight fall off, and HC is preserved--usually due to postnatally acquired illness, e.g. endocrinopathy or other chronic disease
- Pattern #3: Length, weight and HC all fall off the growth curve--usually from prenatal insult--genetic and metabolic diseases, syndromes

Pattern 1: Insufficient Caloric Intake

- Preserve height and HC initially as weight drops off
- Usually due to psychosocial deprivation
- Other causes: malabsorption, increased energy demand (CHF, hyperthyroidism)

Pattern #2: Organic cause acquired postnatally

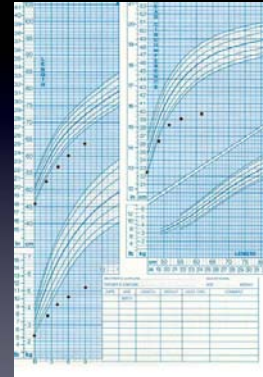
- Period of normal growth followed by drop off of length and weight. Preserve HC.
- Endocrinopathy: GH deficiency, hypothyroidism
- Chronic disease: renal failure, IBD



RW Bassall and J Benjamin. Failure to thrive. Emmedicine. 2006.

Pattern #3: Prenatal insult

- HC, wt and length all drop off curve from birth
- Genetic and chromosomal abnormalities
- In utero toxin exposure



RW Bassall and J Benjamin. Failure to thrive. Emmedicine. 2006.

3 months old

- Continued to vomit frequently
- Weight dropped to 8 lb 14 oz
- Admitted for inpatient management

Hospital H and P

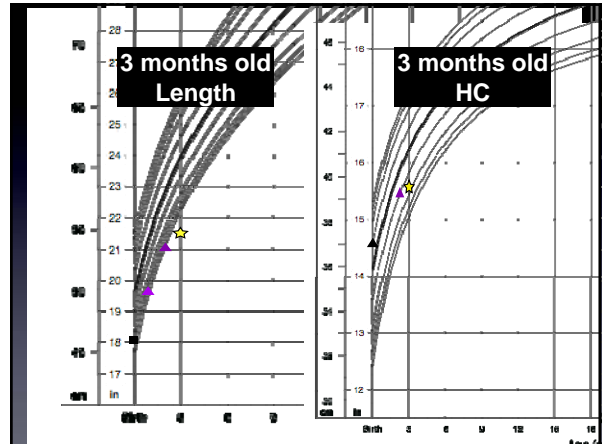
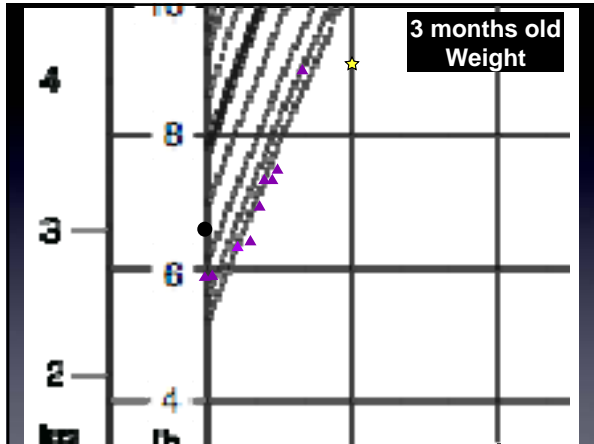
- CC: failure to thrive
- HPI: 3 month old male with history of chronic vomiting and poor weight gain
- Mom reports that pt will take 4 oz of soy formula every 3 hours.
- He does not cough or gag during feeding
- Shortly after feeding, he will vomit up about half of what he has taken
- He has no blood or bile in the vomitus
- Mom has tried Nutramigen, Alimentum, Enfamil without success. Thickening feeds also didn't work

H and P cont.

- PMHX: Term infant
 - Hospitalized at 3 days old for dehydration/hyperbili
 - Has had poor weight gain since then, falling below 3%
 - Had bilateral hernias repaired at 2 months
 - Had normal EGD at 2 months
- Fam hx: negative
- Soc hx: lives with mother and maternal grandparents
- Meds: prilosec, erythromycin

H and P cont.

- ROS: negative for fevers, diarrhea. Positive only for vomiting
- PE: Height 54.5 cm (<3%ile), weight 4.1 kg (9 lbs) (<3%ile), Head circ 39.5 cm (10%ile)
- Gen: well-appearing, smiling, happy
- HEENT: AFOSF, oropharynx slightly dry
- LUNGS: CTA
- CV: RRR
- ABD: s/nt/nd, no hsm
- GU: testes desc bilat, hernia scars appreciated
- EXT: quite thin



A/P

- A: 3 month male with poor growth, suspect secondary to excessive calorie loss from GERD.
- DDX includes metabolic disease, inadequate calorie intake, or chronic low grade dehydration contributing to these symptoms
- Plan: IV fluids
- Calorie counts and monitor I/Os
- Milk scan for gastric emptying
- BMP, LFTs, UA, CBC
- Consider NG or NJ to supplement feeds

Labs

17	11	clumped	140	106	14	169
			4.5	28	0.5	

30% PMNs
 61% lymphs
 8% Monos

- UA: nl
- Milk scan: multiple episodes of reflux, but normal emptying

bili 0.1
 A.P. 207
 ALT 122
 AST 131
 GGT

Summary: 3 day hospitalization

- Pt was awakened every 2-3 hours to feed, and fed well
- Over 24 hours he took 935 ml of 20kcal/oz soy formula for a total of 144 kcal/kg/day
- His weight increased from 4.1 kg (9 lbs) at admit to 4.31 kg (9lbs 7 oz) by discharge
- After the transaminases came back elevated, an abdominal u/s was done, which showed mildly enlarged, hyperechogenic kidneys "consistent with medicorenal disease"

Discharge diagnosis/plan

- Failure to thrive, improved with altered feeding schedule (mom will awaken pt twice/night to feed)
- Follow up with nephrology for possible polycystic kidney disease.
- Suspect mildly elevated LFTs are due to poor nutrition, but will repeat in 3-4 weeks to be sure they normalize with better nutrition
- Continue prevacid

Nephrology clinic- 4 months old

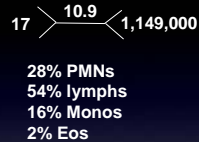
- Reviewed renal u/s which showed bilaterally enlarged kidneys with increased echogenicity, but otherwise normal parenchyma.
- Lytes have been normal
- UA has showed trace protein on occasion
- No fam hx of renal disease, FTT, cystinosis or PCKD

Nephrology clinic PE

- BP 69/53, HR 156, weight 4.72 kg (10 lb 6.5 oz)(<3%), height 56.5 cm (<3%ile), HC 41 cm (12%ile).
- Gen: "very small baby who appears developmentally delayed"
- Appears pale
- Poor head control, has social smile, but does not follow past midline
- Very thin extremities
- Rest of exam described in detail and normal

Labs

- BMP and UA: nl
- ALT 183, up from 122
- AST 135, up from 131
- Albumin 2.8, prealbumin 16
- Free carnitine, total carnitine and acylcarnitine were all mildly low
- Plasma amino acids: nonspecific, mildly elevated threonine, alanine, ornithine, histidine and arginine
- Urine amino acids: nonspecific, mild elevations of essentially all amino acids
- Urine organic acids: negative.



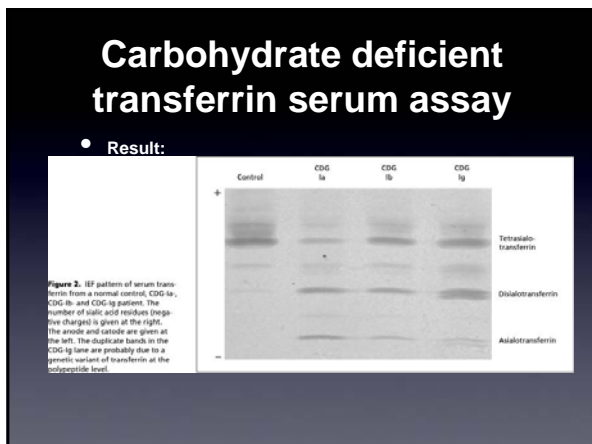
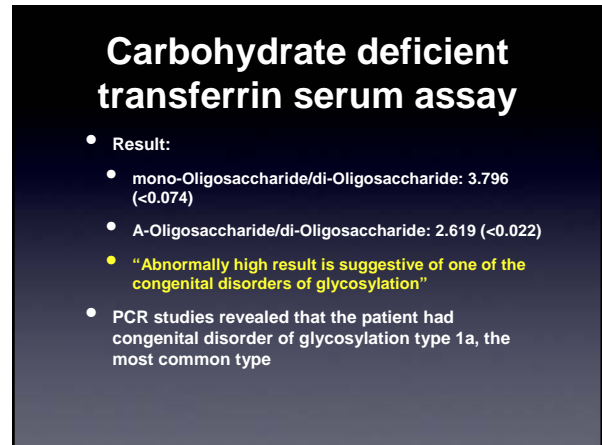
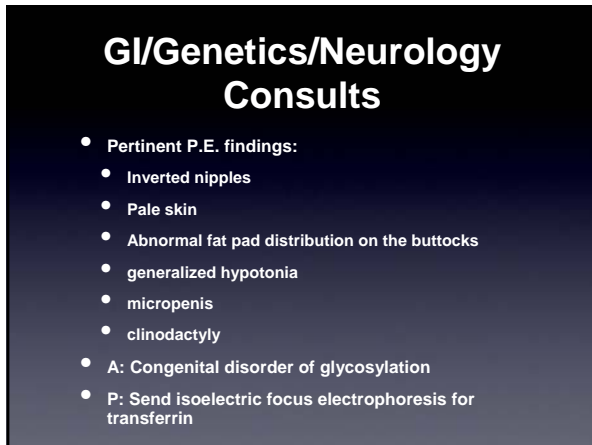
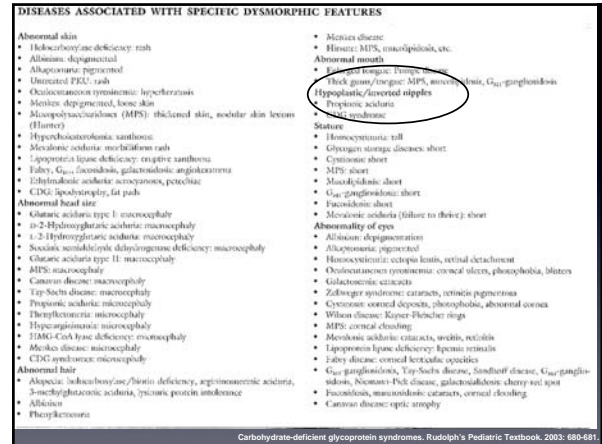
Nephrology clinic A/P

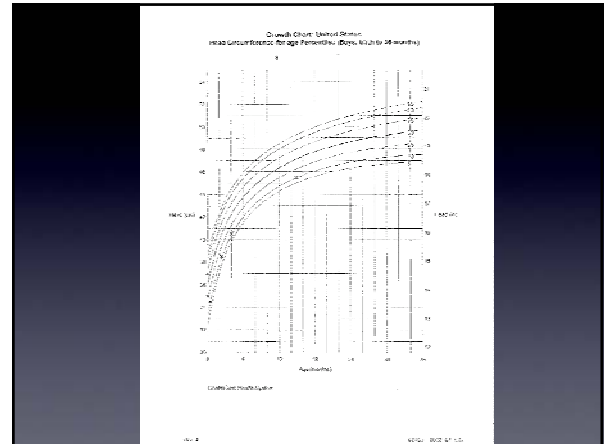
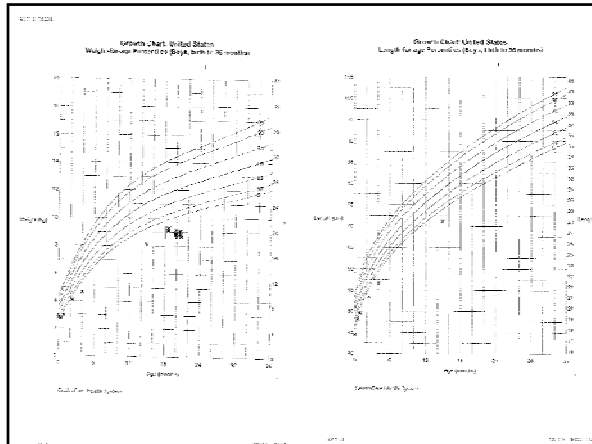
- 4 month male with FTT, mildly elevated liver enzymes, large echogenic kidneys with nl renal function, hypoalbuminemia without proteinuria, and generalized mild aminoaciduria.
- He shows no evidence of RTA, proximal tubule dysfunction, nor cystinosis
- His low albumin is due to poor nutrition, but don't know cause for elevated liver enzymes
- His renal u/s is consistent with PCKD, but FTT doesn't fit with this
- Plan: Open kidney biopsy
- Will see genetics and f/u with GI

Renal biopsy- 4.5 months old

- Renal Biopsy showed immature glomeruli and dilated tubules, but was nonspecific for any syndrome
- Given FTT, elevated LFTs, and hypotonia, GI, Genetics/Metabolism and neurology were consulted

GI consultant sees patient, and identifies a major clue on physical exam...





**Final Diagnosis:
 Congenital Disorder of
 Glycosylation, type 1a**

- ### Congenital Disorders of Glycosylation (CDG)
- Also called Carbohydrate deficient glycoprotein syndromes
 - A complex group of diseases caused by hypoglycosylation of multiple serum and cellular glycoproteins
 - Glycoproteins are proteins with an oligosaccharide attached to either the N or O terminus.
 - If glycoproteins are not glycosylated, they may not function properly.
 - Because of the many proteins affected, these disorders all result in abnormalities in multiple systems, including dysmorphic features
- Carbohydrate-deficient glycoprotein syndromes. Rudolph's Pediatric Textbook, 2003: 680-681.

- ### CDG (cont)
- There are at least 12 subtypes of CDG
 - The most common type is CDG 1a, also known as Jaeken syndrome.
 - CDG 1a is inherited in autosomal recessive pattern
 - Incidence is estimated at 1 in 80,000
- Carbohydrate-deficient glycoprotein syndromes. Rudolph's Pediatric Textbook, 2003: 680-681.

Table 3. Clinical stages of CDG-1a.	
<p>Infantile alarming multisystem stage 1</p> <p>Failure to thrive</p> <p>Floppiness</p> <p>Hypotonia/retardation</p> <p>Abnormal subcutaneous fat pads</p> <p>Inverted nipples</p> <p>Hepatomegaly and liver dysfunction</p> <p>Cerebellar atrophy</p> <p>Esotropia</p> <p>Pericardial effusions</p> <p>Multisystemic failure</p>	<p><small>CDG Denmark Group</small></p>
<p>Childhood ataxia mental retardation stage 2</p> <p>Mental retardation (IQ: 40-60)</p> <p>Motor disability</p> <p>Peripheral neuropathy</p> <p>Cerebellar ataxia</p> <p>Tapetoretinal degeneration</p> <p>Stroke like episodes</p> <p>Seizures</p>	
<p>Teenage leg atrophy stage 3</p> <p>Atrophy of lower limbs</p> <p>Stable cerebellar ataxia</p> <p>Deformity of thorax and spine</p> <p>Osteopenia</p> <p>Absence of puberty in females (hypergonadotropic hypogonadism)</p>	
<p>Adult stable disability stage 4</p> <p>Stable neurological impairment</p> <p>Short stature</p> <p>Kyphoscoliosis and long thin extremities</p> <p>Premature aging of the skin in females</p> <p>Retinitis pigmentosa</p>	

Isanne Kjaergaard. Congenital disorders of glycosylation type Ia and Danish Medical Bulletin, 2004;51:296-93.

Inverted nipples



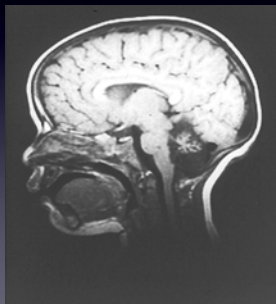
Courtesy of Dr. Brad Miller

Abnormal fat pads



Courtesy of Dr. Brad Miller

Cerebellar hypoplasia



Courtesy of Dr. Brad Miller

CDG 1a: Treatment

- Supportive
- Trials using mannose have been started, but have only been shown to be effective in type 1b.

Susanne Kjaergaard. Congenital disorders of glycosylation type Ia and Ib. Danish Medical Bulletin. 2004;51:350-63.

Thank you



References

- Susanne Kjaergaard. Congenital disorders of glycosylation type Ia and Ib. Danish Medical Bulletin. 2004;51:350-63.
- Carbohydrate-deficient glycoprotein syndromes. Rudolph's Pediatric Textbook. 2003: 680-681.
- RW Bassali and J Benjamin. Failure to thrive. Emedicine. 2006.
- Thank you to Dr. Brad Miller, University of Minnesota, for providing CDG photos.

**Comments
and
Questions**

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