Volatile Induction and Maintenance Anesthesia

VIMA
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Classical situation in Lithuania

Induction: IV
Maintenance: IV+Inhal

Up to 95 percent of general anaesthesia cases with tracheal intubation

Sevoflurane in clinical practice
VIMA - benefit
VIMA
A (new) concept in volatile anesthesia

- Less adjuvant medication = less side effects
- Control on depth of anesthesia
- Rapid and good (quality) recovery

Sevoflurane:
Metabolism
Metabolites

- Metabolized 2-5%
  ⇒ fluorid ion, hexafluoro-izopropanol

- Temperature dependent degradation on soda lime
  ⇒ Compound A (Compound B)
Sevoflurane in clinical practice

Induction

What features make Sevoflurane suitable for Induction:

- non-irritating, pleasant odor
- low - blood/gas - solubility $\Rightarrow F_A/F_I$
- rapid, smooth induction

Low incidence of side effects
- cough, breath holding, laryngeal spasm
- excitation
- disrhythmia

Maintenance

What features make Sevoflurane suitable for Maintenance:

- low - blood/gas – solubility
- C-V stability
- does not effect breathing significantly

Benefits:
Rapid adjustment of anesthesia depth
$\Rightarrow F_D/F_A$
- percentage
- Circuit (Mapleson D $\Leftrightarrow$ re-breathing system)
- FGF
Sevoflurane
in clinical practice

Maintenance

Rapid change in depth of anesthesia (0.5 – 3%)

\[ 4x \]

\[ \frac{F_D}{F_A (SEV)} < \frac{F_D}{F_A (ISO)} \]

(Desflurane is even “faster” agent but irritating and can cause tachycardia)

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Sevoflurane
in clinical practice

Recovery

What features make Sevoflurane suitable for

✓ “smooth and rapid” recovery:
  - low - blood/gas – solubility
  - does not effect breathing significantly
  - low oil/water solubility

Benefit:

✓ rapid recovery:
  - time to eye opening \( \approx 4 - 6 \) min
  - time to discharge \( \approx 2-3 \) h

✓ recovery does not depend on the duration of anesthesia (MAC-h)
Sevoflurane
in clinical practice

VIMA: Volatile Induction and Maintenance of Anesthesia

VIMA benefit = use of single drug
⊗ hypnosis, analgesia, relaxation
⊗ in all phases of anesthesia

VIMA:
Anaesthesia simulation (scenario)

What are the purposes:
• Overpressure sevoflurane induction
• Tidal capacity sevoflurane induction

• Use the sevoflurane different as halothane - take the advantage of sevoflurane
Anesthesia Simulator
Inhalation anesthesia

- MD opinion (based on halothane)
  - Advantage: easy maintenance, one agent
  - Disadvantage: difficult induction, concentration depending side effect

- Consequence:
  - IV induction

- Goal: Use the sevoflurane different from halothane - take the advantage

Induction – “conventional”

Step by step
- Starting with low conc. and increasing $F_d$
- FGF - constant
- Outcome: slow induction (potential complication at intubation)
Options to perform “VIMA” induction:

- “Vital capacity”
- “Overpressure”

Options to perform induction (1)

“Vital capacity” induction:
- Fulfill the system with 8% Sevorane
- Masc on the face
- Ask for deep exhale and after that deep inhale
- The patient should keep the air in as long as he/she can
- Asleeps after the 2-3 breath
Induction

Overpressure
- FGF: high volume
- Start with $F_d$ max, conc. 8
- Fulfill the system with 8% Sevorane
- Deep breath, continues
- Result: Rapid induction

Over-pressure induction

How to prepare the patient?
- Verbal contact
- What to do
  - Deep exhale $\rightarrow$ mask $\rightarrow$ deep inhale ($\rightarrow$ keep the air in)
- Finding
  - The odor of Sevo – not irritating
  - Sleepy $\rightarrow$ continue to breath deep
- Monitoring
- Mistake: not cooperating patient
- Consequence: drag on induction
Over-pressure induction

How to prepare the anesthesia machine (AM)

- Fill up the AM with anesthetic
  - High flow 8-10 l/min
  - $O_2$ or $O_2/N_2O = 1:1$
  - Sevoflurane vaporizer: 8 %
  - Period: min. 40-45 sec
  - Empty the balloon 2 or more times
- Mistake: incorrect fill up
- Consequence: drag on induction

Start the anesthesia

- Repeat the patient instruction
- Deep exhale $\rightarrow$ mask $\rightarrow$ beep inhale $\rightarrow$ keep the air in
- Positive communication with the patient
- Check the depth of anesthesia: monitor + clinical signs (eyelash reflex)
- Mistake: mask removal
- Consequence: slow induction
- Vein puncture: large vein, no reaction to pain.
**Over-pressure induction**

Increase the depth of anesthesia (phase)
- Excitation period (45-60 sec):
  - involuntary movement
  - increase on HR, irregular breathing etc.
- Surgical phase anesthesia (90) – intub. 150 sec
  - Norm HR, breathing rate ↓, regular breath etc
  - Alv conc.: 3%

**Over-pressure induction**

Intubation
- Easy approach
- Moderate increase in hart rate, and BP
⚠️ Mistake: early attempt to intubate
⚠️ Consequence:
  - Cough, trismus,
  - Impossible to intubate
Over-pressure induction

Maintenance of anesthesia (low flow)
- FGF 1-2 lit/min
- $O_2/N_2O$ ratio 50: 50%
- F dialed: ~ 2.2-2.6%

⚠️ Mistake: high drug uptake
⚠️ Consequence: overdose

Why should we?
Why should we?

- The features of Sevoflurane give the benefit of flexibility
- Sevoflurane anesthesia decreases the need of opioids
  - Quicker recovery
  - The recovery – short term - is similar to propofol
  - Recovery – longer term – exceeds the propofol recovery

Why not others?

- Isoflurane is too slow, desflurane is irritating
- Propofol has only hypnotic effect and the decrease of opioids is questionable.
- Increasing the dosage of propofol increases the side effect of the drug, like:
  - Hypotension
  - Delay in recovery
In practice

When it is required to increase the depth of anesthesia it is necessary to:

- Increase the FGF to 6 lit/min
- Increase the Fd to 8%
- Period 2-3 min

In practice

**Induction 1**

- $\text{MAC LMA (laryngeal masc anesthesia)} = \text{MAC surgery} = \text{Fa 2\%}$
- $\text{MAC Intubation}$
  - (without opioid and relaxant) = Fa 4,75%
  - It is possible after 4-5 min
In practice

Induction 2

- Fi 8% gives the Fa 4-5% within 1 min
- Alveolar/brain half time = 3.5 min
- Within 30-60 sec the concentration in the brain will achieve 0.5%
- Patient becomes unconscious=MAC awake

Maintenance 1

“just enough to do the job”

- Balance anesthesia offers an adequate analgesia with:
  - NSAID
  - Local anesthetic

- Minimal use of opioids
In practice.

Maintenance 2
“just enough to do the job”

Post induction
- Decrease of FGF – step by step
- Decrease of vapor conc. Fd – even to 0%
- Maintenance 1.3 – 1.5 MAC
- At this concentration in quite big amount of cases it is not necessary to use opioids during surgical procedures

In practice.

Maintenance 3
“just enough to do the job”

- The Sevoflurane by its futures - the low solubility and non irritating – ensure the immediately respond (compared with highly soluble and irritating anesth. drugs)
- The bolus does not effect the recovery
- Sevoflurane gives the opportunity to perform dynamic anesthesia and decreases the quantity of opioids
- Recovery focused anesthesia
VIMA in Lithuania

How many?

Not so many. Up to 5-10 percent in different settings
VIMA in Lithuania

- How many?
  - Not so many. Up to 5-10 percent in different settings

- Why?
  - We are used to IV induction
VIMA in Lithuania

Should we increase?

Yes, we should.
VIMA in Lithuania

Should we increase?
Yes, we should.

Should we improve VIMA technique?

Yes. Because all of us say “we do VIMA”, but:
Some of us do “ViMA”,
Some – “V(i+IV)MA”,
Some - “V(i+IV)x(MI+MIV)A”
Kaunas University of Medicine: Anaesthesiology clinic Medical simulation center

- Initiated in 2009
- Established in January 2010
- First courses – January 2010
- First foreign group – April 2010