Capio S:t Görans Sjukhus

“Lean Burn” - A standard for inhalation anaesthesia

Authors: Stellan Eriksson, CRNA, Sixten Bredbacka, MD, PhD

Background:

In traditional gas anaesthesia fresh gas flow and anaesthetic agent in excess have been used. With modern anesthesia workstations and agents with low solubility fresh gas flow close to metabolic needs may safely be administered. At Capio S:t Görans Hospital in Stockholm MD and CRNA all claimed to practice low flow anaesthesia (LFA), but did not agree on the definition.

Goal:

To create and implement a standard model for inhalation anaesthesia focusing on:

- Metabolic flow (CCA).
- Ease of use (less dialing on flow/vapor settings).
- Predictability (right concentration, right time).
- Safety for the patient (secured oxygenation).
- Protection of environment and economy.
- Setting a standard that all MD and CRNA would accept to follow.

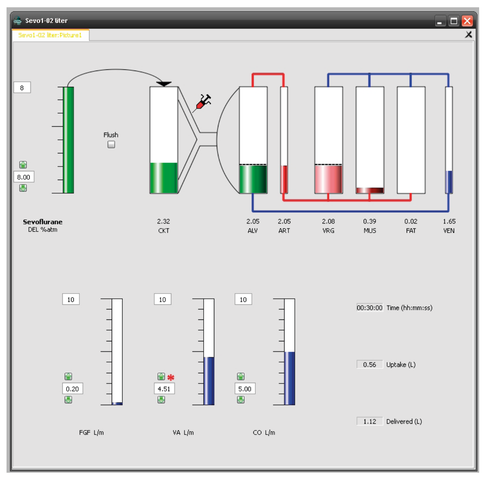
Prerequisites 2009:

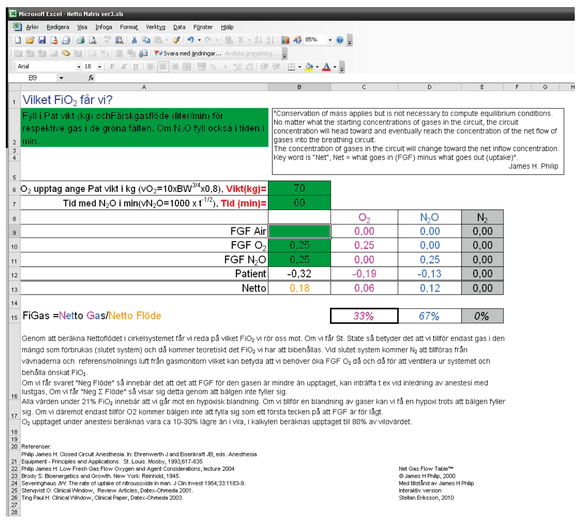
- Patient monitoring including ET_{AA}– available.
- Modern leak free anaesthesia machine – available.
- Stop using N_2O – almost done.
- Good teaching tools – missing.

Teaching tools:

Searching for teaching tools we found,

1. Gas Man®, computer tool for teaching, simulating and experimenting with anaesthesia uptake and distribution.
2. Net flow calculus, by James H. Philip, interactive version by Stellan Eriksson in collaboration with James H. Philip.





Defining a standard:

Parallel to simulating different scenarios in Gas Man® we started testing different models clinically. We found that Gas Man® supported our clinical findings. Soon we could conclude that a vaporizer on maximum and a low FGF could provide the properties we were looking for.

- Good predictability of ET_{AA}, “Human ET Control”.
- Easy to learn and understand.
- Control of circuit leaks, increased safety when IPPV/PSV is applied in combination with LMA
- Optimized use of AA, good for environment and economy.

Correspondence:

Stellan Eriksson, CRNA
E-mail: stellan.eriksson@capiostgoran.se

Sixten Bredbacka, MD, PhD
E-mail: sixten.bredbacka@capiostgoran.se

Next we defined a standard protocol for induction with simple stepwise guidelines.

- Preoxygenation with FGF = MV
- Induction with propofol and fentanyl/remifentanil
- Securing airway by LMA or ETT
- Set FGF to 0.3-1.0 l/min (air in order to lower FiO_2).
  FGF is used to control the course of anesthesia.
  The following have to be considered;
  - *Target MAC*
  - *Ventilation*
  - *Cardiac output*
  - *Type of circuit*
- Sevoflurane 8 %
- After about 5 minutes, target MAC is reached
- Set FGF to 0.2 l/min 100 % O_2 (eventually AIR for a while)
- Sevoflurane 8 %
- If MAC to high, Sevoflurane ↓
- If MAC need to be higher, increase FGF with Sevoflurane 8 %

Next we defined an algorithm for quick increase/decrease of ET_{sevo}

Quick increase of ET_{sevo}

- Set FGF to 0.6-1,0 l/min with vaporizer on 8 %. When target is reached, lower the FGF and, if needed, also vaporizer setting (depending on previous setting)

Quick decrease of ET_{sevo}

- Set FGF to 0.6-1,0 l/min with vaporizer off. When target is reached, lower the FGF and turn on and adjust vaporizer setting (depending on previous setting)

FGF O_2 is set to match current FiO_2, e.g. FiO_2 low set FGF O_2 to 100 %.

2012 we added a similar protocol for Desflurane.

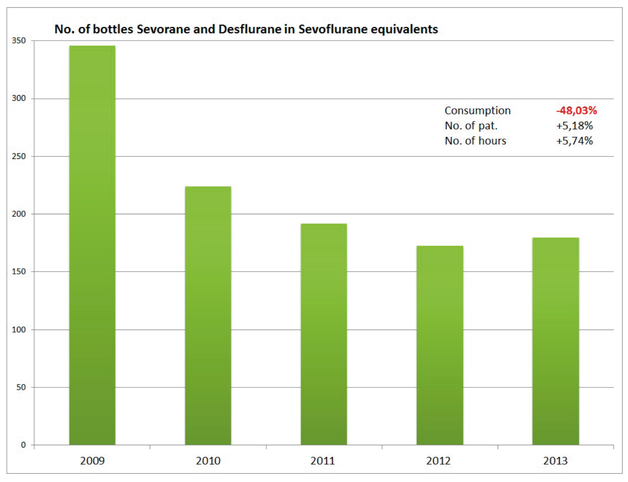
Implementing our standard:

2010, the year of implementation, we gave lectures – using Gas Man as a tool to visualize gas kinetics and how to use our standard protocol. We spent much time on bedside teaching, repetition and follow-up.

Results:

By following consumption of AA we could see how well the staff complied with the model. Our simulations indicated that we could save approximately 50 %, a goal we reached in 2011 and kept since then.

In 2012 a survey was made, we used comments on the model that we picked up from staff members. The statements was rated in 6 steps from strongly agree to strongly disagree. The diagram shows the part of positive answers.



Today we have performed approximately 20 000 cases and no problems reported connected to the method.

Since 2011 this is our model for inhalation anaesthesia. Compliance is monitored by consumption of AA and observations.