

BRAINst

Kraniotomie in der Schwangerschaft Craniotomie durant la grossesse

Christian Kern,
Service d'Anesthésiologie
CHUV - Lausanne

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Congrès d'anesthésie
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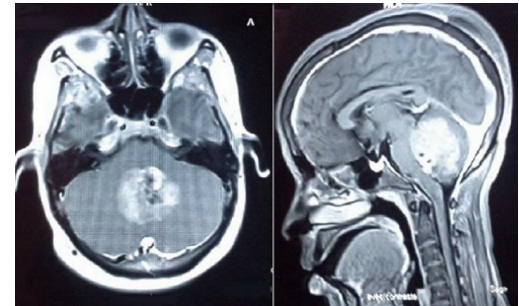
Schweizerische Interessengemeinschaft für Anästhesiepflege
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Plan

- Die Kraniotomie in der Schwangerschaft ?
- Physiologie des Gehirns und der Schwangeren
- Risiken für den Fœtus
- Geburtspläne : Implikationen für den Anästhesisten
- Die Wach Kraniotomie
- Schlussfolgerungen

BRAINst



Kraniotomie: Ursachen und Häufigkeit der Kraniotomie ?

Zwischendurch: 0,3% und 2,5% der schwangeren Frauen werden einer nicht-obstetrischen Operation unterzogen

- Primary Brain Tumors: 6/100'000 females (meningiomas: 0.7-/100'000 females 17-44y)
 - Appendicitis: 1/1'500 (non obst surgery)
- Intracerebral haemorrhage (SAH 65%, AVM 35%): 10-50/100'000 deliveries
 - 7% pregnancy-related maternal mortality
- Trauma Brain Injury

Wang LP ,Paech MJ. Anesth Analg 2008;107:193-200
Laviv Y et al. Acta Neurochir 2018;160:1521-1529
Priddy BH et al. World Neurosurgery 2018; 113:373-382

When to perform surgery?



- Depends on the balance between maternal and fetal risk and urgency of the surgery

1st trimester – Organogenesis

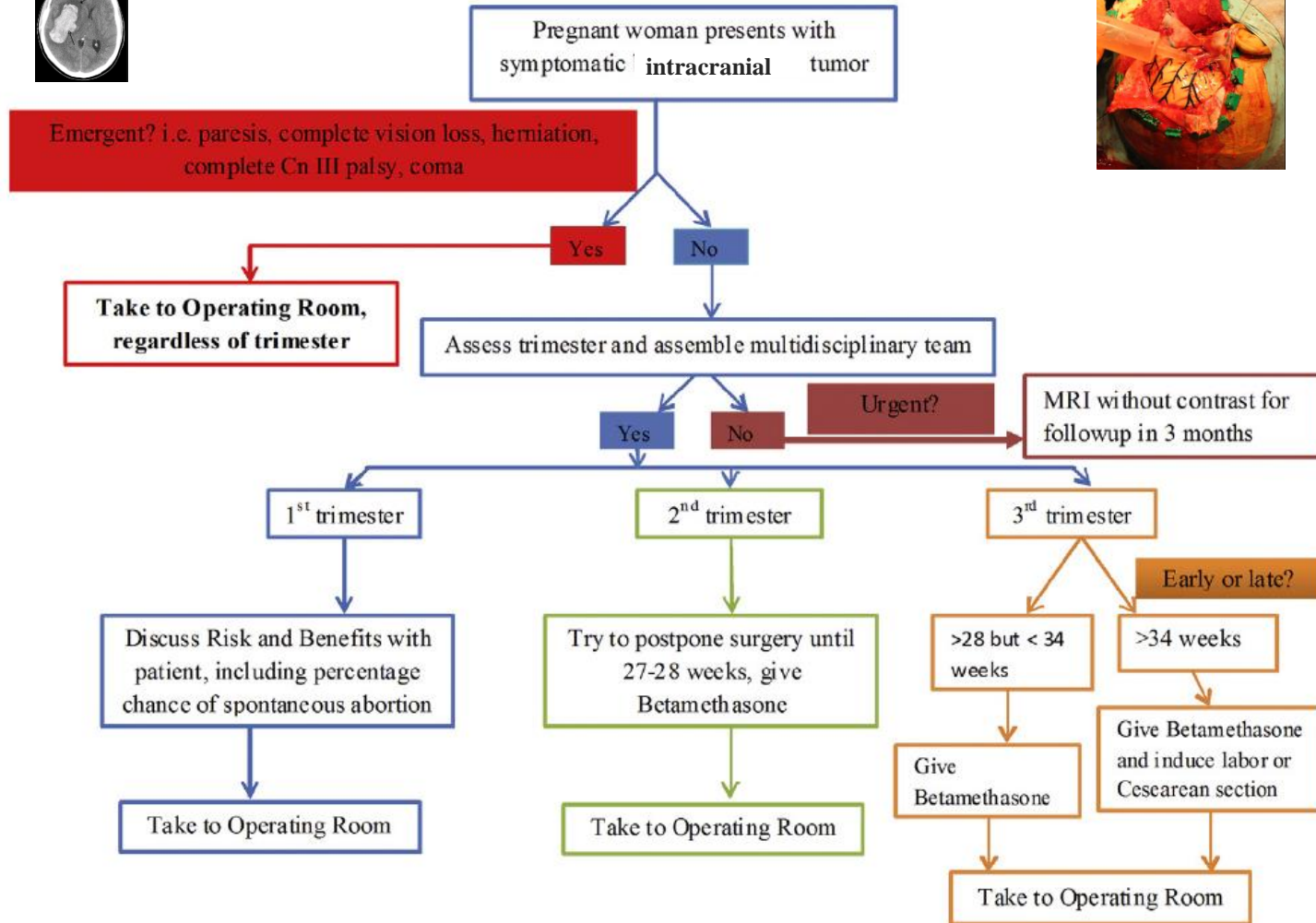
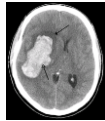
- Increased fetal risk for teratogenesis and abortion

3rd trimester – Peak of physiological changes of pregnancy

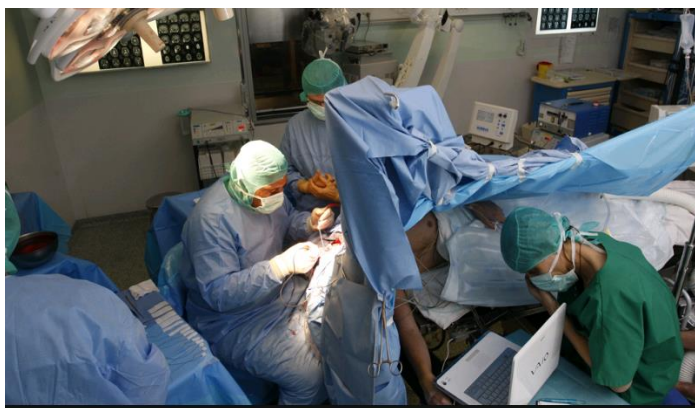
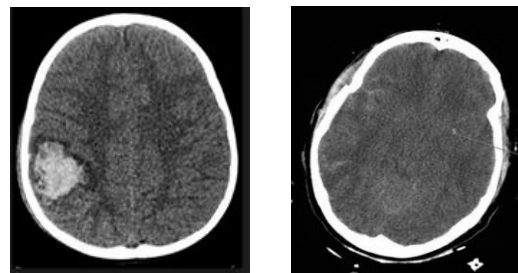
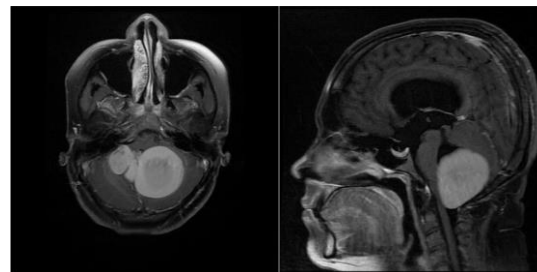
- Increased maternal risk
- Increased risk of preterm labour

- Thus, **2nd trimester** is considered to be a ideal time for non emergency, essential surgeries

Timing for Neurosurgery



Priddy BH et al. World Neurosurgery 2018; 113:373-382



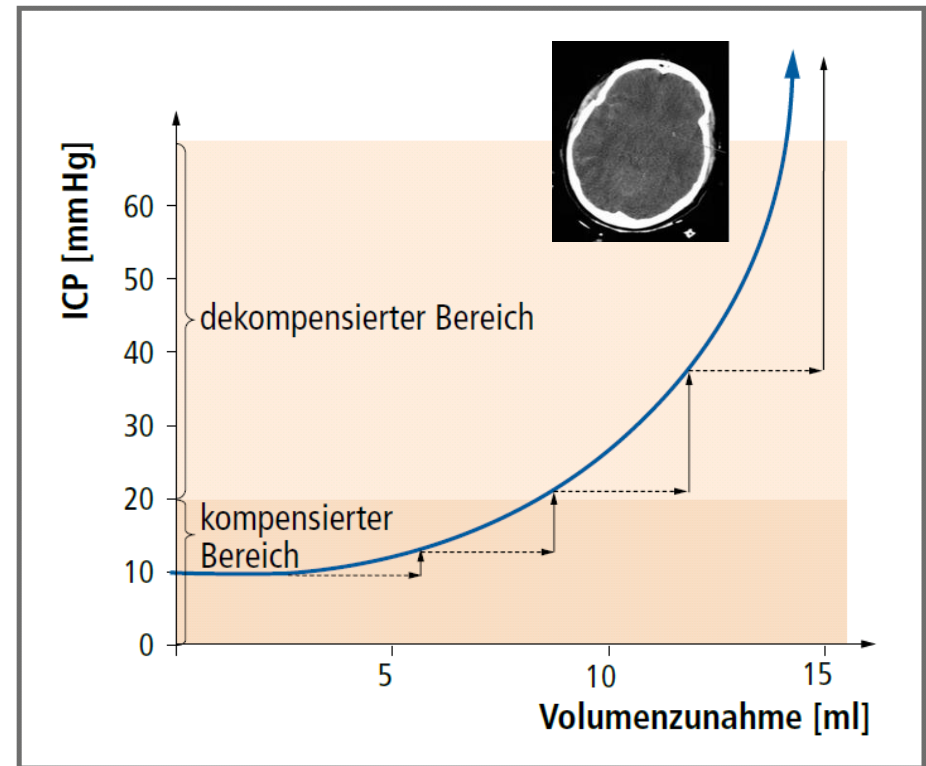
Physiologie des Gehirns (Neuroanesthesia)



Parameter zu beachten:

- Intrakranieller Druck (ICP)
- Zerebraler Perfusionsdruck (CCP)
 - $CPP = MAP - ICP$
- Zerebraler Blutfluss (CBF)
- Zauerstoffverbrauch des Gehirns (CMRO₂)

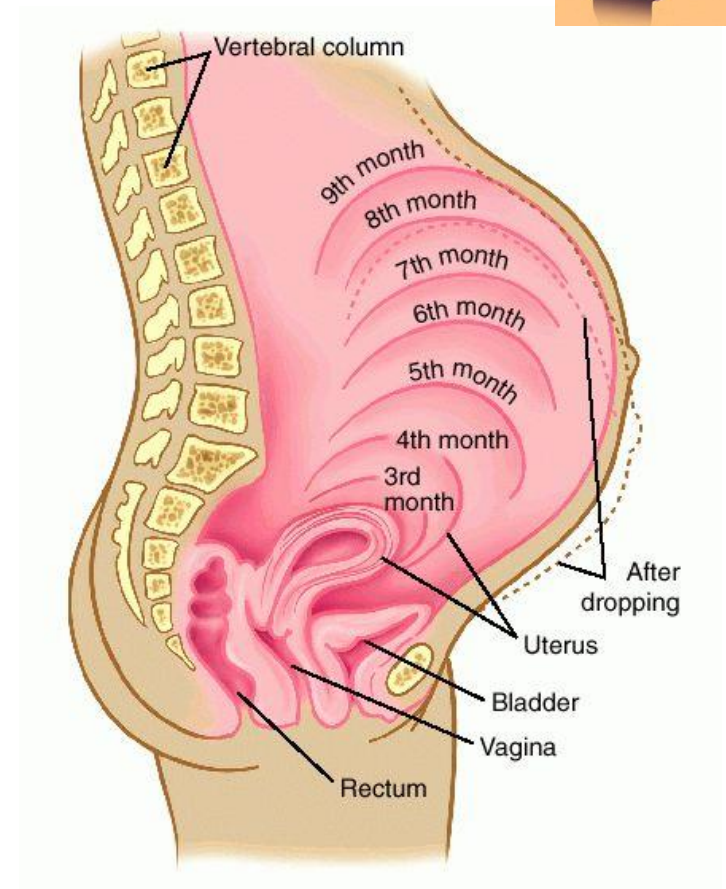
Der CMRO₂ beträgt 3.5 ml/100g/min, d.h ca. 10-mal so viel wie der Gesamtkörper



Physiologie in der Schwangerschaft (Obstetric anesthesia)

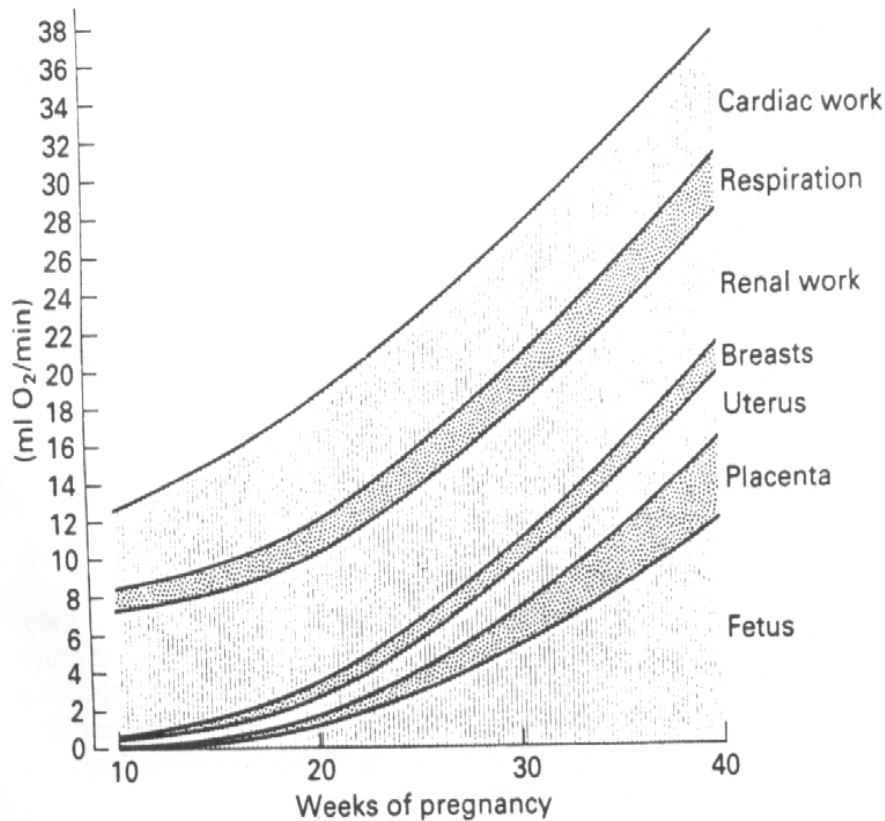


- Hormonal changes
- Increased metabolic demand
- Placental circulation (low resistance)
- Uterine growth



Increased metabolic demand

O₂ consumption during pregnancy



Weight increase (12kg):

- Plasma, interstitial fluid and amniotic fluid increased volumes
- Uterine growth
- Fetus growth
- Fat deposition (energy store for breast feeding in the post partum period).

Respiratory System

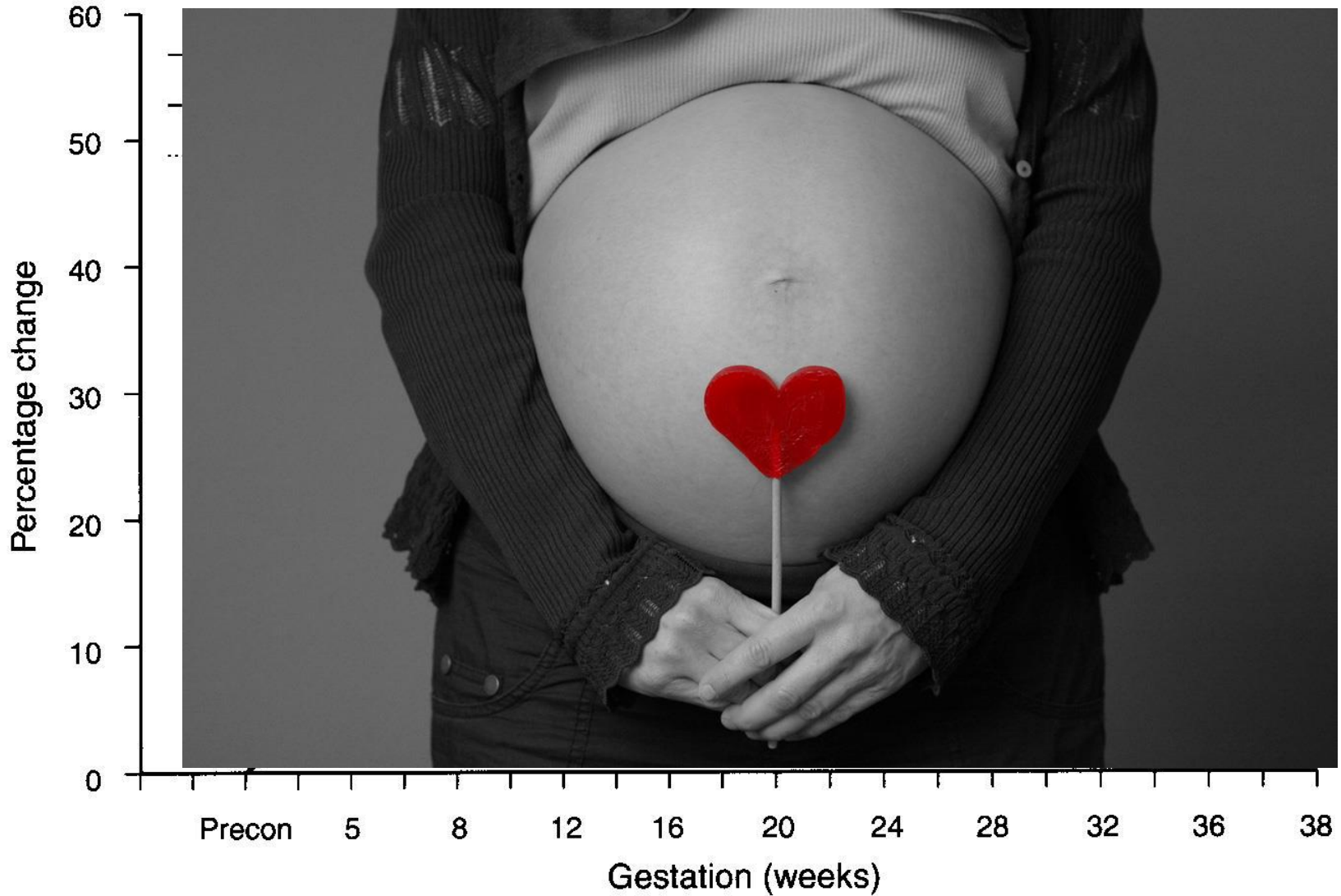
- O_2 consumption 20-50%
- Basal Metabolic Rate 14%
- Minute Ventilation 20-50%*
- Tidal Volume 19-28%
- Respiratory Rate 9%
- FEV_1 no change
- Vital Capacity 0-6%
- TLC 0-5%
- **RV 0-20%**
- **Exp Res Vol 17-20%**
- **FRC 12-25%***

?!

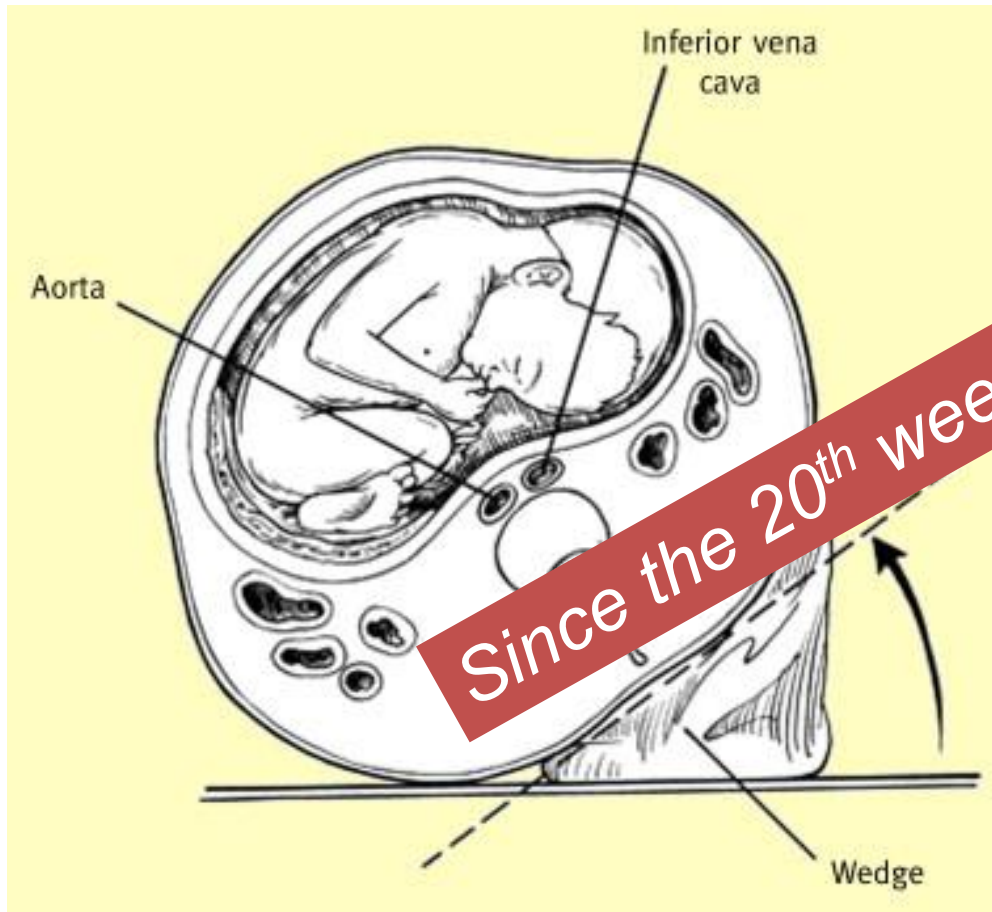


** ↑Uptake of Inhalational Anesthetics

Cardiovascular System



Uterus growth and hemodynamics



Placenta:

**Low resistance placental circulation
(No autoregulation)**

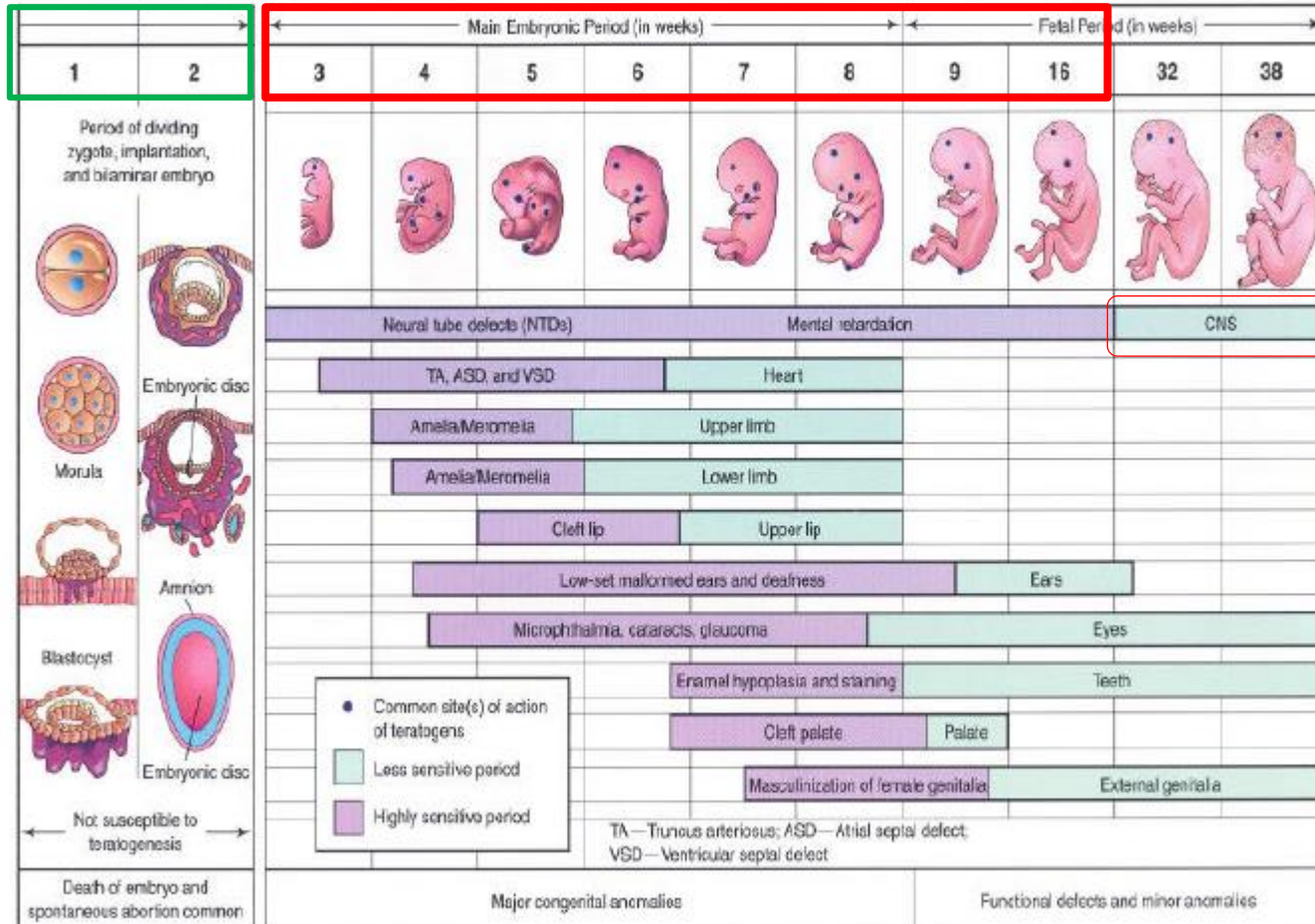
Risks of drugs' transfert

Teratogenicity?



Teratogenic Risks

CRITICAL PERIODS IN HUMAN DEVELOPMENT*



*Narrowly denotes highly sensitive periods when major birth defects may be produced.

<http://www.fda.gov/downloads/scienceresearch/specialtopics/womenshealthresearch/ucm133359.pdf>
 Reviewer guidance Evaluating the risks of drugs exposure in human pregnancies. US FDA, 2005


ACOG Opinion 2019

The following generalizations may be helpful to guide decision making:

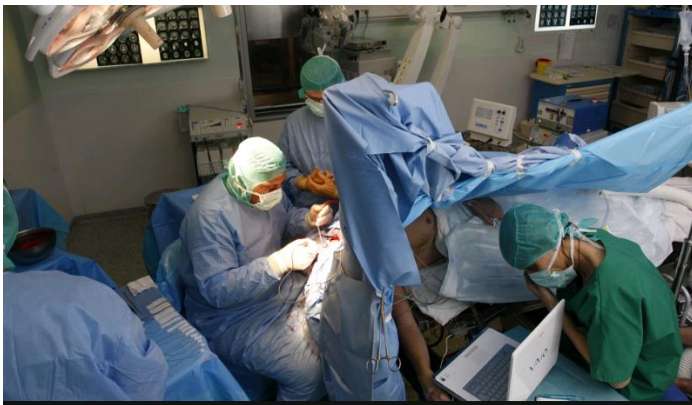
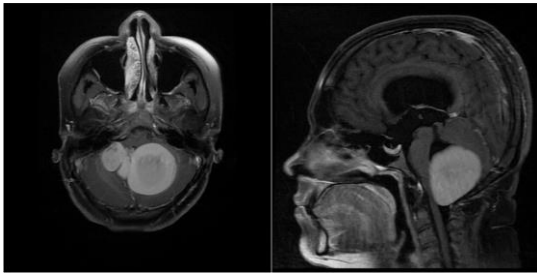
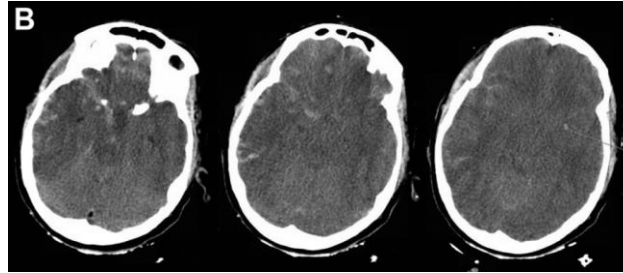
- No currently used anesthetic agents have been shown to have any teratogenic effects in humans when using standard concentrations at any gestational age.
- There is no evidence that *in utero* human exposure to anesthetic or sedative drugs has any effect on the developing fetal brain; and there are no animal data to support an effect with limited exposures less than 3 hours in duration.

Craniotomy and Teratogenicity

Table 1 Drugs associated with teratogenicity

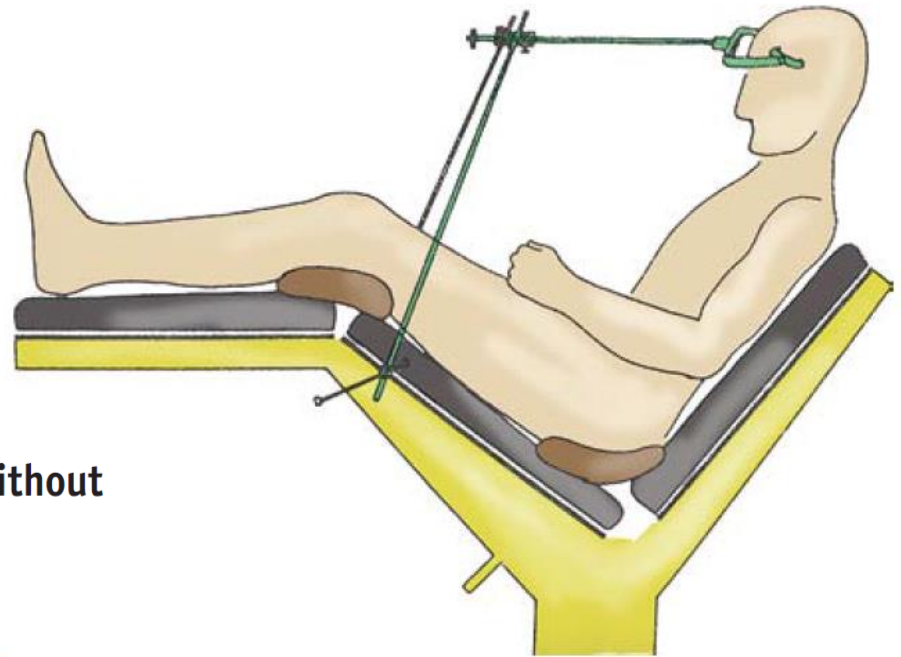
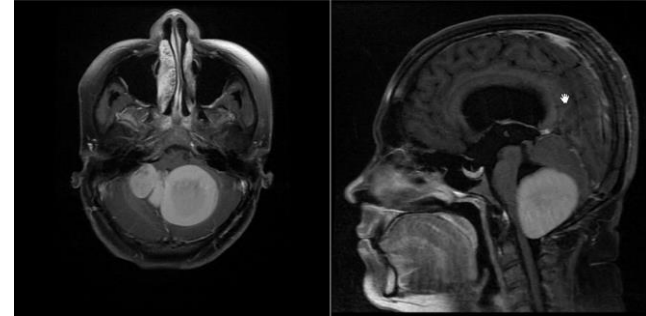
ACE inhibitors		Valproic acid	←
Alcohol		Lithium	
Androgens		Phenytoin	←
Antithyroid drugs		Streptomycin	
Carbamazapem		Tetracycline	
Chemotherapy agents		Thalidomide	
Cocaine		Trimethadione	
Warfarin		Diethylstilbestrol	

Reitman E. BJA 2011;107 ; i72-i78



Location and Positioning?

- Rückenlage ?
- Sitzend ?
- Bauchlage ?*



* Prone position craniotomy in pregnancy without fetal heart rate monitoring[☆]

Jacob J et al. J Clinical Anesth 2016;33:119-122

Anesthetic Management

Vorbereitung/Einleitung

Lagerung

Monitoring der Mutter und des Fötus

AG: Caveats

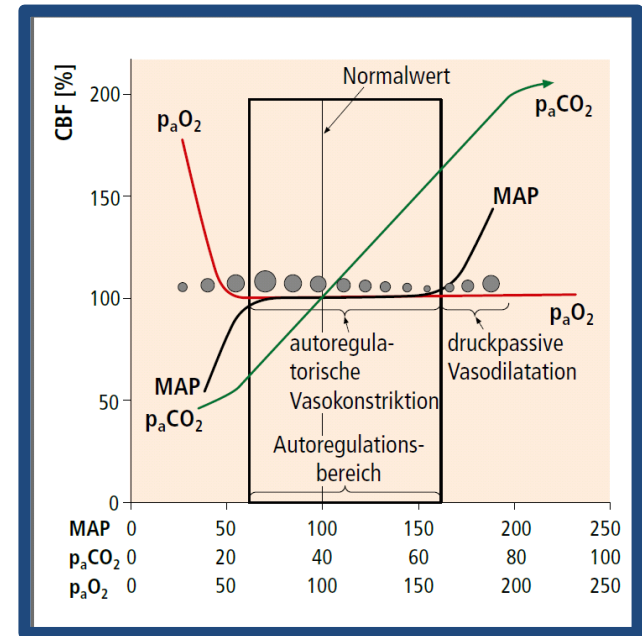
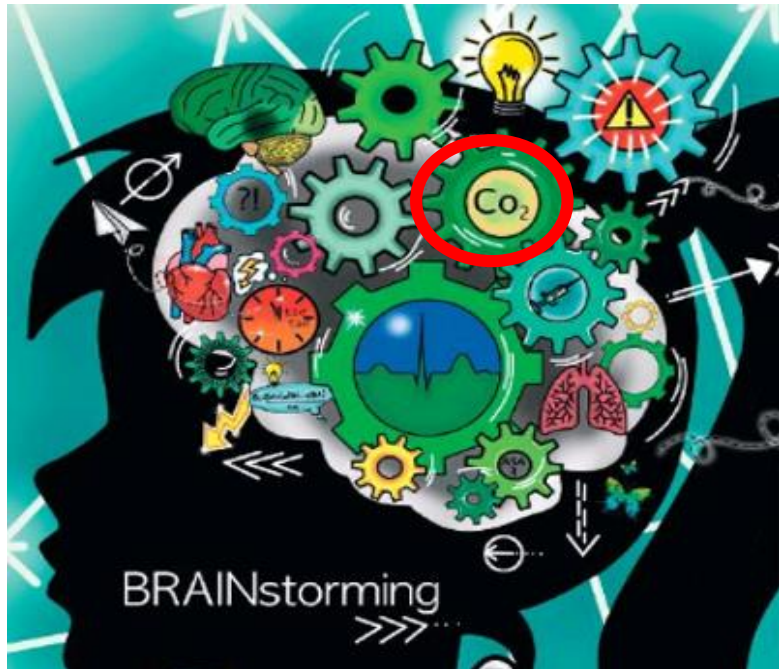
AG oder Wach Sedation?

Verminderung der Hirndurchblutung

Die Hirndurchblutung wird beeinflusst durch:

- arteriellen Kohlendioxidpartialdruck
- arteriellen Sauerstoffpartialdruck
- arteriellen Blutdruck und zerebrale Autoregulation
- zentralen Venendruck
- Anästhetika

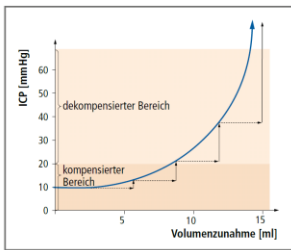
Anesthetic Management



~~Kontrollierte Hyperventilation?~~

- Bei Patienten mit erhöhtem ICP sollte normalerweise eine Normoventilation mit einem p_aCO₂ am unteren Normbereich (p_aCO₂ von 35–38 mm Hg (4,66–5,07 kPa) angestrebt werden (DGAI 2011).
- Eine kontrollierte Hyperventilation sollte nur noch kurzfristig (bei einer akuten Hirndruckkrise) vorgenommen werden, bis andere Maßnahmen (v. a. Gabe von Mannitol) möglich sind.





Erhöhte Hirndruck: Mannitol ?



DGAI Empfehlungen : 0.25-1 G/Kg KG



- **Fetus hyperosmolarity**
- **< 30% reduction of amniotic fluid**
- **Mannitol up to 0.25 (0.5) g/kg max**

4.6 Fertilität, Schwangerschaft und Stillzeit

Schwangerschaft

Mannitol passiert die Plazentaschranke.

Zur Anwendung von Mannitol bei schwangeren Frauen liegen keine oder nur begrenzte Daten vor. Tierexperimentelle Studien ergaben keine Hinweise auf direkte oder indirekte schädliche Wirkungen in Bezug auf Schwangerschaft, embryonale/fetale Entwicklung, Geburt oder postnatale Entwicklung und klinische Berichte über derartige Wirkungen sind bisher nicht bekannt.

Dennoch ist bei der Verabreichung von Mannitollösungen an Schwangere Vorsicht geboten und die Dosen sollten so gering wie möglich sein.

Monitoring: ACOG Opinion 2019

General guidelines for fetal monitoring include the following:

- If the fetus is considered previable, it is generally sufficient to ascertain the fetal heart rate by Doppler before and after the procedure.

Monitoring

- Fetal heart rate monitoring is practical since the 16-18th week.
- Fetal heart rate monitoring may assist in maternal positioning and cardiorespiratory management, and may influence a decision to deliver the fetus.
- FHR variability is only useful variability after the 26th week, and loss of variability is common during anesthesia

ACOG Committee on Obstetric Practice. Non-obstetric surgery in pregnancy. *Obstet Gynecol* 2003;102: 431

Monitoring der Schwangere Frau?

Die Wach Kraniotomie !

Dexmedetomidine is highly selective, α -2 agonist having unique sedative, analgesic, anxiolytic properties with minimal effects on ventilation.

Low-dose propofol ($50\mu\text{g}/\text{kg}/\text{min}$);
Remifentanyl ($0.1\mu\text{g}/\text{kg}/\text{min}$),
Dexmedetomidine ($0.5\mu\text{g}/\text{kg}/\text{min}$) to
maintain a Ramsay sedation score of 2
to 3.



Anesth Analg 2015;120:1099–103
J Clin Neuroscience 2016;24:160-162
J Neurosurg Anesthesiol 2018;30:372-373

Kraniotomie in der Schwangerschaft

Craniotomie durant la grossesse

Take Home Message

- Consider needs to protect the brain (neuroanesthesia)
- Consider maternal changes during pregnancy (obstetric anesthesia)
- Keep stable haemodynamics, ventilation and oxygenation during anaesthesia
- Consider awake craniotomy
- Consider fetal monitoring
- Team work approach
- Avoid what is unusual...

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**Vielen Dank für Ihre
Aufmerksamkeit und
viel Spaß bei Ihrem
Kongress.**