Medical Risks, Treatment and Referral of Very Obese Children

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Venus of Willendorf
30,000-25,000 B.C.

Case report

- African American girl 13 year old
- Casual appointment
- BMI 63
- BP 140/95
- Falling asleep while being examined
- Acanthosis nigricans on exam
- Pitting edema of legs
- Puberty stage 3, no menses

Case report

- History of oxygen discontinued due to missed appointments
- Out of school for months
  - Can’t walk there
  - Teased there
- Labs-
  - Cholesterol 235
  - Alt 80
  - hgA1C 6.5

Case report

- Admitted to chronic care facility for 3 months
- Discharged after 1 month due to loss of 25 kg
- On Bipap, prozac, 1200 calorie diet with additional vitamins and minerals
- Stable weigh at home
- Awaiting psychological counseling for 4 months
- CPS?

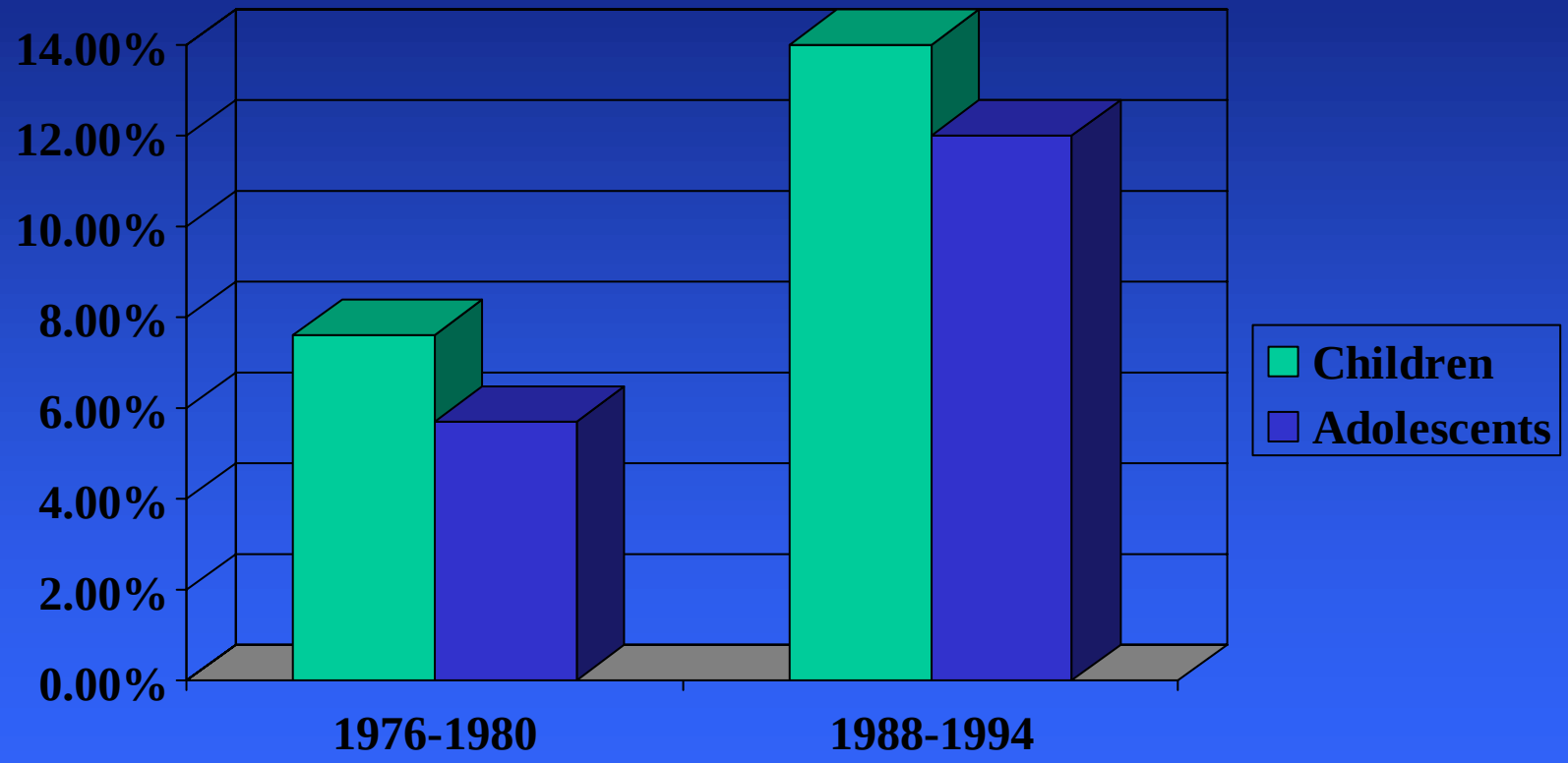
Medical Risks of Very Obese Children

- Epidemiology
- Risks of the adult who was an obese child
- Risks of the obese child
- Treatment of co morbidities
- Intensive therapy of obese children
- Referral

Childhood Obesity
The Problem

- 30% of Adult Obesity Begins in Childhood: Prediction is Possible
- The Prevalence of Obese (BMI>95th%) 6-17 Year Old Children Doubled Between 1980 and 1994
- The prevalence of overweight (BMI>85th%) increased 50% between 1980 and 1994
- Child Onset Obesity may have Worse Consequences Than Adult Onset Obesity

The change in 95% BMI Obesity in Children



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Obesity:
Global Nutritional Concern

Data From All European Countries and Many Middle Eastern and Caribbean Countries Demonstrate the Trend Towards Increasing Prevalence of Childhood and Adolescent Obesity

Obesity:
Global Nutritional Concern

The Westernization of Traditional Diets and Food Portion Sizes

THE COCA-COLONIZATION OF THE WORLD

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Body Mass Index (BMI)

Weight (kg)/Height^2 meters

or

Weight (pounds) x 705/Height^2 (inches)

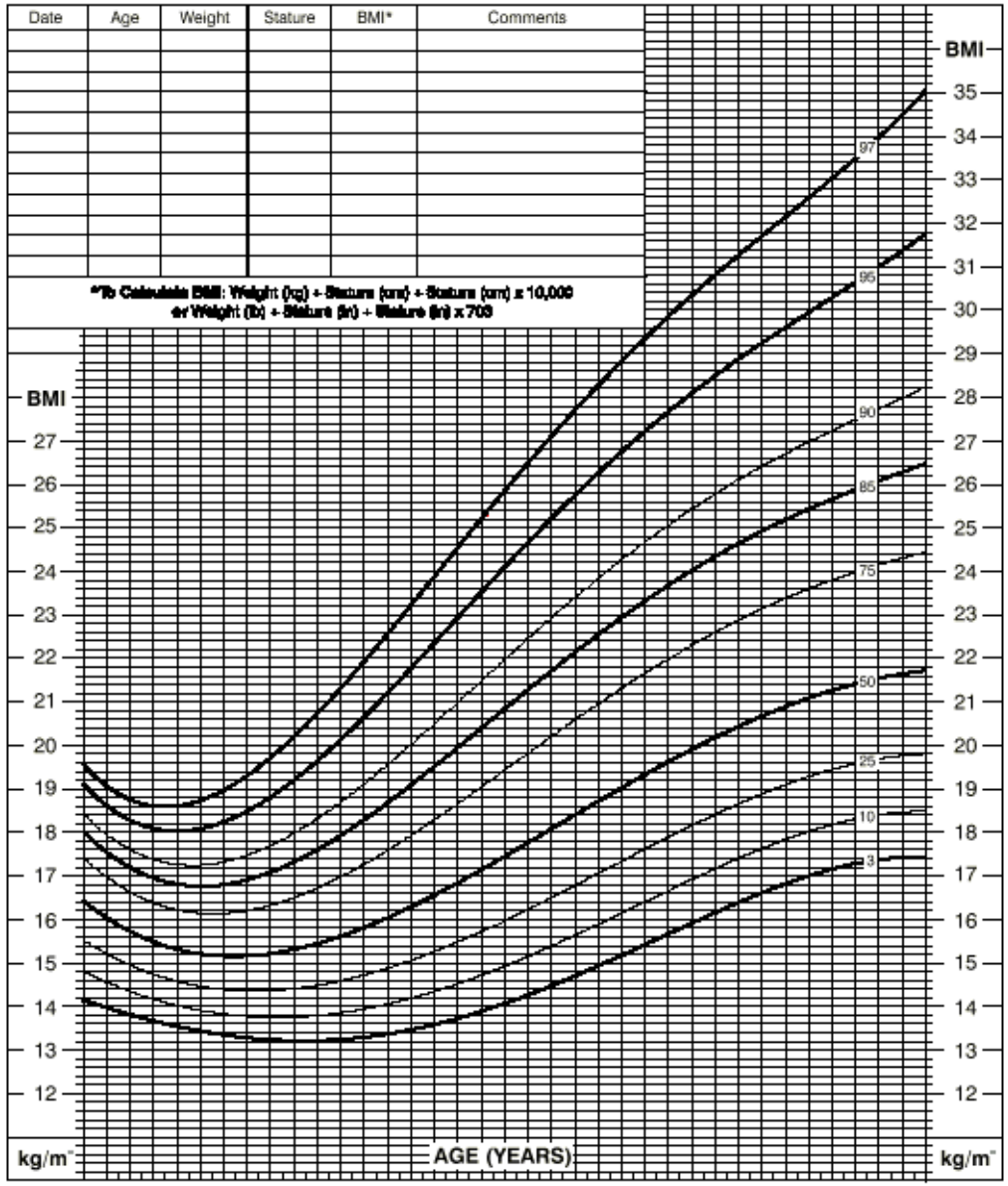
2 to 20 years: Girls
Body mass index-for-age percentiles

NAME _____

RECORD # _____

Date	Age	Weight	Stature	BMI*	Comments

*To Calculate BMI: Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) ÷ Stature (in) x 703



SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

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Body mass index-for-age percentiles

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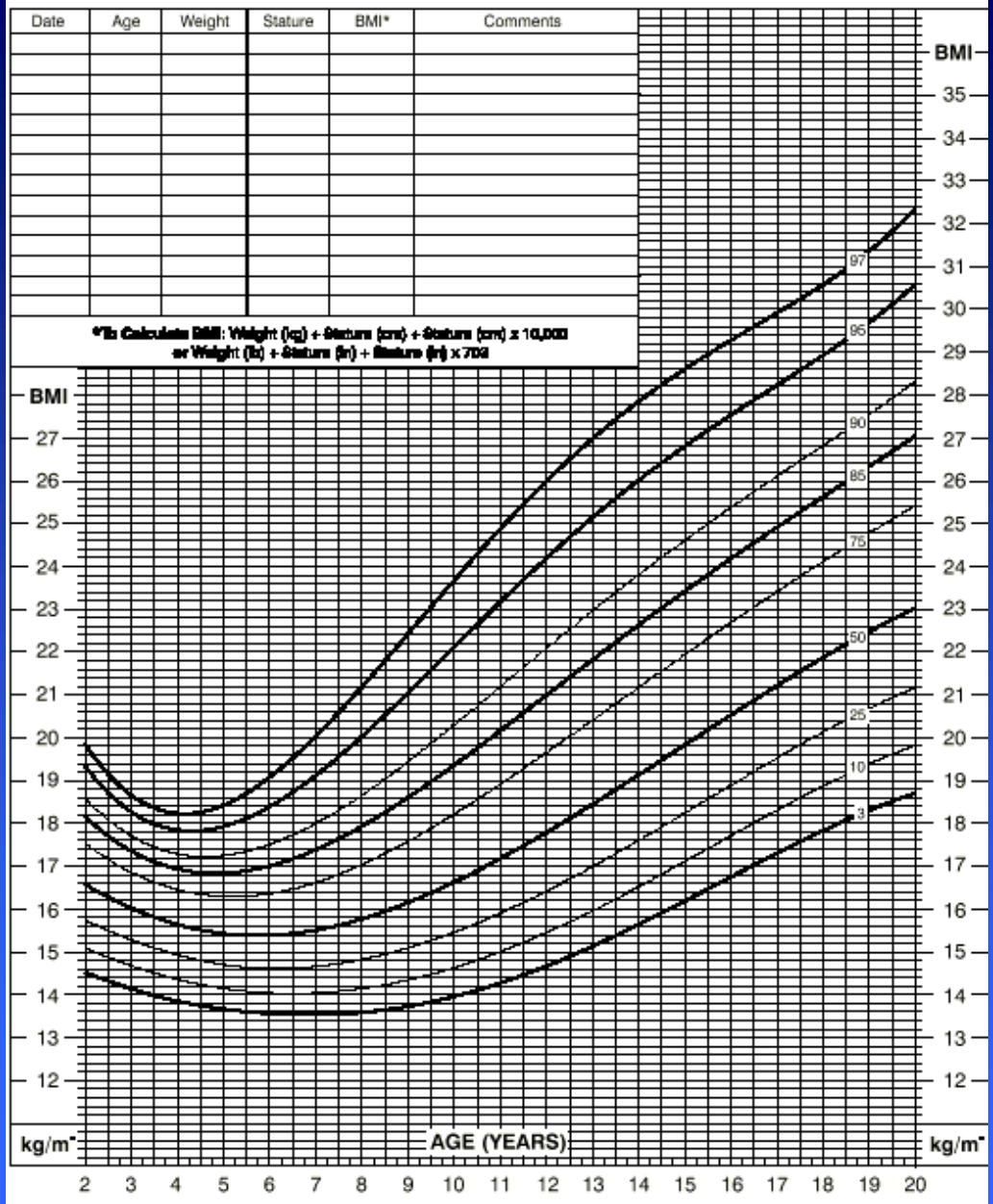

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Childhood Obesity Consequences in the Adult

- **Medical Complications of Childhood Obesity**

  57 year Follow-up of 7 y/o Children with BMI > 75%

– **Cause of Death**	**Hazard Ratio**
All Causes	2.0 (1.2, 3.3)
Cardiovascular Disease	1.6 (0.8, 3.6)
Ischemic Heart Disease	1.9 (0.7, 5.0)
Stroke	0.9 (0.1, 6.1)

(The Lord Byron Orr Cohort Am J Clin Nut 67:1111 1998)

Other data from Maryland, Boston Norway support this trend

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Childhood Obesity

Medical Complications in Childhood

- Increased Height
- Early Menarche
- Increased Heart Rate and Cardiac Output
- Hypertension
- Sleep Apnea
- Pseudotumor Cerebri
- Blount Disease
- Slipped Capital Femoral Epiphysis

Childhood Obesity

Medical Complications in Childhood

- **Increased Height - Increased Expectations**
  - **Bone age is increased in obesity along with height**
  - **Short stature with obesity is suggestive of an endocrine problem**

- **Early Menarche - Linked to Breast Cancer?**
- Increased Heart Rate and Cardiac Output
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Childhood Obesity

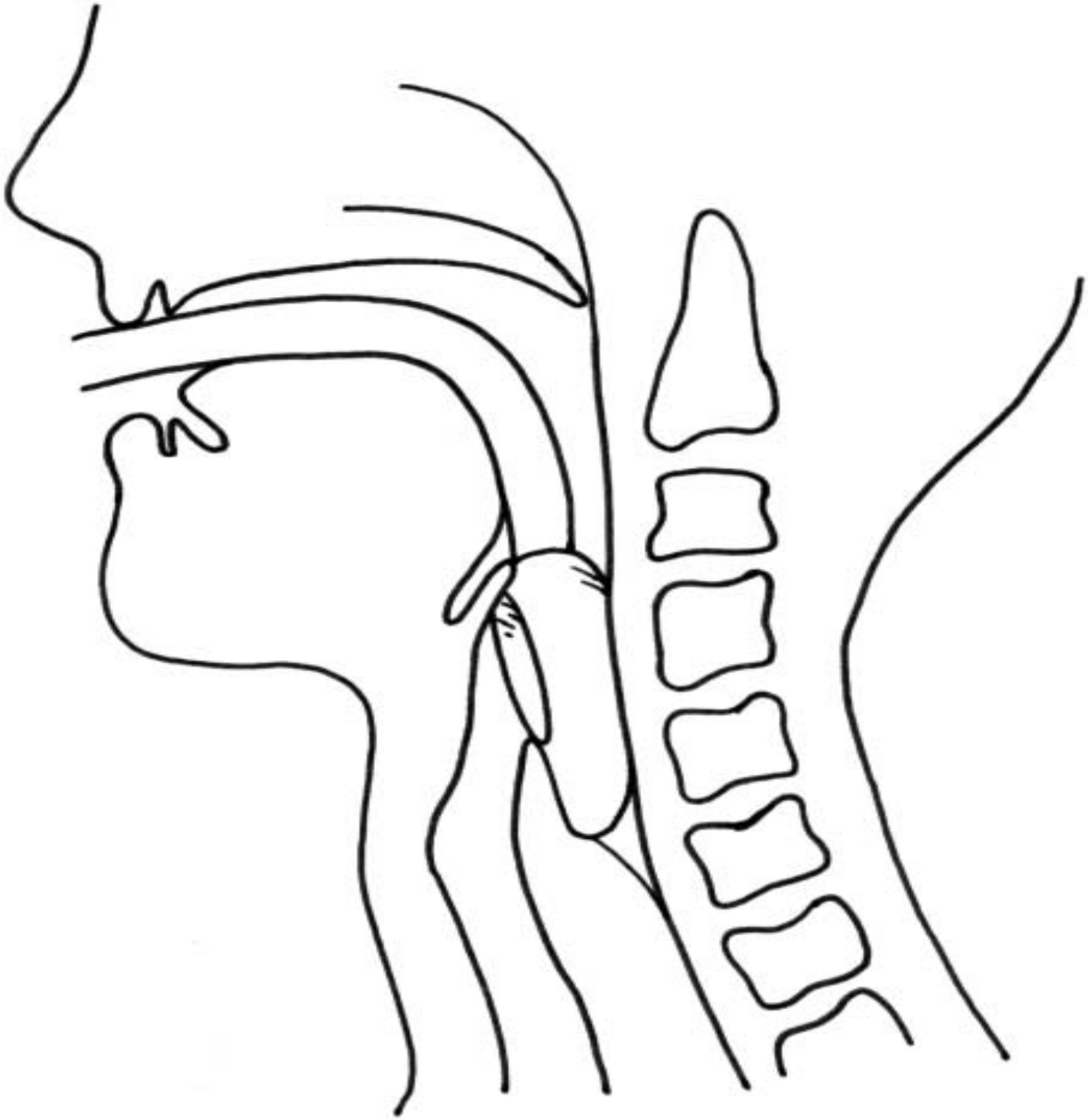
Medical Complications in Childhood

- Increased heart rate and cardiac output
- Possible risk for sudden death due to:
  - obstructive sleep apnea with CO_2 retention, hypoxia, right ventricular hypertrophy and failure
  - Treatment with weight loss, positive pressure by Bipap, adenoidectomy

Childhood Obesity

Medical Complications in Childhood

- Obesity hypoventilation syndrome or Pickwickian Syndrome
  - hypoventilation
  - somnolence
  - CO2 retention
  - hypoxia
  - polycythemia
  - right ventricular hypertrophy and failure
  - pulmonary embolism



From Ray and Senders in PCNA 2000

Childhood Obesity Medical Complications in Childhood

- **Sudden Death in Childhood During Daytime While Awake**
  - Ventricular Arrythmias?
  - Abnormal Conduction?
  - Right Ventricular Hypertrophy ?
  - Prolongation of the QTc interval?

(Warden and Styne 1999)

Childhood Obesity

Medical Complications in Childhood

- Hypertension

Childhood Obesity

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Pseudotumor Cerebri

Benign Intracranial Hypertension

- Increased intracranial pressure must be present
- Ventricular system must be normal or small
- Focal neurological signs must be absent
- Benign outcome

Pseudotumor Cerebri

Benign Intracranial Hypertension

- Etiology:
  - Lateral sinus thrombosis
  - Obstruction to venous drainage due to right heart failure, pulmonary disease with carbon dioxide retention
  - Endocrine conditions such as
    - Congenital adrenal hyperplasia
    - Addison disease
    - Withdrawal of glucocorticoids
    - Hypoparathyroidism
    - Obese young women with galactorrhea, recent menarche, amenorrhea and hirsutism

Pseudotumor Cerebri

Benign Intracranial Hypertension

- Symptoms include:
  - Increased intracranial pressure
    - Headache
    - Dizziness
    - Diplopia
    - Mild unsteadiness
    - Gradual NOT ACUTE

Pseudotumor Cerebri

Benign Intracranial Hypertension

- Signs include
  - Increased intracranial pressure:
    - Papilledema
    - Cranial nerve VI palsy: affects lateral rectus
    - Visual disturbances
    - Diplopia
    - Peripheral visual filed loss
    - Irritability
  - NO FOCAL SIGNS

Pseudotumor Cerebri

Benign Intracranial Hypertension

- Diagnosis
  - MRI
  - Clear spinal fluid under increased pressure
  - Perimetry, measure intraocular pressure and visual acuity
- Weight loss and only rarely:
  - Corticosteroids
  - Carbonic anhydrase inhibitors:acetazolamide
  - Loop diuretics: furosemide
  - Hyperosmolar agents: oral glycerol

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Blount Disease
Tibia Vera

- Bowing of the legs: tibia vera
- Abnormality in the growth of the medial portion of the proximal tibia
- X-rays show irregularity of the growth of the proximal medial tibial phyhsis with beaking of the metaphysis

Childhood Obesity

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Slipped Capital Femoral Epiphysis

Slipped Upper Femoral Epiphysis

- The epiphysis of the proximal femur slips off the metaphysis posteriorly and medially and there is proximal and anterior migration of the femoral metaphsis
- Etiology:
  - Growth hormone deficiency
  - Thyroid deficiency
  - Decreased estrogen or testosterone
  - Classic patient is overweight hypogonadal boy with delayed bone age

Slipped Capital Femoral Epiphysis

Slipped Upper Femoral Epiphysis

- Symptoms:
  - Pain anywhere from hip to foot
  - Can't walk
- Signs:
  - Hip in external rotation
  - Pain to passive manipulation
  - Walking leaning over the the involved hip on the weight bearing leg
  - Shortening of affected leg
  - Decreased internal rotation and abduction
  - AP and lateral Xrays of hip required

Childhood Obesity

Medical Complications in Childhood

- Hyperlipidemia
- Cholelithiasis
- Hepatic Steatosis
- Ovarian Hyperandrogenism
- Insulin Resistance, Glucose Intolerance, Acanthosis Nigricans

Hyperlipidemia

- Elevated lipid levels are related to obesity in childhood as well as in the adult
- Treatment
  - Diet and exercise
  - statins

Childhood Obesity

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- Insulin Resistance, Glucose Intolerance, Acanthosis Nigricans

Cholelithiasis

- Previously mostly female related to pregnancy and obesity
- Prevalence increased in obese children and adolescents after 10 years of age

Childhood Obesity

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- Hepatic Steatosis
- Ovarian Hyperandrogenism
- Insulin Resistance, Glucose Intolerance, Acanthosis Nigricans

Hepatic Steatosis

- Ultrasound evidence show a greater prevalence than serum enzymes: 40%
- Elevated liver enzymes are frequent in childhood obesity:25%
- ALT may be double normal values
- Weight loss seems to be the only treatment

Childhood Obesity

Medical Complications in Childhood

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- Cholelithiasis
- Hepatic Steatosis
- Ovarian Hyperandrogenism
- Insulin Resistance, Glucose Intolerance, Acanthosis Nigricans

Functional Ovarian Hyperandrogenism
Polycystic Ovarian Disease

- Need not have cysts
- Need not have LH>FSH
- Must be differentiated from adrenal disease
  - Non-classical congenital adrenal hyperplasia
    - Very common P450 deficiency>3βOL
    - Basal 17OHP or DHEAS may not be diagnostic
    - May require ACTH stimulation test
- Exaggerated adrenarche is a harbinger

Functional Ovarian Hyperandrogenism

Test	Primary variable	Isolated FOH	Isolated FAH	FOH + FAH	Idiopathic
GnRHa	17OHP	High	Normal	High	Normal
ACTH	DHEA, androstene-dione	Normal	High	High	Normal
Dexa-methasone	Free testosterone	High	Normal	High	Normal

Rosenfield, et.al. 2000

Functional Ovarian Hyperandrogenism

- Hyperandrogenism
  - Oral Contraceptives
    - Low androgens:orthotrycyclin
  - Anti-androgens
    - spironolactone
- Insulin Resistance
  - Metformin
- Weight Loss?

Childhood Obesity

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A Second Epidemic
Type 2 (Adult Onset) Diabetes Mellitus during Childhood

- Rare in adolescents prior to this decade (1-4%)
- Recognized in Native American children in first
- A 10 fold increase noted by 1995 in Cincinnati
- Then recognized in African Americans, Hispanic Americans and now Asian Americans
- Now found where obesity prevalence increases across the world
- Presently 8-45% and probably more that are missed
- Probably will cause early kidney, eye and cardiac disease based upon results of young adult onset

A Second Epidemic
Type 2 (Adult Onset) Diabetes Mellitus during Childhood

- It is not:
  - Maturity onset of the young or MODY
  - Type 1 Diabetes Mellitus
- It is:
  - Different from Adult Type 2Diabetes Mellitus in the possibility of ketosis
  - Included in atypical diabetes mellitus?

Type 2 Diabetes Mellitus in Childhood

Type	Ketosis?	Antibodies	Treatment	Genetics?
Type 1	Yes	Yes	Insulin	Polygenic
MODY	No	No	Diet	Autosomal dominant
Atypical diabetes mellitus	Possible	No	Diet/Oral hypo-glycemics/ insulin	Autosomal dominant in African Americans
Type 2 in childhood	Possible	No	Diet/Oral hypo-glycemics/ insulin	polygenic

A Second Epidemic
Type 2 (Adult Onset) Diabetes Mellitus during Childhood

- Pathophysiology:
  - Insulin resistance
  - βcell inadequacy
  - Finally increased hepatic glucose production
- Risk factors
  - Obesity
  - Ethnic group
  - Puberty
  - Family history
  - FOH
  - Acanthosis nigricans

Arslanian, JPEM 2000

Type 2 Diabetes Mellitus in Childhood

- Treatment
  - Diet and exercise
    - Always indicated
  - Insulin
    - Emergently indicated
    - Should try to wean off
  - Oral hypoglycemic agents
    - Not approved for <16 years
    - In clinical trials

Type 2 Diabetes Mellitus in Childhood

- Biguanides (metformin)
  - Decrease hepatic glucose output
  - Increase hepatic and muscle sensitivity to insulin
  - Anorexia, weight loss
  - Risk of abdominal pain, diarrhea, nausea
  - Risk of lactic acidosis:contraindicated in liver, renal, cardiac or respiratory disease or during administration of radiographic contrast

Type 2 Diabetes Mellitus in Childhood

- Sulfonureas and meglitinide
  - Increase insulin secretion
  - Bind to K+-ATP channel complex to close K+ and open Ca++ channels
  - Classic drug is intermediate
  - Meglitinide is short acting allowing bolus for meals
  - Hypoglycemia and weight gain possible

Type 2 Diabetes Mellitus in Childhood

- α-glucosidase inhibitors (acarbose)
  - Inhibit breakdown of carbohydrates in the upper small intestine and delaying absorption in lower small intestine
  - Reduces absorption of carbohydrates
  - Side effect is flatulance

Type 2 Diabetes Mellitus in Childhood

- Thiazolidinediones-rosiglitazone
  - Activate peroxisome proliferator activator receptors (PPAR)-orphan steroid receptors in adipocytes
  - Increase insulin sensitivity of liver, muscle and adipose tissue and reduce hepatic glucose output
  - Side effects are edema, weight gain, anemia and elevated liver enzymes
  - New forms are safer

A Second Epidemic
Type 2 (Adult Onset) Diabetes Mellitus during Childhood

- There is a tendency for patients and children to take type 2 diabetes less seriously than type 1 and compliance may be even worse
- No immediate medical catastrophes are likely
- Effects take years to appear

BMI	Risk factors	Tests
85 – 94 %	No	Fasting lipid profile
	Yes	Fasting lipid profile
		Fasting insulin and glucose, hgA1C
		Comprehensive chemistry panel
		EKG
BMI > 95%	Yes or No	Fasting lipid profile
		Fasting insulin and glucose; hgA1C
		Comprehensive chemistry panel
		EKG
Depending on History and Physical Assessment		Sleep study
		Holter Monitor
		Extremity films
		Thyroid function tests (free T4 and TSH)

Childhood Obesity Psychological and Social Complications

- Poor Self Esteem
  - 9-11 Year Olds Already Affected
- Prejudiced Reception
  - "Overindulgent"-"No Self Control"
- Limited Opportunities Especially for Girls
  - Acceptance to College
  - Marriage
  - Economic Security

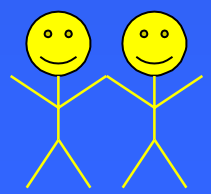
WHAT ARE SOME OF THE REASONS YOU MIGHT OR MIGHT *NOT* WANT TO LOSE WEIGHT?

What are some of the reasons you might want to lose weight? For people to stop making fun of me.

What are some of the reasons you might NOT want to lose weight? I'm proud of who I am.

What are some of the reasons you might want to lose weight? I want to lose weight because people make fun of it

What are some of the reasons you might NOT want to lose weight? I might not want to lose weight because I wouldn't feel like my usual self.



Childhood Obesity
Dangers of Treatment

- Failure Will Lower Self Esteem
- May Cause Eating Disorders
- May Cause Inappropriate Diet
  - Poor Dietary Intake and Subsequent Effects
  - Delay in Puberty and Decreased Growth
  - Decrease in Bone Accretion

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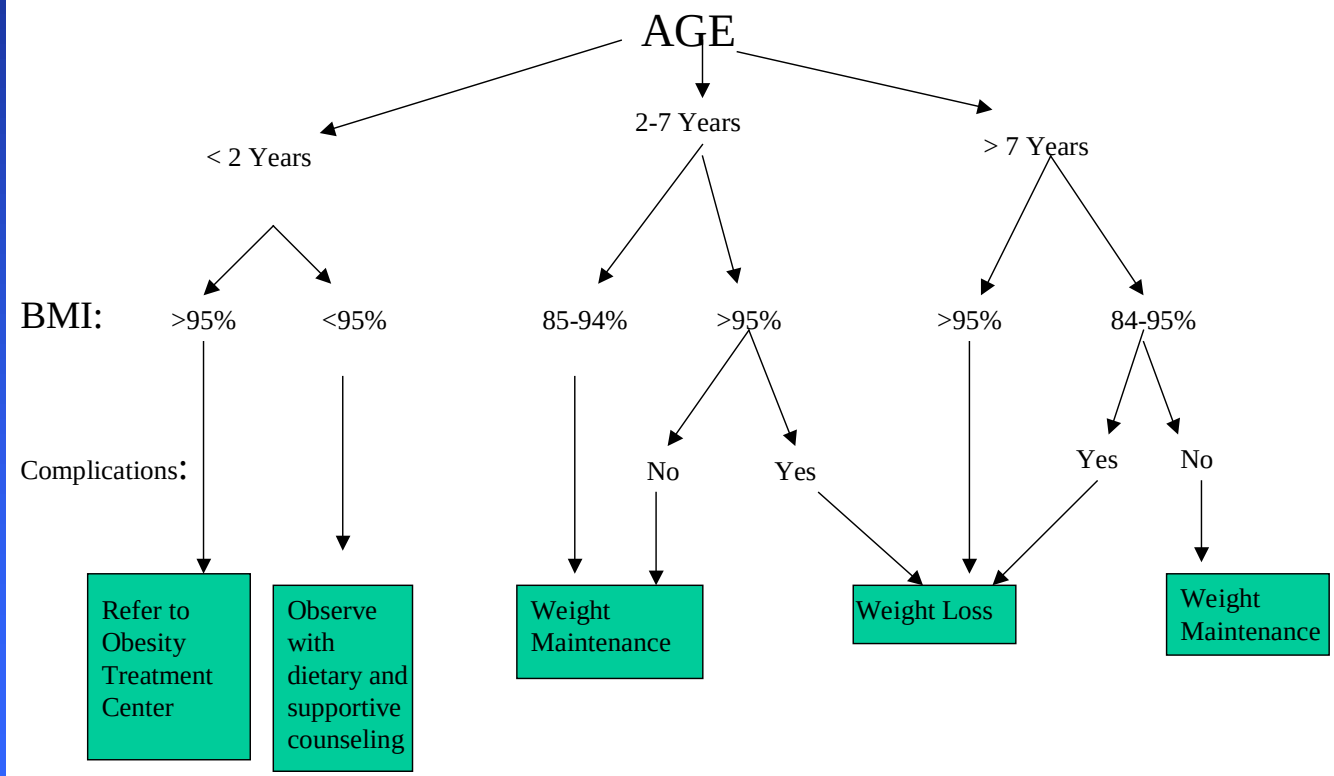
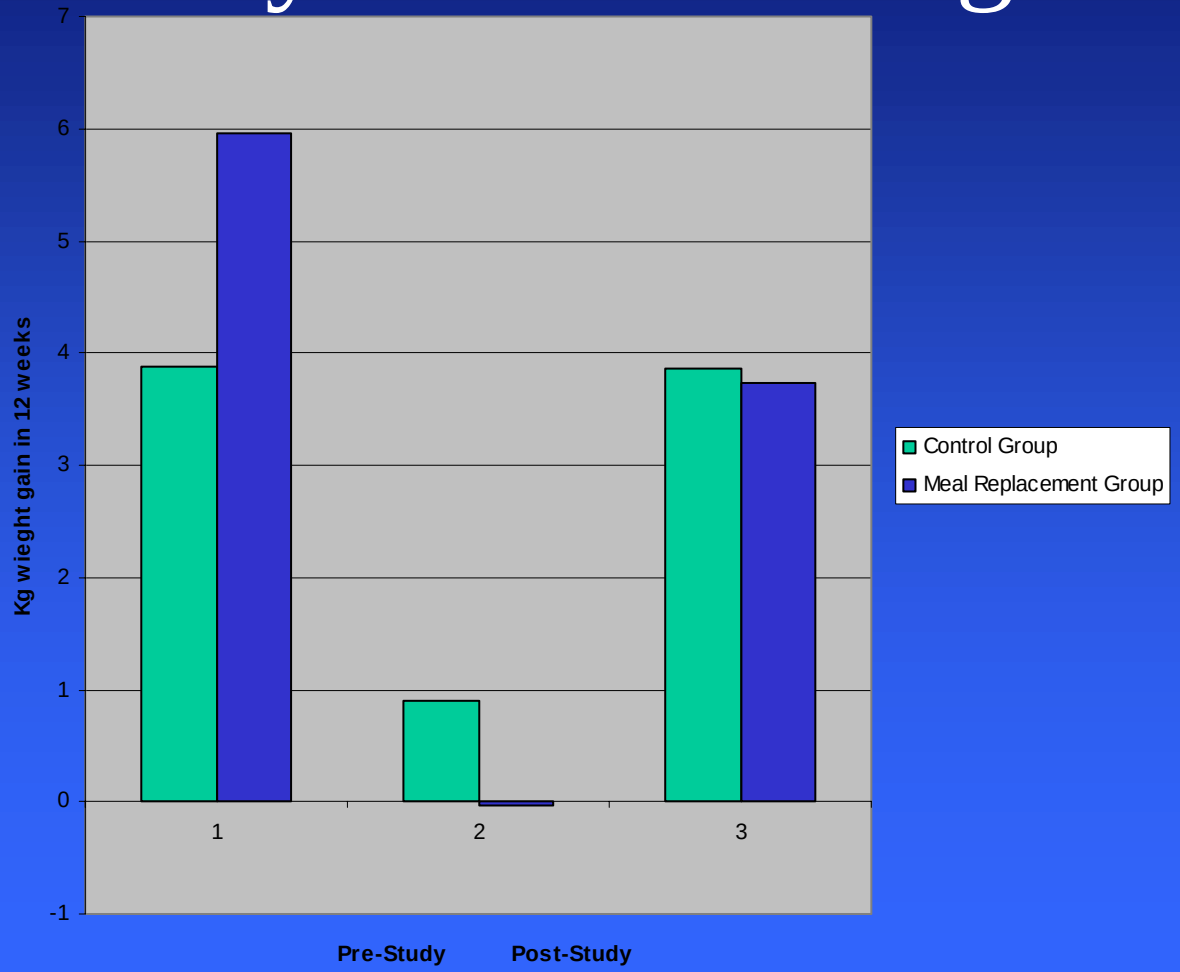
Goals of Therapy Based upon Age, Co Morbidities and BMI



Barlow and Dietz:PEDIATRICS Vol. 102 No. 3 September 1998, p. e29

The Result of an Intensive Family Oriented Program



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Protein Sparing Modified Fast

- For children with severe, often life threatening, consequences of obesity (eg. Sleep apnea) in which rapid weight loss is mandatory
- A medically supervised program of
  - 600 - 800 kcal/d intake
  - 1.5-2.5 g high quality protein per kg ideal body weight (lean meats, poultry, and fish)
  - 20-40 g/d of carbohydrate
  - Daily vitamin and mineral supplementation
  - More than 1500 ml free water
  - Daily monitoring for urinary ketones

Protein Sparing Modified Fast

- Usually lasts no more than 12 weeks
- Risks
  - Cholelithiasis
  - Hyperuricemia
  - Decreased serum proteins, including transferrin, retinol-binding protein, and complement β_1C,
  - Orthostatic hypotension
  - Halitosis
  - Diarrhea

Childhood Obesity Medications?

- None Approved for Use in Children Under 16 Years
  - Present Development and Testing
    - Anorexics
      - Serotonin and norepinephrine reuptake inhibitor
        - » Promotes feeling of fullness
        - » Sibutramine
        - » Increases heart rate
        - » Increases blood pressure

Childhood Obesity Medications?

- None Approved for Use in Children Under 16 Years
  - Present Development and Testing
    - Decreased absorption of Fat to decrease fat absorption
      - Lipase inhibitor
        - » Orlistat
        - » Flatus, diarrhea
        - » Antabuse for McDonalds
    - Drugs for type 2 Diabetes Mellitus
      - Metformin

Childhood Obesity Surgery?

- Minimal information on surgery in early teenagers
- Roux-en-y-gastric bypass (RYGB)
- Wound infections and dehiscence (10%),
- Stomal obstruction (5%),
- Atelectasis and pneumonia (12%), subphrenic abscess (2%), and
- Death (5%).

Childhood Obesity Surgery?

- Iron deficiency anemia (50%),
- Transient folate deficiency (30%)
- Events requiring operative interventions in 40% (cholecystectomy in 20%, small bowel obstruction in 10%, incisional hernia in 10%).

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Medical Risks of Very Obese Children

Referral

- Few resources available but interest is rising
  - Healthy People 2010
- Local dieticians invaluable
- Group programs
  - Traffic Light
  - Shapedown
  - Fit-Kid
- Pediatric obesity centers

Medical Risks of Very Obese Children

Referral

- REFERENCES
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Medical Risks of Very Obese Children

Referral

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