



European Society of
Regional Anaesthesia
& Pain Therapy

ESRA ITALIA

ESRA Italian Chapter

XXVIII CONGRESSO NAZIONALE

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DEL CONGRESSO
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PALERMO 5-7 Ottobre

XXVIII

**CONGRESSO
NAZIONALE**



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Regional Anaesthesia
& Pain Therapy

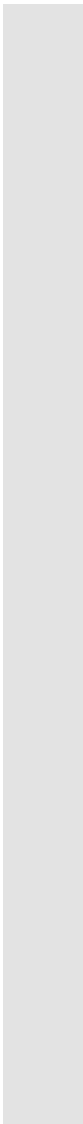
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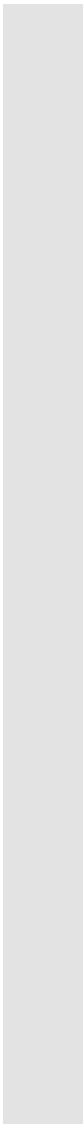
ANESTHESIA FOR NON-OBSTETRIC SURGERY DURING PREGNANCY

Dott.ssa Claudia Ciancimino



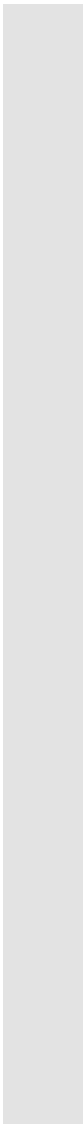




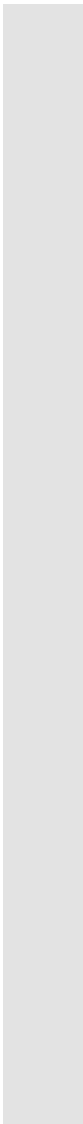


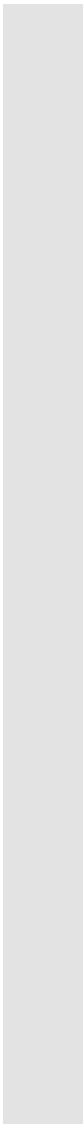
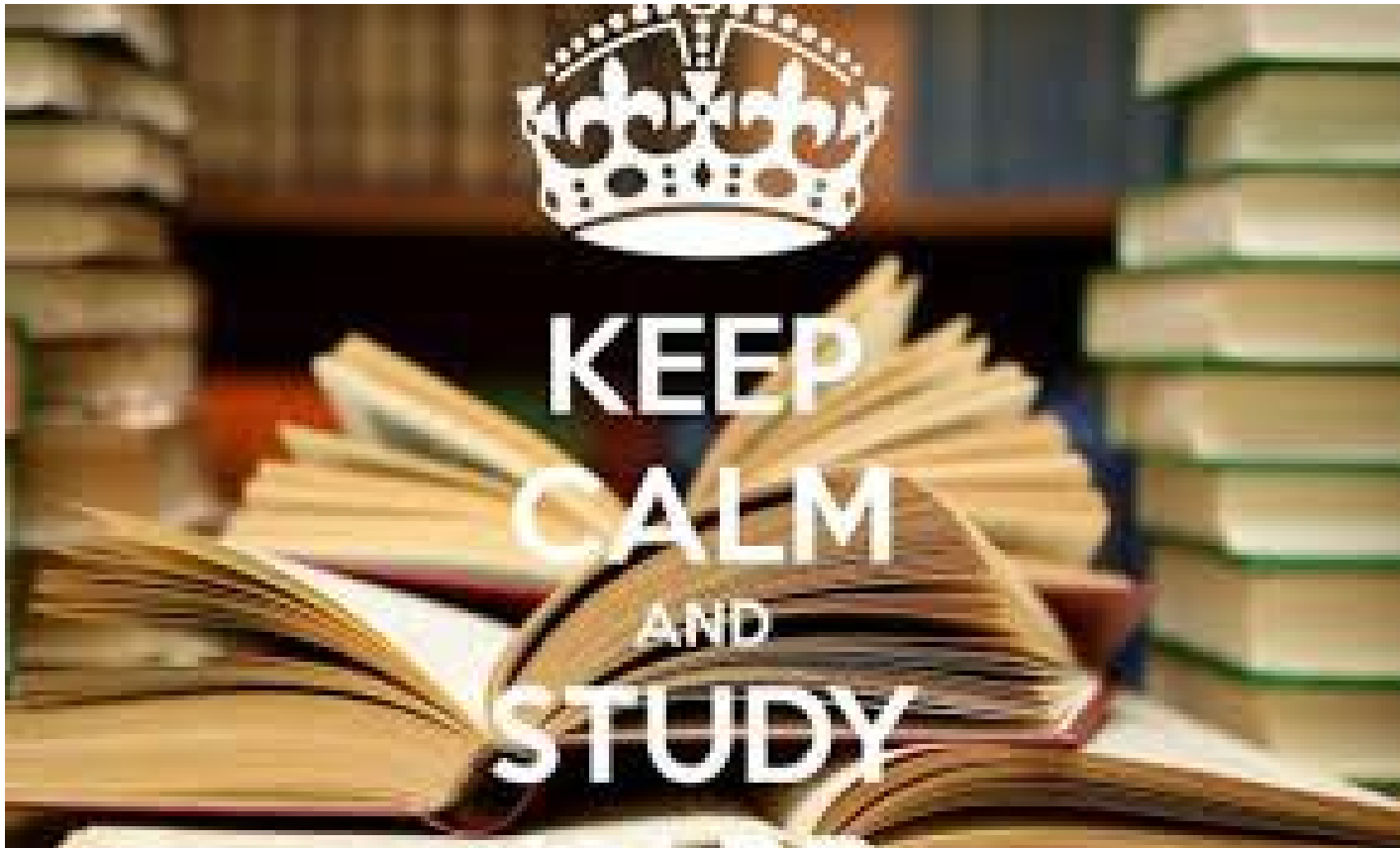




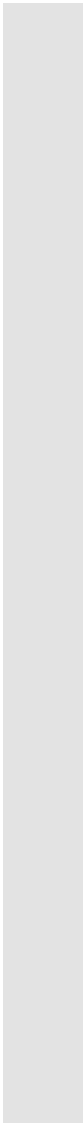
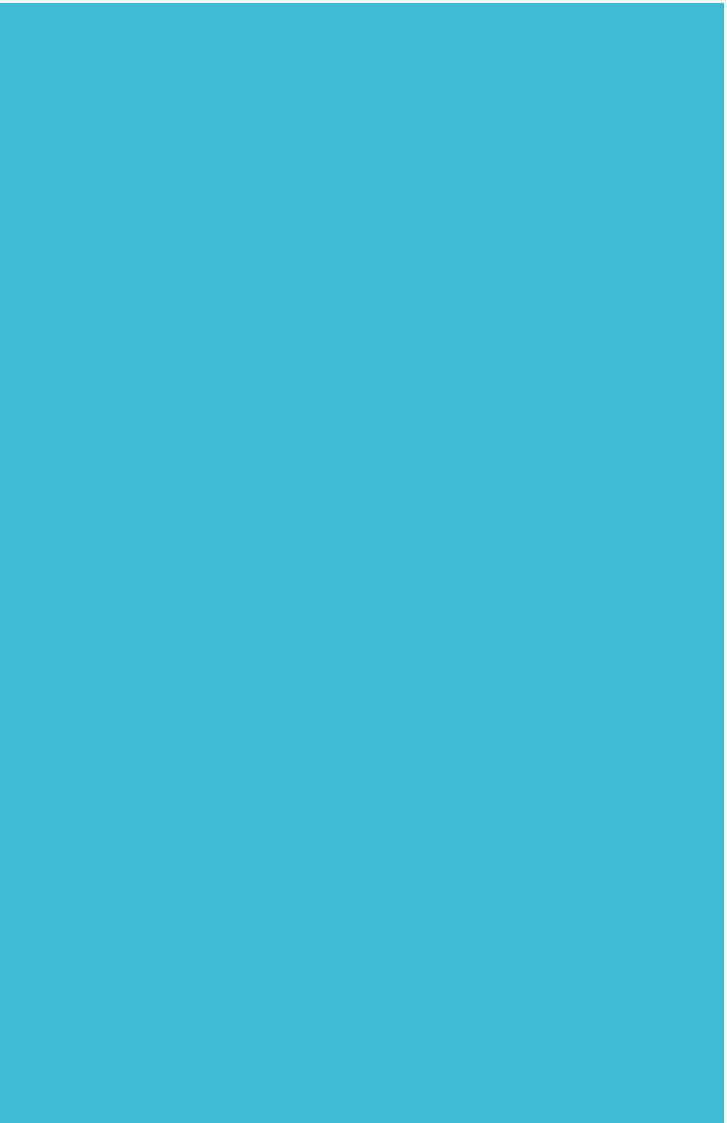








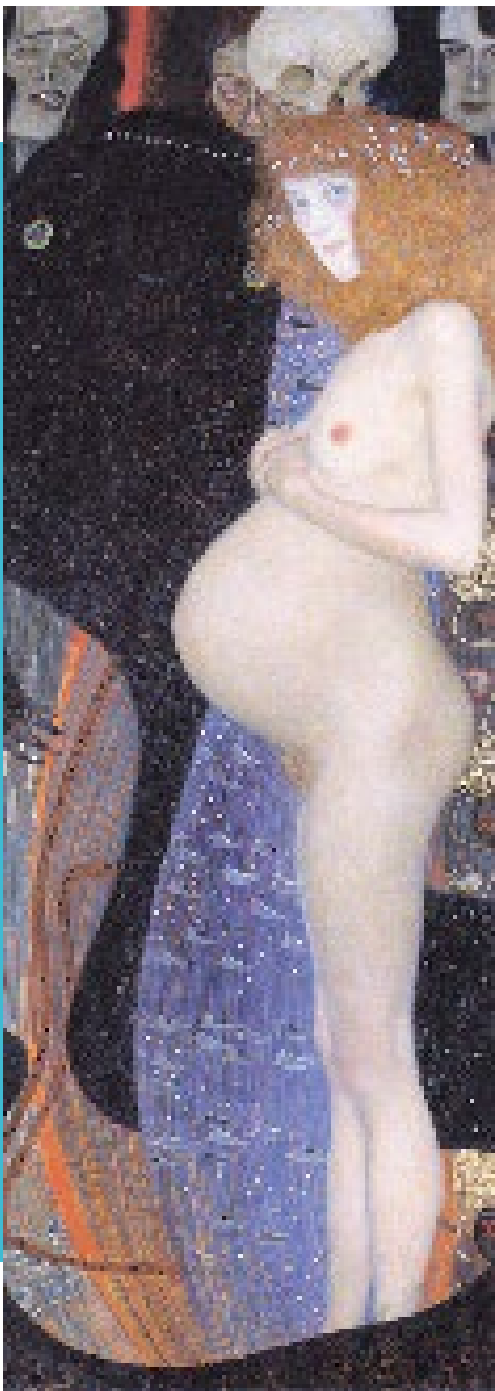




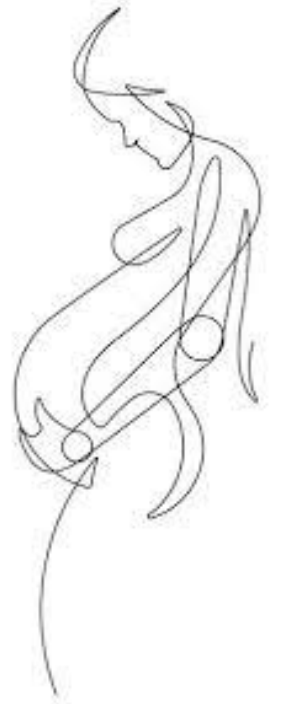


- The need for non obstetric surgery can arise at any point during gestation.
- Physiologic changes of pregnancy occur in virtually all organ systems and are caused by both hormonal and mechanical factors.
- Anatomic and physiologic changes related to pregnancy and concerns for the fetus may require adjustment of anesthetic management.
- Urgent and emergency surgeries are not based on pregnancy, while elective procedures generally can be delayed until after delivery.





- Approximately 1-2% of pregnant women undergo surgery each year for non-obstetric causes (Vasco Ramirez, 2020).
- The frequency of major complications for non-obstetric surgery in pregnancy is around 7%, not different from the frequency in the population of non-pregnant women. (Erekson, 2012)
- Pregnant women with abdominal surgical pathology are more likely to undergo emergency surgery (Moore, 2015).





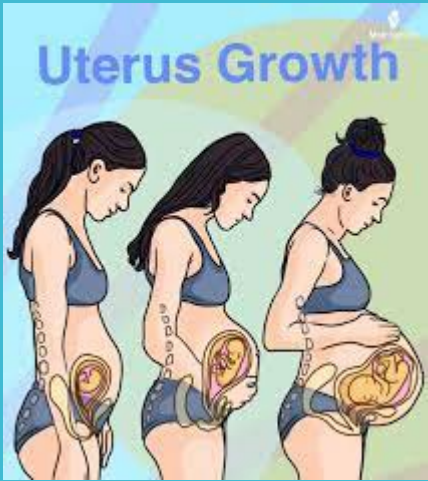
- 1) Give sodium citrate & do a RSI if giving a GA > 16wks gestation
- 2) Remember the TILT/Wedge > 20°
- 3) ALL anesthetics during pregnancy

(Fetal Monitoring During Non-Intubated Anesthesia Protocol. University of Michigan Center Department of Anesthesia)

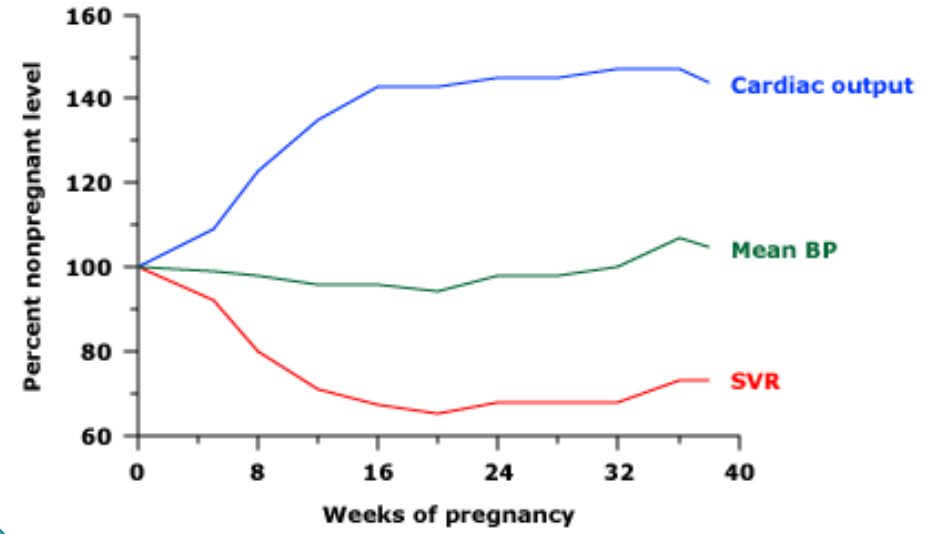




Cardiovascular



- ↑ Cardiac Output (CO)
- ↓ Peripheral Resistances
- ↑ Heart Rate
- Echocardiography: - Eccentric Hypertrophy LV
 - Polmonar Tricuspid Regurgitation (94%)
 - Mitral Regurgitation (27%)
- ↑ Blood Volume
- ↑ Cardiac Contractility





Cardiovascular



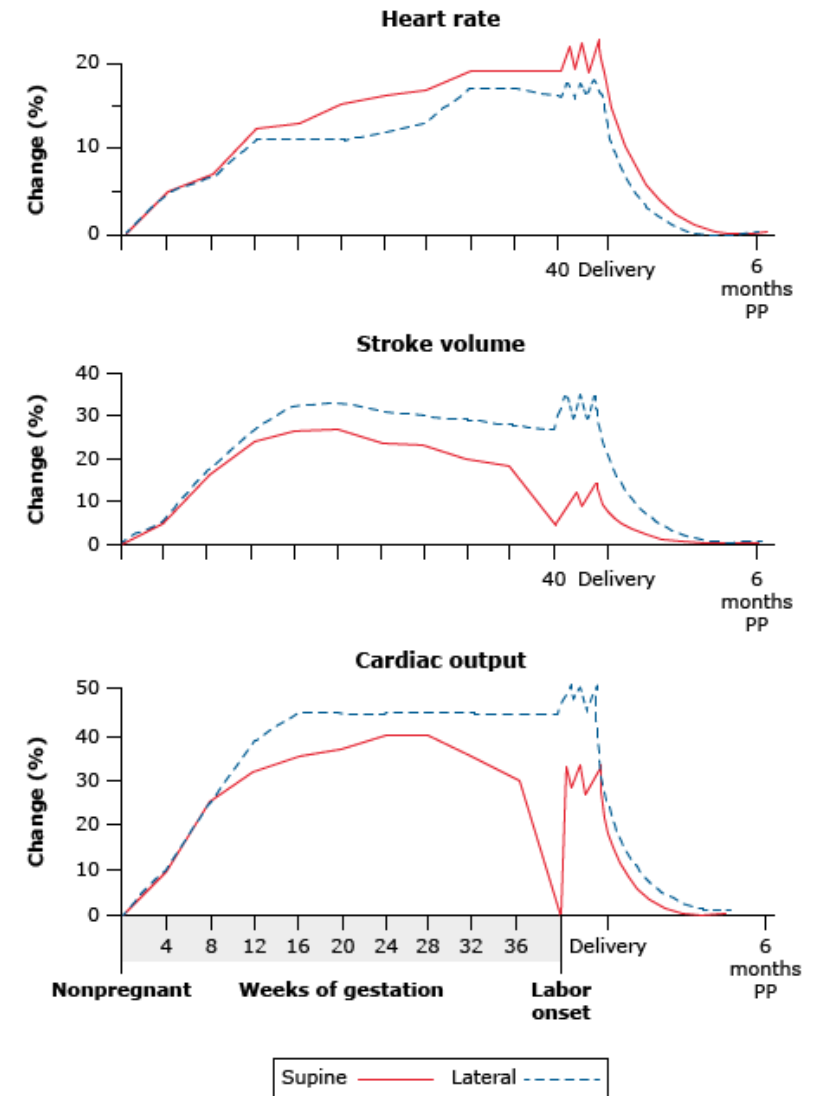
In supine position:

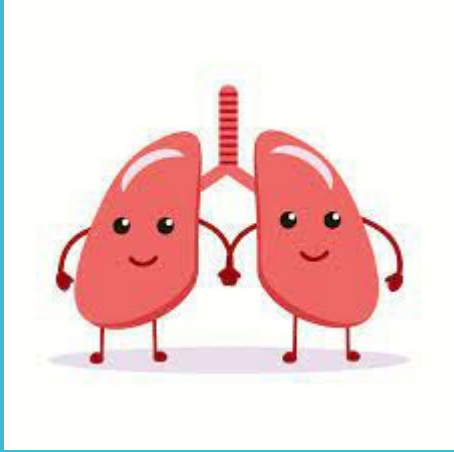
SUPINE HYPOTENSIVE SYNDROME

- ↓ CO
- ↓ Uterine blood flow
- ↓ Lower limbs blood flow
- ↓ Arterial hypotension and bradycardia



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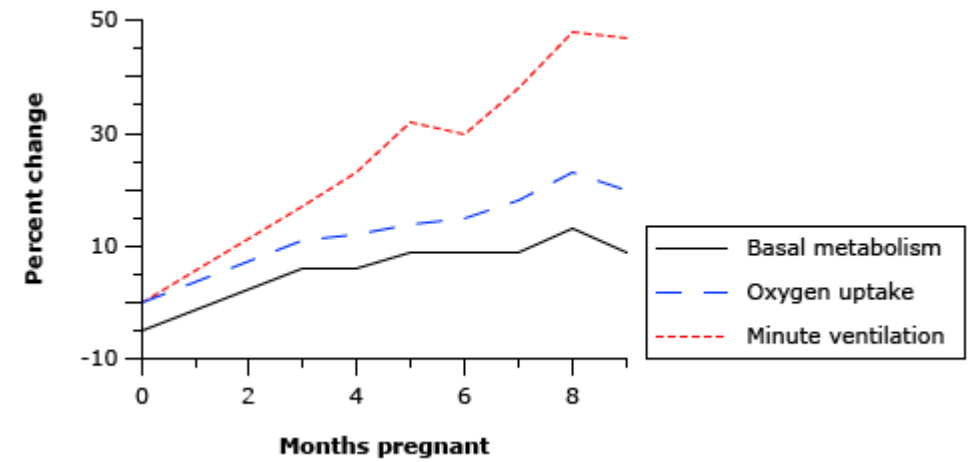




Pulmonary



- $\uparrow V_T > 45\%$
- Partially Compensated Respiratory Alkalosis
(pH = 7.42 to 7.44, HCO_3^- 20 mEq, PaCO_2 30 mmHg).
- Partial Pressure of Carbon Dioxide (PaCO_2) = 28 to 32 mmHg
(normal range in non-pregnant state: 35 to 45 mmHg).
- \uparrow Progesterone-induced stimulation of ventilation.
- \downarrow FRC (20 weeks of gestation) < 80% upward displacement of the diaphragm.





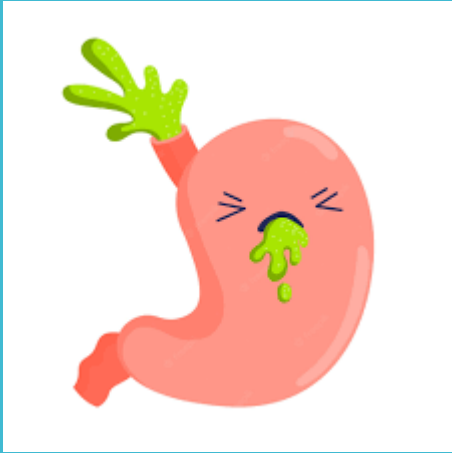
Hematologic

- ↑ Plasma volume
- ↓ Hemoglobin concentration

Normal hemoglobin may be as low as 11 g/dL by the end of the first trimester and approximately 10.5 g/dL in the second trimester.

- Relatively Hypercoagulable State (until 12 weeks postpartum).
- ↑ Fibrinogen
- = or ↓ PTL
- ↓ Albumin
- ↓ Cholinesterase < 25%
- ↑ AF x 4
- ↑ AST, ALT, LDH
- ↑ Bilirubin
- ↑ Biliary Acids = cause of sudden intrauterine death due to cord spasm





Gastrointestinal



- Gastroesophageal reflux (40 to 85 %):
 - ↓ lower esophageal sphincter tone
 - ↑ intra-abdominal pressure
- Gastric Emptying = Pregnancy
 - ↓ Labor and after administration of Opioids.
- = or ↓ Gastric Acid Secretion in pregnant women.

[J Clin Anesth 2005, Chestnut's Obstetric Anesthesia 2009]



FDA Drug Safety Podcast: FDA review results in new warnings about using general anesthetics and sedation drugs in young children and pregnant women (01/14/2022)



On December 14, 2016, FDA is warning that repeated or lengthy use of general anesthetic and sedation drugs during surgeries or procedures in children younger than 3 years or in pregnant women during their third trimester may affect the development of children's brains.

ACOG (2019) American College of Obstetricians and Gynecologists

- None of the drugs currently in use has teratogenic effects on humans when used at standard concentrations at any gestational age.
- There is no evidence that exposure of human fetuses in utero to anesthetic or sedative drugs affects the developing nervous system.
- There are no animal data to support effects when exposure is limited in time (< 3 hours).



EFFECTS OF ANESTHETICS ON THE FETUS AND THE PREGNANCY

- There is no compelling evidence that any specific **anesthetic agent** is teratogenic in humans or that a specific anesthetic-related medication should be avoided during the perioperative care of a pregnant patient.
- The possible exception to this is SUGAMMADEX, which encapsulates progesterone and reduces free progesterone levels in pharmacologic simulation studies.

[<https://www.ema.europa.eu/en/medicines/human/EPAR/bridion>].

- The results of animal studies of miscarriage and teratogenicity of sugammadex are mixed.

[Balkan Med J 2015,
https://www.accessdata.fda.gov/drugsatfda_docs/label/2015/022225lbl.pdf]

- Studies in humans have not reported complications. Although total numbers are insufficient to conclude that sugammadex is safe during pregnancy.
- Thus, the Society of Obstetric Anesthesia and Perinatology has recommended avoiding routine sugammadex use during pregnancy, and instead using other reversal agents. [SOAP 2019]

Fetal brain development

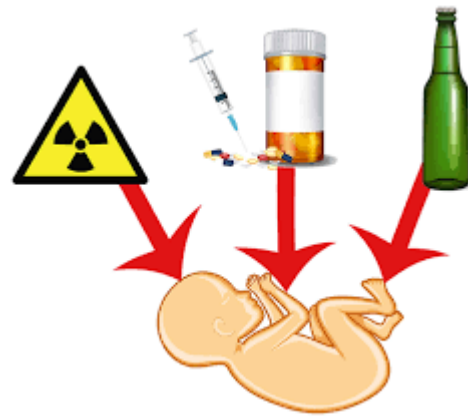
- Data on the effects of in utero exposure to anesthesia are limited.
- Both the FDA and the American College of Obstetricians and Gynecologists (ACOG) advise that necessary surgery should not be avoided or delayed during pregnancy.

[FDA December 21, 2016 – ACOG 2019]





Teratogenicity



- Theoretically, any medication could be teratogenic if given in a high enough dose, for a long enough duration of time, and at precisely the right time of development.
- No anesthetic agents have been shown to have teratogenic effects in humans, and multiple large retrospective studies have not shown an increase in congenital anomalies in infants born to mothers who had surgery and anesthesia during pregnancy.
- It is important to note that cumulative dose plays a large role in the development of congenital malformations.



- Some medications, such as **opioids**, have been associated with congenital malformations when used **chronically** throughout pregnancy. [Lind, Pediatrics 2017]
- In contrast, the use of all **anesthetic medications** in the perioperative setting in clinically relevant doses and concentrations has **not** been associated with teratogenicity.

Benzodiazepines

- Some early reports suggested that DIAZEPAM use in early pregnancy may be associated with cleft palate. Subsequent studies have failed to demonstrate this association or a definite risk of other anomalies, although a small increase in risk could not be excluded. [Dolovich BMJ 1998 – Ornoy, Reprod Toxicol 1998]
- MIDAZOLAM has never been associated with congenital malformations.

Nitrous oxide

- Has been shown to be a weak teratogen in animal models.
- However, no human study has shown any increase in congenital malformations' rate associated with nitrous oxide use.
- To avoid nitrous oxide during the first trimester if there are reasonable alternatives.

Need for neonatal support after emergency delivery

- Anesthetics and opioids cross the placenta. Thus, neonates delivered urgently during non obstetric surgery may require ventilatory support until the respiratory depressant effects of residual anesthetics and opioids subside.
- Because most muscle relaxants are highly ionized with low lipid solubility, there is minimal placental transfer. VECURONIO crosses the placenta in small amounts, but neonatal outcome does not appear to be affected. [Anesth Analg 1990]



Anesthesia is not just a question of drugs but the ability to maintain *delicate balances*.



- The decision to subjecting the woman to surgery must be undertaken as a TEAM

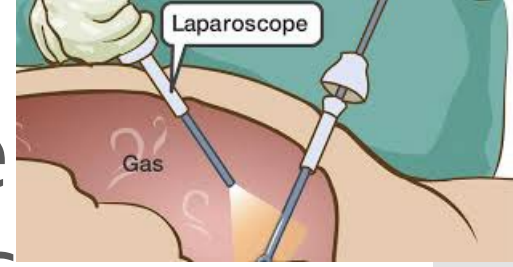
...considering:

- Effects of the disease itself and of the relative therapy
- Possible teratogenicity of the drugs administered
- Intraoperative alterations of uteroplacental perfusion and of fetal oxigenation
- Preterm birth and risk of fetal death



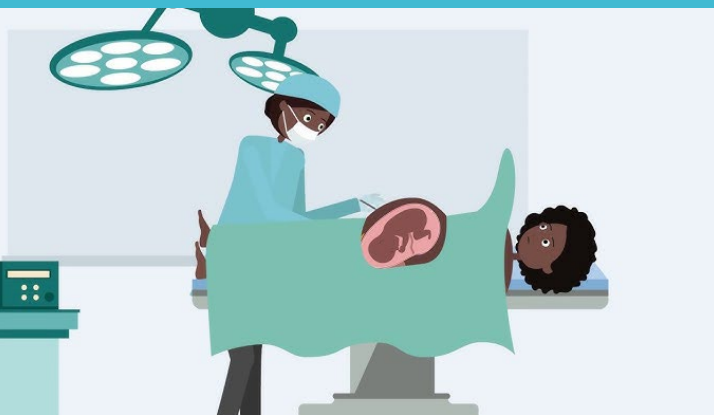


Maternal and fetal adverse events are significantly less frequent in case of videolaparoscopic procedure



CHOICE OF THE TYPE OF INTERVENTION

- The laparoscopic surgical technique carries the risk of reduction of uteroplacental flow due to:
 - 1) high intra-abdominal pressures cause aortocaval compression reducing venous return;
 - 2) increase in pCO₂ values.
- Significant reduction in placental flow was detected for intra-abdominal pressures of 20 mmHg in the absence of fetal adverse events.





- Location Trendelenburg:
 - reduces maternal residual functional capacity
 - increases the risk of hypoxemia.

- “Anti-Trendelenburg” position: can exacerbate hypotension.





TIMING OF THE INTERVENTION

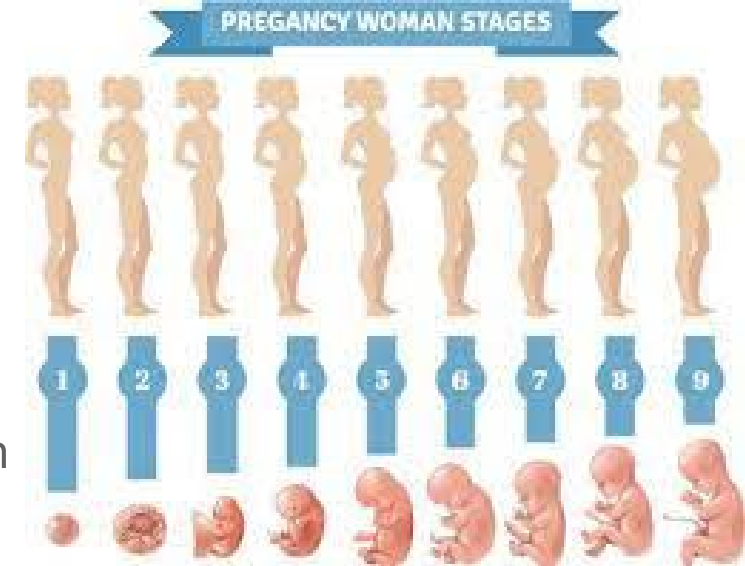
THE SEVEN SCANS YOU CAN GET DURING PREGNANCY



- I trimester (1-13 W):
 - The teratogenic effect is all or nothing
 - No correlation between the use of anesthetics and fetal organogenesis.



- II trimester (14-26 W):
 - Lower risk of preterm birth
 - Optimal exposure of the surgical field
 - Almost complete organogenesis



- III trimester (27-40 W):
 - Evaluate corticosteroids for lung maturation
 - Monitor for signs of preterm labor



- Urgent or emergency surgery should be performed regardless of the trimester.
- Non urgent surgery that cannot wait until after delivery is generally performed in the early second trimester.
- Delay elective surgery until after delivery.





The surgical procedure must be complete in the less time possible!





PREANESTHESIA EVALUATION

- Pregnant patients should be evaluated preoperatively in the same manner as non pregnant patients.
- Additional testing is not indicated in an uncomplicated pregnancy.
- The American College of Obstetrics and Gynecologists (ACOG) recommends that the primary obstetric care provider should be notified or, if that provider is not at the institution where surgery is performed, another obstetric care provider with privileges at the institution should be involved. [ACOG 2019]





PREPARATION FOR ANESTHESIA

- **Incidence of aspiration** – Multiple large studies have failed to identify pregnancy as a risk factor for aspiration.
[Anesthesiology 1993, J Clin Anesth 2006, Anesthesiology 2014]
- The risk of aspiration in nonobese pregnant patients, who have met fasting guidelines, is **extremely low** and likely not different from non pregnant patients.

Conditions that increase risk of aspiration during induction of anesthesia

Full stomach-nonfasted, emergency surgery or trauma

Pregnancy after 12 to 20 weeks gestation (gestational age for increased risk is controversial)

Symptomatic gastroesophageal reflux

Diabetic or other gastroparesis

Hiatal hernia

Gastric outlet obstruction

Esophageal pathology

Bowel obstruction

Increased intra-abdominal pressure-ascites, abdominal mass



PREOPERATIVE FASTING



- Solid Food → 6 h (8 h for large meals and fried or fatty foods)
- Clear Liquids → 2 h [ASA]

Antacids, H₂ receptor antagonists, Metoclopramide for patients who are beyond 18 to 20 weeks gestation.





SEDATIVE PREMEDICATION

- If anxiolysis is required.
- Small doses of a sedative can safely be titrated to effect (eg, midazolam 1 mg IV, repeated as necessary).





MANAGEMENT OF ANESTHESIA

We are treating
TWO PATIENTS



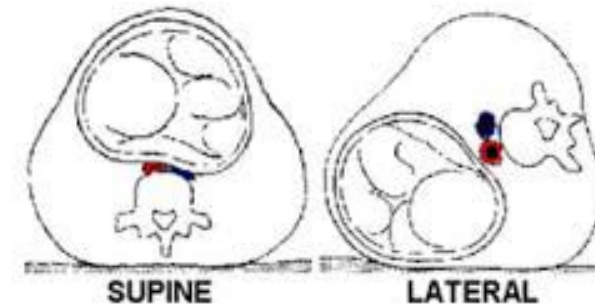
MANAGEMENT OF ANESTHESIA



POSITIONING

- ↓ **Aorticaval Compression** : - 15 to 30 degree left lateral tilt when supine (after 18 to 20 ws)

If LUD compromises surgery and the supine level position is required, blood pressure may fall and should be maintained with intravenous (IV) fluid and vasopressor therapy.



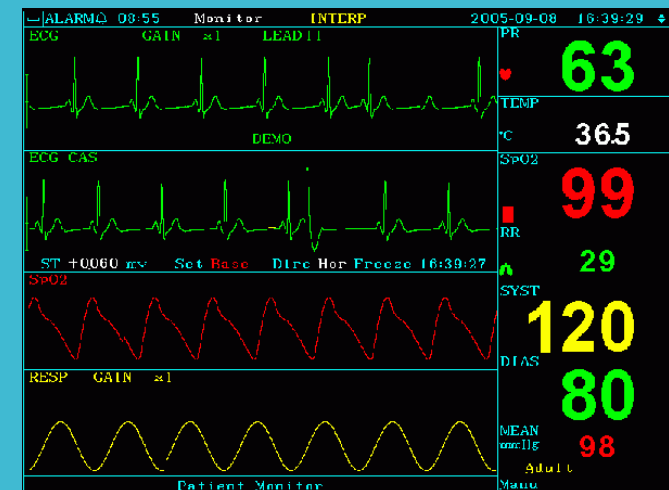
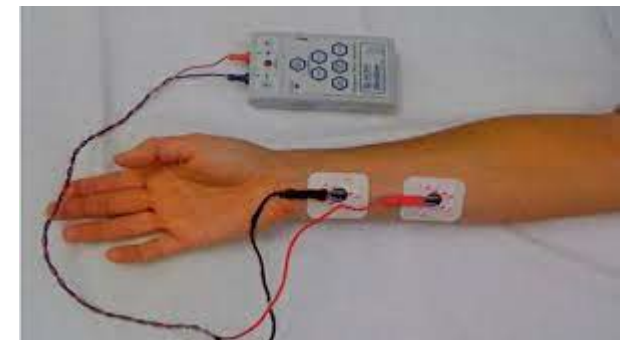


MONITORING



- *Standard* physiologic monitors

No additional patient monitors are required because of pregnancy.



FETAL HEART RATE MONITORING



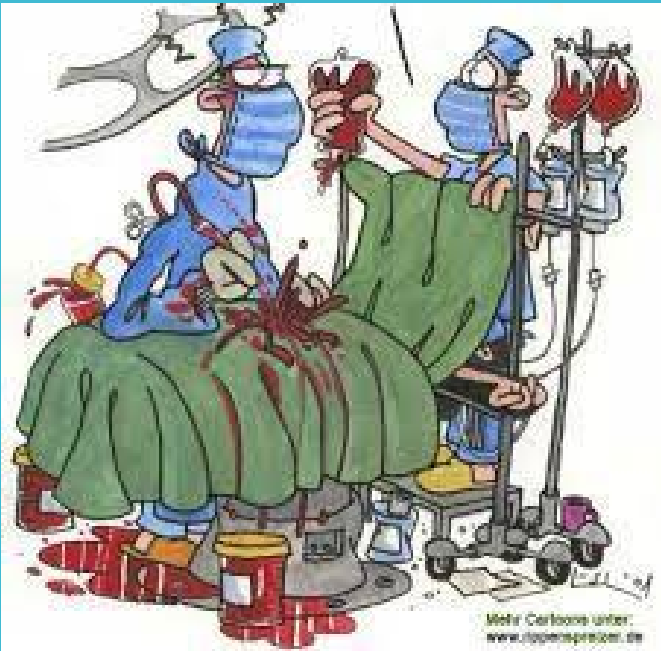
- FHR pre- and postoperatively.
- Intermittent or continuous FHR monitoring during surgery only if
 - fetus is viable (> 23 - 24 ws),
 - qualified personnel is available to interpret FHR
 - emergency Cesarean Delivery can be performed during surgery.

Non obstetric surgery after 23 to 24 weeks gestation should be performed in hospitals with pediatric services appropriate for the fetal gestational age.



THROMBOPROPHYLAXIS

- The hypercoagulable state of pregnancy increases the risk of a thromboembolic event in the postsurgical period.
- Use thromboprophylaxis for all pregnant patients undergoing surgery [Chest 2012]:
 - pneumatic compression devices on all pregnant women
 - pharmacologic prophylaxis if patient has risk factors (thrombophilia, prolonged immobilization, past history of venous thrombosis, malignancy, diabetes mellitus, varicose veins, paralysis, maternal age, obesity).
- Early mobilization after surgery.





AVOID:

- Prolonged maternal hypo/hyperthermia
- Hypoxemia
- Hypo / hypercapnia
- Hypotension

me taking notes



AT LEAST YOU STILL
HAVE VENOUS RETURN
FOR NOW

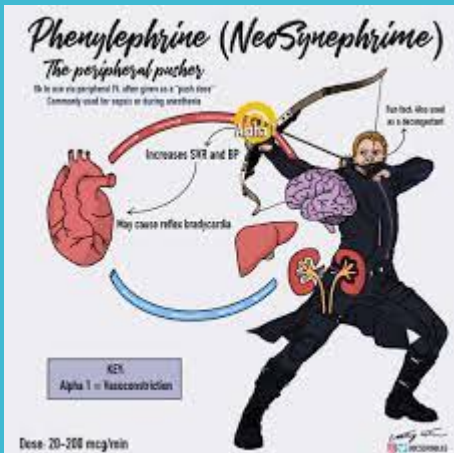


HEMODYNAMIC MANAGEMENT

Anesthetic agents have minimal direct effects on uterine blood flow [Anesthesiology 1993, J Anesth 2009] but can contribute to uteroplacental hypoperfusion via systemic hypotension.

- Maintain the patient's baseline blood pressure
- Administer vasopressors if:
 - blood pressure ↓ 20 %
 - nausea, vomiting or lightheadedness
 - fetus distress without another identifiable cause.

Vasopressors

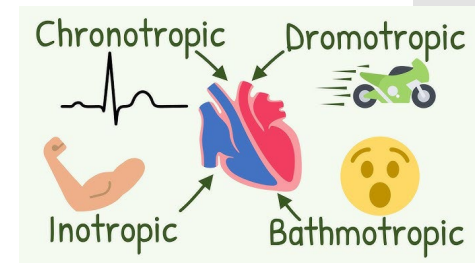


- ↓ FHR variability (presumably by anesthetizing the brainstem center that controls cardiac automaticity) [Can Anaesth Soc J 1985], but within the normal range.
- Fetal bradycardia, tachycardia or repetitive decelerations →
 - optimize uteroplacental oxygen delivery and blood flow (ie, LUD, maternal blood pressure, optimal oxygenation and maintenance of normocarbia).

PHENYLEPHRINE and EPHEDRINE = reasonable choices

Phenylephrine: reflex bradycardia.

- Ephedrine:** - ↑ maternal heart rate
 - ↑ fetal metabolic activity and ↓ fetal pH [Anesth Analg 2002].
 - crosses placenta and can ↑ FHR variability and baseline FHR lasting several hours [Obstet Gynecol 1981].



NOREPINEPHRINE preserves maternal cardiac output and heart rate and has shown similar fetal outcomes when used for cesarean delivery [Anesthesiology 2005].



CHOICE OF ANESTHETIC TECHNIQUE

- For patients in whom either regional or general anesthesia would be appropriate, use **regional anesthesia**. [Grade 2C]

REGIONAL ANESTHESIA: -↓ fetal drug exposure
-↓ reduces the need to manage the airway
-↓ provides some degree of postoperative analgesia

Sedative medications may be safely administered during regional anesthesia according to patient preference and the clinical situation.

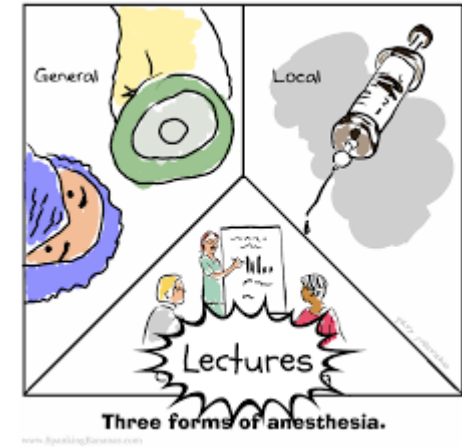


REGIONAL ANESTHESIA

- Hypotension
- ↓ Placental perfusion.

IV fluid and *vasopressors* should be used.

Lower doses of spinal and epidural local anesthetics may be required during pregnancy due to mechanical and hormonal factors.



LAST

- ↑ risk for Local Anesthetic Systemic Toxicity (LAST) due to increased local anesthetic-induced cardiotoxicity and reduced serum levels of proteins that bind local anesthetics.

This is of particular concern for blocks placed in vascular sites and those that require high volumes of local anesthetics!!!





GENERAL ANESTHESIA

- **Preoxygenation and apneic oxygenation** —Apnea during attempts at airway management leads more rapidly to significant desaturation in pregnant women.



INDUCTION OF ANESTHESIA

- Perform **rapid sequence** induction and intubation.
- **Propofol** is the preferred induction agent for routine induction.

Use induction doses based on actual body weight and titrate to effect in a similar manner to non pregnant patients.





NEUROMUSCULAR BLOCKING AGENTS



- **Succinylcholine** – The duration of action of succinylcholine is unpredictable in pregnant patients:
 - ✓ ↓ PCHES could prolong neuromuscular block after succinylcholine
 - ✓ Levels of succinylcholine during pregnancy may be lower due to increased volume of distribution.
- **Nondepolarizing NMBAs** – NMBAs have no direct effect on the fetus since they do not cross the placenta in clinically significant concentrations.

MAINTENANCE OF ANESTHESIA

- Use *processed electroencephalography* (eg, bispectral index [BIS]) to determine maintenance dosing of anesthetics and prevent relative overdosing and subsequent hypotension from anesthetic agents.
- None of the standard anesthetic agents have been proven *teratogenic* or to have relatively increased *adverse effects on human brain development*.





Sensitivity to anesthetic medications

- ↓ MAC for volatile anesthetics. [Anesthesiology 1994]
- Do not change the choice or doses of anesthetic medications during pregnancy.
- Monitor and titrate to effect (eg, TOF for neuromuscular blocking agents, BIS for general anesthetics), in a similar manner to non pregnant patients.





- Inhalation agents ↓ **UTERINE TONE.**

This is overall advantageous, particularly for abdominal procedures in the second and third trimester, as it may reduce the incidence of pre-term contractions and pre-term labor. However, in the event of emergency delivery, higher doses of uterotonic agents may be required.



Mechanical ventilation



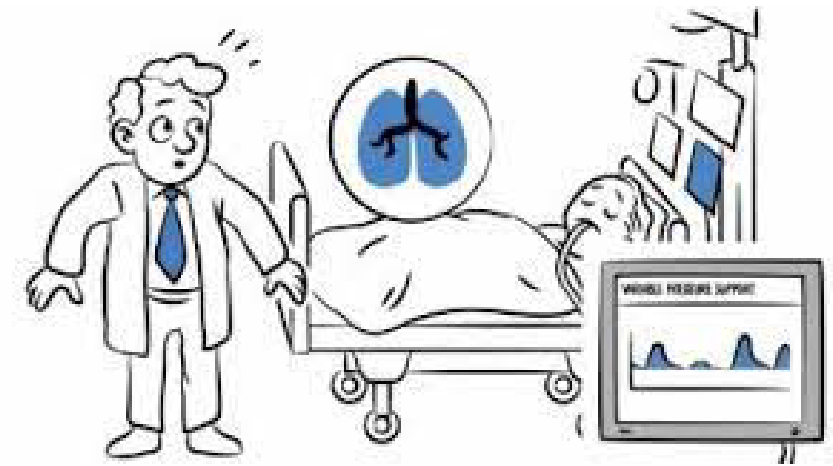
- $E_T\text{CO}_2$ during mechanical ventilation should be **30 to 32 mmHg** in the last half of pregnancy.

CO_2 crosses the placenta.

Maternal Hypercarbia → **Fetal Acidosis** → **Myocardial Depression.**

Maternal severe Respiratory Alkalosis ($P_a\text{CO}_2 < 23 \text{ mmHg}$ and $\text{pH} > 7.5$) can compromise uterine blood flow and fetal oxygenation.

CÁNULA DE OXÍGENO		MÁSCARA DE OXÍGENO		MASK DE OXÍGENO CON RESERVORIO (Con bolsa de reservorio Respiratoria)	
Litros x minuto	Porcentaje Oxígeno	Litros x minuto	Porcentaje Oxígeno	Litros x minuto	Porcentaje Oxígeno
1	24%				
2	28%				
3	32%				
4	36%				
5	40%	5-6	40-45%		
6		6-7	45-50%		
7		7-8	55-60%		
8				8	60%
9				9	65%
10				10	70%
11				11	75%
12				12	80%



- It is a good practice to administer a FiO_2 of at least **50 %** during anesthesia. No cases of *fetal retinopathy* have been reported after non obstetric surgery.

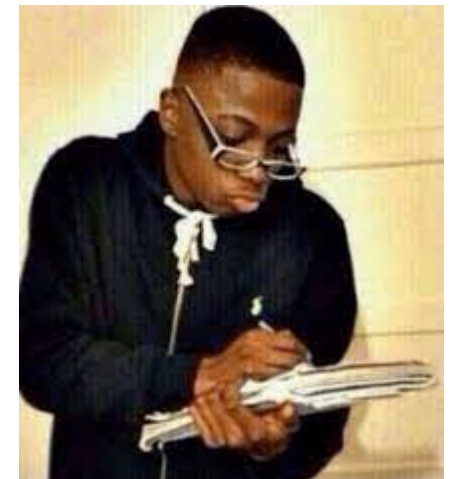


POSTOPERATIVE CARE

Things to
Remember

Important!

- **Maternal monitoring** – close monitoring (particularly of the airway and respiratory system).
- **Fetal assessment** – The **FHR** should be monitored in the recovery room, intermittently for pre-viable fetuses, and continuously for the viable fetus. **Uterine activity** should also be monitored in cases in which the fetus is viable. [Obstet Gynecol 2017]
- **LUD** – Left lateral position or uterine displacement should be maintained until the patient is fully awake, alert, and able to adjust her own position.





POSTOPERATIVE PAIN CONTROL



- **Multimodal analgesia**

1. Nonpharmacologic methods of pain control
2. Acetaminophen
3. Regional anesthesia techniques
4. Local anesthetic infiltration with opioids.

- ***Nonsteroidal antiinflammatory drugs (NSAIDs)*** should not be used routinely (particularly in the early first and late third trimesters) because of potential fetal effects, although a single dose for refractory postoperative pain in midgestation is likely safe.



