Pediatric Obesity

Nurse Practitioner Alliance of Alabama
15th Annual Conference
November 12, 2021

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Abstract

The statewide epidemic of childhood and adolescent obesity and it's immediate as well as long -term consequences as a whole cannot be overemphasized. Obesity in children and adolescents has been widely documented to have a negative impact on a child's physical health, social, emotional wellbeing and self-esteem. Co-morbid conditions such as psychological, metabolic, cardiovascular, orthopedic, neurological, hepatic, pulmonary, and renal disorders have been seen in association with childhood obesity.

This presentation will consist of a panel of Children's of Alabama Nurse Practitioner sub-specialists discussing the impact of abnormal weight gain in their area of expertise. Case studies will be utilized to describe and identify common co-morbidities associated with childhood and adolescent obesity as well as treatment and management goals.

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Learning Objectives

- Participants will increase their knowledge of identifying comorbidities associated with obesity in children and adolescents.
- Participants will be familiar with commonly used medications to manage comorbidities in this population.
- Participants will understand the when and how referral process to specialists at Children's of Alabama

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Presenters

- Shelley Coskery, MSN, CRNP-AC
- Jessica Edmondson, CPNP, MSN
- Karen McCarty, PhD, MPH, MSN, CPNP
- Leslie Pitts, MSN, CPNP-AC, CDCES, AP-PEN
- Courtney Reeves, MPH, MA, MSN, CRNP
- Laurel Williams, CRNP-AC

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Case study #1
16 year old obese female

- Susan is a 16 year old female who reports being overweight all her life. She lives in the home with her mother and 12 year old sister. Her mother reports that everyone in the family is big. Mom works full time, they eat out often. Susan is not involved in any after school activities and reports being bullied at school because of her weight. She reports sadness and loneliness and doing poorly in school. She reports chest pain after eating and when she lies flat. She reports irregular cycles and unwanted hair on her face.
- Mom states she is difficult to wake in the morning, takes a nap each day after school, sleeps late on weekends. Mom states she snores loudly. She has poor sleep hygiene.
- She reports headaches 3-4 times a week. Her vision was recently checked and was normal.

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Vital signs/labs

Weight: 250 pounds BMI: 43

Blood pressure: 143/92 repeated: 140/90A

Abnormal labs:

HgbA1C: 6.1%:

low HDL

elevated cholesterol

elevated testosterone level

Vitamin D: 11

Family history:

Mom: obese, HTN, elevated cholesterol,

Dad: Obese, OSA

MGP: HTN, Type 2 diabetes

PGP: elevated cholesterol, breast cancer

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Physical Exam: Abnormal findings

Hirsutism (face and neck), acanthosis nigricans around neck and inner thighs, Straie on back, abdomen and thighs, buffalo hump,

Unable to palpate abdomen due to large girth. Heart and lung sounds distant due to large body habitus. Tonsils and adenoids normal.

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Case Study #1
Endocrine Considerations

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Metabolic Syndrome

Characterized by:

- Central Obesity
- Hypertension
- Abnormal Lipids
  - Low HDL
  - High LDL
  - High Triglycerides
- Glucose Intolerance

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Pediatric Obesity

- Pediatric Obesity
  - BMI ≥ 95th percentile
  - BMI ≥ 30 kg/m^2
- Severe Pediatric Obesity
  - BMI ≥ 99th percentile
- Mainstay of Therapy
  - Dietary and Lifestyle Modification
- Pharmacotherapy for Adolescent Obesity
  - Metformin
  - Orlistat
  - Phentermine
  - Liraglutide
- Bariatric Surgery

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Dyslipidemia

Abnormally high Total Cholesterol

Abnormally high LDL-C

Abnormally low HDL-C

Lipid Screening Recommendations:

- Universal Screening:
  - 9-11 years of age
  - 17-21 years of age
- Targeted Screening:
  - 2-10 years of age
  - Family history dyslipidemia or CVD, risk factors for CVD

Familial Hypercholesterolemia Facts

LDL ≥ 160: Consider Familial Hypercholesterolemia

LDL ≥ 190: Heterozygous Familial Hypercholesterolemia

LDL ≥ 400 mg/dL: Homozygous Familial Hypercholesterolemia

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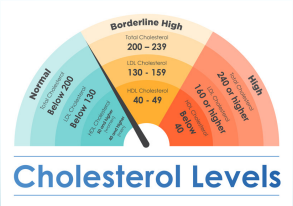
Management of Elevated LDL-C



- Diet Modification: ↓ LDL-C 10%
- Statin: ↓ LDL-C 30-50%
- Bile Acid Sequestrants: ↓ LDL-C 6-12%
- Ezetimbe: ↓ LDL-C 20%
- PCSK9i: additional ↓ LDL-C 50-60%

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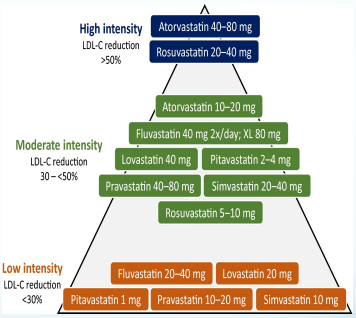
Which Statin to choose? Dose and Intensity

Statin Rule of 6's:

Each doubling of statin dose will decrease the LDL by approx. 6%

Statin Therapy Tips:

- Council on pregnancy
- Monitor serum CK levels



Statin dosing and ACC/AHA classification of intensity. (McGowan, Dehkordi, Moriarty & Duell, 2019)

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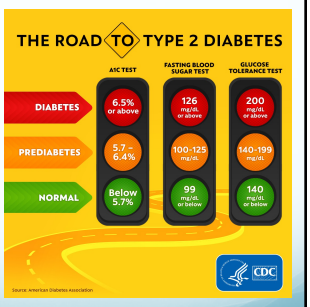
Impaired Glucose Tolerance

Considerations:

- If A1c ≥ 8% Call Endocrine
  - May need admission
- Do Not Order Insulin Level
  - C-Peptide more useful
- Consider GAD-65 Ab testing
  - Obesity does not exclude the possibility of T1DM



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Acanthosis Nigricans

- Typically, a benign skin condition that is an important indicator of systemic disease.
- Velvety, papillomatous, hyperkeratotic, darkly pigmented skin lesions found in body folds such as the axilla and neck.
  - Insulin resistance or diabetes
- Results from factors that stimulate epidermal keratinocyte and dermal fibroblast proliferation- elevated insulin
- Screening:
  - HbA1c screening
- Broadened Differential
  - Addison's Disease
  - Hypothyroidism
  - Disorders of Androgen Excess
- Topical Treatment Options
  - Retinoids
    - Tretinoin 0.1%
  - Keratinolytic
    - Salicylic acid

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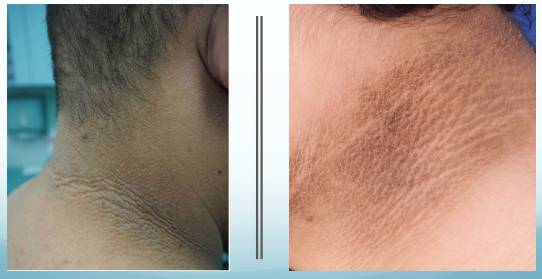
Acanthosis Nigricans



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Prediabetes Treatment Options

Diet and Lifestyle Changes

Metformin

- Mainstay of **Pediatric Pharmacologic Treatment**
- Start at 500mg daily
- Increase to 500mg BID
- Increase to 1,000mg BID
- GI Side Effects
  - Take with food
  - Take consistently
- Consider ER if GI intolerance
  - Recall on some ER Metformin products due to NDMA levels
- **Must temporarily discontinue before contrast studies**

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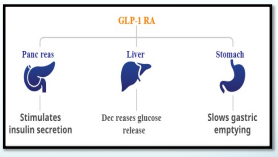
Type 2 Diabetes Treatment Options: GLP-1 Agonists

- GLP-1 use gaining ground in pediatrics for T2DM
  - Liraglutide daily SQ Injection
  - Dulaglutide weekly SQ injection
  - Semaglutide weekly SQ injection
    - Oral Semaglutide Clinical Trials



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Dysfunctional Uterine Bleeding

Adolescents: Anovulatory Dysfunctional Uterine Bleeding is the most common etiology for irregular menses.

- Immature Hypothalamic-Pituitary-Ovarian Axis

Other common etiologies:

- Pregnancy
- Hyperandrogenism
- Hyperprolactinemia
- Thyroid abnormalities
- STDs
- Noncompliance with OCP
- Sexual abuse or assault
- Vulvovaginitis
- Trauma
- Skin lesions
- Foreign bodies
- Tumors

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Definition: PCOS

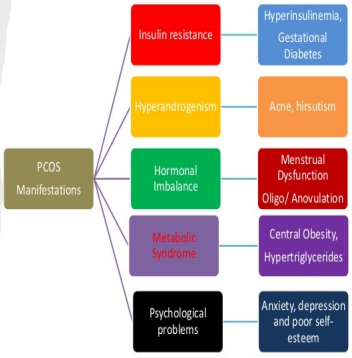
Polycystic Ovarian Syndrome

Stein-Leventhal Syndrome

Characterized by:

- Hyperandrogenism
- Irregular cycles
- Metabolic Abnormalities
  - Glucose intolerance
  - Hyperinsulinemia

Characteristics of PCOS



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Risk Factors of PCOS

- Genetics
  - 20-40% have first-degree relative with PCOS
- Intrauterine Exposures
  - Testosterone in utero may predispose to the later development of PCOS
- Environmental/Lifestyle
  - Sedentary lifestyle
  - Metabolic dysfunction
  - Weight gain
  - Oligo-anovulation
  - Hyperandrogenism
  - Environmental Exposures?
- Obesity
  - 30-75% of women with PCOS are obese
  - Adipose dysfunction
  - Glucose intolerance
  - Hyperinsulinemia
  - Exaggerates the manifestations of hyperandrogenism

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Pathophysiology: PCOS

- **Hyperandrogenism** is the most characteristic feature of PCOS
- Women with PCOS have an increase in the frequency of GnRH pulses, which promote the production of LH and decrease production of FSH
  - **Increased LH:FSH Ratio**
- Unclear etiology of intrinsically faster GnRH pulsation mechanism
- **Lower progesterone levels** due to anovulation
  - no ovulation → no corpus luteum → low progesterone
- 50-70% of patients with PCOS exhibit **metabolic abnormalities**
  - Patients with PCOS have a greater degree of insulin resistance than patients with the same BMI and visceral adiposity who do not have PCOS
- **Insulin resistance** is the result of a defect in the insulin-mediated glucose transport & signaling in adipocytes and myocytes
- Hyperinsulinemia leads to **Acanthosis Nigricans**

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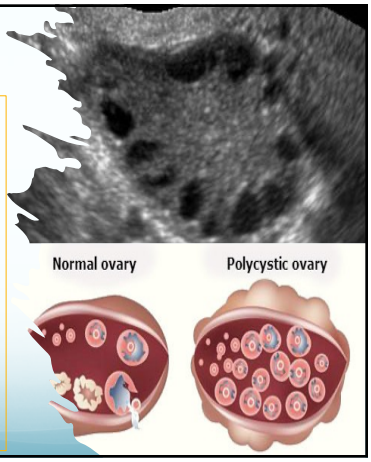
Pathophysiology PCOS

- **Polycystic ovaries** are present in 20-30% of women. Women with > 12 "cysts" are considered to have polycystic ovaries.
  - These aren't true cysts, but rather antral follicles that have arrested development
  - This is thought to occur because of hormonal abnormalities
    - Hyperandrogenism: Increased 5-alpha-reduced androgens **inhibit aromatization of estrogen**, which is required for follicle development
    - Hyperinsulinemia:
      - Promotes **Androstenedione and Testosterone production** by increasing 17-alpha-hydroxylase activity;
      - Promotes LH and IGF1-stimulated androgen production;
      - **Decreases SHBG production** which **increases free testosterone production**

Pelvic Ultrasound is not essential for pediatric PCOS evaluation!



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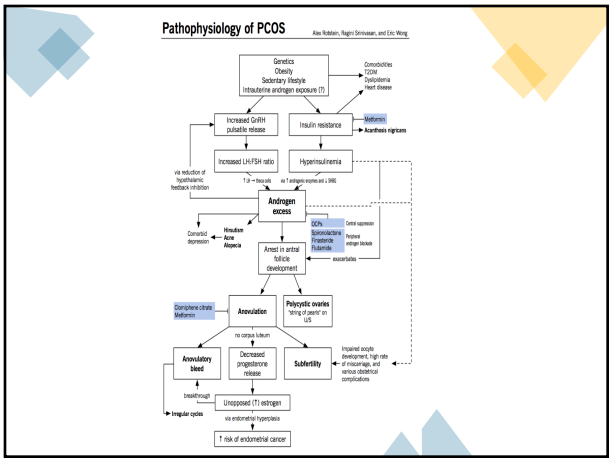

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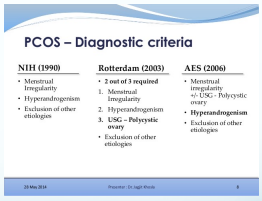
Clinical Features PCOS

Manifestations of PCOS

- Hyperandrogenism:
  - Hirsutism
  - Acne
  - Alopecia: male-pattern hair loss
- Hyperinsulinemia
  - Acanthosis Nigricans
- Irregular menstrual cycles
  - Must be > 2 years from menarche
- Overweight : not always!



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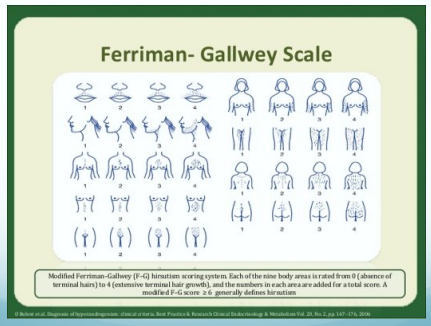
The Ferriman-Gallwey Scoring System



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Long-Term Risks PCOS

- Poor Fertility
- Miscarriage
- Cardiovascular Disease
  - Dyslipidemia
- Type 2 Diabetes
  - 10% develop T2DM before 40 years of age
- Malignancies
  - Combination of hyperinsulinemia, hyperandrogenism, and oligo-anovulation increases the risks of endometrial cancer and other endometrial disorders
- Psychiatric Disorders
  - Increased risk of anxiety, depression, binge-eating disorder, and bipolar disorder

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Progesterone Challenge

- Oral medroxyprogesterone acetate 10mg daily for 5-10 days
  - Menstruation 2-7 days after the progestin is completed
- **Obtain UPT prior** to progesterone challenge
- Adolescents with irregular menses without recent cycle
  - Menstruation = Estrogen
    - Anovulation
  - No menstruation = low estrogen or an outflow tract issue.

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Vitamin D Deficiency and Obesity

- Vitamin D deficiency negatively affects bone density, muscle function, glucose metabolism and insulin sensitivity.
- Levels are impacted by race, season, sunlight exposure, diet, adiposity and puberty.
- Association between increasing BMI and lower serum Vit D concentrations
  - Reduced cutaneous synthesis
  - Reduced intestinal absorption
  - Altered metabolism
  - Sequestration of Vit D in adipose tissue

Vitamin D sufficiency 20 to 100 ng/mL (50 to 250 nmol/L)

Vitamin D insufficiency 12 to 20 ng/mL (30 to 50 nmol/L)

Vitamin D deficiency <12 ng/mL (<30 nmol/L)

Vitamin D Replacement and Maintenance Supplementation:

- Infants < 12 months old: 2,000 IU daily for 6-12 weeks, followed by maintenance dosing of 400 IU daily
  - Calcitriol or Drisdol
- Children > 12 months old: 2,000 IU daily for 6-12 weeks, followed by maintenance dosing of 600-1,000 IU daily or
- Ergocalciferol (D_2) or Cholecalciferol (D_3) 50,000 IU weekly for 6-12 weeks, followed by maintenance dosing.
- Children with obesity or malabsorptive disease may require higher replacement and maintenance doses.

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Case Study #1: GI Considerations

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Concern for Reflux

- Obesity in and of itself can cause reflux.
- Medications are not always helpful, but worth a try to see if any relief is found
- Worse when laying down – would give meds at night, if intermittent through the day, would give in the morning, if both, would do BID dosing.

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Medications to think about

- H2 blocker – would usually use Zantac/Ranitidine to start, but has been removed from the market after a concern for a like to cancer
- Now we are using famotidine/Pepcid
- Dosing 1mg/kg/day, divided BID (Max dose 40 mg BID)

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Medications to think about (continued)

- PPI – proton pump inhibitor
- Usually start with omeprazole (PRILOSEC) 1mg/kg
- For obese patients, weight-based dosing is not recommended, so if they are over 40 kg, we stay there unless there is some evidence of inflammation or ulcer
- Obese patient are more likely to have a hiatal hernia on the differential for reflux, can do imaging – Upper GI/Barium swallow or EGD if not responsive to medication or dietary changes

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Case Study #1
Nephrology (Hypertension) Considerations

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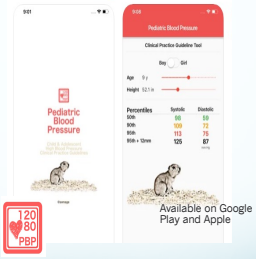
How do we define elevated BP vs Hypertension?

2017 American Academy of Pediatrics updated definitions for pediatric blood pressure categories

	For children aged 1 to <13 years	For children aged ≥13 years
Normal BP	Systolic and diastolic BP <90th percentile	Systolic BP <120 and diastolic BP <80 mmHg
Elevated BP	Systolic and diastolic BP ≥90th percentile to <95th percentile, **or** 120/80 mmHg to <95th percentile (whichever is lower)	Systolic BP 120 to 129 and diastolic BP <80 mmHg
Stage 1 HTN	Systolic and diastolic BP ≥95th percentile to <95th percentile+12 mmHg, **or** 130/80 to 139/89 mmHg (whichever is lower)	130/80 to 139/89 mmHg
Stage 2 HTN	Systolic and diastolic BP ≥95th percentile+12 mmHg, **or** ≥140/90 mmHg (whichever is lower)	≥140/90 mmHg

BP: blood pressure; HTN: hypertension.

UpToDate



Available on Google Play and Apple

- For patient ages 1 to <13 years: Use this app to get the 90th and 95th %
- For patients >13 years: Use this app once treatment is started to determine goal of <90th%

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Guidelines per the 2017 Recommendations

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2017 Guidelines: Normal Blood Pressure

- If BP is normal or normalizes after repeat readings (i.e. <90th percentile), then no additional action is needed.
  - Give standard lifestyle recommendations (nutrition, sleep, physical activity, etc.).
  - Recheck BP at next routine well-care visit.

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2017 Guidelines: Elevated Blood Pressure

1. If BP is elevated
   - Lifestyle recommendations at each visit
   - Recheck BP in 6 months (auscultation)
2. If BP is still elevated after 6 months
   - Check upper and lower extremity BP
   - Recheck BP in 6 months (auscultation)
3. If BP is still elevated after 12 months (i.e. 3 time points)
   - ABPM (prior to diagnostic evaluation)
   - Diagnostic evaluation
   - Consider subspecialty referral
4. If BP normalizes at any point, return to annual screening

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2017 Guidelines: Stage 1 Hypertension

1. If BP is Stage 1 HTN and patient is asymptomatic
   - Lifestyle recommendations at each visit
   - Recheck BP in 1–2 weeks (auscultation)
2. If BP is still Stage 1 HTN after 1–2 weeks
   - Check upper and lower extremity BP
   - Recheck BP in 3 months (auscultation)
3. If BP is still Stage 1 HTN after 3 visits
   - ABPM (prior to diagnostic evaluation)
   - Diagnostic evaluation
   - Consider subspecialty referral
   - Initiate treatment (primary care provider or subspecialist)

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2017 Guidelines: Stage 2 Hypertension

1. If BP is Stage 2 HTN and patient is asymptomatic
   - Lifestyle recommendations at each visit, if appropriate
   - Check upper and lower extremity BP
   - Recheck BP or refer to subspecialty care within 1 week

2. If BP is still Stage 2 HTN after 1 week
   - ABPM (prior to diagnostic evaluation)
   - Diagnostic evaluation
   - Consider subspecialty referral within 1 week
   - Initiate treatment (primary care physician, subspecialist)

If patient is symptomatic or BP is >30 mm Hg above the 95th percentile (or >180/120 in an adolescent), refer for emergency care.

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Realistically-- What We Expect to Happen at the PCP?

Initial evaluation:

- If BP is in "elevated" range and previously normal, recheck at next visit.
- If BP is Stage I range and previously normal, recheck in 2 weeks, and again 1 to 2 weeks later. If remains Stage I, refer them to us BEFORE starting meds if asymptomatic and if possible, because we will do an ABPM before starting meds to ensure true HTN v. WCH.
- If BP is Stage II range and previously normal and patient asymptomatic, recheck in one week. If recheck is remaining in Stage II range, if symptomatic, go ahead and start meds. If asymptomatic, send referral and hold meds.
- **If patient is symptomatic or BP is >30 mm Hg above the 95th percentile (or >180/120 in an adolescent), refer for emergency care.**
- If at any point you feel you need a second opinion, you can always call the hospital and request them to page the Nephrology attending on-call OR call the office at 205-638-9781 and we can assist with the call.

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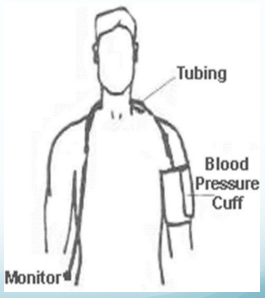
Ambulatory Blood Pressure Monitoring

- Patient wears a BP cuff continually for 24 hours
  - Readings q20–30 min
- Captures BP in many settings:
  - Home, school, work
  - Awake, asleep
- ABPM allows for evaluation of
  - Out-of-office BP
  - Circadian BP patterns



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How to take the blood pressure correctly

AAP video reviews aspects of proper BP measurements at http://youtu.be/JLzkNBpqwi0

- No wrist or forearm measurements in children/adolescents
- Make sure to use an appropriate size cuff
- BP should be measured in the right arm by using standard measurement practices
  - Exception atypical aortic arch anatomy such as right aortic arch, aortic coarctation or left aortic arch with aberrant right subclavian artery
- Seated in a chair with feet uncrossed
- Use auscultation if oscillatory measurements are elevated

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Three Classifications of Hypertension (HTN)

White Coat HTN

- Anxiety / Hormone drive
- Clinic visits, home checks, store checks
- Not treated in isolation

Components of more than one classification is not uncommon.

Secondary HTN

- Renovascular (did they have umbilical lines as Newborn?)
- Kidney disease previously unaware of
- Renal artery stenosis?
- Thyroid disease
- Abnormal hormones, etc.
- CoArc, cardiac issues

Essential (Primary) HTN

- Genetics --who all in the family has HTN? (only takes one family member)
- Obesity- being overweight and/or obese significantly increases risk factors

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When to Refer

- 3 elevated BPs >95th%tile on THREE separate occasions that are NOT sick visits.
  - What is 95th percentile?
    - <13 years old: Refer to pediatric BP APP available for both iPhone and android.
    - 13 years old and up: 130/80.
- If <6 years old, definitely would not recommend treating at PCP due to risks for secondary causes of the elevation.
- If >17 years old, consider sending to adult cardiologist due to age being almost adult.
  - (We will still see them if establishing care before 18yo but typically transition to adult internist/cardiologist at age 18/19yo so helps with continuity)

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How to Refer for elevate BP/HTN:

- Refer to Pediatric Nephrology HTN Clinic
  - Do Not send referral to Peds Cardiology (unless you strongly suspect cardiac abnormality) because they will send it to us
- Send referral form, demographics, clinic notes (with 3 separate dates of BP's –can include home log), and any labs
- Pediatric Nephrology- Fax: 205-975-7051/Phone: 205-638-9781

Do you need to do additional testing before sending referral?

- Urine dip for blood/protein is non-invasive and is helpful
- Additional labs: not necessary to get before referring, unless you are screening for other disease processes because most of us will repeat them when we see them in clinic.
- Imaging: We prefer doing the RUS and ECHO at COA when feasible due to our equipment and pediatric radiologists/cardiologists doing the interpretations

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What to do if they cannot get to Birmingham?

- Lab work before starting any medications:
  - CMP (assess kidney/liver function and have a baseline)
  - CBC (assess for anemia or abnormalities)
  - Plasma Renin AND Plasma Aldosterone (we mainly use these to help us decide which medication to use as well as to screen for primary hyperaldosteronism)
  - Uric Acid (high levels support essential HTN)
  - TSH/ Free T4 (to assess for secondary causes)
  - UA and random Urine protein:creatinine ratio (looking especially for proteinuria and hematuria)
  - If overweight/obese- add Lipid panel and HgA1c to screen for comorbidities
  - Plasma Metanephrines (typically only get if BP is extremely elevated/variable in conjunction with other symptoms such as tachycardia, excessive sweating, "weird" symptoms)

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What to do if they can't get to Birmingham? (cont.)

- Imaging:
  - Renal Ultrasound with doppler of vessels
    - Assessing for any renal abnormalities (size discrepancy >1 cm, cysts in the kidney, hydronephrosis, renal artery stenosis, etc.)
  - ECHO
    - assessing for any structural abnormalities that could cause HTN
    - Assessing for LVH and/or elevated LVMI >95th%tile which would point to EOD from long-term untreated HTN.

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First-line treatment for Stage I HTN: Lifestyle Changes OR Pharmacological Therapy?

Considerations:

- Are they motivated to change their diet/lose weight/exercise? Do they have the resources to be successful?
  - If yes, give 4 to 6 months and then recheck.
  - If no, proceed with pharmacological therapy
- Are they symptomatic (headaches, fatigue, tachycardia, chest pain)?
  - If yes, proceed with pharmacological therapy
- Do they have comorbidities such as diabetes or cardiac abnormality/LVH on ECHO?
  - Proceed with treatment due to higher risk for End Organ Damage (EOD)

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First-line treatment for Stage I HTN: Lifestyle Changes

Diet:

- Brief DASH handout
  - https://www.nhlbi.nih.gov/files/docs/public/heart/dash_brief.pdf
- Complete free DASH booklet
  - https://www.nhlbi.nih.gov/files/docs/public/heart/new_dash.pdf

Exercise:

- Recommendations for moderate to vigorous physical activity at least 3 to 5 days per week (30-60 min per session)

Stress Reduction:

- Breathing techniques
- Counseling
- Learning coping skills
- Decrease "extra" activities when overloaded

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First-line treatment for Stage I HTN: Pharmacologic Therapy

- 1st line agents may include:
  - Angiotensin-converting enzyme (ACE) inhibitor or
  - Angiotensin receptor blocker (ARB)
  - Long-acting calcium channel blocker
  - Thiazide diuretic

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Angiotensin-Converting Enzyme (ACE) inhibitors

- Lisinopril- (longer acting: 24 hour duration)
  - Most common adverse effects: cough, headache, dizziness
    - Cough- "dry, hacky, non-productive" stop medication. Change to a different class of meds
    - Headache/dizziness- increase water intake (start the day with 8-16 oz of water)
  - Severe adverse effects: hyperkalemia, acute kidney injury, angioedema, fetal toxicity, elevated LFTs
  - Contraindications: pregnancy, angioedema
  - Monitoring parameters: Blood pressure, BUN, serum creatinine, renal function, urine dipstick for protein, serum potassium, LFTs, WBC with differential, especially during first 3 months of therapy for patients with renal impairment and/or collagen vascular disease; monitor for angioedema and anaphylactoid reactions; hypovolemia and postural hypotension when beginning therapy, adjusting dosage, and on a regular basis throughout
  - Dosing:
    - Initial 0.07mg/kg/dose once daily; max initial daily dose 5mg/day; maximum daily dose 0.6mg/kg/day or 40mg/day (If it is a pt >13 yo, I will start with 10mg/day especially if Stage II HTN.)
    - Available in tablets: 2.5mg, 5mg, 10mg, 20mg, 30mg, 40mg (can be chewed/crushed)
    - Available in liquid: Qbrelis 1mg/ml (PA typically required)
  - SPECIAL consideration:
    - If comorbidity of DM or proteinuria- this is best choice due to nephroprotective properties.
    - Some studies have shown that after 20mg, there is not much additional benefit. Personal preference: After Lisinopril 20mg, I will add a second agent—typically HCTZ or Amlodipine

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Angiotensin-Converting Enzyme (ACE) inhibitors (cont.)

- Enalapril- (shorter acting: 12-24 hours duration, typically needs split BID dosing)
  - Most common adverse effects: cough, headache, dizziness
    - Cough- "dry, hacky, non-productive" stop medication. Change to a different class of meds
    - Headache/dizziness- increase water intake (start the day with 8-16 oz of water)
  - Severe adverse effects: hyperkalemia, acute kidney injury, angioedema, fetal toxicity, elevated LFTs
  - Contraindications: pregnancy, angioedema
  - Monitoring parameters: Blood pressure, renal function, WBC, serum potassium, serum glucose, LFTs, UA; monitor for angioedema and anaphylactoid reactions
  - Dosing:
    - Initial 0.07mg/kg/dose once daily; max initial daily dose 5mg/day; maximum daily dose 0.6mg/kg/day or 40mg/day
    - Available in tablets: 2.5mg, 5mg, 10mg, 20mg
    - Available in liquid: Epaned 1mg/ml (PA typically required)

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Angiotensin II Receptor Blocker- ARBs

- Losartan
  - Most common adverse effects: headache, dizziness
  - Severe adverse effects: hyperkalemia, acute kidney injury, fetal toxicity
  - Contraindications: pregnancy
  - Monitoring parameters: Blood pressure, renal function, serum electrolytes, LFTs, CBC, UA
  - Dosing:
    - ≥6 years and Adolescents: Oral: Initial: 0.7 mg/kg once daily; maximum initial dose: 50 mg/dose; titrate to desired effect; maximum daily dose: 1.4 mg/kg/**day** or 100 mg/**day**; may be administered once daily or divided twice daily
    - Available in tablet form: 25mg, 50mg, 100mg
  - Special Considerations: Losartan has uricosuric property (helps the kidneys to remove uric acid from the body via urine) which in turn can help to further lower BP and protect from end organ damage

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Angiotensin II Receptor Blocker-ARBs (cont.)

- Valsartan
  - Most common adverse effects: headache, dizziness
  - Severe adverse effects: hyperkalemia, acute kidney injury, fetal toxicity
  - Contraindications: pregnancy
  - Monitoring parameters: Blood pressure, BUN, serum creatinine, renal function, serum electrolytes, LFTs, CBC, UA
  - Dosing:
    - Children and Adolescents <17 years: Oral: Initial: 1 mg/kg/dose once daily; maximum initial daily dose: 40 mg/**day**; some patients may require a higher initial dose of 2 mg/kg/dose once daily. May titrate to effect up to a maximum daily dose: 4 mg/kg/**day** not to exceed 160 mg/**day**.
    - Adolescents ≥17 years: Oral: Initial: 80 mg or 160 mg once daily; some patients may require a higher initial dose. May titrate to effect up to a maximum daily dose: 320 mg/**day**.
    - Available in tablets as 40mg, 80mg, 160mg, 320mg
  - Personal Preference: I typically only use Valsartan if I need to go to triple therapy (ie. ARB + CaCh + diuretic).

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SPECIAL CONSIDERATIONS for ACE and ARBs!

Female Patients

For female patients of childbearing age (ie. Have started having menstrual cycles):

- Do NOT use ACE/ARB due to risk of teratogenic effects.
  - Exposure in the first trimester is associated with increased risk of fetal malformations and can lead to severe injury or death to fetus
- At EACH encounter, discuss this AND document it.
  - "What is it about your medicine you want to tell me?"
  - Answer: "It doesn't like babies!" (ie. If I get pregnant, stop the medicine immediately and make provider aware)

Cough with ACE inhibitor?

ARBs do not affect cytokine pathways, so will not cause the cough and can be used as alternative tx

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Medications (Calcium Channel Blocker)

- Amlodipine
  - Most common side effects: peripheral edema, flushing, dizziness
    - Edema→they need to decrease salt/sodium more, and increase water intake
  - Monitoring parameters: blood pressure heart rate, liver enzymes
  - Dosing:
    - <6yo: 0.1mg/kg/dose daily; max 5mg/day
    - >6yo: initial 2.5mg daily, titrate up to max of 10mg/day
    - Available as tablets: 2.5mg, 5mg, 10mg.
    - Available as liquid: Katerzia 1mg/ml (most insurances require PA)
  - Special Considerations:
    - If patient is pregnant OR is high risk to get pregnant, use Calcium Channel Blocker.

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Medications (Diuretics)

- Hydrochlorothiazide (HCTZ)
  - Most common side effects: dizziness, hypokalemia, dehydration, muscle cramps
  - Severe adverse effects: cardiac dysrhythmias, cholestatic jaundice
  - Contraindications: anuria
  - Monitoring parameters :Serum electrolytes, BUN, creatinine, blood pressure, fluid balance, serum glucose levels
  - Dosing:
    - >/= 2 yo-12yo: 1 to 2 mg/kg/day in 1 to 2 divided doses. (manufacturer's max is 100mg/day; personal preference max 25-37.5mg)
    - Adolescents: initial 1mg/kg/day once daily, may increase to 3mg/kg/day; max 50mg/day
    - Available in 12.5mg, 25mg, and 50mg
  - Personal Preferences:
    - I tend to avoid with athletes as long as possible due to risk of dehydration.
    - I tend to avoid in patients who have enuresis when feasible
    - I do not use diuretics as First-line medication treatment.

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Why not Beta Blocker?

- Lots of side effects as they are "pure" vasodilators (ie. Not selective)
- Can cause/exacerbate depression, mood changes
- Increased risk for bronchospasms
- Diabetics- may potentiate hypoglycemia or mask symptoms
- Can cause abnormal heart beat
- Increased tiredness/fatigue
- Weight fluctuation
- If patient gets dehydrated, they can "tank" quickly

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BP: To Treat or Not to Treat?

16 year old-
BP: 143/92 and 140/90
-Stage II HTN
-symptomatic with multiple headaches week.

-Get baseline labs, set up for ECHO/RUS in the coming days

Is she sexually active?
-If no, start Lisinopril 10mg daily x 1 week, then increase to 20mg daily
If yes, start Amlodipine 5mg daily x 1 week, increase to 10mg daily.

RTC in 4 to 6 weeks.

2017 American Academy of Pediatrics updated definitions for pediatric blood pressure categories

	For children aged 1 to <13 years	For children aged ≥13 years
Normal BP	Systolic and diastolic BP <90th percentile	Systolic BP <120 and diastolic BP <80 mmHg
Elevated BP	Systolic and diastolic BP ≥90th percentile to <95th percentile, **or** 120/80 mmHg to <95th percentile (whichever is lower)	Systolic BP 120 to 129 and diastolic BP <80 mmHg
Stage 1 HTN	Systolic and diastolic BP ≥95th percentile to <95th percentile+12 mmHg, **or** 130/80 to 139/89 mmHg (whichever is lower)	130/80 to 139/89 mmHg
Stage 2 HTN	Systolic and diastolic BP ≥95th percentile+12 mmHg, **or** ≥140/90 mmHg (whichever is lower)	≥140/90 mmHg

BP: blood pressure; HTN: hypertension.

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How often should I see them back?

- If starting medication/changing dosage- every 4 to 6 weeks
  - Assess BP to see if now controlled
  - Assess labs to look for medication toxicity
  - Assess for clinical symptoms that would warrant change of therapy
- If BP well controlled on meds- every 3 to 6 months

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Hypertension and the Athlete

- There has been no evidence that exercising while hypertensive increases sudden death risk.
- Physical activity such as playing sports/exercising are essential treatments for HTN.
- Please do not tell them they cannot play sports because they have HTN!
  - Once they have completed assessment for CV risk (ECHO) and target organ effects, they can participate in competitive sports.
  - The only exception is if BP >Stage 2 to which competitive sports should be held UNTIL the BP is lowered below the Stage 2 range. Then, they should return to being active!

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Case Study #1 Pulmonary and Sleep Considerations

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Sleep Guidance and Hygiene

- Total Sleep Time (TST)
  - Preschoolers (ages 3-5 years) generally need between 10-13 hours of sleep
  - School-age children (ages 6-13 years) need between 9-11 hours of sleep
- Sleep Hygiene - quick questions to assess:
  - Bed time
  - Wake time
  - Sleep environment
  - Awakening

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Sleep Hygiene

- Sleep Hygiene Anticipatory Guidance:
  - Stick to the same bedtime and wake time every day, even on weekends
  - Beds are for sleeping
  - Set up a cool, quiet, and comfortable bedroom
  - Develop a bedtime routine.
  - Quiet, calm, and relaxing activities → **No screen time 1 hour before bed**
  - Exercising earlier in the day
  - Avoid caffeine after lunch

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Obstructive Sleep Apnea

- Characteristics of OSA:
  - Snoring, pausing, gasping, choking noises, cough (non-asthma related)
  - Frequent arousals during sleep, restless, positional changes
  - Nighttime sweating
  - Parasomnias (sleep terrors, sleep walking, sleep talking)
  - Nocturnal enuresis
  - Excessive daytime sleepiness
  - Morning headaches
  - Behavioral issues, hyperactivity, trouble focusing

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Overnight Sleep Study

- Diagnostic Sleep Study (Polysomnography) is the gold standard for OSA
  - All patients referred to COA Sleep will be seen in Sleep Clinic prior to overnight sleep study
  - Exception of these direct referral diagnosis: Achondroplasia, Chiari, Duchenne, Jouberts, Pierre-robin, SMA, Spina bifida, and Trisomy 21
  - Apnea Hypopnea Index (AHI) is used to categorize severity of OSA

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Case Study #1 Mental Health Considerations

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Psychotherapy matters...

- Metanalysis: 52 studies (3,623 patients) both depressive and anxiety disorders
- Difference between pharmacotherapy alone and combined treatment was moderately large, lasting up to 2 years after treatment
  - Hedges' g = 0.43 (95% CI: 0.31-0.56)
- "..effects of pharmacotherapy and those of psychotherapy are largely independent from each other, with both contributing about equally to the effects of combined treatment."

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Psychiatric differential diagnoses:

- If....Depression
  - Then....Selective Serotonin Reuptake Inhibitor (SSRI) is First line: Lexapro, Prozac, and Zoloft are FDA approved for pediatrics
- If...ADHD
  - Then....Methylphenidate derivatives (e.g., Ritalin) vs. Amphetamine derivatives (e.g., Adderall) vs. non-stimulants (e.g., Strattera or Quelbree)
    - http://www.adhdmedicationguide.com/
- If....Binge Eating Disorder
  - Vyvanse: FDA approved for Binge Eating Disorder and ADHD
  - Also SSRI – Prozac and Zoloft have FDA pediatric indications for OCD

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Case Study #2
12 year old Hispanic Male

- Carlos is a 12 year old Hispanic male. He has had a recent weight gain of 25 pounds in one year. He is an only child and lives in the home with both parents who are of Mexican descent. Mom cooks traditional Mexican food but he prefers pizza and fast food. Dad often gives in and buys him the food he wants after dinner. Mom doesn't allow him to participate in any after school physical activities because of his exercise induced asthma.
- Mom reports that his teachers are concerned about his lack of attention at school. Mom reports he often eats food he is not allowed quickly without thinking of the consequences. He has become angry at home when he doesn't get the food he wants.
- He reports abdominal pain and constipation.
- Mom reports he has urinary accidents during the day and night. He comes home from school with wet underwear. Due to his large abdomen he has difficulty cleaning himself and self care.

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Case Study #2

- Weight: 145 pounds
- BMI: 35
- Blood pressure: borderline high/normal
- Abnormal labs: elevated liver enzymes and GGT
  Elevated TSH, Normal T4
- Elevated Triglycerides
- Family history:

Mom: obese, pre-diabetes

Dad: healthy

MGP: type 2 diabetes

PGP: unknown

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Physical Exam: abnormal findings

- Acanthosis nigricans around neck, under arms
- Central obesity: large abdominal girth
- Buried penis from large fat pad
- Polite, playing video games on phone during consultation

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Case Study #2
Endocrine Considerations

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Hypothyroidism

Subclinical Hypothyroidism in Obesity

- Characterized by mild TSH elevation with normal Free T4 levels
- Must evaluate for evolving hypothyroidism
  - Thyroid Stimulating Hormone (TSH)
  - Free Thyroxine (Free T4)
  - Total T3
  - Anti-TPO Antibodies
  - Anti-Thyroglobulin Antibodies
- Free T4 is low or Antibodies Positive
  - Treatment indicated
- T4 is normal & Antibodies Negative
  - DO NOT TREAT

- Subclinical Hypothyroidism in Obesity is thought to be a consequence rather than a cause of obesity.
- Postulated Causes of increased TSH levels in obesity:
  - Subclinical hypothyroidism caused by iodine deficiency or autoimmune thyroiditis
  - Derangement in the hypothalamic-pituitary axis
  - Thyroid hormone resistance
  - Adaptation process to increase energy expenditure

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Thyroid Hormone Replacement

General Guidelines

- Check TSH, Free T4, Anti-TPO Antibodies
- If Antibodies are positive
  - Hashimoto's Thyroiditis
- If TSH≥ 10 uIU/mL or Free T4 is low
  - Hypothyroidism

Starting Levothyroxine tablets

- Generic IS OKAY
- Start at 1-2 mcg/kg/day
  - 25mcg-50mcg typical starting dose
- Titrate based on TSH and Free T4
  - Labs 6 weeks after starting
- Council to take on an empty stomach when possible
  - Okay to take at night
  - Okay to chew tablets
  - Make up any missed doses (double up)

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Hypertriglyceridemia

TABLE 1

Classification of hypertriglyceridemia based on fasting triglyceride levels

Designation	Triglyceride levels	Clinical significance	Remarks
Normal finding	<150 mg/dL (<1.7 mmol/L)		The threshold level of 150 mg/dL is now accepted by all medical societies (2–5).
Moderate hypertriglyceridemia	150–1000 mg/dL (1.7–11.4 mmol/L)	– Increased risk of cardiovascular events – Slightly increased risk of acute pancreatitis (dose-dependent)	Different medical societies define moderate hypertriglyceridemia differently: – Lower threshold: 150 mg/dL (175 mg/dL); – Upper threshold: between 500 mg/dL (5.6 mmol/L) (3) and 1000 mg/dL (11,4 mmol/L), 885 mg/dL (10 mmol/L) is also commonly reported (2, 3, 5).
Severe hypertriglyceridemia	>1000 mg/dL (>11.4 mmol/L)	– Increased risk of cardiovascular events – Significantly increased risk of acute pancreatitis (dose-dependent)	See remarks on "moderate hypertriglyceridemia"

(Parhofer & Laufs, 2019)

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Drug Therapy for Hypertriglyceridemia

Table 1: Drug Therapy Overview for Hypertriglyceridemia

Therapy	Agent	Effects on TG	Education
Statins	Rosuvastatin (5-40 mg/day) Simvastatin (5-80 mg/day) Atorvastatin (10-80 mg/day) Lovastatin (10-80 mg/day) Pravastatin (10-80 mg/day) Fluvastatin (20-80 mg/day)	↓ TG 7%-30%	Myopathy; ↑ liver enzymes; use caution in patients concomitantly receiving fibrates or niacin
Fibrates	Gemfibrozil (600 mg bid) Fenofibrate (48-145 mg/day)[a]	↓ TG 20%-50%	GI complaints; myopathy; ↑ liver enzymes; use caution in combination with fibrates; monitor PT/INR in patients receiving warfarin
Niacin	IR (≥500-3,000 mg/day) SR (not recommended) ER (500-2,000 mg/day)	↓ TG 20%-50%	Flushing; hepatotoxicity; hyperglycemia; hyperuricemia; titrate dose slowly; bedtime dosing and avoid hot beverages
Omega-3 PUFAs	OTC formulations vary Omega-3-acid ethyl esters Optimal dosing: ≥4 g/day	↓ TG 20%-45%	Fishy taste; GI complaints; use caution in patients receiving aspirin, clopidogrel, and/or warfarin

[a] *Multiple formulations exist for fenofibrate. One listed based on Tricor.*
↓: decreased; ↑: increased; GI: gastrointestinal; INR: international normalized ratio; PT: prothrombin time; PUFA: polyunsaturated fatty acid; TG: triglycerides.
Source: References 10-16.

(Dixon, 2

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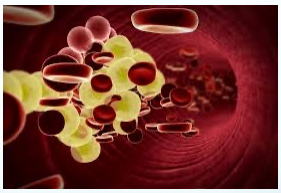
Severe Hypertriglyceridemia

Triglycerides > 1,000 mg/dL

- Abdominal Pain
- High Risk of Pancreatitis
- Requires Hospital Admission
- IV Insulin drip
  - Clears TGs by activation of LPL
- Start Treatment to lower Triglycerides
- NPO
- Diet Goal ≤ 10-15% fat



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Case Study #2: GI Considerations

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Abdominal pain

- Concern that abdominal pain is from constipation, can also be a cause of urinary incontinence
- Would start out with Miralax – an osmotic laxative – at 17 gm QAM
- Could add in Senokot - a stimulant laxative – at 8.6-17.2 mg QHS

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Abdominal pain

- Abdominal pain has many different diagnoses on the differential
  - Constipation
  - Reflux from spicy, greasy foods
  - Overeating
  - Could also be from under treated asthma
  - Could try Bentyl/dicyclomine – an antispasmodic – at 20 mg up to TID PRN to help with abdominal pain, but would wait to see how it responds to treating constipation

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Elevated liver enzymes

- Elevated liver enzymes and GGT may indicate autoimmune hepatitis, or more likely, fatty liver disease
- Liver enzymes can increase due to illness and obesity
- Would repeat in 3 months, if still elevated would refer to GI hepatology
- Once autoimmune hepatitis is ruled out, would need liver ultrasound with doppler and elastography to evaluate blood flow and any fibrosis.

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Case Study #2 Nephrology (Hypertension) Considerations

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BP: To Treat or Not to Treat?

12 year old-
BP: 127/80 and 129/78

90th: 115/75
95th: 118/78

Assuming that he is not symptomatic,
-If previously elevated on other visits, I would refer to Nephrology for us to do the work-up and 24 hour ABPM, especially given
-If not previously elevated, have them come back in 2 additional times for BP rechecks. If remains elevated, send them to us.

2017 American Academy of Pediatrics updated definitions for pediatric blood pressure categories

	For children aged 1 to <13 years	For children aged ≥13 years
Normal BP	Systolic and diastolic BP <90th percentile	Systolic BP <120 and diastolic BP <80 mmHg
Elevated BP	Systolic and diastolic BP ≥90th percentile to <95th percentile, **or** 120/80 mmHg to <95th percentile (whichever is lower)	Systolic BP 120 to 129 and diastolic BP <80 mmHg
Stage 1 HTN	Systolic and diastolic BP ≥95th percentile to <95th percentile+12 mmHg, **or** 130/80 to 139/89 mmHg (whichever is lower)	130/80 to 139/89 mmHg
Stage 2 HTN	Systolic and diastolic BP ≥95th percentile+12 mmHg, **or** ≥140/90 mmHg (whichever is lower)	≥140/90 mmHg

BP: blood pressure; HTN: hypertension.

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Hypertension and ADHD medications

- On a population level both stimulant and non-stimulant meds cause a "statistically significant" but minimal rise in SBP, DBP and HR
  - SBP mean +1.6mm
  - DBP mean +1.7mm
  - HR mean +3.7bpm
- 0.5-1% of treated patients have large BP effect that are idiosyncratic and often resolve with a medication change.
- General tips for practice:
  - If small rise in BP, monitor for a few months if continues to increase, try a different family of medications
  - If large rise in BP, change to a different family of medications.
  - If large rise persists despite change, then most likely true HTN and needs to be seen in HTN clinic for an ABPM monitor to further define.
  - If non-stimulant medication is an option, that would be the best change. However, we understand for most, that is not a therapeutic option.

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Bedwetting the facts- true or false?

- Bedwetting is a common problem that all children will grow out of
- **False**
- Bedwetting is usually not treated until the age of 7 years
- **False** – 5 years of age
- Bedwetting is due to the child being lazy.
- **False-** this is not something that the child can help and they should not be punished for it. It is however, appropriate to give positive reinforcement/reward if they are making progress with treatment and achieving some dry nights.
- Bedwetting can run in families
- **True** - Autosomal dominant inheritance
  - -both parents had NE= 77% chance for child
  - -one parent had NE= 45% chance for child.
- Treating bedwetting has been shown to improve a child's overall health and well-being
- **True**

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Nocturnal Enuresis (Bedwetting)

- Enuresis is defined as the voluntary or involuntary wetting of clothes/bedding with urine for a period of at least 3 consecutive months in children older than 5 years of age.
- **Primary:** if no continence has ever been achieved
- **Secondary:** if it occurs after at least 6 months of dry nights.
- **Monosymptomatic:** only nighttime symptoms (encompasses >80% of patients with nocturnal enuresis)
- **Non-monosymptomatic:** nocturnal enuresis **AND** daytime symptoms to include urge, frequency, or incontinence, etc.
  - Typically requires referral to subspecialist

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Pathophysiology Factors in Bedwetting

- High nocturnal urine production due to abnormal circadian rhythm
  - Normal conditions-vasopressin secretion is higher at night than in the daytime→50% less urine production in the night. Patients with enuresis, lack adequate secretion of vasopressin.
  - Inadequate secretion of the antidiuretic hormone (ADH) leads to increased production of urine.
- Nocturnal low bladder capacity and/or increased detrusor activity
  - Functional bladder capacity may be 70% of the expected capacity for age/size
  - Bladder wall thickness can be abnormal affecting bladder contractions
- Arousal disorder
  - Patient has difficulty with awakening from sleep (could be OSA or other underlying issues)

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Work-up

- Take a good history:
  - Frequency of bedwetting?
  - Daytime incontinence? Urgency? Habit of postponement?
  - Hx of UTIs?
  - Deep sleeper? (OSA?)
  - Loud snoring/pauses in breathing/enlarged tonsils?
  - Stooling daily? Caliber of stools?
  - ADHD?
    - Children with ADHD have shown to have a 2.1 times higher risk of enuresis
  - Stressors? (death in the family, divorce, separation, birth of a sibling, new school, etc.)
  - Any possibility of abuse?

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Work-up (cont.)

- Urinalysis/urine dip
  - Assess for any blood, protein, or glucose/ketones
  - Assess for ability to concentrate urine by checking specific gravity
  - Culture and sensitivity to r/o UTI
- Renal Ultrasound
  - If having daytime symptoms, it is needed to look for anatomy changes/causes that may need further intervention
- Additional testing:
  - VCUG- if recurrent UTIs
  - Urodynamics if persistent (referral to urology)

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Nocturnal Enuresis Treatment

Nonpharmacological:

- Constipation- aggressively treat constipation
- Stop caffeine in diet (bladder irritant that increases bladder contractions/spasms)
- Limit fluid intake two to three hours prior to bedtime
- Double voiding- Go to the bathroom 30 minutes before bedtime, then again immediately before going to bed to ensure bladder is as empty as possible.
- Diary of events- have family try and identify what time the bedwetting is occurring during the night. Then, preventively awaken child to go to bathroom before bedwetting occurs.
- Bedwetting Alarms- helps to condition the body to awake for urination before bedwetting occurs. (Studies shows it is effective in both PMNE and MNE and should be the first treatment choice in children under 8 years of age with adequate family support and no nocturnal polyuria)
  - Some insurances will pay for the bedwetting alarm if an order is written by the provider.

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Nocturnal Enuresis Treatment (Cont.)

Pharmacological Treatments:

- Desmopressin (DDAVP)-
  - Side effects: headache, nasal congestion, nosebleeds, abdominal cramps, water intoxication, allergic reactions, hyponatremia, anorexia, nausea, bad taste in mouth, problems with visitation, and HTN.
  - Dosing:
    - Children ≥6 years and Adolescents: Initial: 0.2 **mg** once before bedtime; titrate as needed to a maximum of 0.6 **mg**/day**;** fluid intake should be limited to a minimum from 1 hour before desmopressin administration until the next morning, or at least 8 hours after administration
  - In our dysfunctional voiding clinic, we do not routinely use this either

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Case Study #2
Pulmonary and Sleep Considerations

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Asthma

- Asthma is a chronic, inflammatory disease of the airways characterized by airway edema + mucous production, bronchoconstriction and airway hyperresponsiveness
- Leads to variable and recurring symptoms including:
  - Cough/ nocturnal cough, wheeze, SOB, and chest tightness
  - Symptoms more common during the night, early AM, with activity, and with trigger exposure
- Exercise-induced asthma is a narrowing of the airways in the lungs triggered by strenuous exercise. It causes shortness of breath, wheezing, coughing, and other symptoms during or after exercise.

Asthma doesn't have to hold your patients back from physical activity if it's managed well.

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Asthma Management

Asthma Medication Management

- Quick relief (QR) medications
  - Albuterol, levalbuterol
- Controller medications
  - Inhaled corticosteroids (ICS)
  - Combination drugs (ICS + Long Acting Beta Agonist)
- Adjunct medications
  - Anticholinergics
  - Leukotriene receptor antagonists
- Biologics – Pulmonary Clinic

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QUICK RELIEF MEDICATIONS Updated: 01/06/2021

These medications are **Short-acting Beta Agonist (SABA)** and cause smooth muscle relaxation. Onset of action is 3-5 min. and last approximately 4 hours. All asthma patients should have a form of this medication readily available at all times.

Generic Name	Brand Name	Delivery Method	Dose	Prime, Re-prime	Medicaid
Albuterol	Ventolin	MDI	4 puffs	4 puffs; 2 weeks	Requires PA
Albuterol	ProAir	MDI	4 puffs	3 puffs; 2 weeks	yes
Albuterol	ProAir RespiClick**	BAI*** (no spacer used)	4 puffs	n/a	Requires PA
Albuterol	Proventil	MDI (no counter)	4 puffs	4 puffs; 2weeks	Requires PA
Albuterol		Nebulized	1 vial	n/a	yes
Levalbuterol	Xopenex	MDI(no counter) & Nebulizer Sol	4 puffs	4 puffs; 3 days	yes; brand
Levalbuterol		Nebulized	1 vial	n/a	yes; generic

**=Do Not Prescribe If Allergic to Lactose or Milk Proteins. ***Breath actuated inhaler s (BAI) and Dry Powder Inhalers (DPI) Do Not Use A Spacer

CONTROLLER MEDICATIONS

I. Inhaled Steroids (ICS)-given daily to control inflammation in patients with persistent asthma. Always **rinse** and **spit** after use.

Generic Name	Brand Name	Strengths	Delivery Method	Dose	Prime	Medicaid
Fluticasone Propionate	Flovent HFA	44mcg,110mcg,220mcg	MDI	2 puffs 2 x day	4 puffs	yes
Flovent Proprionate	Flovent Diskus	50mcg, 100mcg, 250mcg	DPI***	1-2 breaths 2 x day	None	yes
Beclomethasone	Qvar RediHaler	40mcg, 80mcg	BAI (no spacer used)	2 puffs 2 x day	2 puffs	yes
Mometasone	Asmanex Twisthaler	110mcg, 220mcg	DPI***	2 puffs daily	none	yes
Mometasone	Asmanex HFA	100mcg, 200 mcg	MDI	2 puffs 2 x day	4 puffs	yes
Budesonide	Pulmicort Flexhaler	90 mcg, 180mcg	DPI***	2 puffs 2 x day	2 treats	yes
Budesonide	Pulmicort Respules	0.25mg, 0.5mg, 1mg	Nebulized	1-2 x day	none	yes-generic
Ciclesonide	Alvesco	80mcg, 160mcg	MDI	1-2 puff(s) 2 x day	3 puffs	Requires PA
Fluticasone Furoate	Arnuity Ellipta	100mcg, 200mcg	DPI***	1 breath daily	none	Requires PA

II. Combination Drugs- Combines varying dose of ICS with a Long-acting Beta Agonist (LABA) in one inhaler

Brand Name	Strengths	Delivery Method*	Dose	Prime	Medicaid
Advair MDI (Flovent + Salmeterol)	45/21, 115/21, 230/21mcg	MDI	2 puffs twice daily with spacer	4 puffs	yes
Advair Diskus (Flovent + Salmeterol)	100/50, 250/50,500/50mcg	DPI***	1 puff twice daily	none	yes; brand and generic (Wixela Inhub)
AirDuo RespiClick (Flovent + Salmeterol)**	55/14, 113/14, 232/14mcg	BAI	1 breath twice a day	none	Requires PA
Dulera (Asmanex + Formoterol)	100/5,200 /5mcg	MDI	2 puffs twice daily with spacer	4 puffs	yes
Symbicort (Pulmicort + Formoterol)	80/4.5, 160/4.5mcg	MDI	2 puffs twice daily with spacer	2 puffs	yes; brand and generic
Breo Ellipta (Arnuity + Vilanterol)**	100/25, 200/25mcg	DPI***	1 breath once a day	none	Requires PA

*=available in generic-lowest prices at Walgreens

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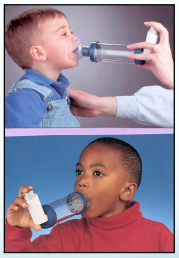
Medication Administration

- Asthma medicines are most effective when used correctly.
- Metered dose inhalers (MDI)/ HFA
  - Always use a spacer
- Dry powder inhalers (DPI) & Breath activated inhalers (BAI)
  - Do not need a spacer
  - Reserved for older children/ adolescents with greater lung volume, inspiratory strength, and coordination.



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Case Study #2
Mental Health Considerations

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Psychiatric differential diagnoses:

- If Disruptive behavior or impulse control problems: Oppositional defiant disorder (ODD) or Intermittent Explosive Disorder (IED)
  - Then…Clonidine or Guanfacine - Alpha 2 agonists - FDA pediatric indication for ADHD impulsivity; off label for ODD; short and long-acting formulations
  - Then…Risperdal or Abilify – Atypical antipsychotics with FDA pediatric indication for Autism related irritability; off label for Impulse control problems; caution for those w/ increased BMI
    - Requires regular lab work – can cause increase in glucose, cholesterol, liver enzymes, BMI
  - Then…Trazodone (anti-depressant) or Buspar (anti-anxiety) – limited research
- If ADHD
  - Then….Methylphenidate derivatives (e.g., Ritalin) vs. Amphetamine derivatives (e.g., Adderall) vs. non-stimulants (e.g., Strattera or Quelbree)

(Testing for intellectual disabilities may be indicated to employ school interventions e.g., Individual Education Program - IEP)

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Case Study #3
5 year old Female

- Jane is a 5 year old female. She lives with her maternal grandparents and older teenage cousins. MGM reports they are concerned that she always wants to eat. She never seems full. She is a very picky eater and only eats certain foods, no fruits or vegetables. She hides food in her room. MGM reports that she was delayed in walking and talking . She does not play well with other children.
- She has a history of asthma and has been hospitalized in the past for asthma episodes. She has been on and off steroids.
- Mom reports she is snoring.
- She has a history of encopresis and nocturnal enuresis.
- MGM has noticed recent breast development and is concerned because of her age.

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Case Study #3

- Weight 65 pounds
- BMI: 42
- Uncooperative for accurate blood pressure
- Lab work: all normal
- Family history:

Mom: history of drug abuse

Dad: unknown

MGP: HTN, elevated cholesterol

PGP: unknown

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Physical exam: Abnormal findings

- Lipomastia
- Limited to no eye contact: un-cooperative
- Large tonsils

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Case Study #3
Endocrine Considerations

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Puberty- Tanner Stage Review

Box 1. Tanner puberty stages

Girls
Stage 1: Preadolescent; elevation of papilla only.
Stage 2: Breast bud stage; elevation of breast and papilla as a small mound, enlargement of areola diameter.
Stage 3: Further enlargement of breast and areola, with no separation of their contours. (Note that menarche occurs mainly in stages 3 and 4.)
Stage 4: Projection of areola and papilla to form a secondary mound above the level of the breast.
Stage 5: Mature stage; projection of papilla only, owing to recession of the areola to the general contour of the breast.

Boys
Stage 1: Preadolescent; testes, scrotum and penis are of approximately the same size and proportion as in early childhood.
Stage 2: The scrotum and testes have enlarged, and there is a change in the texture of the scrotal skin. There is also some reddening of the scrotal skin.
Stage 3: Growth of the penis has occurred, at first mainly in length but with some increase in breadth. There has been further growth of testes and scrotum.
Stage 4: Penis further enlarged in length and breadth with development of glans. Testes and scrotum further enlarged. There is also further darkening of the scrotal skin.
Stage 5: Genitalia adult in size and shape. No further enlargement takes place after stage 5 is reached.

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Central Precocious Puberty

Breast Development prior to 8 years of age in females

- If occurs < 6 years of age > Head MRI
- R/o intracranial abnormality
  - Hypothalamic Hamartoma

Testicular Enlargement (≥ 4mL) prior to 9 years of age in males

- Any male with CPP is at risk for intracranial abnormalitity > Head MRI

- Leuprolide-Stimulation Testing
  - Baseline LH > 0.6 mIU/mL
  - Stimulated LH > 5 mIU/mL
  - 24-hour Estradiol > 30 pg/mL
- Advanced bone age on x-ray
- Treatment
  - GnRH-agonist
    - Lupron SQ every 3 months
    - Triptodur SQ every 6 months
    - Supprelin Implant annually
  - Weight Gain

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Puberty & Obesity

- Obesity is associated with early puberty (girls)
  - Increased Leptin levels
    - Permissive effect on puberty and pubertal growth
  - Increased circulating Estrogen
    - Hyperinsulinemia > Decreased Sex Hormone Binding Protein
    - Increased Aromatase Activity
  - Increased Androgens
    - Increased Cytokines > Promote Production of Androgens
    - Premature Adrenarche & Advanced Bone Age
  - Increased Free Insulin-Like Growth Factor

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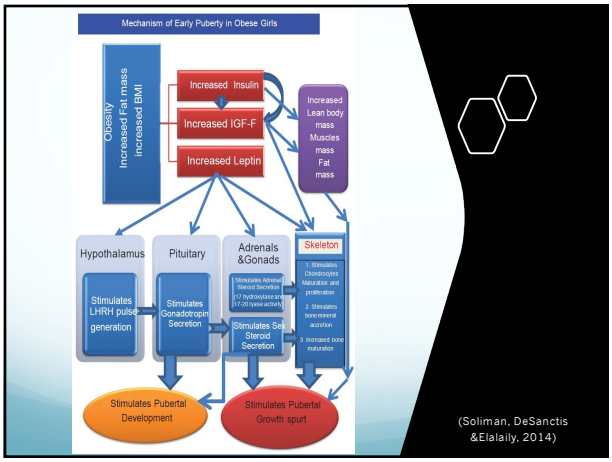

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Gynecomastia: A Brief Mention

- Glandular breast development in males
- Prevalent in puberty
- Consider other causes:
  - Medications
  - Substance Use (marijuana, testosterone, etc)
  - Primary Hypogonadism
  - Tumors (testicular, adrenal
  - Retro-areolar mass
  - Underlying Illness (cirrhosis, renal failure…)
  - Trauma

Obesity related -

- Pseudogynecomastia
  - Lipomastia
  - Proliferation of adipose tissue rather than glandular tissue

Treatment Options:
Weight Loss
Tamoxifen
Aromatase Inhibitors: Anastrozole
Surgery

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Case Study #3: GI Considerations

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Constipation and Encopresis

- Encopresis is usually related to overflow incontinence from constipation
- Would evaluate with KUB for stool burden and then recommend a clean out with miralax and Exlax (sennosides 15 mg/sq)
- Usually use miralax (4 gm/kg – max 238 gm/14 caps) mixed in any fluid but milk, usually 8 oz fluid/cap, but younger kids sometimes have a hard time drinking all that. Can use 3-4 oz/cap.

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Constipation and encopresis

- After clean out, recommend a daily maintenance dose of 17 gm of miralax each morning and Exlax 1 square each evening
- Structured toilet sitting - sit for 10 minutes after meals, after school and before bed
- May need inpatient clean out if home clean out does not resolve encopresis and nocturnal enuresis
- If there is any concern for autism, constipation and encopresis is more common and can be difficult to resolve

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Case Study #3
Nephrology (Hypertension) Considerations

113

BP: To Treat or Not to Treat?

5 year old-
Ht: 96.5cm; Wt: 29.5kg
90th: 104/61
95th: 107/65

Can't get good BP.
-bubbles, desensitize, still do secondary work-up and if LVH or LVMI increased, go ahead and start meds.

-If I had to start meds on this patient, I would do lisinopril.

2017 American Academy of Pediatrics updated definitions for pediatric blood pressure categories

	For children aged 1 to <13 years	For children aged ≥13 years
Normal BP	Systolic and diastolic BP <90th percentile	Systolic BP <120 and diastolic BP <80 mmHg
Elevated BP	Systolic and diastolic BP ≥90th percentile to <95th percentile, **or** 120/80 mmHg to <95th percentile (whichever is lower)	Systolic BP 120 to 129 and diastolic BP <80 mmHg
Stage 1 HTN	Systolic and diastolic BP ≥95th percentile to <95th percentile+12 mmHg, **or** 130/80 to 139/89 mmHg (whichever is lower)	130/80 to 139/89 mmHg
Stage 2 HTN	Systolic and diastolic BP ≥95th percentile+12 mmHg, **or** ≥140/90 mmHg (whichever is lower)	≥140/90 mmHg

BP: blood pressure; HTN: hypertension.

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Nocturnal Enuresis

- Refer to previous Case Slides

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Case Study #3 Pulmonary and Sleep Considerations

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Steroids in Asthma

- Oral Steroids (Orapred, Prednisone, Prednisolone)
  - Dosing is based on severity of symptoms
    - 1-2 mg/kg/day x 3-5 days
  - If 2-3 bursts needed per year patient's asthma considered un-controlled
  - Goal is to minimize steroid "bursts" but maximizing controlled medication

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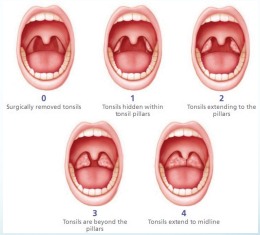
HEENT Exam Findings

- Physical exam should include HEENT assessing for tonsillar hypertrophy
  - Referral to ENT Clinic vs Sleep Clinic
  - In obese children, adeno-tonsillectomy is the first step in management



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Nocturnal Enuresis in Sleep

- Nocturnal enuresis has been reported in 10-40% of children with obstructive sleep apnea
- Obstructive sleep disorder breathing decreases the arousal response (particularly in non-REM sleep)
- Complete resolution of nocturnal enuresis has been reported in 31 to 76% of OSAS children within months of surgical intervention

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Case Study #3
Mental Health Considerations

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Psychiatric differential diagnoses:

- If…Avoidant/Restrictive Food Intake Disorder (ARFID)
  - Then…SSRIs Prozac or Zoloft have both anxiety and OCD FDA indications
- If…Trauma and Stressor Related Disorder
  - SSRI – Zoloft has adult FDA indication for PTSD
    - Also FDA pediatric indication for OCD (also Prozac)
- If…Autism Spectrum Disorder (ASD)
  - Then…Risperdal or Abilify – Atypical antipsychotics with FDA pediatric indication for Autism related irritability
    - Requires regular lab work – can cause increase in glucose, cholesterol, liver enzymes, BMI

(Testing for intellectual disabilities may be indicated to employ school interventions e.g., Individual Education Program - IEP)

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Contact information and Bios of the Presenters

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Shelley Coskery

Shelley Coskery is a nurse practitioner in the division of pulmonary and sleep medicine at Children's of Alabama. She's been an nurse for 11 years and a NP for the last 8 years practicing in both inpatient and outpatient pulmonary medicine. She's particularly interested in sleep medicine as well as patients with neuromuscular disease. She lives in Birmingham with her husband and son.

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Jessica Edmondson

Jessica Edmondson is an acute care pediatric nurse practitioner with the Division of Pediatric Nephrology at Children's of Alabama. Her clinical focus is on pediatric patients with hypertension and patients with congenital anomalies of the kidneys, ureter, and bladder (CAKUT). She has been in her current position for 3 years. Prior to that she was an NP with the Neuro-Oncology team at COA for 4 years and a Pediatric Primary Care NP in Gadsden, AL, for 3 years. Her pre-NP nursing career was focused on nephrology patients in general med-surg but also as a dialysis nurse and coordinator for the CRRT program at COA from 2008-2011.

She is active in her community as a pastor's wife, PTO mom, volunteer Volleyball coach, and church food pantry coordinator. She is married and has one beautiful daughter. She currently resides in Boaz, AL.

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Karen McCarty

Dr. McCarty is a graduate of UABSON 1977. She has been practicing nursing for 44 years. She retired from academics in 2018. Her research focus has been in pediatric obesity since the early 1990's. She has published, presented and conducted research in this specialty. She has been the CPNP at COA Weight Management Clinic since 2005.

Dr. McCarty lives on a farm in Wilsonville with her husband. She has 3 children, 3 stepchildren, 3 grandchildren and about 50 plus animals that all call her mom.

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Leslie Pitts

Leslie Pitts, MSN, CPNP-AC, CDCES, AP-PEN has been an endocrine nurse practitioner for 11 years at Children's of Alabama. She serves as an Endocrine consultant with the Alabama Department of Public Health for state newborn screening. Leslie is actively involved in research aimed at improving endocrine newborn screening, diabetes clinical care and Congenital Adrenal Hyperplasia management. Her passion is patient and provider education. She is a member of the Pediatric Endocrine Society serves as the chair of the PES Advanced Practice Providers Special Interest Group. Leslie is also a member of the Pediatric Endocrine Nurses Society, serving on their education committee. She also participates in NAPNPA and the JDRF Junior Board. Leslie is married and has two children, ages 10 and 7. She is currently pursuing her doctorate in nursing at the University of Alabama at Birmingham.

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Courtney Reeves

Courtney Reeves was certified as a Psychiatric Mental Health NP in 2007 after working in medical/surgical inpatient units as an RN for years. She also holds a Master of Public Health from UAB specializing in health behavior as well as a Master's in Counseling Psychology from Boston College. She currently works at Children's Hospital Emergency Department.
She lives in Birmingham with her husband and two daughters ages 12 and 14.

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Laurel Williams

Laurel Williams, CRNP-AC started at Children's in 1992 as a floor nurse, changed to Case Management in 1999. She went back to UAB in 2012 and graduated with Masters degree in 2014. She started with Peds GI 2015. She has her own independent clinic 3.5 days a week.
Any GI referrals, fax referral to 205-638-9919. Patient will be seen by an MD to start and then usually sent to NP for follow up.

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SHINE Clinic: Who Are We?

- Support and Help in Nutrition and Exercise
- Mission: Improve health/weight-related behavior, physical functioning, and weight-related quality of life of child and their families through evaluations from interdisciplinary team.
  - Strengths-based approach with patient/family goal setting
  - Life-long behaviors changes
  - Long-term relationship to achieve goals
- Member of the POWER collaborative
  - National collaborative of pediatric obesity treatment clinics
- Statistics:

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SHINE Clinic Appointments
INTERDISCIPLINARY TEAM
Pediatrician/Adolescent Medicine Specialist
Nurse Practitioner
Nurse/Clinical Assistant
Physical Therapist
Social Worker
Registered Dietician
Physical Therapist
Psychologist
CLINIC VISITS (THURSDAYS AM/FRIDAYS)
Triage (Height/Weight/ Blood Pressure)
Fasting Labs
Individual evaluation with each discipline
◦ Aprox. 30 minutes each provider
Assessments
◦ Bullying
◦ Pediatric Symptoms Checklist
Interdisciplinary Goal Sheet
◦ Discuss with family by each provider- printed at discharge
UAB MEDICINE
PEDIATRICS
Children's of Alabama

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