Vaccinations in Women
Physiologic changes in Pregnancy
Robotic Hysterectomy

Purpose of Vaccinations
• Prevent disease in the person who is vaccinated.
• Prevent you from spreading a disease.

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.
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.

Vaccinations in Women

- Ideally, women should be vaccinated prior to conception.
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.

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.

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.
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.

Other Vaccines

• Tdap - 1 dose of Tdap and then followed by Td every 10 years.
• 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.

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 23-valent and by 1 dose of 23-valent shot (if not ever received) at least 1 year after the 23-valent shot.
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.

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.

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).
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

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

Recommended Vaccines in PG
- Influenza – inactivated.
- Tdap -1 dose each pregnancy.
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.

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.

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.
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.

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 age are at highest risk of morbidity and mortality.
  - Over 50% of affected infants with pertussis contract the disease from family members.

Pertussis Protection
- Placental transfer of maternal antibodies is highly effective.
  - Provides passive immunity in infants.
ACIP Recommendations

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

Vaccination Resources

- CDC
- ACIP
- Uptodate

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. 1000g and has a cavity of 5L to 20L.
- Becomes a thin walled muscular organ capable of accommodating the fetus, placenta and amniotic fluid.
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.
Hematological Changes

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

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

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.

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.....
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.

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

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.

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

Cardiac Output in PG

• Late pregnancy in the supine position compresses the venous return from the lower body.
• Causes significant arterial hypotension (referred to as: supine hypotensive syndrome).
• Uterine blood flow is decreased by 1/3rd in supine women in late PG.
• Term PG women lying in a side position have approx. a 20% increase in cardiac output.
Changes in posture affect arterial blood pressure.

Brachial artery pressure when sitting is lower than when in a lateral recumbent supine position.

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.

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

Oxygen consumption increases approx. 20% during PG and higher in multifetal PG. During labor O2 consumption increases 40-60%.

Physiological dyspnea – an increased awareness to breathe. Should not interfere with normal physical activity. Results from increased tidal volume which lowers the blood Pco2. Though largely due to progesterone. Progesterone acts centrally and lowers the threshold & increases the sensitivity of the chemoreflex response.
A quick word about other physiological changes in PG.

**Urinary system:**
- Kidney size increases approx. 1.5cm
- GFR increases by 50%.
- Glucosuria during PG not always abnormal.
- Hematuria may represent contamination. If not, may be an UTI.
- Proteinuria – becomes a problem when 300mg/day is excreted.

**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.
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.

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.
Relatively few and subtle.
Memory decline in third trimester.
Resolves after delivery.

We call it Placental shunting.........

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
Central Nervous System

• **Eyes:** Corneal thickness increases, most likely related to edema.
  • Difficulty with previously conf. 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.

Most Common PG Complaints

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

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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.

Additional surgical training.

Increased costs & operating room time.

Bulksiness 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.
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 arm 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.

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.
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.

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.

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.
The End