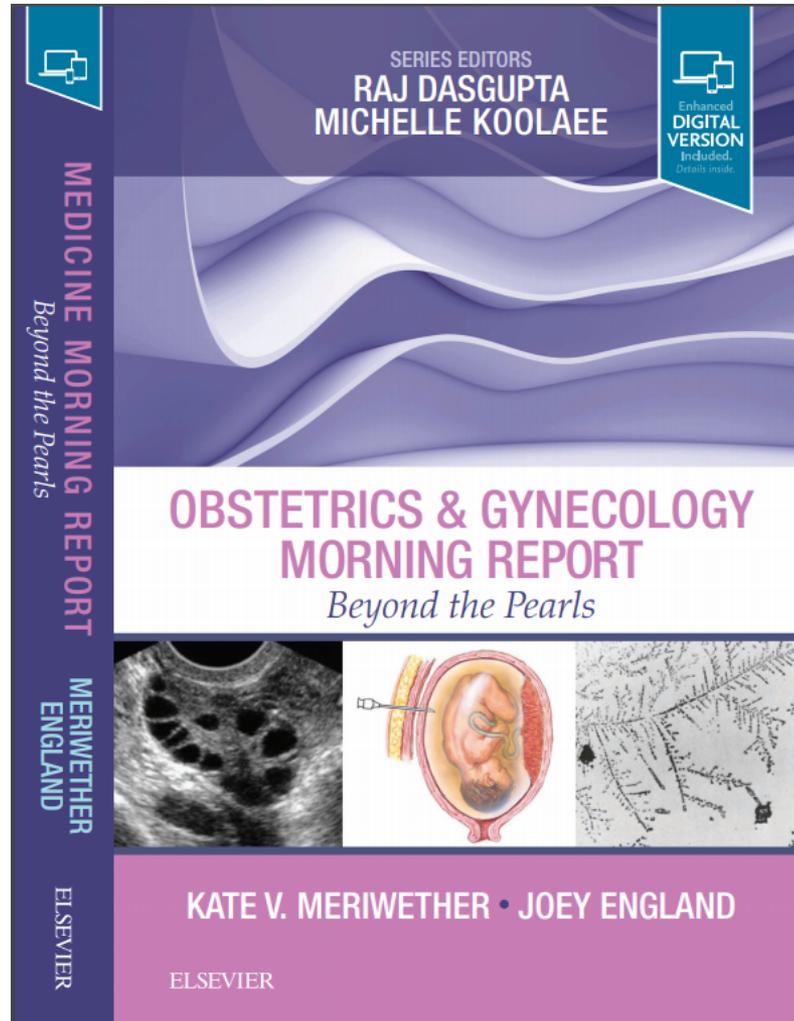


Asthma and Pregnancy



Obstetrics & Gynecology: Morning Report

- 27-year-old woman G1P0 (16 weeks of gestation) presents for outpatient evaluation of **asthma** management during pregnancy

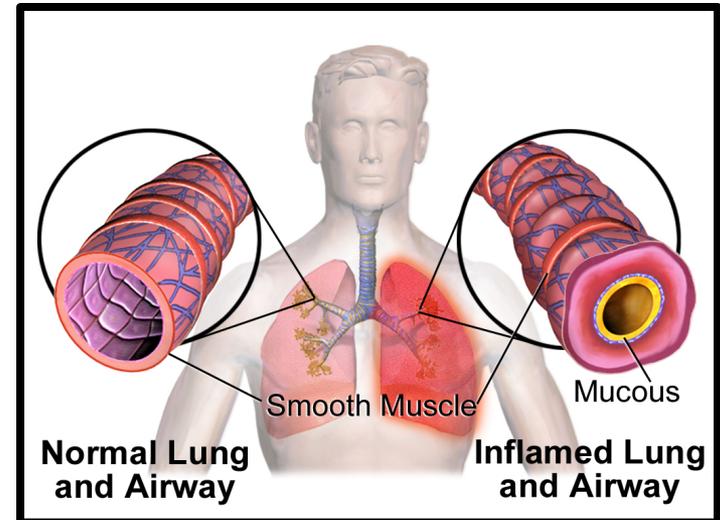


Gravidity and Parity are the number of times a female is or has been pregnant (gravidity) and carried the pregnancies to a viable gestational age (parity)

What is Asthma?

(Step 1 Basic Science Pearl)

- **Chronic** inflammatory disease of the respiratory tree to various **sensitizing** stimuli resulting in **reversible** airway obstruction
- Characterized by:
 - I. **Bronchial hyperresponsiveness (BHR)**
 - Challenge testing
 - II. **Abnormalities in airway smooth muscle function**
 - Bronchothermoplasty



Obstetrics & Gynecology: Morning Report

- She brings you her records from her primary care doctor and obstetrician. The records include her medical history, current medication regimen, and **PFTs** from a month ago
- She has no other past medical or surgical history. Her mother was diagnosed with hypertension, and her father suffered from a myocardial infarction



Obstetrics & Gynecology: Morning Report

- She does not smoke, drink alcohol, or use illicit drugs. She has an allergy to cats
- Currently takes albuterol as needed for shortness of breath and inhaled low-dose budesonide daily
- She asks what you think of her PFTs.



How is Asthma Diagnosed? (Step 2 & 3 Clinical Pearl)

- Pattern of symptoms and response to therapy
- Spirometry and /or PFTs + BD response
 - FEV1/FVC, FEV1, PEF
 - TLC, DLCO
- Challenge testing
 - Exercised induced bronchoconstriction & chronic cough
 - Exercise
 - Cold air
 - Methacholine

- Fraction of exhaled NO (FE_{NO})
 - Eosinophilic inflammation in the airways stimulates airway epithelial cells to produce NO
- Sputum “eosinophiles”
 - Charcot leyden crystals
 - Indicative of a disease involving eosinophilic inflammation
 - Curschmann's spirals
 - Spiral shaped mucus plugs in the sputum

Obstetrics & Gynecology: Morning Report

- Her PFTs show a flow-volume loop consistent with airflow limitation, and her **FEV1/FVC 69%** with **(+) bronchodilator response**. Lung volumes are significant for mild air trapping, and gas exchange is normal
- She tells you she uses her albuterol inhaler 1-2 times a week for shortness of breath. She is able to conduct all of her usual daily activities but does awake with shortness of breath at night 2-3 times a month
- She has never been intubated for an asthma exacerbation, and her last hospitalization was several years ago. She avoids cats as this causes immediate worsening in her symptoms.

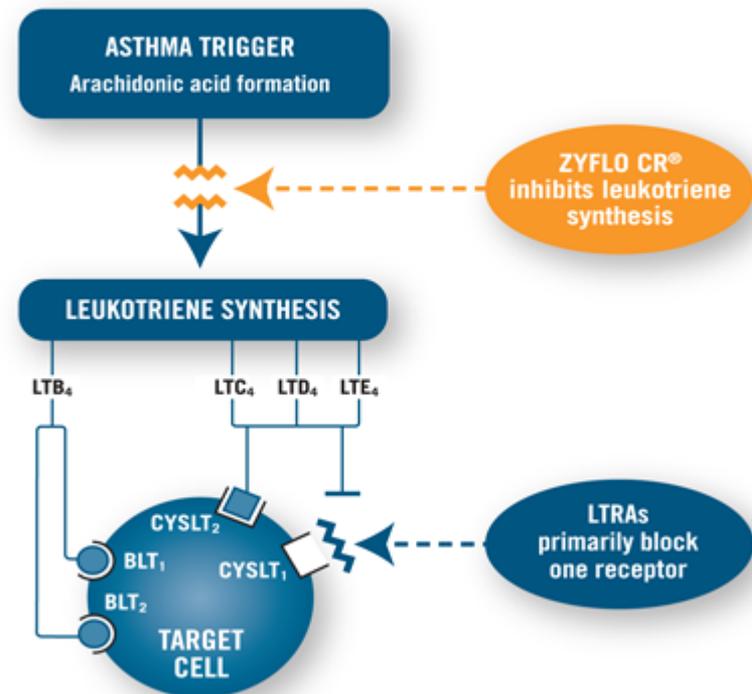
How is Asthma Treated? (Step 2 & 3 Clinical Pearl)

- **Anti-inflammatory medicines**
 - **Corticosteroids**
 - Route: Oral, inhaled, IV and intramuscular
- **Direct bronchodilators** (short and long acting)
 - **Beta 2-agonists** (increases cAMP)
 - Salbutamol, albuterol, levalbuterol
 - **Anti-cholinergics** (M3 receptor in airway smooth muscle)
 - Helpful & recommended in the acute setting
 - Ipratropium bromide

How is Asthma Treated ? Leukotriene Pathway

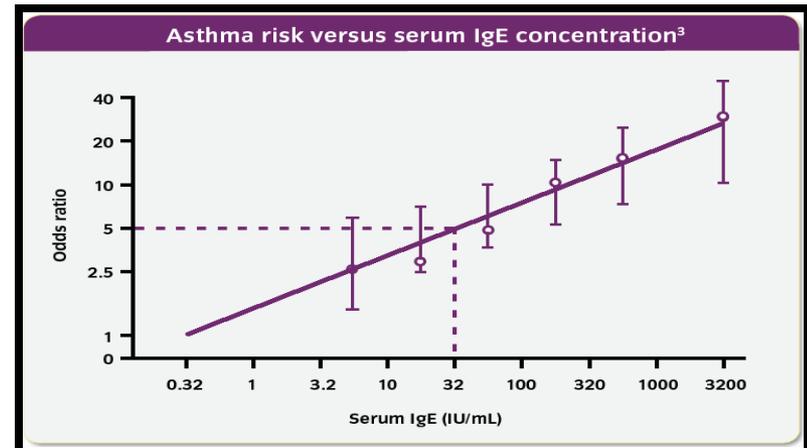
- **Zyflo:**
 - Leukotriene synthesis inhibitor
- **Singulair:**
 - Leukotriene receptor antagonist

The 5-lipoxygenase (5-L0) inflammatory pathway¹



How is Asthma Treated? Immunologic Therapy

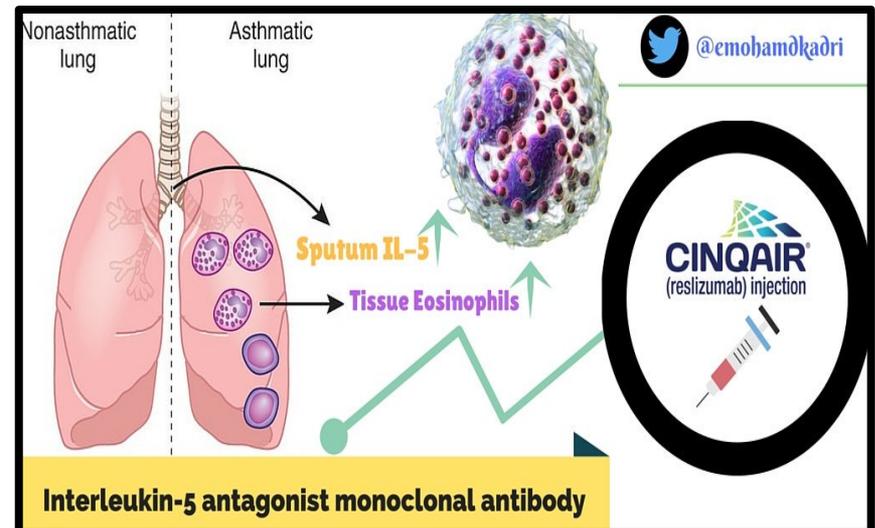
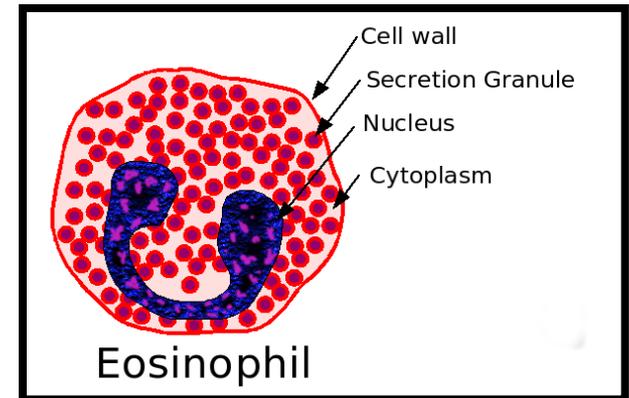
- **XOLAIR®** (Omalizumab)
 - o Subcutaneous injection for people who are 12 years of age and above
 - o Moderate to severe persistent asthma that is triggered by year-round allergens in the air
 - o Dosed on **IgE levels** & weight
 - o Epinephrine auto-injector (EpiPen)



Burrows B, Martinez FD, Halonen M, Barber RA, Cline MG. Association of asthma with serum IgE levels and skin-test reactivity to allergens. *N Engl J Med.* 1989;320:272-277

How is Asthma Treated? New Immunologic Therapy

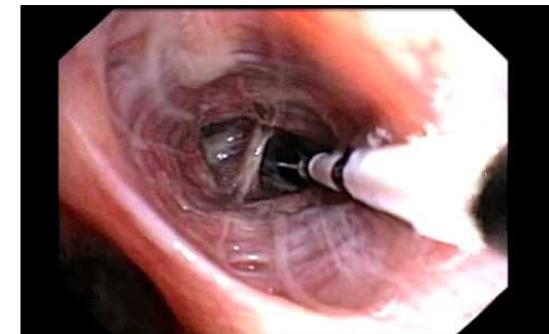
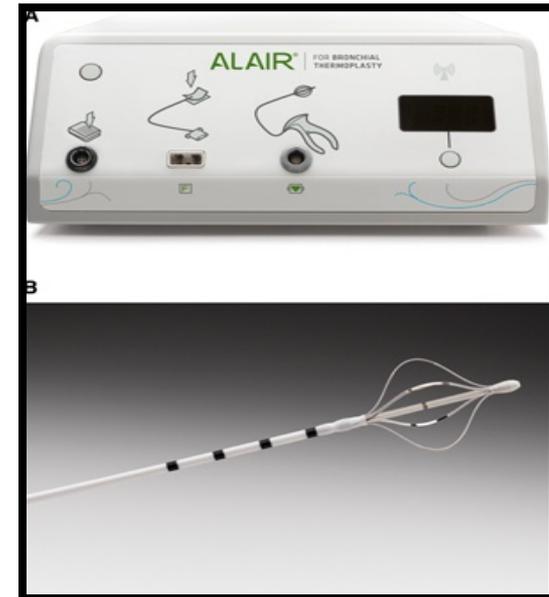
- FDA has recommended **mepolizumab** for add-on maintenance treatment in patients aged 18 years or older with severe eosinophilic (peripheral) asthma
- No lower limit on peripheral eosinophil count
- Monoclonal antibody that binds to and inactivates interleukin-5



IV: 3 mg/kg once every 4 weeks

How is Asthma Treated? Bronchial Thermoplasty

- FDA approved on April 27th 2010
- This non-pharmacologic therapy for severe asthma in patients 18 years of age and older not well controlled with currently available medical therapies
- Targets airway remodeling by reducing airway smooth muscle mass which is responsible for
 - Bronchoconstriction
 - Mucus production
 - Airway hyperresponsiveness



Dr. Raj Performing Bronchial Thermoplasty



Obstetrics & Gynecology: Morning Report

- VS: Temp 37° C, HR 68, RR 14 and BP 112/75
- On exam, she is a well-developed woman in no distress. The oropharynx is clear, and there is no cervical lymphadenopathy. The heart rate is regular with no murmurs, and the breath sounds are clear without evidence of wheezes. The abdomen is gravid, consistent with an early 2nd-trimester pregnancy. The extremities are normal, with good peripheral pulses
- Following the exam, she asks your opinion on her current regimen of medications and if you **recommend any adjustments**

Obstetrics & Gynecology: Morning Report

- Given her current symptoms, you classify her with **mild-persistent asthma** and recommend continued therapy with daily low-dose budesonide and albuterol as needed
- After you **review inhaler technique** with her, she asks what the effects are of pregnancy on her lungs.



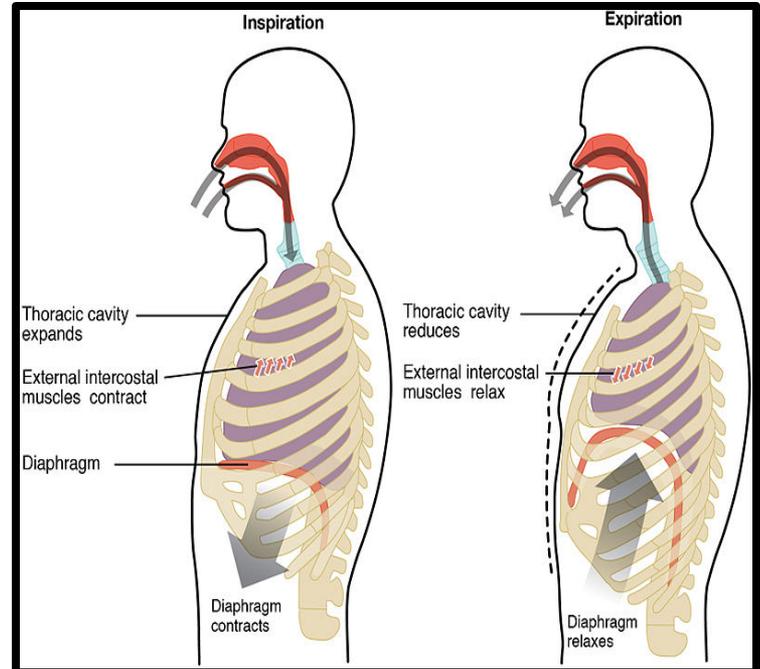
What is the normal physiology of the respiratory system during pregnancy? (Step 1 Basic Science Pearl)

- Airway mechanics do **not** significantly change during pregnancy and so spirometry values for FVC, FEV1, and FEV1/FVC remain normal compared to non-gravid individuals
- Thus, the diagnosis of asthma during pregnancy remains the same as previously stated

What is the normal physiology of the respiratory system during pregnancy? (Step 1 Basic Science Pearl)

- Lung volumes, on the other hand, have some variability
- The increased circumference of the thoracic cage allows the **VC** to remain unchanged, and the **TLC** decreases only minimally by term
- The enlarging uterus and its impact upon the diaphragm, the **RV** and **FRC** are decreased compared to normal individuals

During pregnancy the rib cage is actually expanding to increase your lung capacity as well as to make room for the uterus and this can of course also cause discomfort



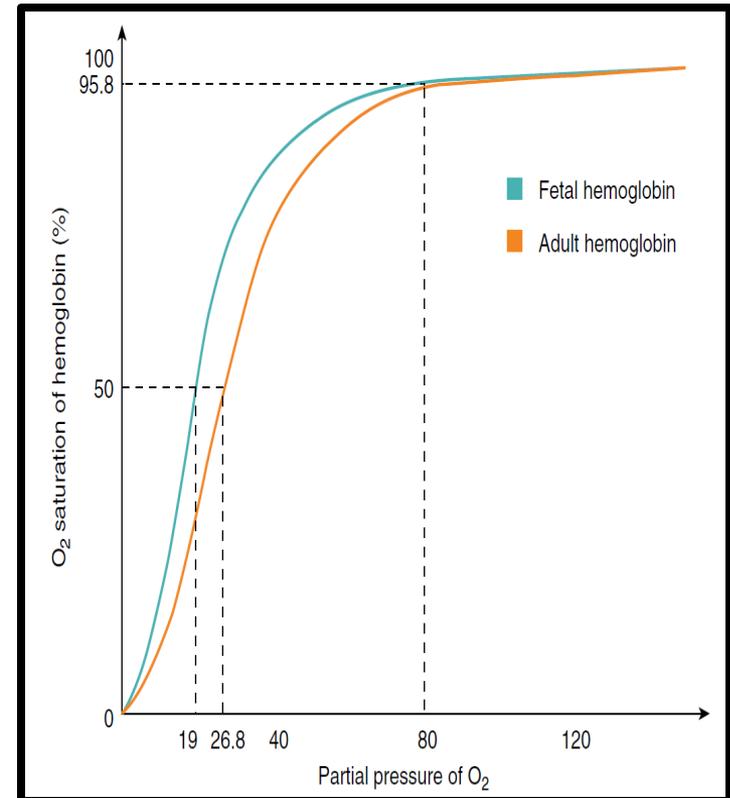
Diaphragmatic excursion is the movement of the thoracic diaphragm during breathing. Normal diaphragmatic excursion should be 3-5 cm, but can be increased in well-conditioned persons to 7-8 cm.

What is the normal physiology of the respiratory system during pregnancy? (Step 1 Basic Science Pearl)

- As progesterone levels rise, minute ventilation increases beyond the metabolic demand
- This has two effects:
 - Partial pressure of arterial carbon dioxide (PaCO_2) decreases (28-30 mm Hg)
 - Partial pressure of arterial oxygen (PaO_2) increases (100-106 mm Hg)
- The chronic reduction in PaCO_2 causes a compensatory excretion of bicarbonate in the urine and results in a compensated respiratory alkalosis.

What is the normal physiology of the respiratory system during pregnancy? (Step 1 Basic Science Pearl)

- HbF is composed of 2 alpha chains and 2 gamma chains as opposed to the usual 2 alpha and beta chains seen in HbA
- Placenta has higher levels 2,3-BPG that causes a right shift of the HbA dissociation curve, coaxing oxygen release from mother's blood that is then rapidly bound by HbF in the fetal circulation



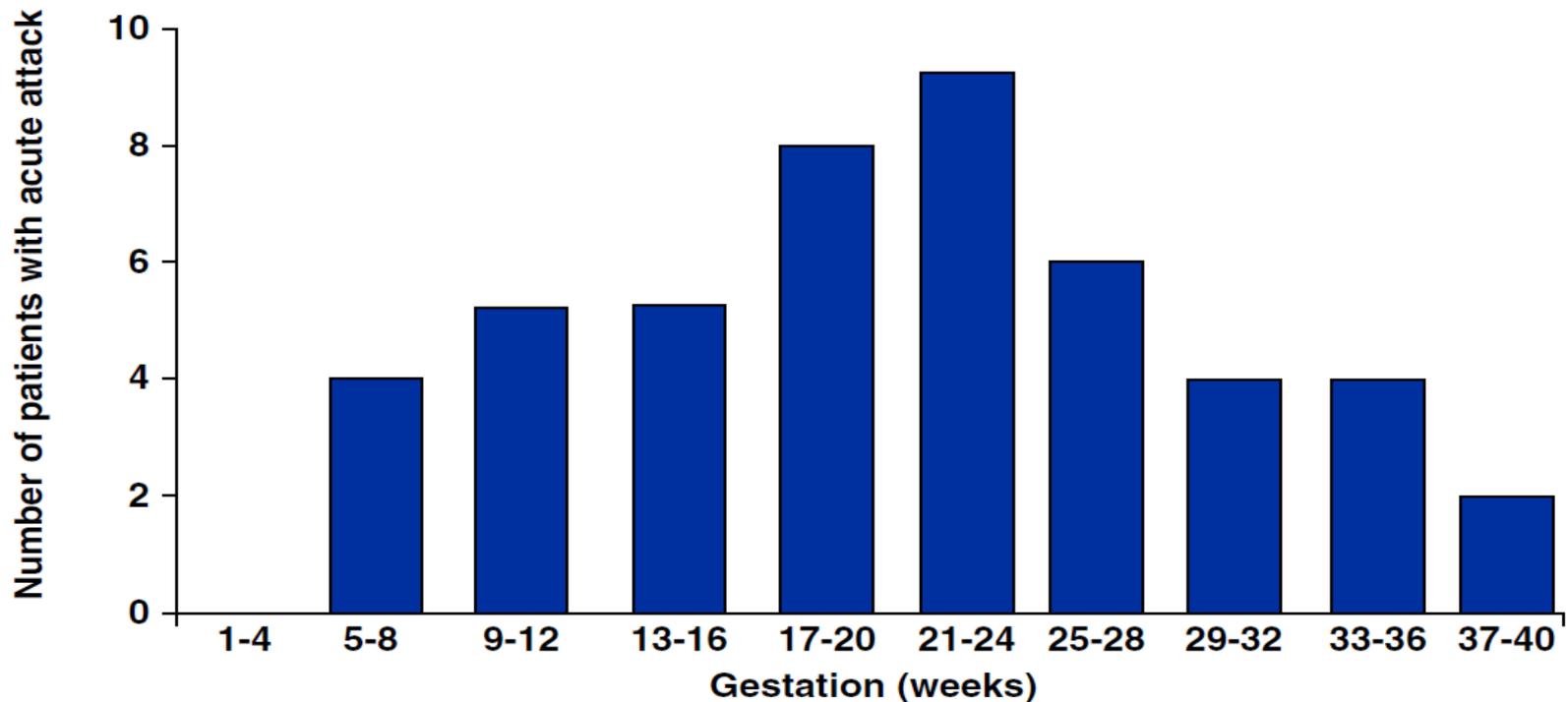
What is the effect of pregnancy on asthma?

- Most studies have demonstrated variable effects of pregnancy on asthma
- A prospective study of 366 pregnancies in patients with asthma revealed
 - Worsening of symptoms in 35%
 - Improvement of symptoms in 28%
 - Unchanged in the remainder



What is the effect of pregnancy on asthma?

Frequency distribution of acute attacks during pregnancy



Asthma attacks during pregnancy were seen most frequently between weeks 17 and 24 of gestation.

What is the effect of asthma on pregnancy?

- Pregnancies of women with moderate to severe asthma had increased risk of:
 - Miscarriage
 - Antepartum & postpartum hemorrhage
 - Anemia
 - Depression
 - Cesarean delivery
 - Increased risk for low-birth-weight infants

How does management differ for the pregnant patient with asthma?

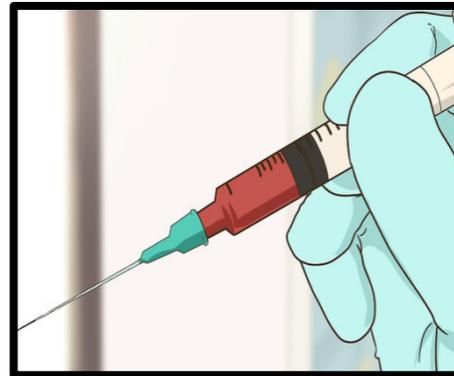
- The strategies for controlling asthma are the same in pregnant women
- The emphasis of therapy should be in avoiding triggers
- The step-up guidelines remain pertinent but do have variation because of the pregnancy categories of current medications

Obstetrics & Gynecology: Morning Report

- The patient thanks you for your time and leaves with scheduled follow-up in 2 months
- 6 weeks later, you are called to the ER for a stat consult. You arrive and are surprised to see your clinic patient. She was brought in by ambulance after exposure to cat dander. Shortly following the exposure, she reported increased shortness of breath, audible wheezing, and cough. She is noticeably dyspneic and in distress.
- Vitals reveal a RR 31 and O2 sat 91% on 10-L face mask. On auscultation, she has tachycardia with no audible wheezing. The abdomen is gravid, consistent with 22 weeks' gestation. She has received several breathing treatments with nebulized albuterol
- The ER attending asks for your opinion

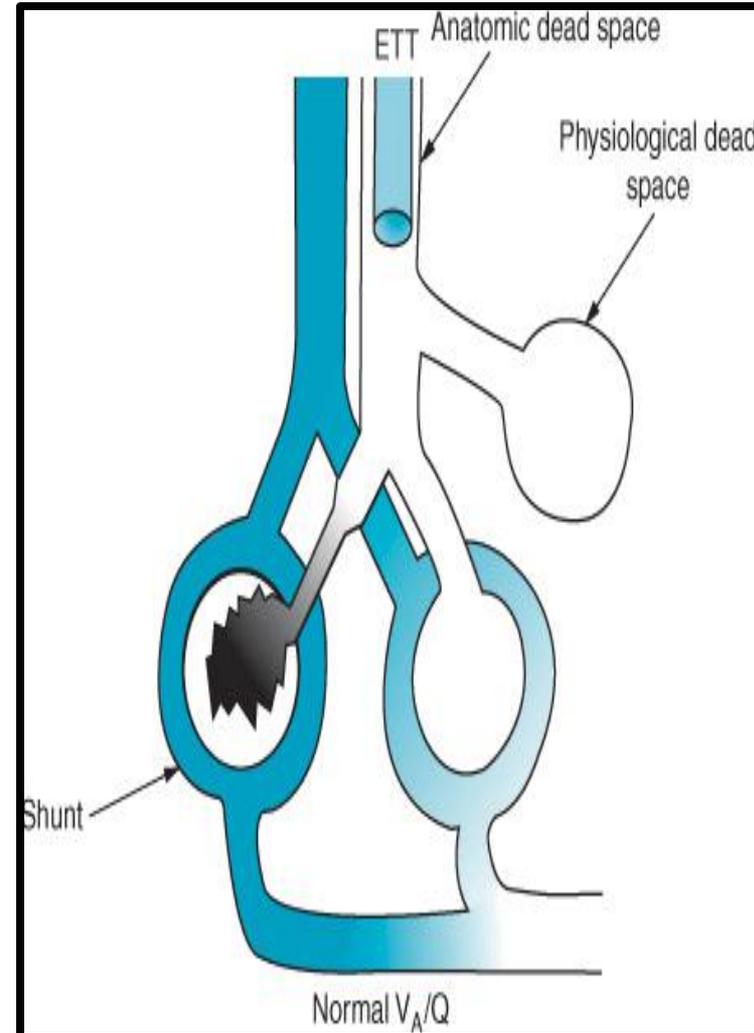
Obstetrics & Gynecology: Morning Report

- Albuterol nebulized treatments are continued, and a first dose of IV Solumedrol is given with a 2 g magnesium sulfate infusion. The CXR reveals hyperinflation but no pulmonary infiltrates or significant atelectasis
- ABG taken at the bedside results in a pH of 7.38, PaCO₂ 41 mm Hg, and a PaO₂ of 62 mm Hg.



What is the optimal ventilator strategy for an acute asthma exacerbation?

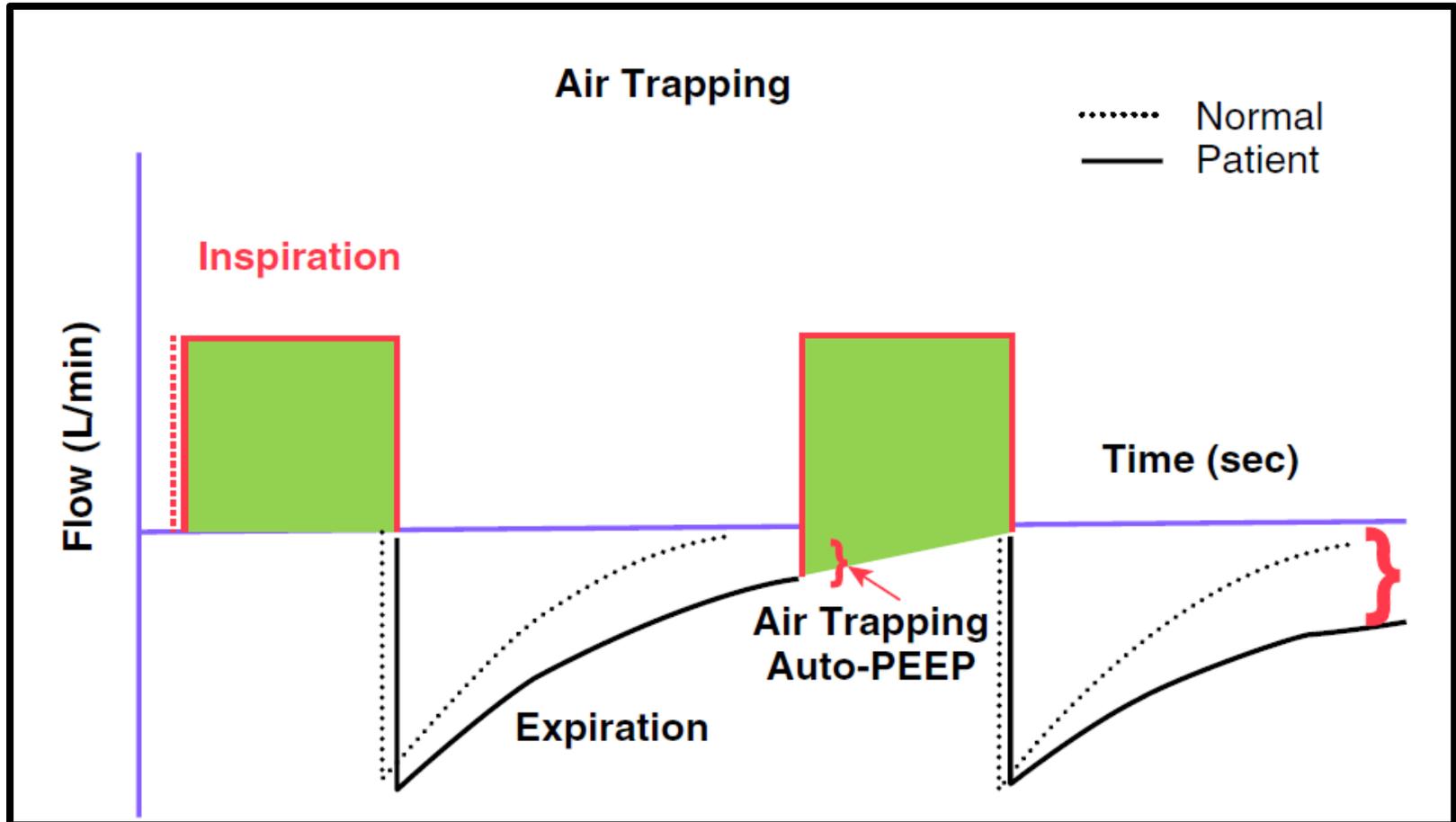
- Because some patients can develop significant **hypercapnia**, often ventilators are set to optimize minute ventilation with high respiratory rate and/or high tidal volumes
- The pathophysiology of asthma directly affects the flow of air **out** of the lungs. The narrowed airways and mucous plugging cause air trapping and **increased dead space** that contributes to hypercapnia
- As air trapping worsens, the alveoli become overdistended, and further contributes to hypercapnia



What is the optimal ventilator strategy for an acute asthma exacerbation?

- The preferred ventilator strategy should be to maximize expiration and decrease minute ventilation to prevent further air trapping
 - Setting a tidal volume of 6 mL/kg
 - Respiratory rate less than 20
 - Inspiratory/expiratory ratio of 1:3 to 1:5
- Permissive hypercapnia is allowed as long as serum pH does not drop below 7.3
 - This rarely happens because, as air trapping improves, the overdistention of alveoli decreases and actually improves ventilation/perfusion mismatch

What is the optimal ventilator strategy for an acute asthma exacerbation?



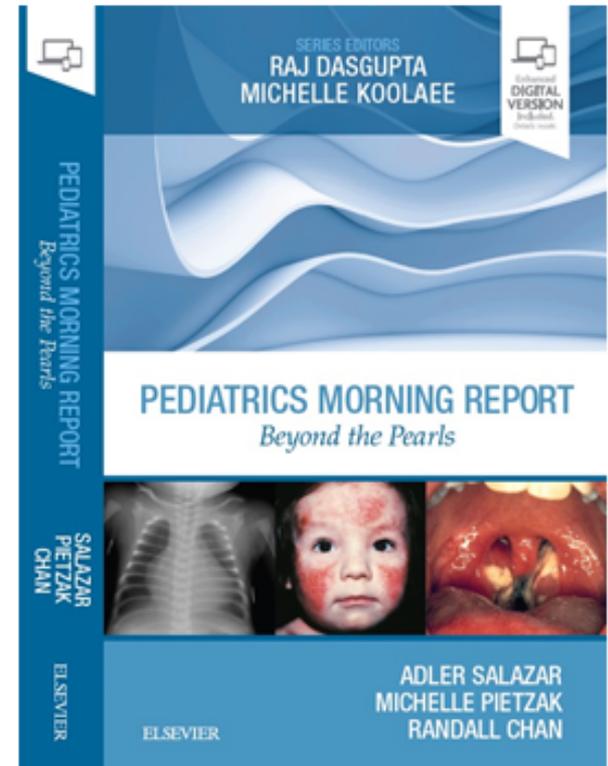
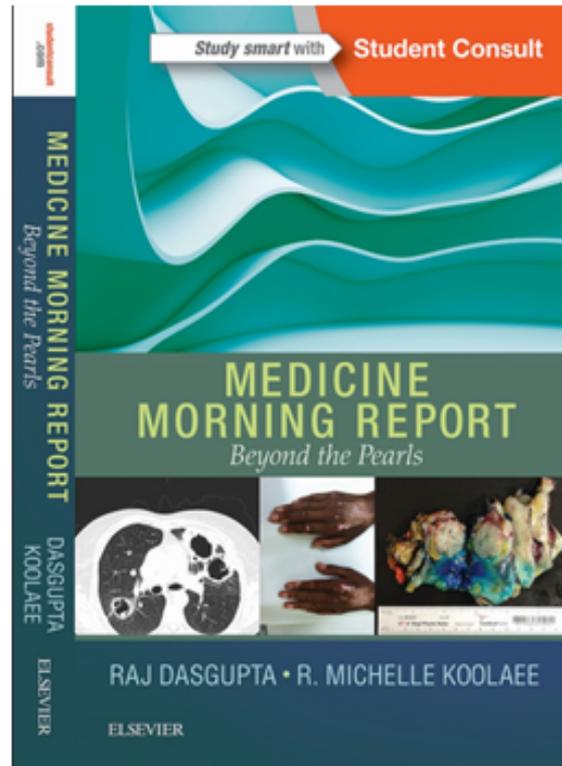
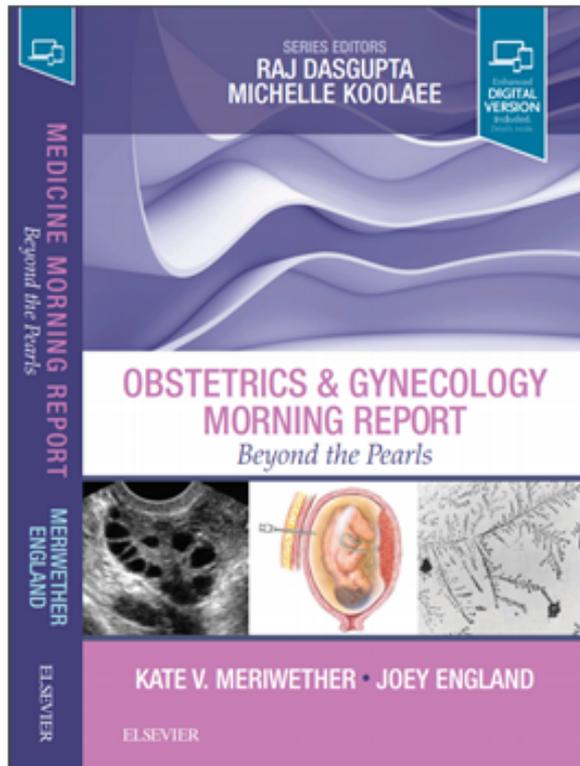
Obstetrics & Gynecology: Morning Report

- Your patient remains intubated for 2 days on continued SABA and IV corticosteroid therapy, following which respiratory mechanics significantly improve and spontaneous breathing trials are begun
- She is extubated without complication and transferred to the floor the following day
- She is discharged 2 days later, following an uncomplicated stay with follow-up with her obstetrician and your clinic in 1 week.

Beyond the Pearls

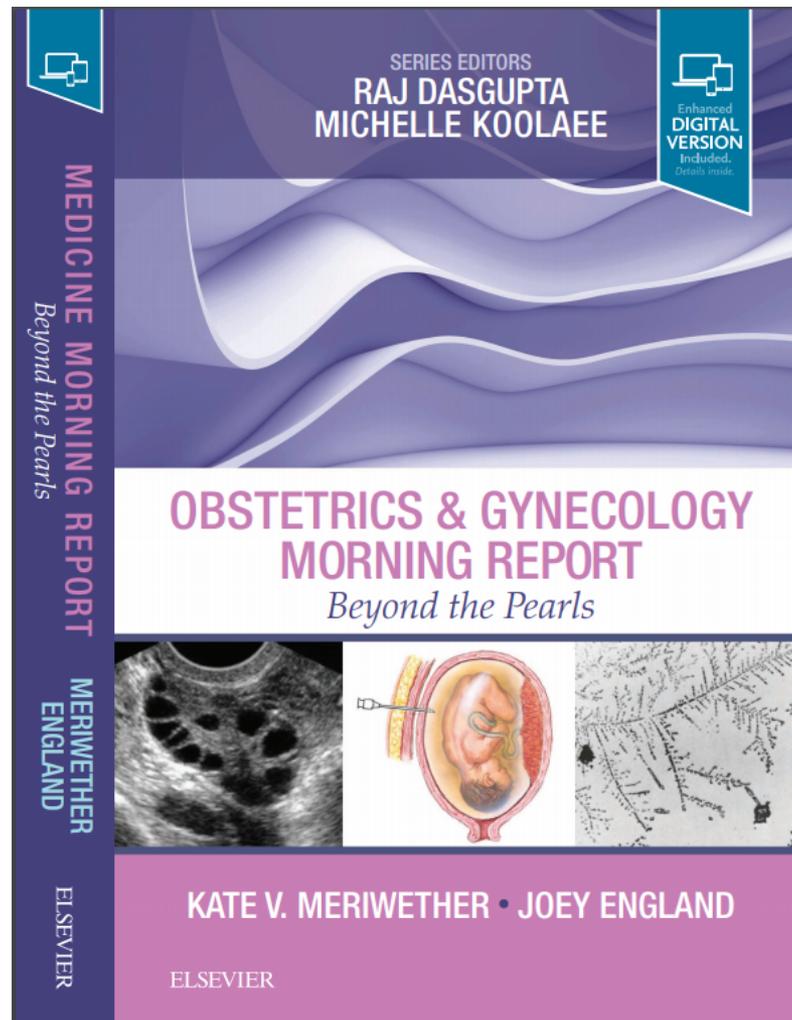
- ER literature supports the use of ketamine as a preferred sedative agent for rapid-sequence intubation, given its potential as a bronchodilator.
- Heliox is a mixture of helium and oxygen that can be delivered through a ventilator to patients with severe asthma exacerbation. It functions by decreased resistance to airflow, thereby improving airway mechanics.
- There is no role for IV epinephrine in the treatment of an asthma exacerbation.

Beyond the Pearls Series



beyondthepearls.net

Pulmonary Hypertension and Pregnancy

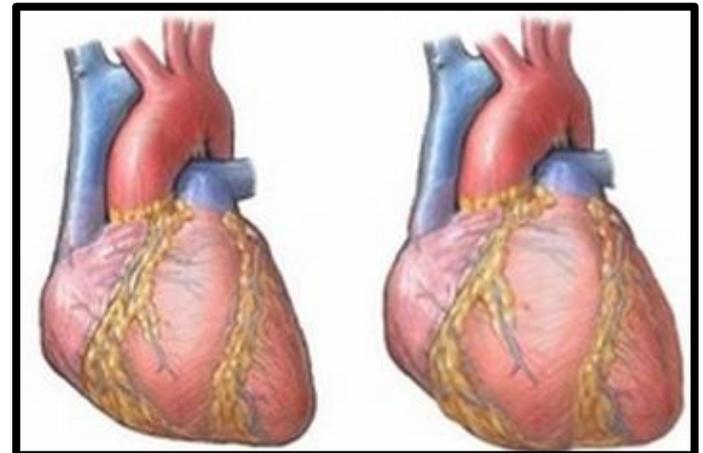
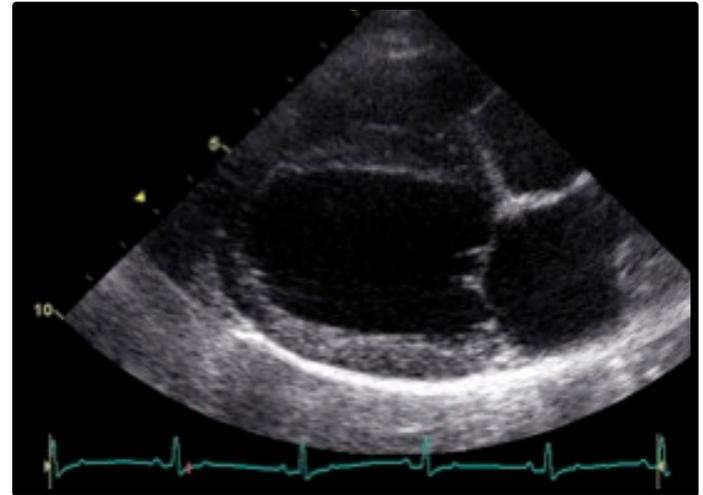


Obstetrics & Gynecology: Morning Report

- 29-year-old healthy G1P0 woman (32 weeks of gestation) presents to the emergency room complaining of shortness of breath (SOB)

What is the differential diagnosis of SOB in pregnancy?

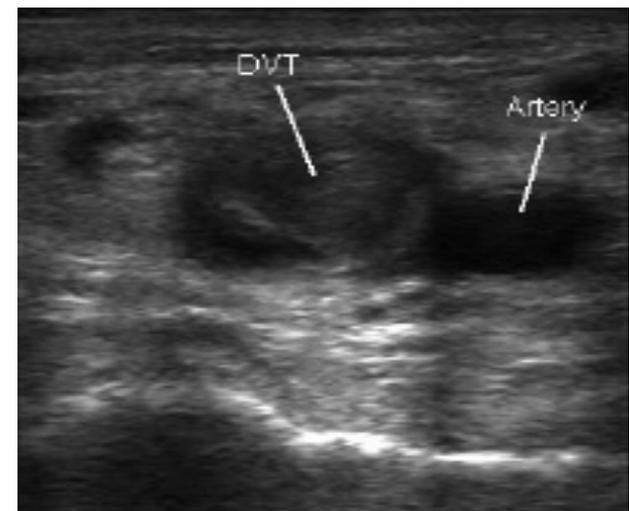
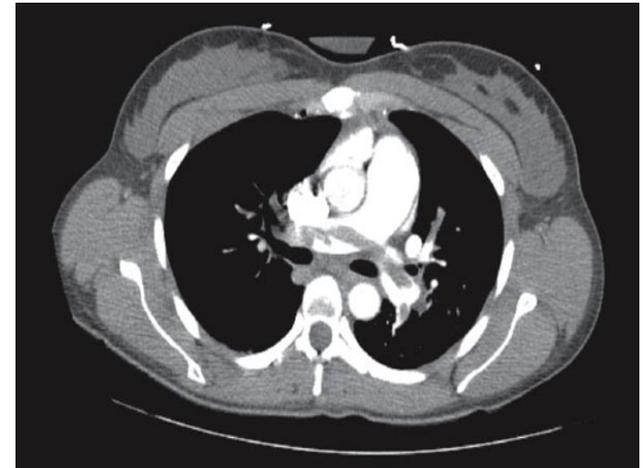
- **Cardiovascular**
 - Peripartum cardiomyopathy
 - Rare disorder (LVEF <45%)
 - Occurs up to 6 months after delivery
 - Mimics systolic heart failure



What is the differential diagnosis of SOB in pregnancy?

- **Pulmonary**

- Asthma
- Pneumonia
- Pulmonary embolism
 - Increased estrogen

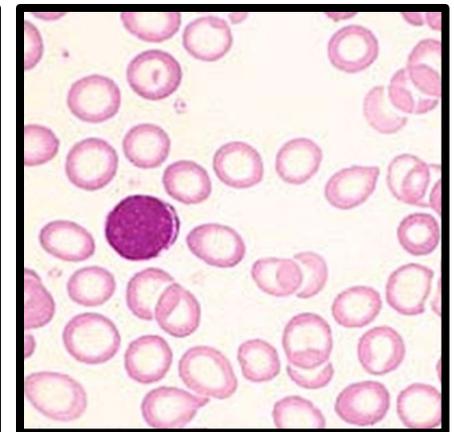
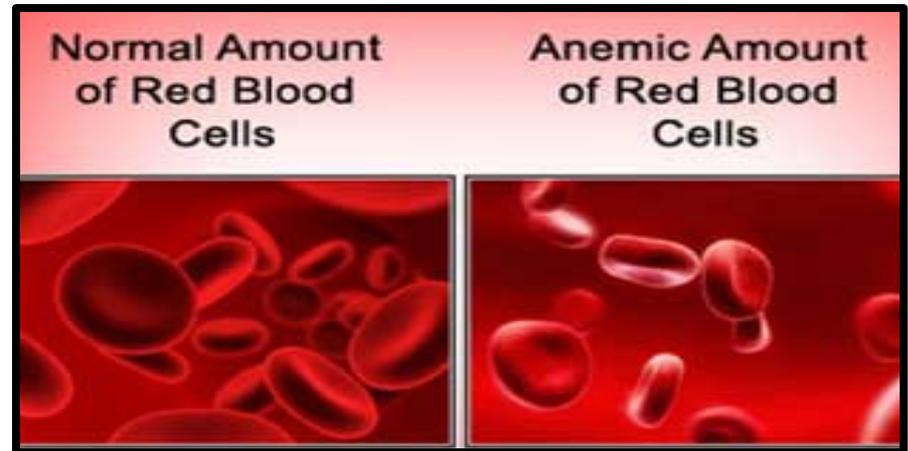


What is the differential diagnosis of SOB in pregnancy?

• Hematopoietic systems

○ Anemia

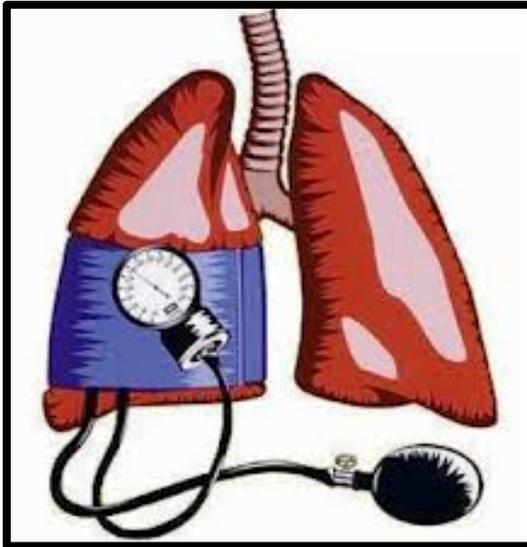
- Increase plasma volume dilutes Hgb
- Placenta and developing fetus utilize large amounts of dietary iron and can further exacerbate anemia
- Iron supplementation is paramount in prenatal care and should exceed 1 g/day to ensure adequate stores



Obstetrics & Gynecology: Morning Report

- The patient reports an insidious onset of her SOB that has progressed over the **4 weeks** since her last visit
- She admits to decreased exercise tolerance as well as new-onset **bilateral lower extremity edema**. She has severe SOB with ambulation around her home
- She has no past medical or surgical history. Both her mother and father have HTN. She is taking her prenatal vitamins as instructed and takes no other medications at this time
- Five years prior, she did take herbal supplements for **weight loss**, which she bought online from Europe. She has no drug allergies
- Review of systems is otherwise negative

Beyond the Pearls: Fen-Phen



Did You or Someone You Love Develop Primary Pulmonary Hypertension (PPH) After Taking a Diet Drug Like Fen-Phen ?

If so, you or your loved one may be entitled to monetary compensation – even if you stopped using the drug 20 years ago!

[Click Here to Find the Right Fen-Phen PPH Lawyer,](#)
[Or Call 888-315-3997 Now.](#)



Primary Pulmonary (PPH) Hypertension Lawsuits

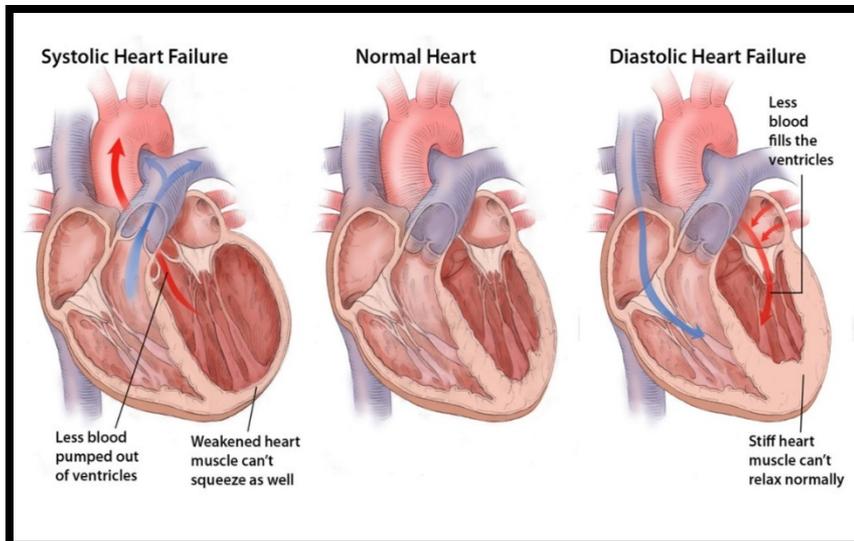
What is the physiology of heart failure? (Step 1 Basic Science Pearl)

Systolic Dysfunction

- Abnormal reduction in ventricular emptying due to impaired contractility or excessive afterload

Diastolic Dysfunction

- Decrease in ventricular compliance during the filling phase of the cardiac cycle due to either changes in tissue stiffness or impaired ventricular relaxation
- The consequence is diminished Frank-Starling mechanism

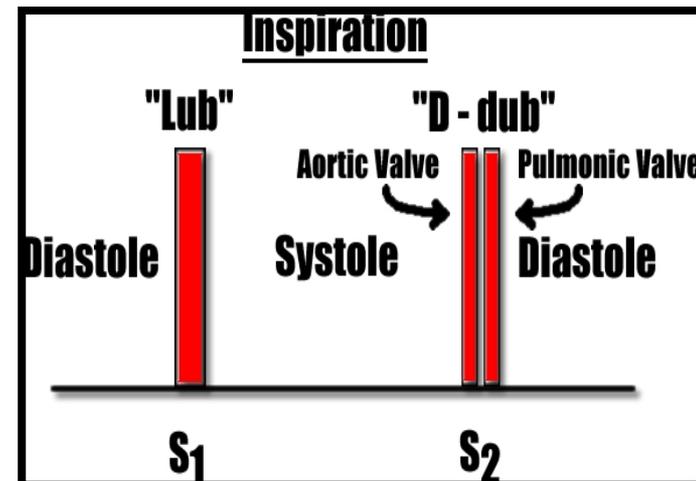
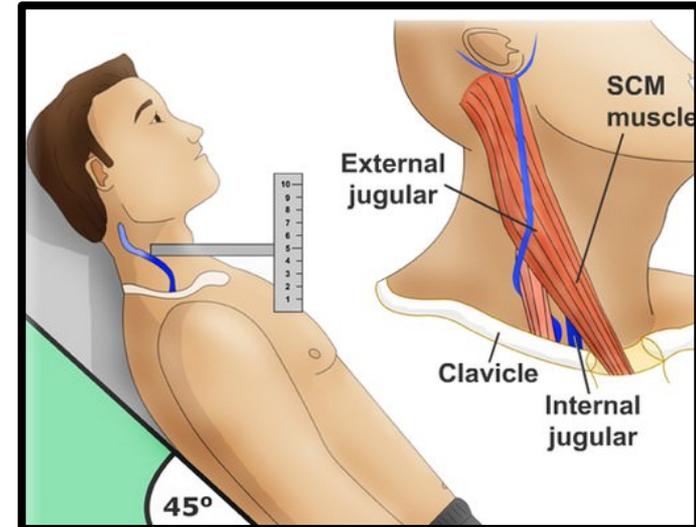


How does heart failure present on physical exam? (Step 2 & 3 Clinical Pearl)

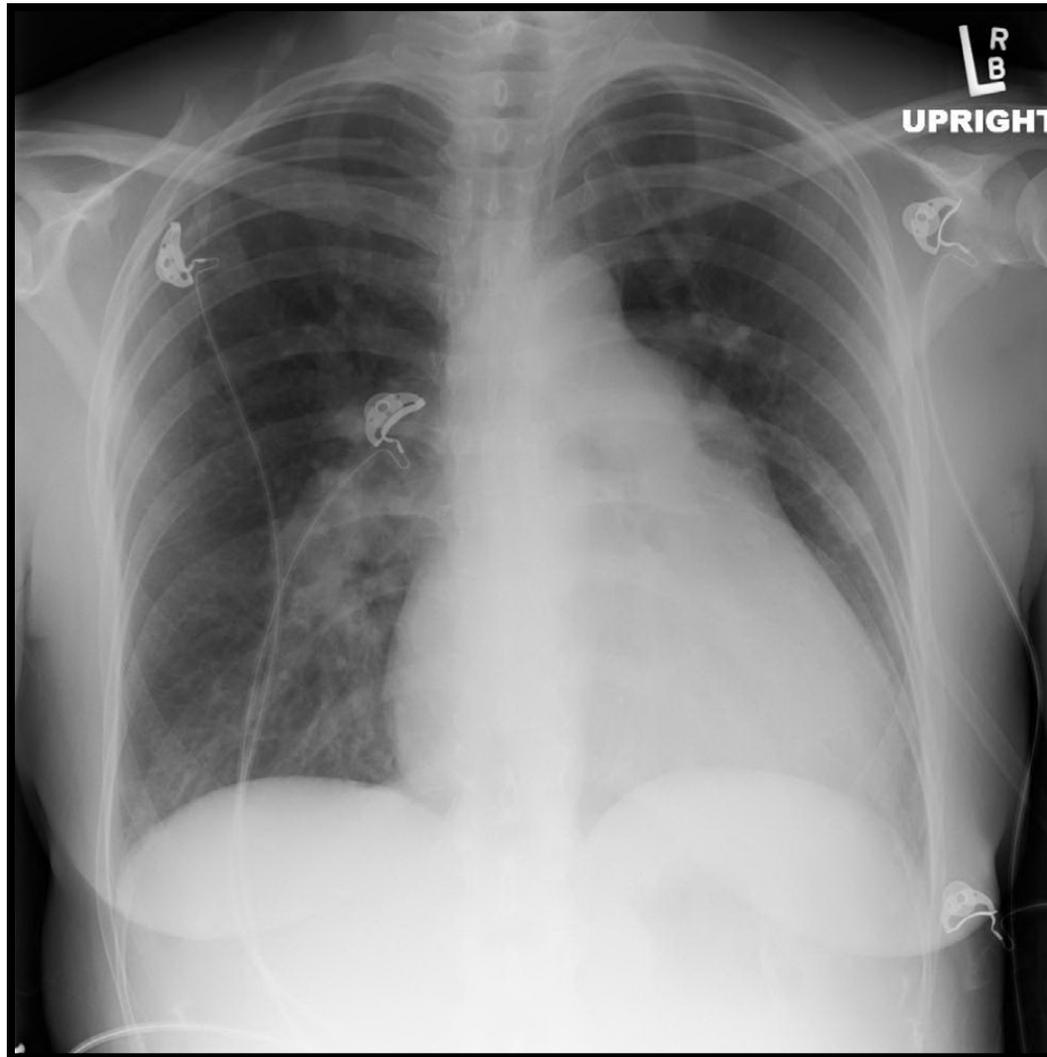
- **Tachycardia**
- **Pulmonary rales**
- **Gallop rhythm**
- **Peripheral edema**
- **Elevated JVP**
- **Displaced LV apex impulse**
- **Right ventricular heave**
- **Cheyne-Stroke respiration**
- **Liver engorgement**
- **Wheezing**
- **Pleural effusions**

Obstetrics & Gynecology: Morning Report

- On exam, she is afebrile, BP 103/54, HR 92, RR 22 and O2 sat of 93% on RA. She appears to be in mild respiratory distress
- She has obvious **JVD** up to the angle of the mandible
- Her lungs are clear, and she has a **loud P2** with a **3/6 holosystolic murmur** best heard at the 5th intercostal space, parasternal border
- She has 2+ peripheral, **pitting edema**. The remainder of the exam is WNL
- She is admitted to the obstetrics floor for further evaluation. Pulmonology is consulted from the emergency room.



CXR Interpretation (Step 2 & 3 Clinical Pearl)

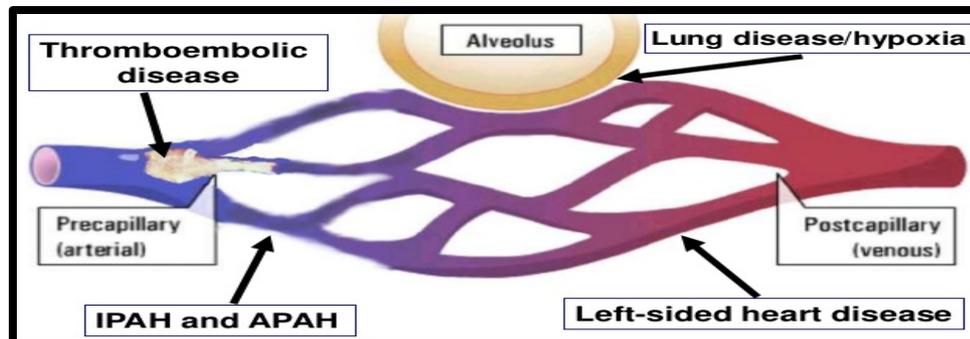


What is pulmonary hypertension? (Step 1, 2 & 3 Pearl)

- PH refers to elevated pulmonary arterial pressure
 - Can be due to a primary elevation of pressure in the pulmonary arterial system alone (pre-capillary PH)
 - Secondary to elevations of the pulmonary venous and pulmonary capillary pressures
- PH can be a progressive, fatal disease if untreated

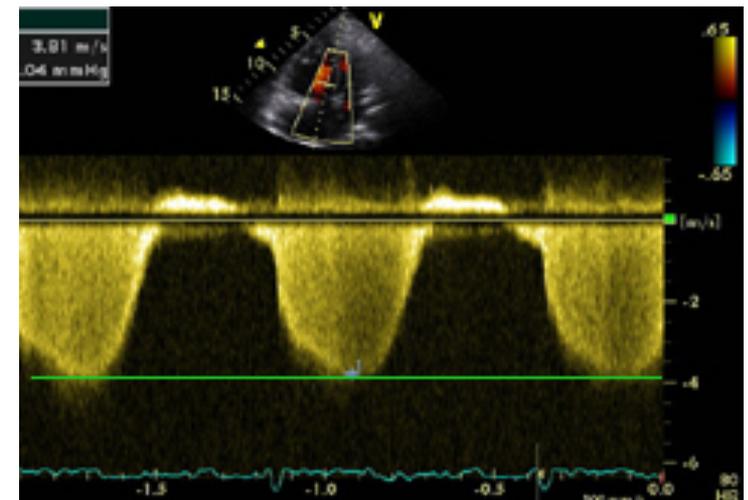
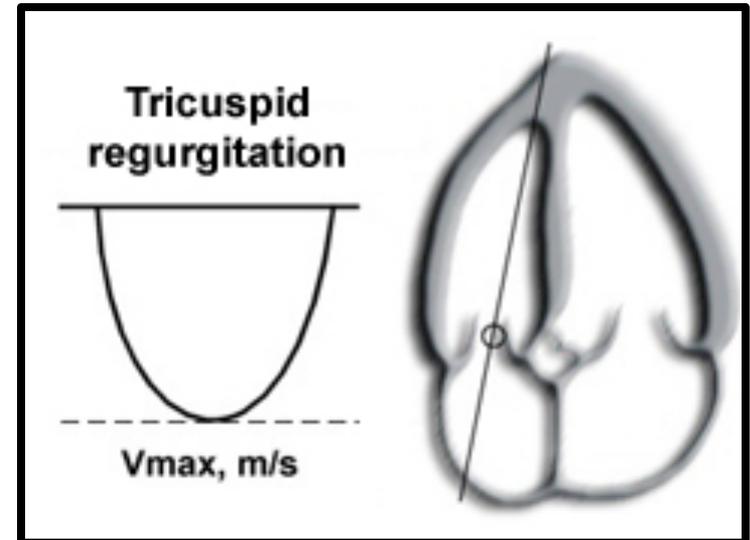
TABLE 2. Clinical classification of pulmonary hypertension

GROUP 1	Primary pulmonary hypertension: idiopathic, familial, drug and toxin induced (appetite suppressant drugs), rare medical conditions
GROUP 2	Secondary to left ventricular disease: mitral valve disease, left ventricular systolic or diastolic failure.
GROUP 3	Secondary to pulmonary disease or hypoxia: COPD, sleep disordered breathing, obesity hypoventilation
GROUP 4	Secondary to chronic thromboembolism
GROUP 5	Unclear and multifactorial etiologies



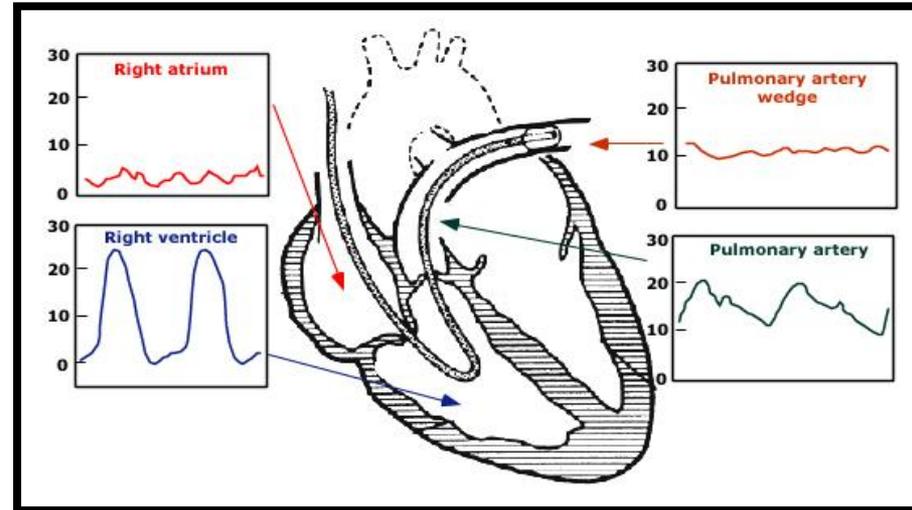
What is the evaluation for pulmonary hypertension? (Step 2 & 3 Clinical Pearl)

- Echocardiography for assessment of pulmonary artery systolic pressure (PASP)
- Modified Bernoulli equation:
 - $4 \times (\text{TRV})^2 + \text{RA pressure}$
- Estimated right atrial pressure (RAP) must be added to this obtained value

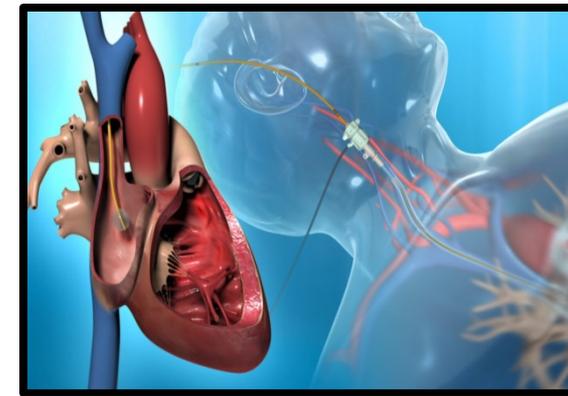
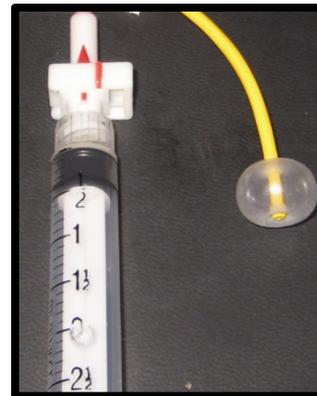


What is the evaluation for pulmonary hypertension? (Step 2 & 3 Clinical Pearl)

- PH is defined by a mean pulmonary arterial pressure (mPAP) ≥ 25 mmHg at rest usually confirmed by right heart catheterization
- Although PH can be measured on echocardiography, the gold standard for diagnosis is right heart catheterization



mPAP (\uparrow), PVR (\uparrow), PCWP (nl), CO (nl)



Obstetrics & Gynecology: Morning Report

- The patient undergoes right heart catheterization which reveals:
 - mPAP 45 mm Hg
 - PCWP 12 mm Hg
 - CO 3.5 L/min
 - Cardiac index 2.1
 - SVR 1300 dynes
 - PVR of 9.5 Woods units
 - She is not responsive to a vasodilator challenge
- Based on these findings, she is diagnosed with Group 1 PAH, likely as an effect of the dietary supplements she took several years prior

Obstetrics & Gynecology: Morning Report

CLINICAL PEARLS

STEPS 2/3

The decision to place a PAC in a pregnant patient should be made on a case-by-case basis after carefully weighing the potential benefits against the risks for the individual patient and the fetus. Common complications of PAC insertion include the occurrence of atrial and/or ventricular arrhythmias. Perforation of a cardiac chamber and rupture of a cardiac valve or the pulmonary artery are rare complications that can be catastrophic. Complications of catheter use include pulmonary artery rupture, pulmonary infarction, thromboembolic events, infection, and data misinterpretation.

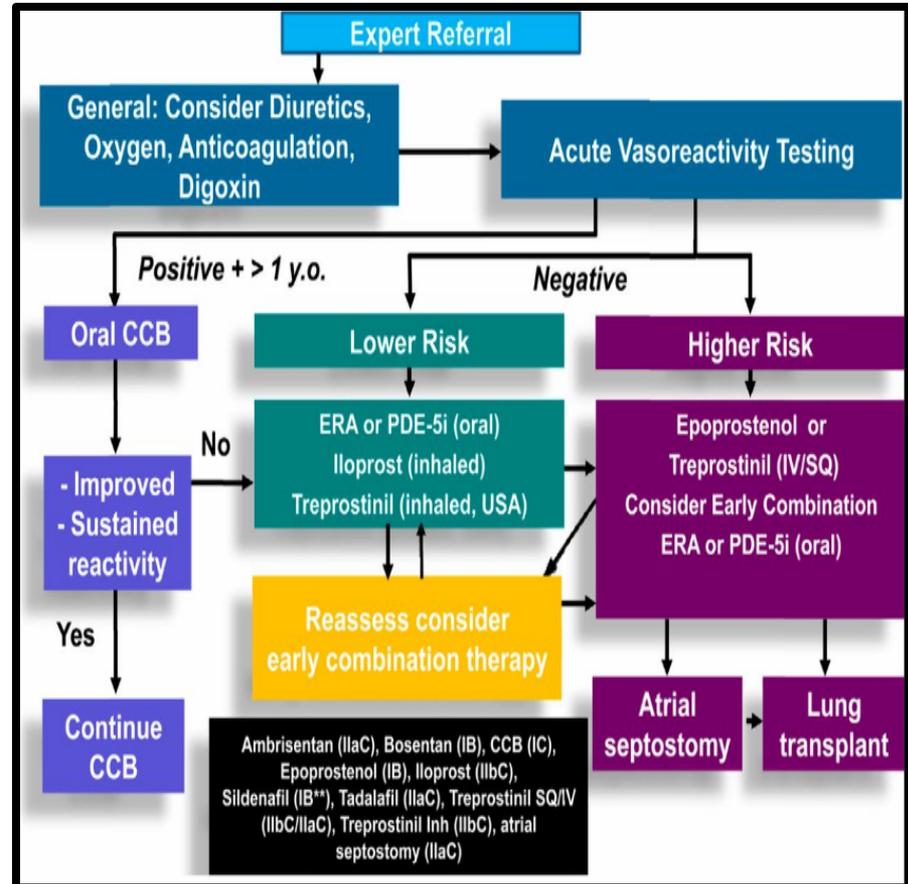
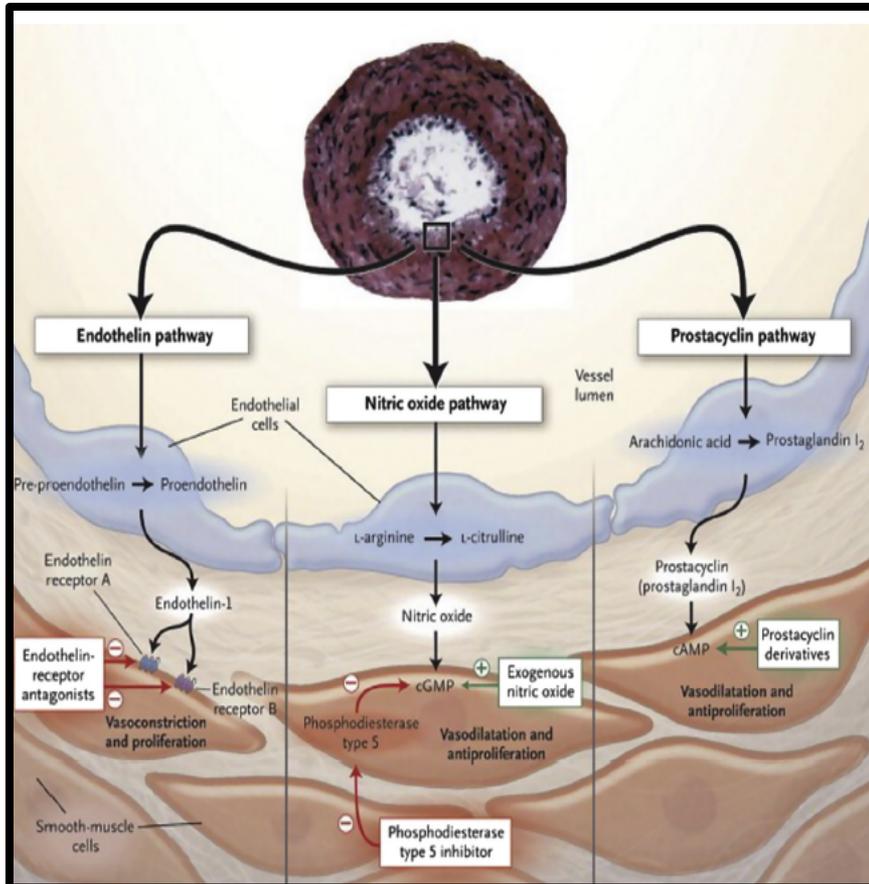
CLINICAL PEARLS

STEPS 2/3

A positive vasoreactive study is defined as a decrease of the mPAP by more than 10 mm Hg and below 40 mm Hg overall without a decrease in cardiac output. Unique to those patients who respond is the option to treat with a calcium channel blocker.

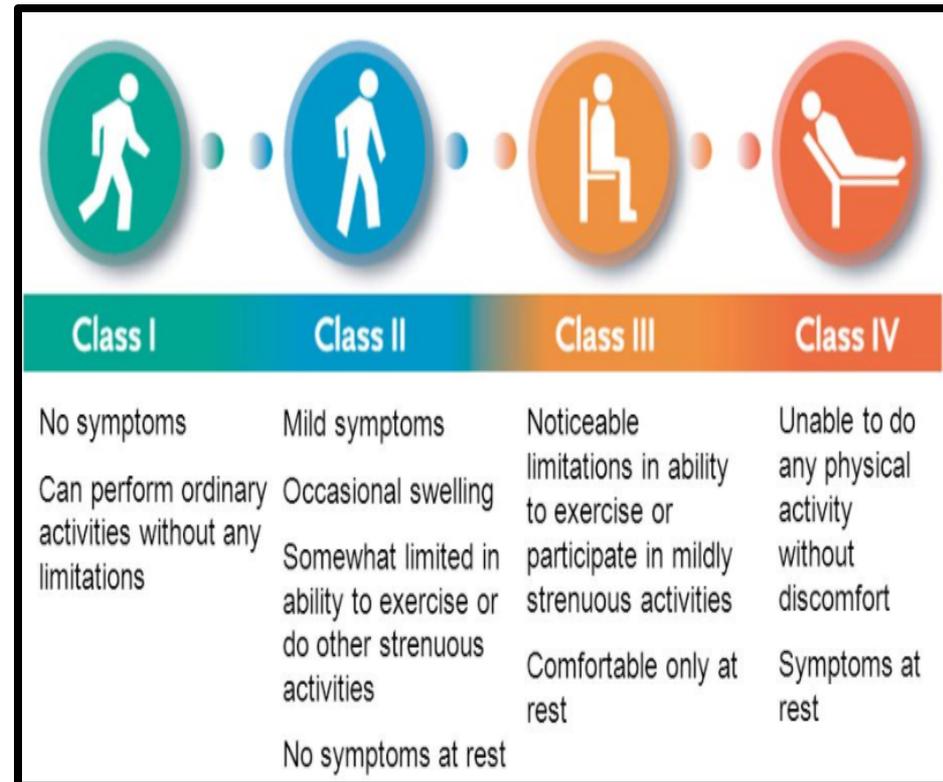
What are targeted therapies for PAH? (Step 1 ,2 & 3 Pearl)

- Treatment of the underlying cause, and for some cases advanced PAH-specific therapy



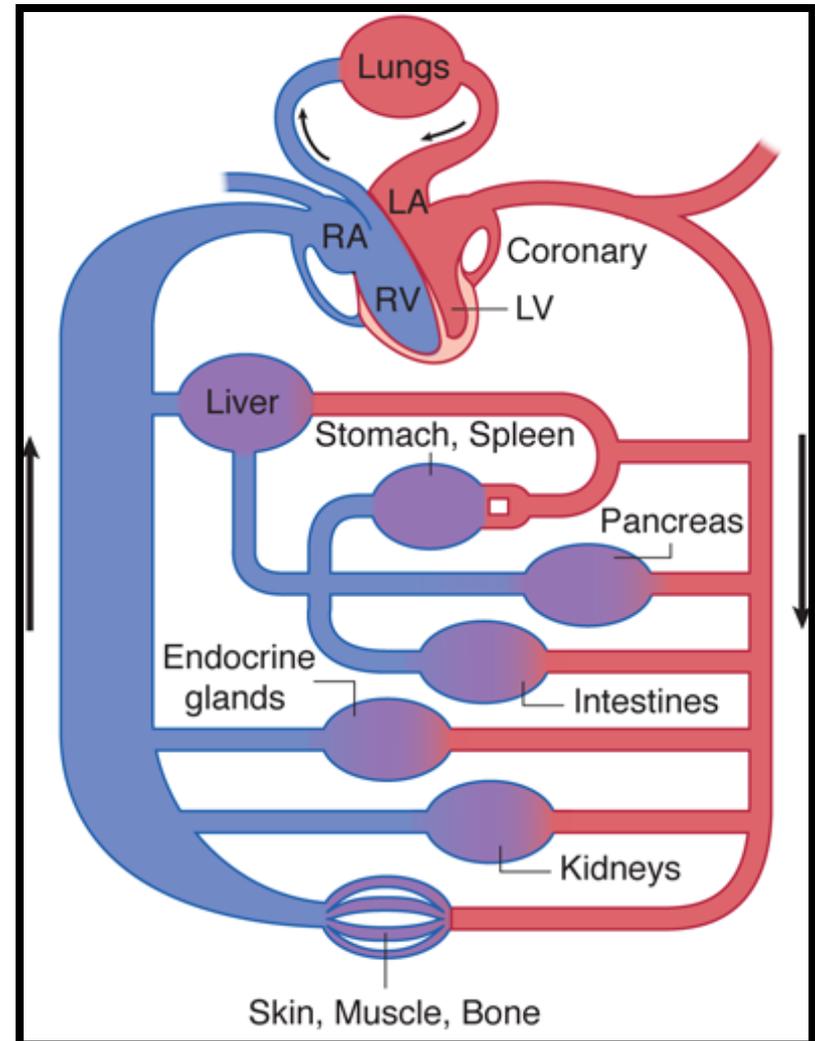
Obstetrics & Gynecology: Morning Report

- The patient is categorized as **NYHA functional class 3** based on symptoms with minimal activity, and the choice is made to begin IV epoprostenol
- Fetal monitors show no abnormalities
- She is anxious to know the management plan for her pregnancy.



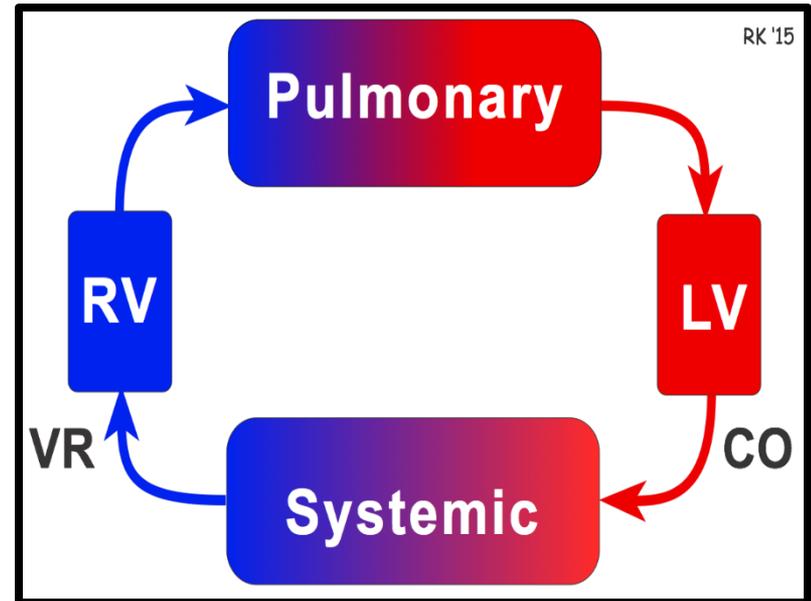
What is the physiology of pregnancy and PAH? (Step 1 Basic Science Pearl)

- Normal cardiovascular changes that occur with pregnancy
 - Total blood volume increases
 - CO increases to meet the metabolic demand of the developing fetus
 - CO is augmented by the change in plasma volume, which **increases preload**
 - Reduced afterload through:
 - Vasodilatory effects of estrogen
 - Placenta being connected in parallel in the CV circuit



What is the physiology of pregnancy and PAH? (Step 1 Basic Science Pearl)

- In women with PAH, the **right ventricle** is compromised by the increased effort of working against **high pressures**
- Once the system is taxed further by increasing the overall volume of blood and the need for higher cardiac output, the **right heart inevitably fails** and cardiovascular collapse ensues



How does pregnancy impact PAH?

- Women with known PAH are recommended **against** pregnancy, and **dual contraception** should be employed in all reproductive-age women
- In those who do become pregnant, a **multidisciplinary discussion** involving the obstetrician and pulmonary hypertension specialist regarding the risks and benefits of elective abortion and continuation of the pregnancy must occur
- There is **no consensus** to the time of delivery



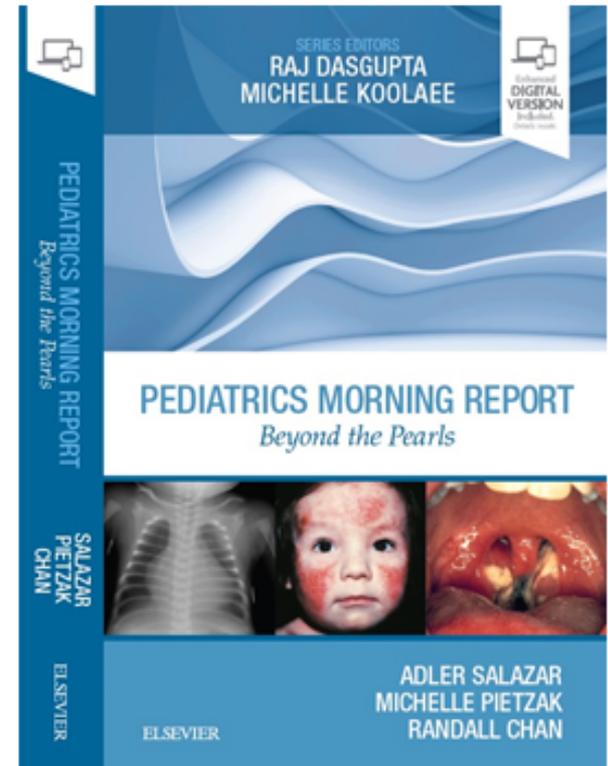
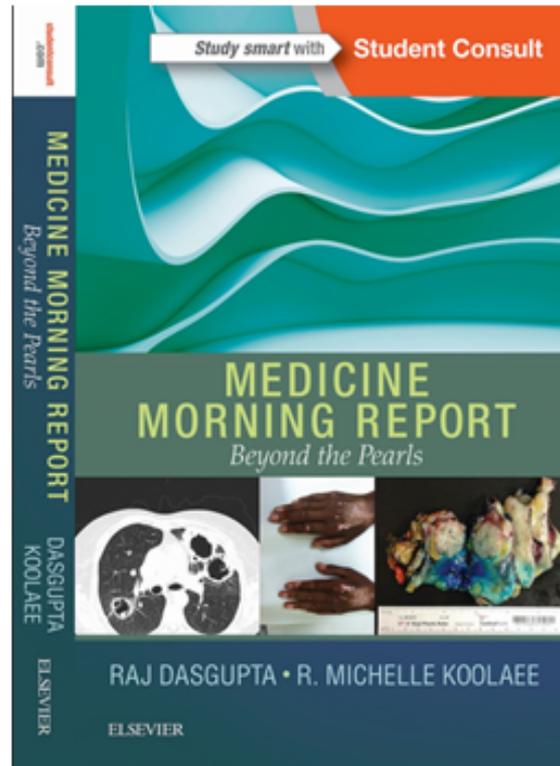
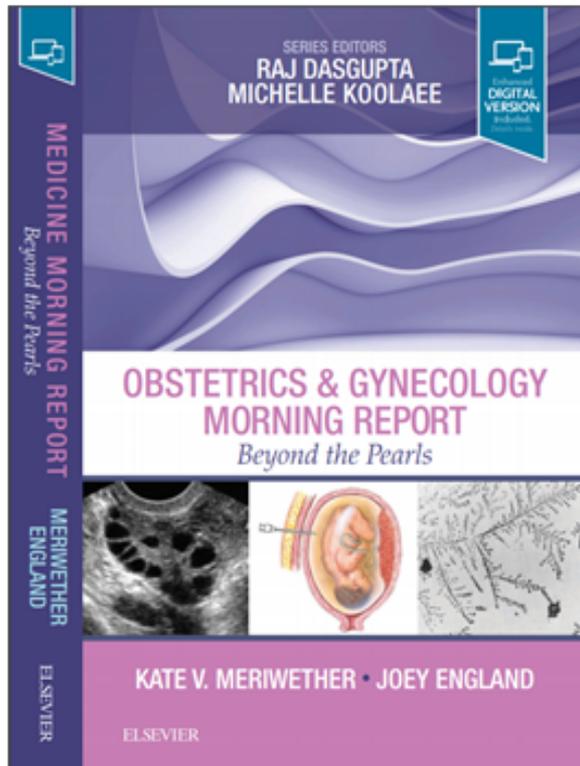
Obstetrics & Gynecology: Morning Report

- The patient shows good initial response to IV epoprostenol, and, after multidisciplinary discussion between obstetrics and pulmonology, she is discharged home for weekly follow-up in the outpatient clinic
- She chooses to proceed to **34 weeks** of pregnancy and then undergo an elective cesarean delivery
- She undergoes an uncomplicated delivery and is monitored in the **medical ICU**
- After an uncomplicated hospital course, she and her child are discharged home with follow-up in the pulmonary hypertension clinic in 1 week

Beyond the Pearls

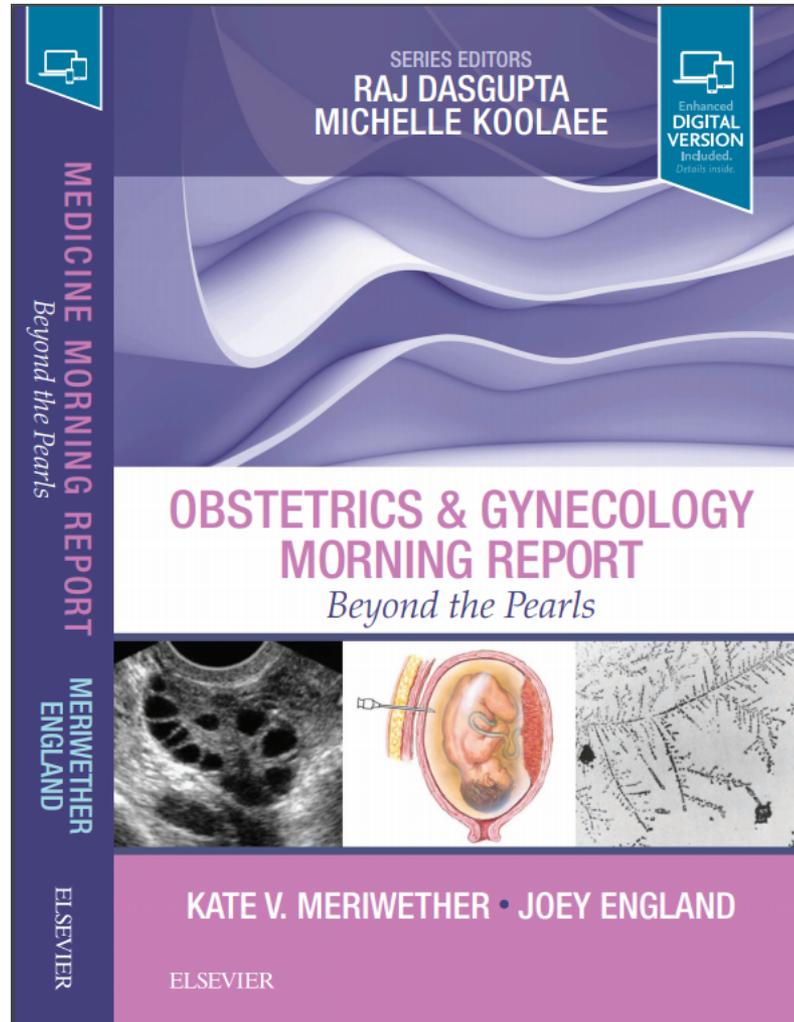
- Large shifts in **volume status** are poorly tolerated in PAH. Volume management should be conservative, with small boluses given for resuscitation if needed and low-dose drips for diuresis.
- Patients without contraindications should be referred for lung **transplantation** if still having NYHA 4 disease despite maximal medical therapy
- IV epoprostenol, while very effective, has significant side effects including diarrhea, nausea, jaw pain, flushing, and headache. These symptoms tend to **minimize** over time with continued use of the medication.

Beyond the Pearls Series



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Obstructive Sleep Apnea and Pregnancy



Obstetrics & Gynecology: Morning Report

- 34-year-old woman presents for a routine 2nd-trimester prenatal visit and is feeling **severely fatigued**
- She reports that she is able to fall asleep quickly at night and feels like she “sleeps through the night,” but wakes up feeling tired in the morning
- She feels tired throughout the day and is falling asleep on the **couch** while watching TV in the evenings
- Her pre-pregnancy body BMI was 32 and she has had appropriate weight gain during pregnancy



Obstetrics & Gynecology: Morning Report

- Patient reports that she sleeps from 10 pm to 6 am. Denies any difficulty falling asleep or staying asleep
- She denies any atypical sensations in her legs that disrupt her sleep
- Prior to pregnancy, she reports that she drank three to 4 cups of **coffee** daily and sometimes would have an “**energy drink**” in the afternoon; however, she has cut this down to one cup of coffee per day since she became pregnant.



Obstetrics & Gynecology: Morning Report

- She has had intermittent **headaches** in the morning, but attributed this to “caffeine withdrawal” since cutting back on coffee
- Denies drowsy driving, falling asleep at the wheel, and motor vehicle collisions related to sleepiness. She does not nap
- Her husband has also **complained** that recently she has started snoring loudly every night, to the point that it is disrupting his sleep
- He reports that previously she would snore only occasionally, particularly after alcohol intake or if she “had a cold,” but not on a regular basis.



What is the definition of OSA (Step 1 Basic Science Pearl)

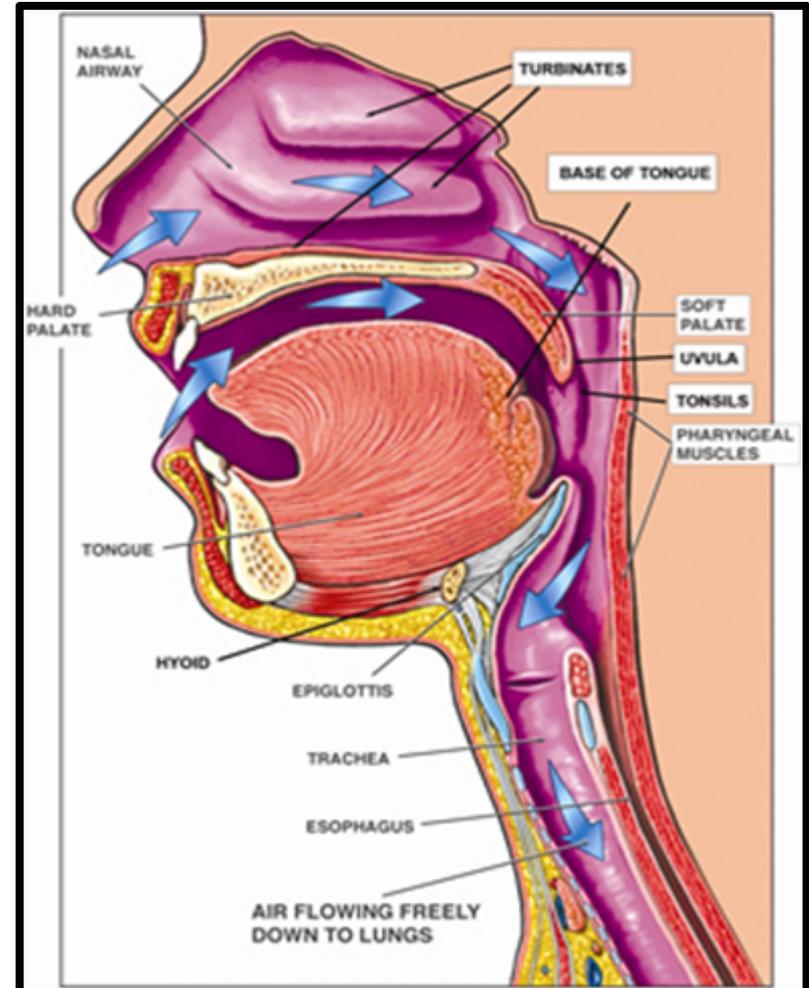
- **Obstructive apnea** is defined as:
 - Cessation of airflow $> 90\%$ in the thermal sensor and 10 seconds duration, oxygen desaturation is NOT part of the definition
- **Obstructive hypopnea** has multiple definitions:
 - Medicare rule:
 - Cessation of airflow $> 30\%$, 4% decrease in oxygenations and lasting 10 seconds
 - Alternative rule:
 - Cessation of airflow $> 50\%$, 3% decrease in oxygenation or an arousal
- **RERA (Respiratory effort related arousals)**
 - Last for 10 seconds, the event is not an apnea or hypopnea

Classic Obstructive Sleep Apnea Patient



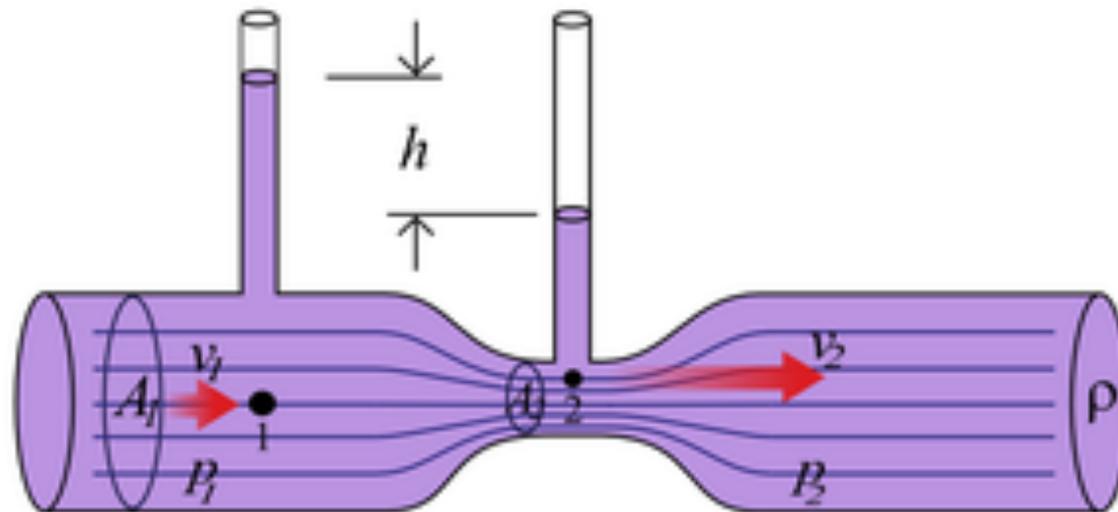
Upper Airway Physiology (USMLE Step 1 Basic Science Pearl)

- The **patency** of the airway is dependent on the interaction of forces that:
 1. Collapse the lumen
 2. Open the lumen
- OSA is the clinical manifestation that occurs when these forces are **skewed towards the collapse** of the airway lumen
- Two principles of fluid/air flow
 1. Bernoulli principle
 2. Venturi effect



Upper Airway Physiology: Venturi Effect (USMLE Step 1 Basic Science Pearl)

- When air/fluid passes through the narrowest section of a tube it moves faster
- Greater the speed of the air the less pressure exerted



Upper Airway Physiology: Bernoulli Principle (USMLE Step 1 Basic Science Pearl)

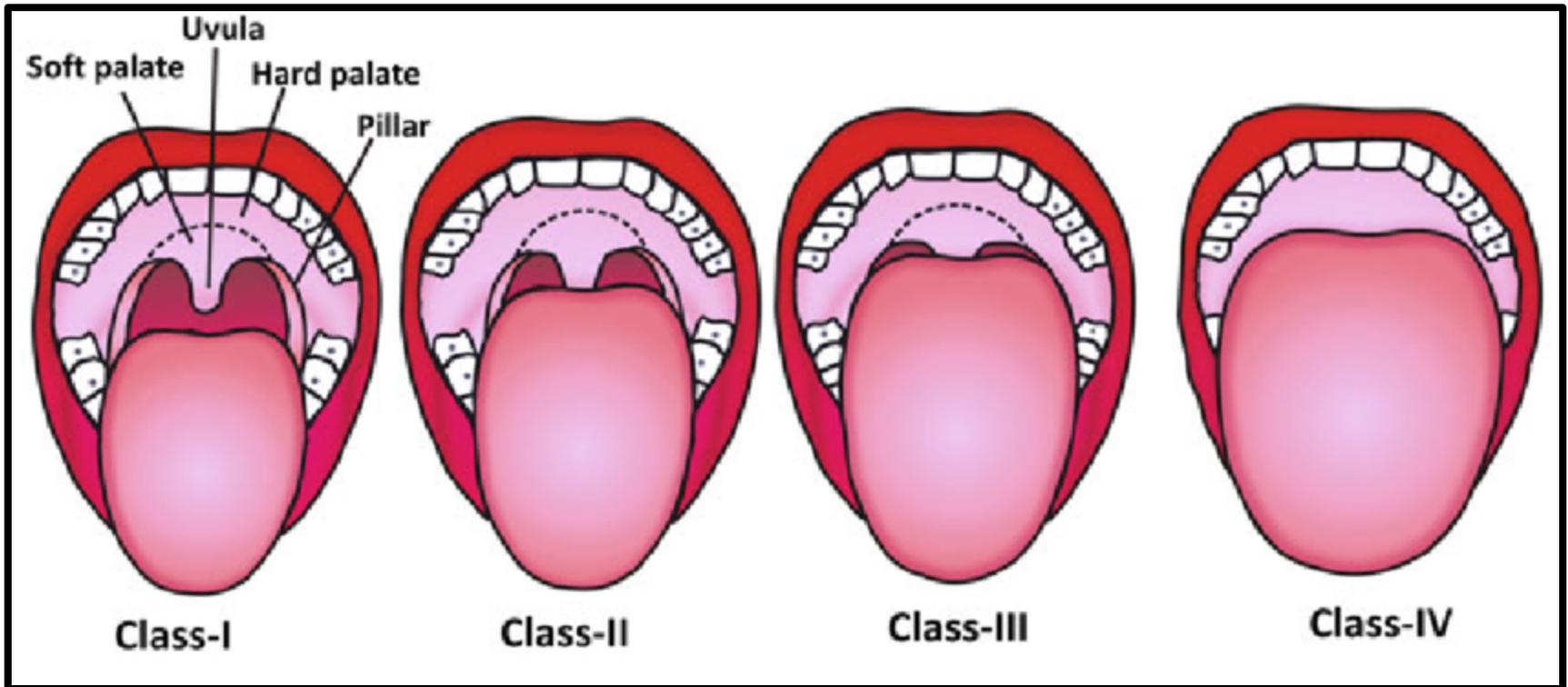
- As the velocity of a fluid/air increases, the pressure exerted by that fluid decreases
- A partial vacuum exists at the outer edges of a column of moving fluid/air
 - As airflow speed increases, the partial vacuum pressure increases
 - This principle is illustrated by a **drinking straw**: if too much negative pressure is generated within the straw, it collapses



Are there physiologic reasons that OSA would be worse during pregnancy?

- While weight gain is a known risk factor for OSA, there are other factors responsible during the **1st & 2nd** trimesters when weight gain is not significant:
 - 1. Nasal patency is reduced during pregnancy**
 - Due to changes in estrogen and progesterone
 - 2. Narrowing of the pharyngeal airway**
 - Increase in the Mallampati grade as pregnancy progresses
 - 3. Maternal blood volume**
 - Increases during pregnancy
 - Lying down at night may result in increased fluid volume in the upper airway, leading to increased collapsibility

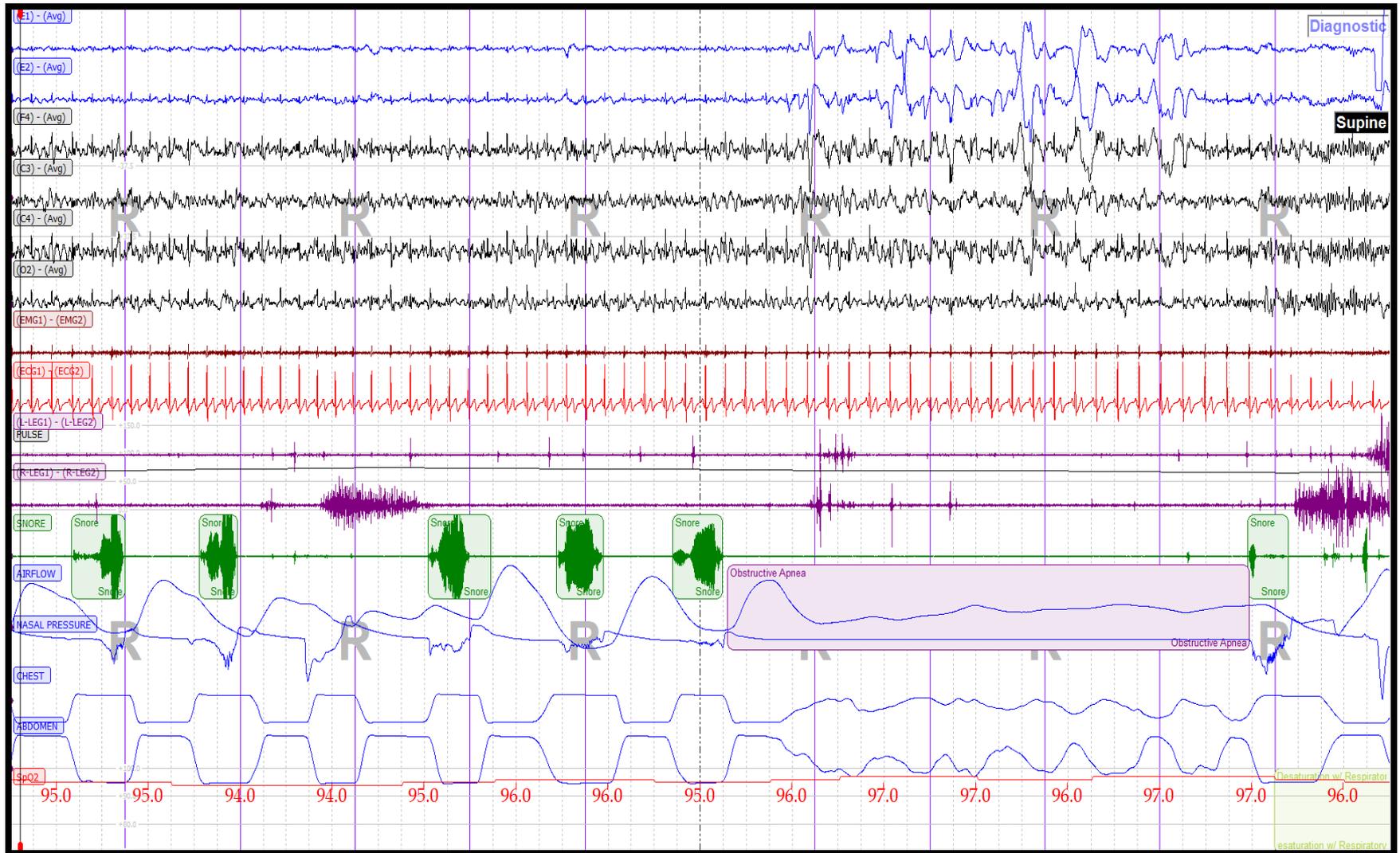
Beyond the Pearls: Mallampati Score



What are the testing options to diagnose sleep apnea? (USMLE Step 2 & 3 Clinical Pearl)

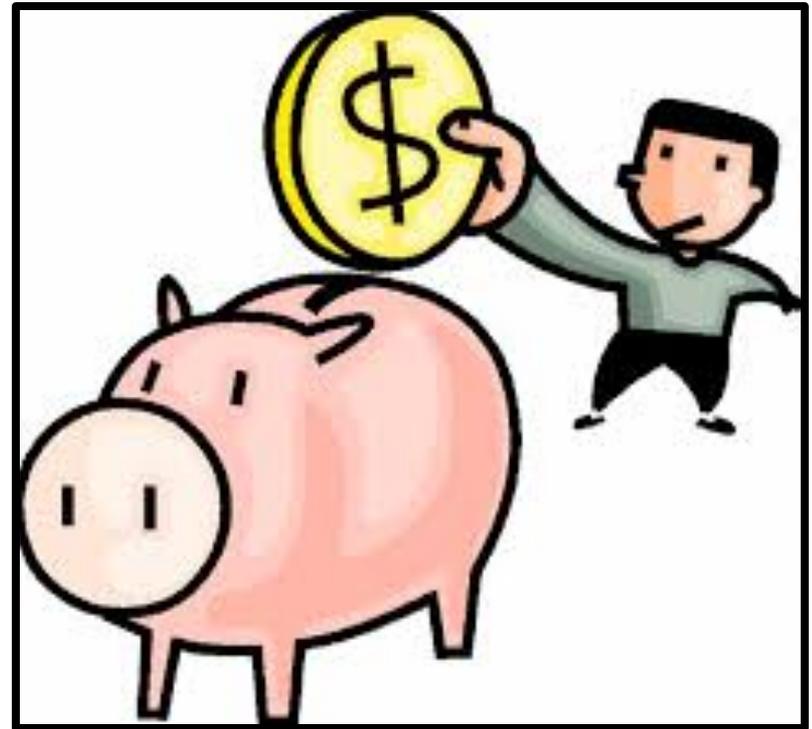
- **Previously the best initial test**
 - Overnight pulse oximetry desaturation study
 - Good to evaluate hypoxemia in patient's using PAP
 - Does not differentiate OSA and CSA
- **Traditional confirmation test**
 - Polysomnography
 - EKG, EEG, EMG, Oximeter, Tidal CO₂ recorder
 - Split study
 - Severity of the disease
 - Normal <5/hr
 - Mild 5-15/hr
 - Moderate 15-30/hr
 - Severe >30/hr

Polysomnography (USMLE Step 2 & 3 Clinical Pearl)

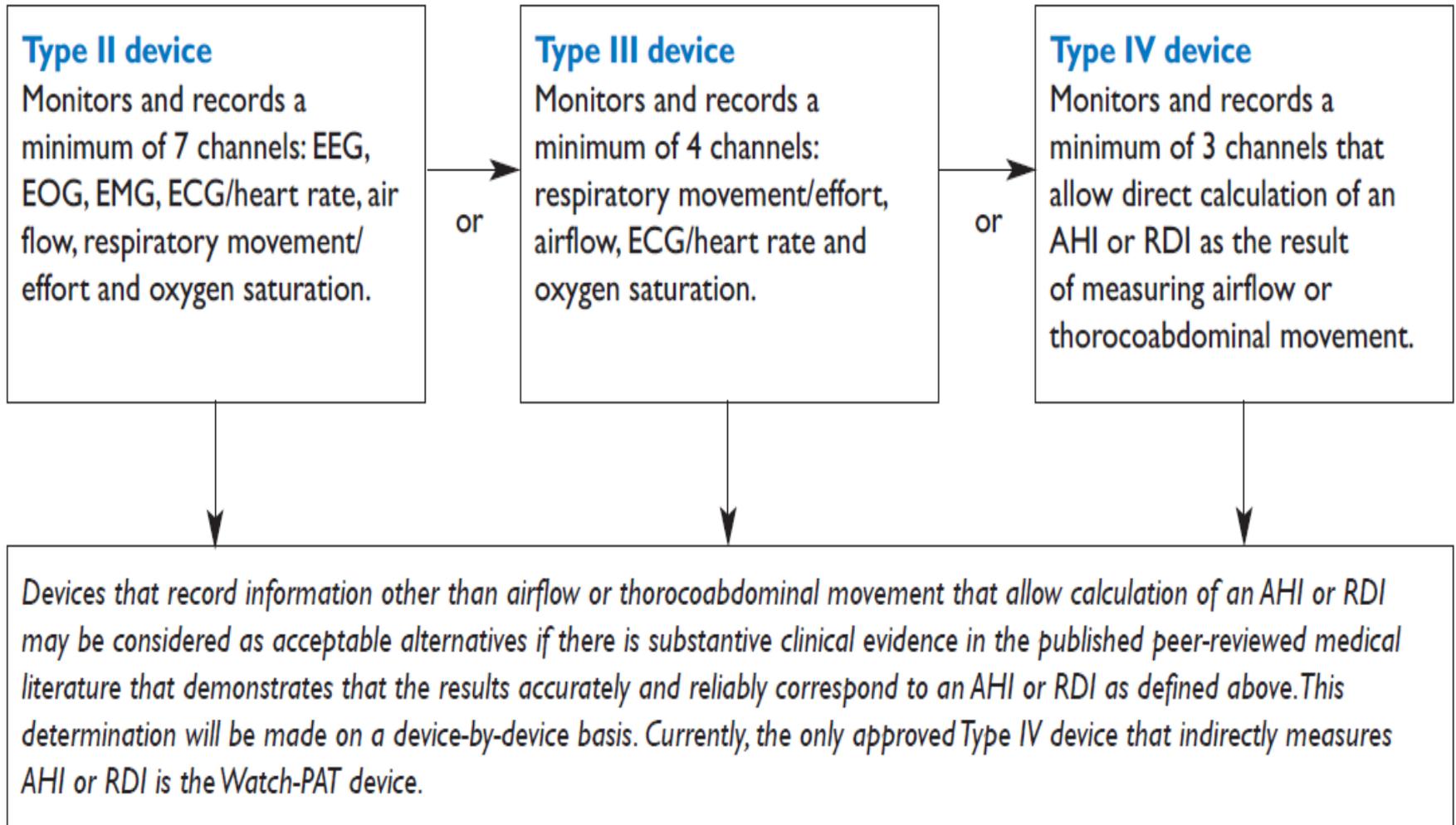


Home Sleep Testing (USMLE Step 2 & 3 Clinical Pearl)

- Familiar surroundings
 - Reducing first night effect
- Advantageous for:
 - Home-bound
 - Chronic illness
 - Arranging time
 - Circadian rhythm issues
- Fraction of the cost of an in-lab sleep study



What are the testing options to diagnose sleep apnea? Home Sleep Testing (USMLE Step 2 & 3)



What does Dr. Raj use in his office ?

- Type III home sleep testing device
- Capable of recording up to 5 channels of information:
 1. Respiratory effort
 2. Pulse
 3. Oxygen saturation
 4. Nasal flow
 5. Snoring



Obstetrics & Gynecology: Morning Report

- Your patient has an overnight, in-lab polysomnography and is diagnosed with moderate OSA
- Her AHI is **17.9** events per hour, with an oxygen desaturation index of 19 events per hour, and an oxygen nadir of 83%

Are there any potential risks of untreated OSA to the fetus?

- One relatively large population based observational study observed an increased risk of preterm birth in patients with OSA
- Association with risk of:
 - Low birth weight
 - Small for gestational age
 - Increased risk of cesarean delivery



Treatment Options for OSA (USMLE Step 2 & 3 Clinical Pearl)

- **Lifestyle modifications**

- Weight loss
- Avoiding
 - Alcohol
 - Sedatives
 - Hypnotics
- Not sleeping in the supine position



Treatment Options for OSA (USMLE Step 2 & 3 Clinical Pearl)

• PAP ventilation

- **CPAP**
 - Continuous positive airway pressure
- **BiPAP**
 - Bi-level positive airway pressure
- **ASV**
 - Adaptive servo ventilation
- **AVAPS**
 - Average volume assured pressure support

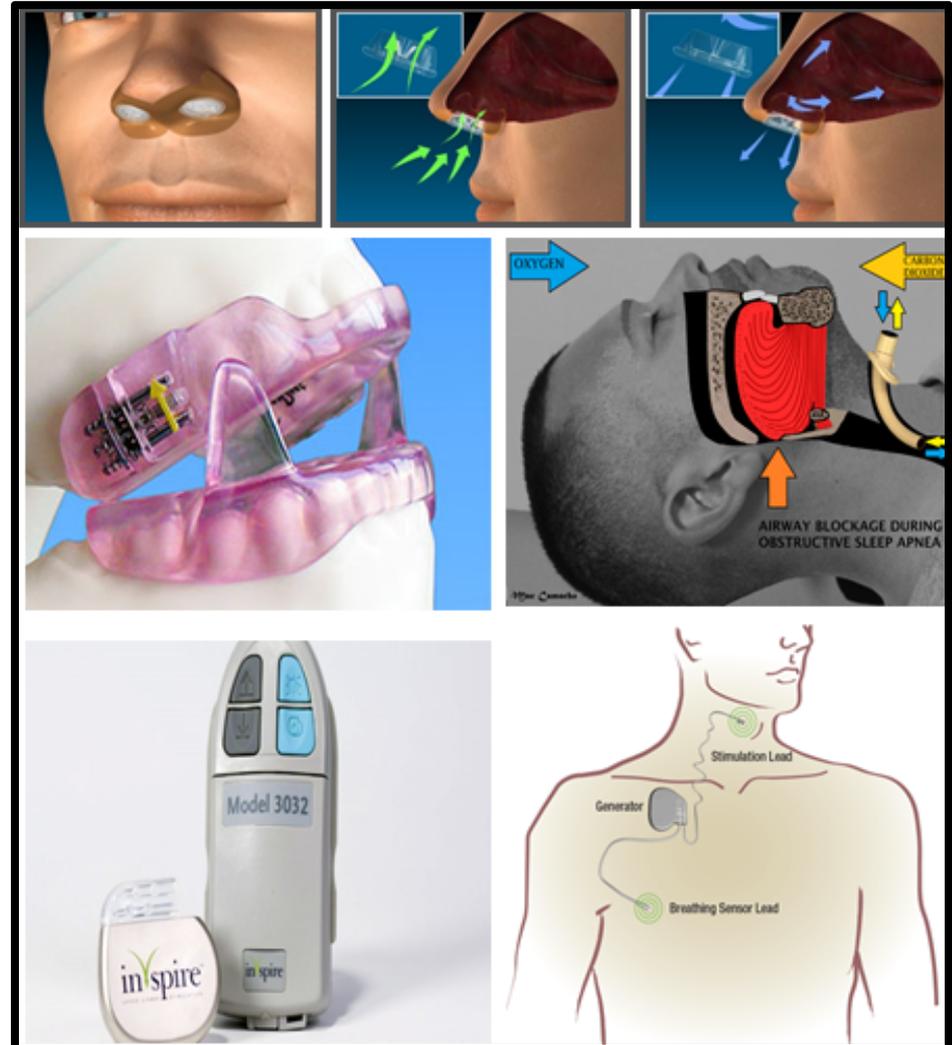


Treatment Options for OSA (USMLE Step 2 & 3 Clinical Pearl)

- Dental devices
- UPPP
- Tracheostomy
- Provent
- Inspire



Uvulopalatopharyngoplasty



Obstetrics & Gynecology: Morning Report

- Your patient is referred to a sleep medicine provider and is given an **autotitrating** CPAP machine, which she tolerates well
- At her next visit with you, she reports that she is sleeping well with it throughout the night and uses it most nights of the week
- Her husband reports that she is no longer snoring since starting to use CPAP at night



USMLE Step 2 & 3 Clinical Pearls

- Pregnancies with associated OSA should be considered “high-risk”
- CPAP minimizes the morbidities and secondary health risks associated with untreated OSA
- Patients using CPAP should bring their equipment with them to the hospital when they present for delivery
- Increased risk of complications from general anesthesia in patients with untreated OSA
- Opioid medications can suppress respiratory and worsen nocturnal hypoxemia.

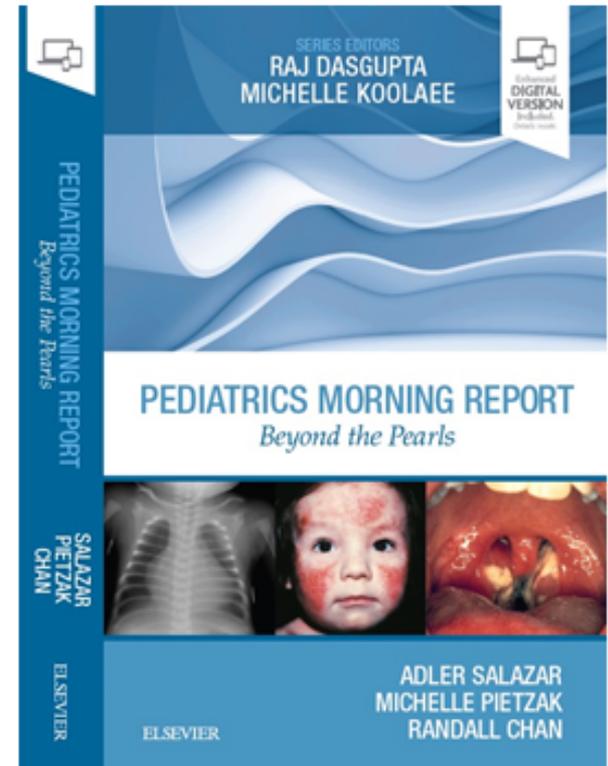
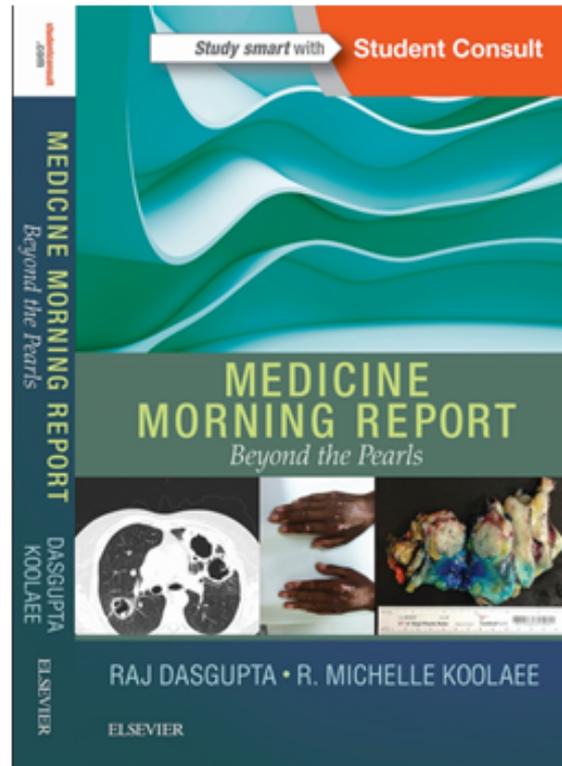
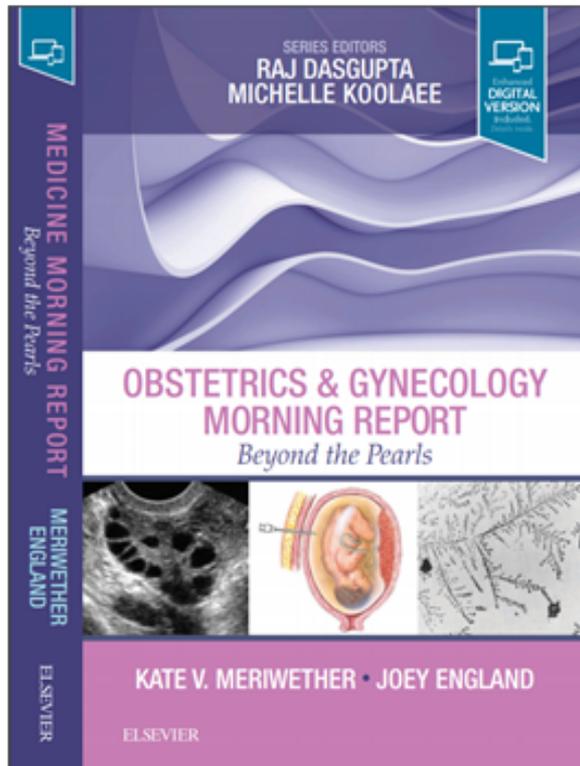
Will OSA “resolve” after delivery? (USMLE Step 2 & 3 Clinical Pearl)

- Once postpartum weight stabilizes repeat sleep study to assess severity of OSA and continued CPAP needs
- Often weight loss can lower CPAP pressure requirements which is why autoPAP is often used

Beyond the Pearls

- It is common for healthcare providers and patients to think that poor sleep and excessive daytime fatigue are “normal” symptoms of pregnancy. Resulting in the under-diagnosis of sleep apnea
- 3rd trimester is associated with the most significant changes in sleep from general discomfort, increased nocturnal urination, heartburn, back pain and nasal congestion
- 2 main effects of untreated OSA in pregnancy include the increased risks of developing **gestational diabetes** and **preeclampsia**
- Consider screening women with OSA for diabetes **early** in pregnancy and repeat screening at 24 to 28 weeks in those with an initial negative screen

Beyond the Pearls Series



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