

# Marilyn Miller, MSN, APRN, CFNP

Vaccinations in Women  
Physiologic changes in Pregnancy  
Robotic Hysterectomy

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## Purpose of Vaccinations



- Prevent disease in the person who is vaccinated.
- Prevent you from spreading a disease.

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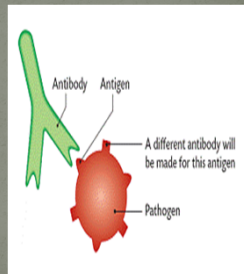
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## How Vaccinations Work

- Expose your immune system to antigens.
- Pre-existing immune response waiting to respond to the agent.
- Immune system is faster and more robust.
- Producing memory T cells & B cells with plasma cells that can live for decades waiting for the chance to respond.



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## How Vaccinations Work

- If you don't get the infection then you can't spread to others.
- Herd immunity which make outbreaks smaller and epidemics don't happen.



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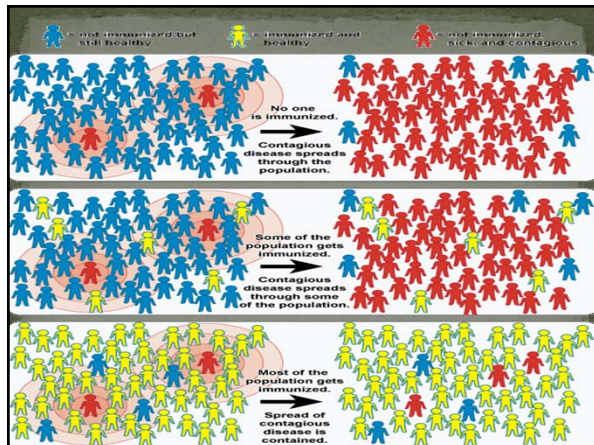
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## Vaccinations in Women

- Ideally, women should be vaccinated prior to conception.

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## Recommended Vaccines in Women

- Any female age 19 or older:
  - Recommended vaccination schedule.
  - Influenza yearly. Inactivated influenza vaccine(IIV) or recombinant influenza(RIV).
  - Administer to adults with hives-only allergy.

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## A word more on flu technologies

- Three different influenza production technologies.
  - Egg based: viruses injected into fertilized hen eggs.
    - Incubated for several days and allowed to replicate.
    - Virus containing fluid is harvested from the eggs.
    - Flu viruses are killed and antigen is purified.
    - Requires large numbers of eggs and takes longer than other processes.

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## Cell-Based Flu Vaccines

- August 2016 FDA approved Seqirus. Cell-based flu vaccine.
- Manufacturers inoculate the cells into the cultured mammalian cells. They are allowed to replicate.
- Virus containing fluid is collected and purified.
- Does not contain require chicken eggs. Vaccine is grown into animal cells.

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### Recombinant Flu Vaccines

- This process does not require an egg-grown virus.
- A certain protein is isolated from a naturally occurring("wild type") recommended vaccine virus.
- The proteins are combined with portions of another virus that grows well in insect cells. It's allowed to replicate and then purified after harvesting.
- Only 100% egg-free vaccine.

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### Other Vaccines

- Tdap-1 dose of Tdap and then followed by Td every 10years.
- MMR – administer 1 dose of MMR to adults without evidence of immunity. Born before 1957, documentation of receipt of MMR or laboratory immunity.
- Varicella – administer to adults without evidence of immunity. 2 doses 4-8 weeks apart.

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### Other Vaccines Cont.

- Zoster – administer 2 doses of vaccine 2-6 months apart to adults aged 50 or older regardless of past episode of herpes zoster.
- HPV – to females ages 9-26. 3 dose series at 0,1-2, and 6 months. Do not restart series if late on one of the injections.
- Pneumonia – administer to aged 65 or older 1 dose of 13-valent and by 1 dose of 23-valent shot(if not ever received) at least 1 year after the 13-valent shot.

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### Other Vaccines Cont.

- Hepatitis A – administer to adults with a specific risk.
- Hepatitis B – administer to adults with a specific risk.
- Meningococcal vaccination – refer to CDC website for more specifics.

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### Routine Vaccinations in Pregnant Women

- Vaccinations include: Tdap and influenza.
- Good safety profile in pregnancy.
- Can provide passive protection to the newborn.
- Not associated with miscarriage.

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### Vaccinations in Pregnancy

- Providers should administer appropriate vaccines to pregnant women with medical or exposure indications that put them at risk for vaccine preventable infections. (Uptodate, 2018).

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## Vaccinations in Pregnant Women

- Postpartum women should receive all recommended vaccines that could not be or were not administered during pregnancy.
- Providers should be aware of and follow contraindications and precautions for immunization of pregnant women:
  - NO LIVE ATTENUATED VIRUS VACCINES

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## Vaccines contraindicated during PG

- MMR
- Varicella
- Shingles shot
- No recommendation include:
  - HPV
  - HIB
  - PCV13 – pneumococcal vaccine.
  - MenB
  - Hib

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## Recommended Vaccines in PG

- Influenza – inactivated.
- Tdap -1 dose each pregnancy.

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## Placental Transfer

- Healthy PG women mount similar immune responses to vaccines as non-pregnant women.
- Transplacental passage of antibodies depends on maternal concentration, antibody type and gestational age of fetus.



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## Neonatal Immunity

- Important factor to consider is when passive neonatal immunity is the goal.
  - Maternal IgG levels reach their peak around 4 weeks after the vaccination.
  - Example of this is the pertussis vaccine.

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## Minimizing Risks

- PG women should minimize their risk of exposure to infections they are susceptible to by:
  - Avoiding travel to high -risk locations.
  - Assuring that household members are vaccinated to the standard immunization schedule.
  - Good hygienic practices.

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### Vaccination Safety

- Weigh the benefits to mother and fetus should outweigh the risks.
- No evidence of harm to PG women or fetuses.
- **Avoid all live vaccinations as most are harmful to a developing fetus.**

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### Protection against Pertussis for the fetus

- Pertussis prevalence is increasing.
  - Pertussis immunity after vaccination is waning.
  - Adults who develop pertussis can transmit to susceptible infants.
  - Infants under three months of are at highest risk of morbidity and mortality.
  - Over 50% of affected infants with pertussis contract the disease from family members.

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### Pertussis Protection

- Placental transfer of maternal antibodies is highly effective.
  - Provides passive immunity in infants.

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### ACIP Recommendations

- Vaccination between 27-36 weeks of gestation.
- Maximizes both maternal antibody response and passive antibody transfer to the infant.
  - Women vaccinated <6days before birth effectiveness is lower.
  - Women vaccinated remote from delivery antibodies insufficient to protect the infant.

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### Vaccination Resources

- CDC
- ACIP
- Uptodate

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### Physiologic Changes in Pregnancy

- To start.....
  - Uterus in a **non-pregnant** state weighs approx. 70g
  - Almost solid except for a cavity of 10ml or less
- **Pregnant** uterus at term weighs approx. 1100g and has a cavity of 5L to 20L.
- Becomes a thin walled muscular organ capable of accommodating the fetus, placenta and amniotic fluid.

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### Uterine size, shape & position

- Uterus stays pear shaped until 12 weeks.
- At 12 weeks the fundus becomes globular .
- Moves out of the pelvis.
- As uterus enlarges it comes in contact with the anterior abdominal wall.
- With uterine ascent rotates to the right as the rectosigmoid is on the L side of the pelvis.

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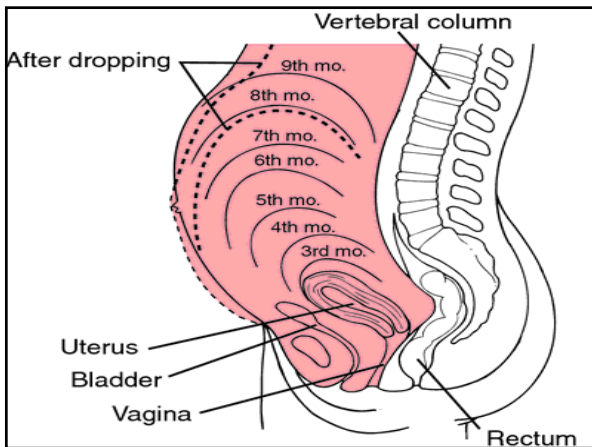
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## Hematological Changes

- Hypervolemia state – 40-45% increase in blood flow.
- Fetus not essential for this change – also seen in molar pregnancies.

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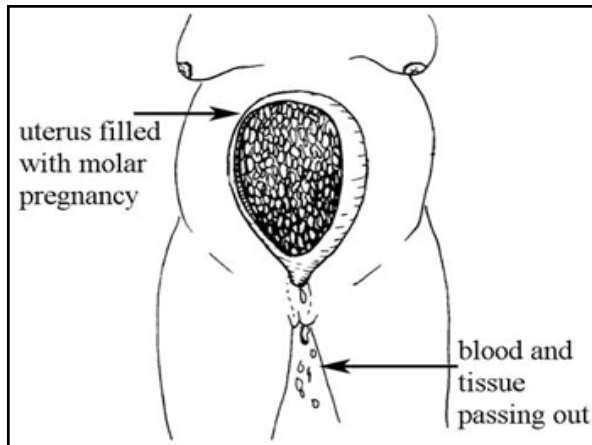
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## Hematological Changes Cont.

- Several important functions:
  - Meet the metabolic demands of the enlarged uterus.
  - Provides abundant nutrients & elements to rapidly growing fetus.
  - Safeguards the mom against adverse effects of intrapartum blood loss.
  - At term: Circulating utero placental blood volume can range from 450ml-650ml/min.
    - **To put this in context:**
  - Non-pregnant state entire circulation is approx. 5000ml/min.

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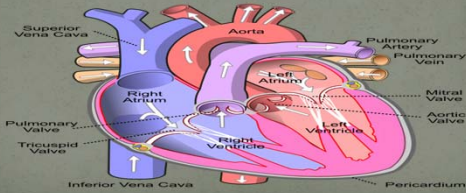
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- Which leads to the next subject of Cardiovascular system changes.....




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### Cardiovascular Changes in PG

- Cardiac function changes occur during first 8 weeks of PG.
- Cardiac output is increased by the fifth to eighth week.
- Reduced systemic vascular resistance.
- Resting heart rate is increased approx. 10 beats/min.

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### Maternal Posture on Hemodynamics

- Ventricular performance is influenced by
  - Decrease in systemic vascular resistance
  - Changes in pulsatile arterial flow.
  - Allow the physiological demands of the fetus to be met and still maintain maternal CV integrity.
- *The following graph depicts this well.....*

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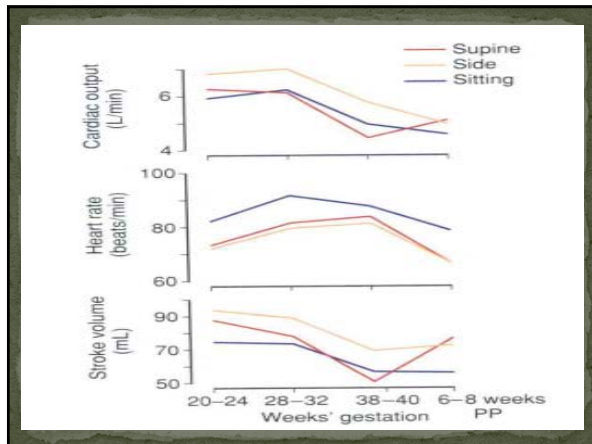
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### Heart Changes in PG

- Diaphragm becomes progressively elevated.
- The heart is displaced to the left and upward.
- Larger cardiac silhouette.
- Some degree of benign pericardial effusion.

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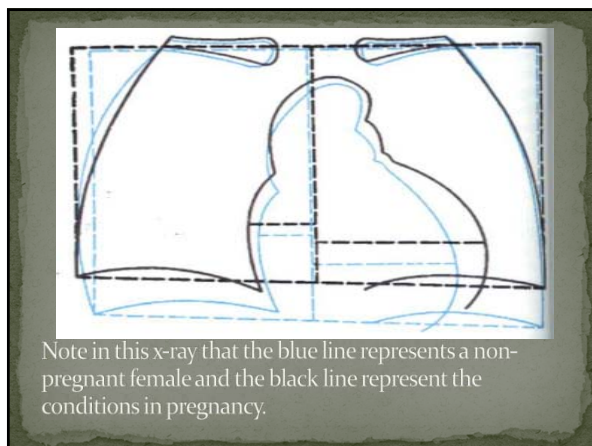
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Note in this x-ray that the blue line represents a non-pregnant female and the black line represent the conditions in pregnancy.

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Cardiac Sounds in PG

- Many normal sounds are modified in PG.
- Exaggerated splitting of the first heart sound.
- No definite changes in the aortic & pulmonary elements.

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Cardiac Sounds in PG

- Loud, third sound can be heard.
- 90% of pregnant women have a systolic murmur that can be heard during inspiration or expiration in others. Disappeared after delivery.
- No change in septal thickness or in ejection fraction.

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Cardiac Output in PG

- Ventricular function is normal.
- For the given filling pressures there is appropriate cardiac output.
- Cardiac function is considered eudynamic.

*The following graph shows this.....*

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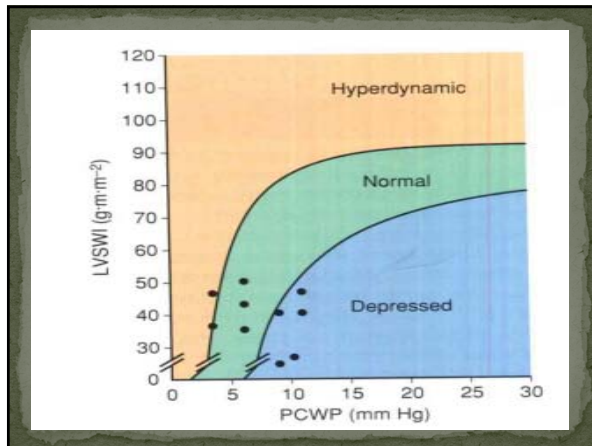
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**Cardiac Output in PG**

- Mean arterial pressure & vascular resistance decrease.
- Blood volume & basal metabolic rate increase.
- Cardiac output at rest increases significantly in the left lateral recumbent position.

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**Cardiac output in PG cont.**

- Late pregnancy in the supine position compresses the venous return from the lower body.
  - Causes significant arterial hypotension (referred to as: supine hypotensive syndrome).  
Ultimately can affect fetal heart rate patterns.
- Uterine blood flow is decreased by 1/3<sup>rd</sup> in supine women in late PG.
- Term PG women lying in a side position have approx. a 20% increase in cardiac output.

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Circulation & Blood Pressure Changes in PG.

- Changes in posture affect arterial blood pressure.
- Brachial artery pressure when sitting is lower than when in a lateral recumbent supine position.

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Circulation & Blood Pressure Changes in PG.

- Venous blood flow in the legs is slow to return during PG. End result can be:
  - Blood stagnation in the lower extremities attributed to latter pregnancy.
  - Compression of pelvic veins and inferior vena cava by the enlarged uterus.
  - Lateral recumbent position alleviates the slowed blood flow from the extremities.

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*Circulation & Blood Pressure Changes in PG.*

- Blood stagnation contributes to:
  - Dependent edema.
  - Varicose veins in the vulva and legs.
  - Hemorrhoids.
  - Predispose to deep-vein thrombosis.
- *Now moving to the pulmonary function....*

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### Pulmonary Function in PG

- Diaphragm rises about 4cm during PG.
- Sub costal angle widens.
- Thoracic circumference increases about 6cm.
- Functional residual capacity decreases by 20-30%
  - This decline is due to diaphragm elevation.
  - Progressive decline across pregnancy.
  - Respiratory rate unchanged.
  - Tidal volume & resting minute ventilation increase from 10.1 to 14.1L/minute.

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This picture shows the diaphragm elevation & the widening of the sub costal angle.

4 cm

68.5°

103.5°

Uterus (37 weeks)

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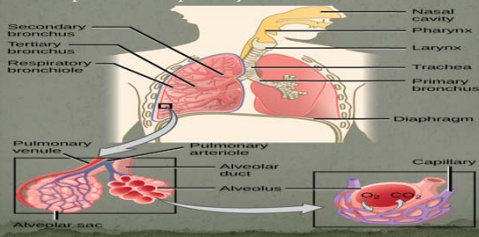
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## Pulmonary Function in PG

- Increased minute ventilation caused by:
  - Stimulatory action of progesterone.
  - Low expiratory reserve volume.
  - Compensated respiratory alkalosis.



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## Oxygen needs in PG

- Oxygen consumption increases approx. 20% during PG and higher in multifetal PG.
- During labor O<sub>2</sub> consumption increases 40-60%!



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## Acid-Base Equilibrium

- Physiological dyspnea – an increased awareness to breathe.
  - Should not interfere with normal physical activity.
  - Results from increased tidal volume which lowers the blood P<sub>CO2</sub>.
  - Though largely due to progesterone.
  - Progesterone acts centrally and lowers the threshold & increases the sensitivity of the chemoreflex response.

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## Other Physiological Changes

- A quick word about other physiological changes in PG.
- Urinary system:
  - Kidney size increases approx. 1.5cm
  - GFR increases by 50% .
  - Gloucosuria during PG not always abnormal.
  - Hematuria may represent contamination. If not, may be an UTI.
  - Proteinuria – becomes a problem when 300mg/day is excreted.

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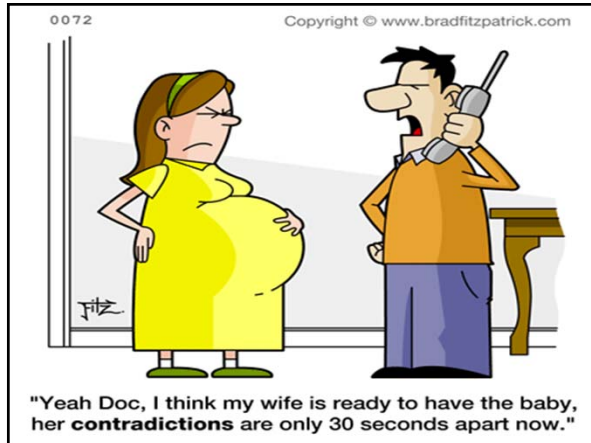
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## Other Physiological Changes

- GI tract
  - Pregnancy gingivitis happens as gums become hyperemic and softened. Generally, resolves after delivery.
  - Pyrosis(heartburn) – altered stomach position contributes as does lower esophageal sphincter tone is decreased.
  - Gastric emptying time unchanged during PG, but can be prolonged during labor.
  - Hemorrhoids – common. Constipation and elevated pressure in veins below the enlarged uterus are causes.

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### Other Physiological Changes

- Gallbladder – contractility is reduced. Leads to increased residual volume.
- Progesterone can impair gallbladder contraction.
- Intrahepatic cholestasis linked to high circulating levels of estrogen.

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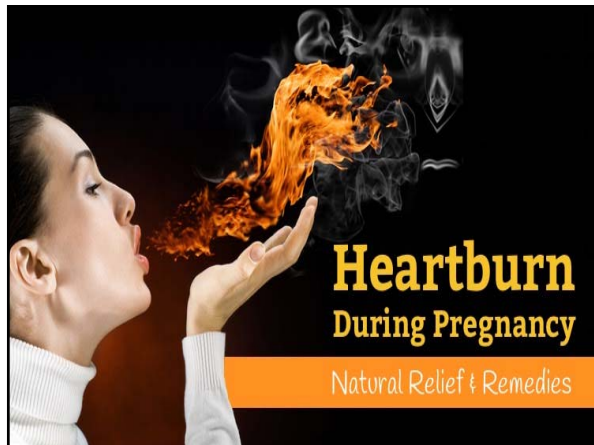
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### Musculoskeletal system

- Progressive Lordosis normal feature of PG. shifts the center of gravity back over the lower extrem.
- Sacroiliac, sacrococcygeal and pubic joints have laxity and increased mobility.
- Aching, numbness and weakness common in upper extrem.
- Joint strengthening begins immed. After delivery.

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Central Nervous System

- Relatively few and subtle.
- Memory decline in third trimester.
- Resolves after delivery.
- *We call it Placental shunting.....*

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Those who say they sleep like a baby  
have apparently never had one  
break-dancing in their belly  
in the middle of the night.

*Mommy Knows What's Best*

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## Central Nervous System

- **Eyes:** Corneal thickness increases, most likely related to edema.
  - Difficulty with previously comf. Contact lenses.
  - Visual function unaffected by PG.
- **Sleep:** Beginning as early as week 12 and extending through 2 months postpartum women have difficulty
  - Going to sleep, frequent awakenings, fewer hrs. of night sleep, and reduced sleep efficiency.
  - Concern now about obese women and sleep apnea.

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## Most Common PG Complaints

- Back pain.
- Pubic bone aching and pain.
- Urinary frequency with nocturia.
- Sleep disturbance.
- Heat intolerance.
- Emotional roller coaster.



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I grow humans.  
What's your  
super power?



 mindful mum

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Changing Gears: Moving on to Robotic Surgery



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Hx. of Surgical Robot

- First robotic surgery was in 1985 for neurosurgery.
- Robotic surgery extended to urology in 1988, ortho in 1992, and gynecology in 1998.
- Robotic camera holder introduced in 1994.

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### Robotic vs other Surgical Approaches

- Conventional laparoscopy – optics and instrumentation are limited and advanced surgical training is required.
- Poor ergonomics leads to fatigue and joint strain for the surgeon.
- Advantage is decreased morbidity, rapid recovery and small incisions.
- Increased risk of bladder and ureteral injury.
- Small movements are amplified by the surgeon.

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### Robotic Surgery Advantages

- Superior visualization – 3D vision, rapid zooming and panning of the camera.
- Mechanical improvements – instruments less likely to break. Often better to use with obese patients as size of the laparoscope is larger.
- Robotic instruments have 7 degrees of freedom.
- Stabilization of instruments within the surgical field.
- Improved ergonomics for the surgeon. Performed in a seated position.

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### Limitations of the Robotic Surgery

- Additional surgical training.
- Increased costs & operating room time.
- Bulkiness of the device.
- Instrumentation limitations (lack of a robotic suction & irrigation device, size, cost).
- Lack of haptics (tactile feedback).
- Risk of mechanical failure.
- Increased anesthesia time.

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## Are Surgical Robots Cost-effective?

- Robotic surgery is expensive.
- Average cost of a da Vinci system between \$1.85 and \$2.3 million.
- Each robotic arms costs between \$2200 and \$3200. Requires replacement after 10 uses.
- Costs include capital acquisition, limited use instruments, team training expenses, equipment maintenance and repair and OPERATING ROOM SET-UP TIME.

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## Robotic Assisted Laparoscopic Vaginal Hysterectomy

- Surgical robot: computer aided device to aid in the positioning & manipulation of surgical instrument.
- Typically used in laparoscopy rather than open surgical approaches.
- Da Vinci robot FDA approved for gyn surgery.

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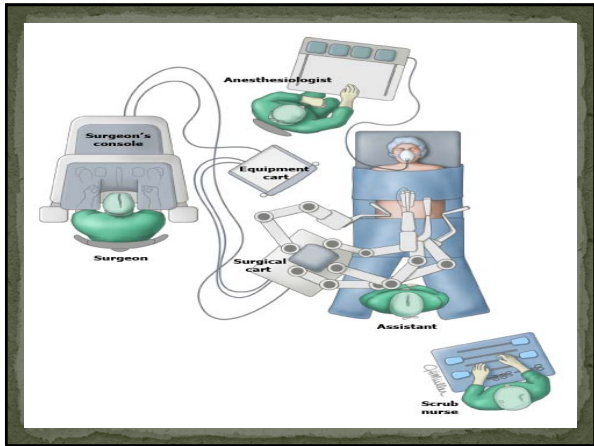
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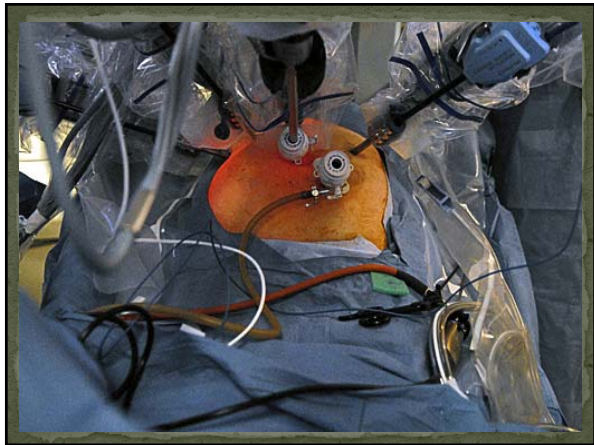
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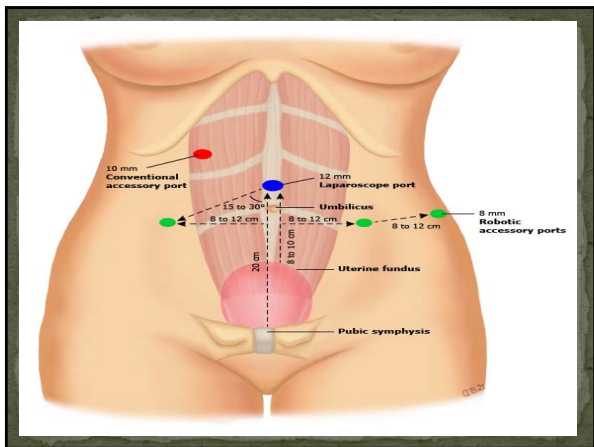
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## Active Robots

- Surgeon uses the robot as a tool.
- Actively engaged in the operative field.
  - Made possible by 3D magnification.
  - Use of direct line of sight to position the instruments that the surgeon is controlling.
  - Haptics (tactile feedback) is a limitation of the robot.
    - Surgeon can't feel the resistance of the tissue as the instrument meets or manipulates the tissue.
    - Uses visual cues and knowledge of anatomy and surgical planes to accommodate for this limitation.

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## What's the role of the APRN

- Referral to a gyn physician for surgery.
  - Conditions can include: chronic pain, heavy bleeding, fibroids, endometriosis and/or prolapse.
- Preoperative exam/clearance.
- Patient education about procedure and what to expect.
  - Potential benefits include: significantly less pain
  - Less blood loss and need for a transfusion
  - Less risk of infection
  - Shorter hospital stay (usually overnight)
  - Quicker recovery.
  - Small incisions
  - Patient satisfaction.

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## Post op Instructions

- 10# weight restriction including no pushing, pulling, lifting, bowling or painting ceilings for at least six weeks.
- No sexual activity 8-12 weeks. Increased risk of bowel dehiscence.
- Post-op incision checks.
- Generally a speculum exam is performed at the 6-8 week mark to evaluate for vaginal cuff healing.

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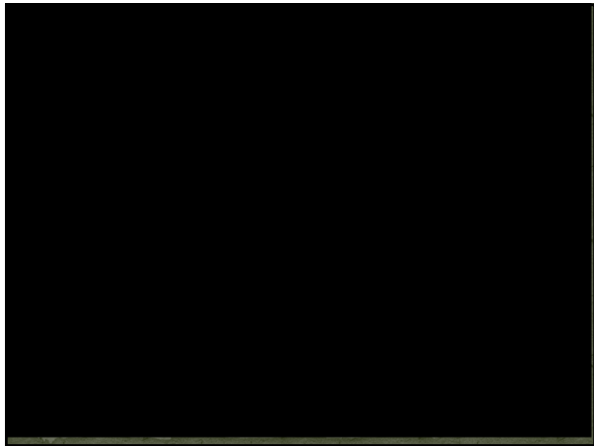
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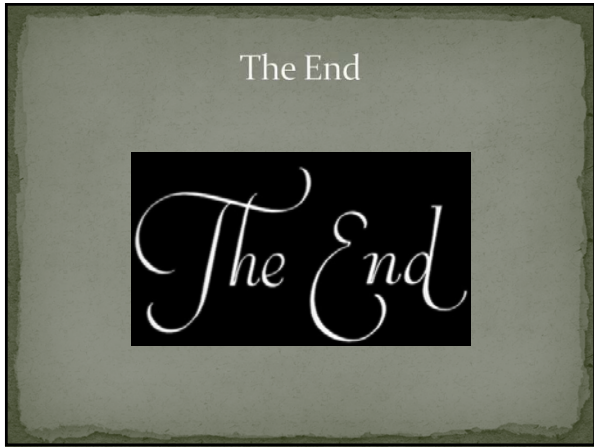
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