

# The device

## Syringe pump - Vaporizer

- Vaporizer is integrated into anesthesia machine.
- Vaporizer is fail safe.
- Vaporizer is specific for one volatile.
- Fewer refillings with vaporizer!



# The route of administration is different

## Airway



## Vascular system - Vein

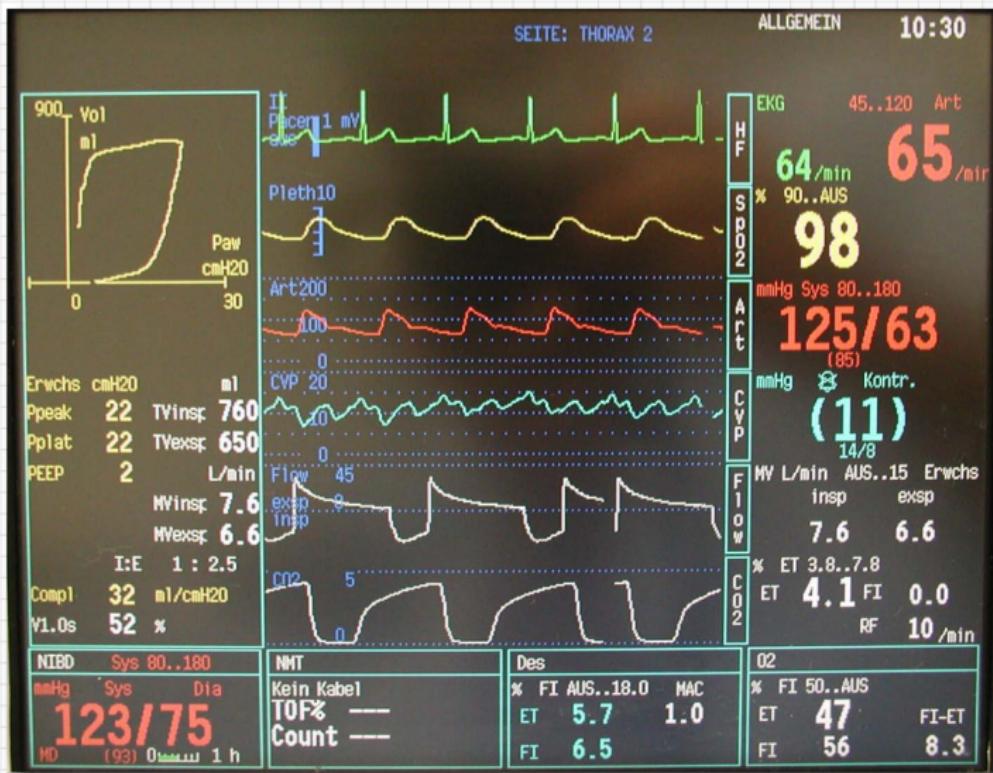


# The drug concentration is measured!

At least we know that there is drug in the system!



# Best monitored route of administration!



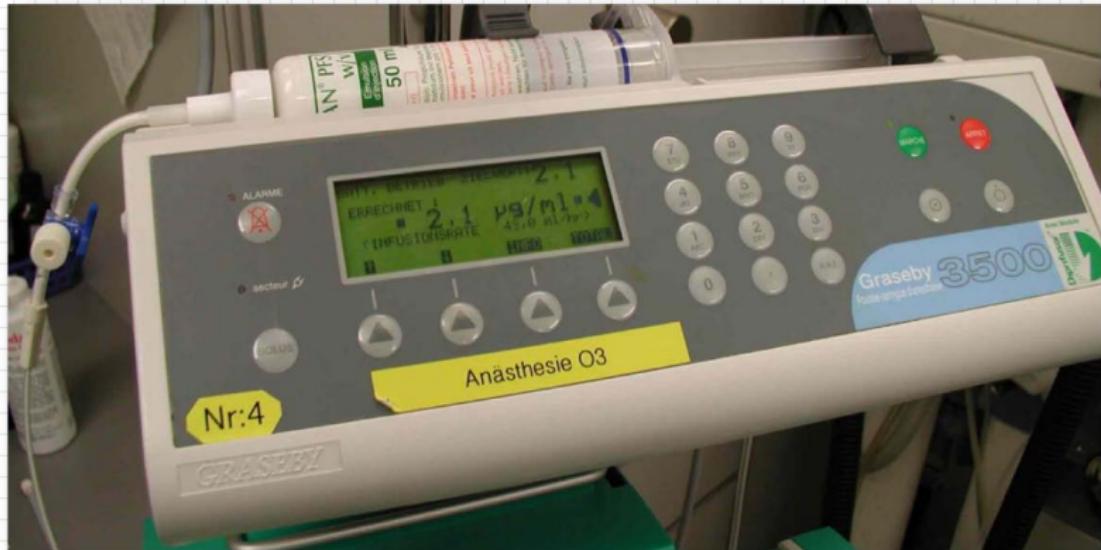
# Setting up the drug!

Getting the dilution right

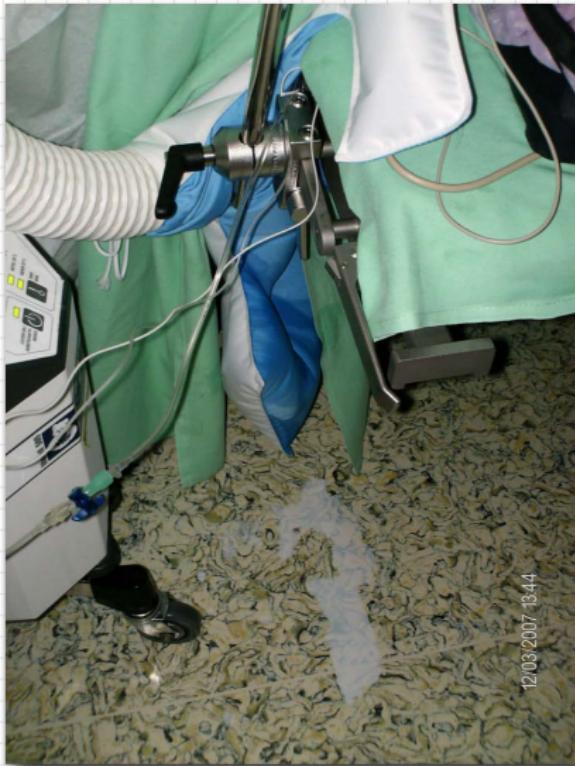


# When the pump fails ...

Internal disengagement of plunger!



# Inadequate anesthesia ...



That was the problem ...



# When the infusion line is interrupted ...

The infusion can disconnect.



# When the infusion line is interrupted ...

Anesthesia for shoulder surgery!



# When the infusion line is interrupted ...

Limited access to the patient!



# When the infusion line is interrupted ...

What happened?

- No access to the distal part of the i.v. line.
- Kinking of the cannula!
- Backflow into the drip counter!



i.v. access covered - delayed disconnection



# Summary: General i.v. drug administration risks

## From ampoule to blood:

- If anything can go wrong, it will!
- To err is human!
- There is no disconnection alarm, no online concentration measurement!!!

# Overview:

- 1 Comparison: TIVA - Volatile
- 2 i.v. drug administration - „Hardware”...
- 3 PK - TCI specific issues
- 4 Software – general
- 5 How to improve safety.

# The wrong model!

## The issue:

- Pump for a *remifentanil* TCI was prepared.
- Distraction during setup of pump.
- By mistake the propofol model was chosen.
- That is: The pump „thought“ there was propofol in the syringe.

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# Propofol model instead of the remifentanil model!

PROP/REM SCH		PROPOFOL REMIFENTANIL	10.0 mg/ml 50.0 µg/ml	 
PROPOFOL		PROPOFOL	10.0 mg/ml	
REMIFENTANIL		REMIFENTANIL	50.0 µg/ml	
Ohne				

# The pump thinks it's propofol!

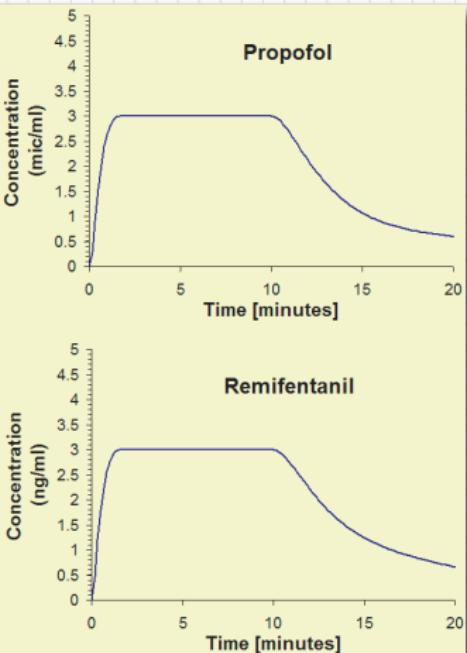
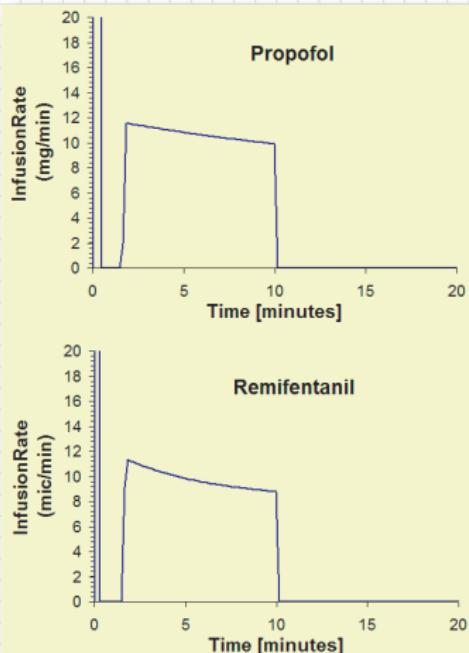


# Remifentanil or propofol?

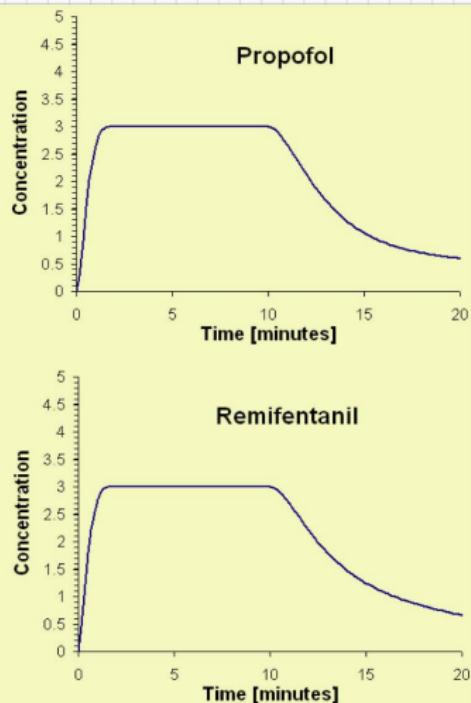
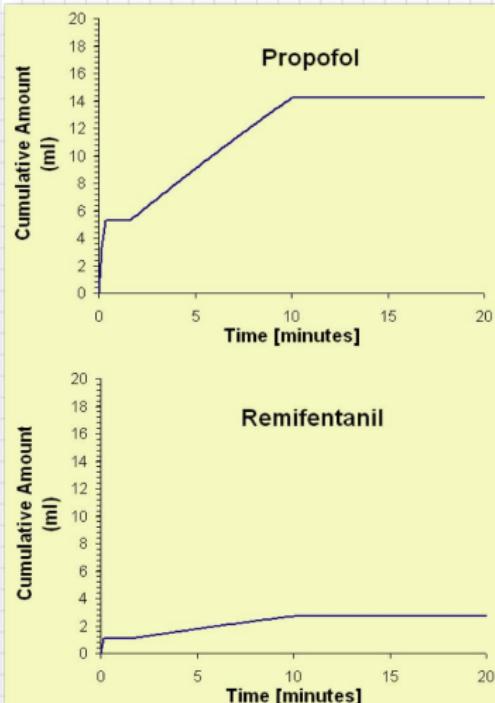
The setting:

- Concentration of remifentanil: 50  $\frac{\mu g}{ml}$
- (Assumed) Concentration of propofol: 10  $\frac{mg}{ml}$
- Target: Effect Site concentration of: 3  $\frac{\mu g}{ml}$

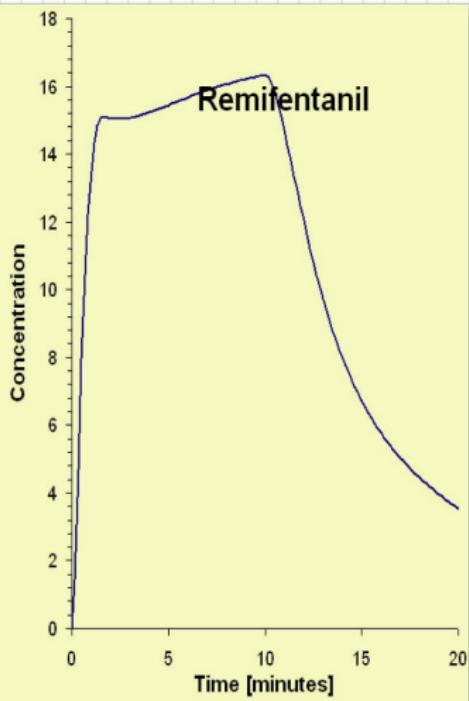
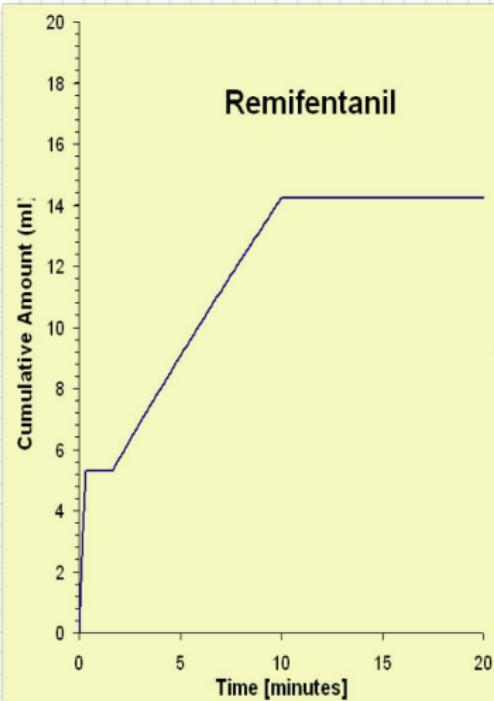
# The infusion rates - when everything is normal!



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# Whoops ... That's a lot!



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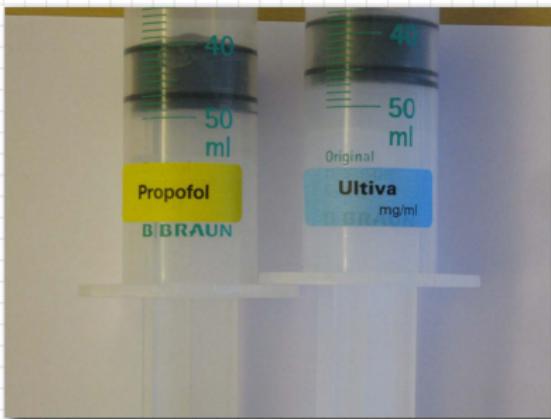
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# Improving safety: Some tips!

- Regarding drug administration
- Regarding TCI specific problems (models)
- ... and in general!

Immediately put the label on the syringe.

Use the same system for labeling in the whole department. (ISO 26825)

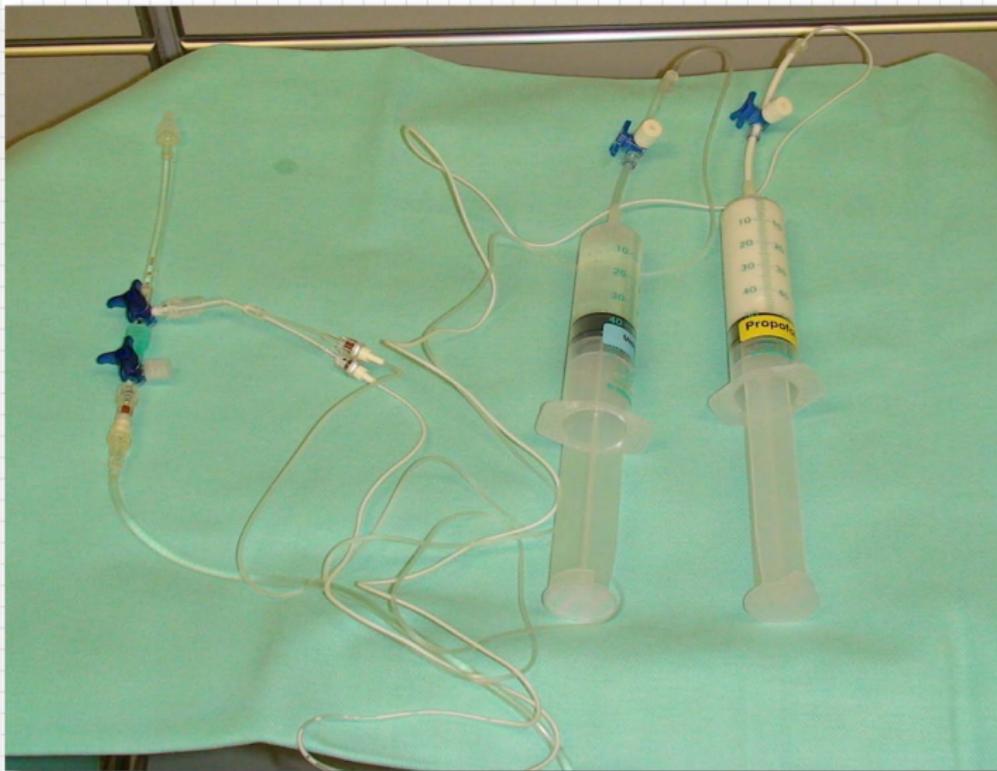


Standardize the setup of drug and pump setup.  
Use some system - rule for preparing the drug!



# Use appropriate tubing! (Anti-reflux valves!)

Standardize the setup of drug and pump setup.



# Make sure the drug goes into the patient!

Without i.v. access no i.v. anesthesia



# Make sure the drug goes into the patient!

Appropriately sized cannula in a good **accessible** vein!



# Things will go wrong!

Measure the effect of the anesthetic - in the paralyzed patient mandatory!



# Improving safety: Some tips!

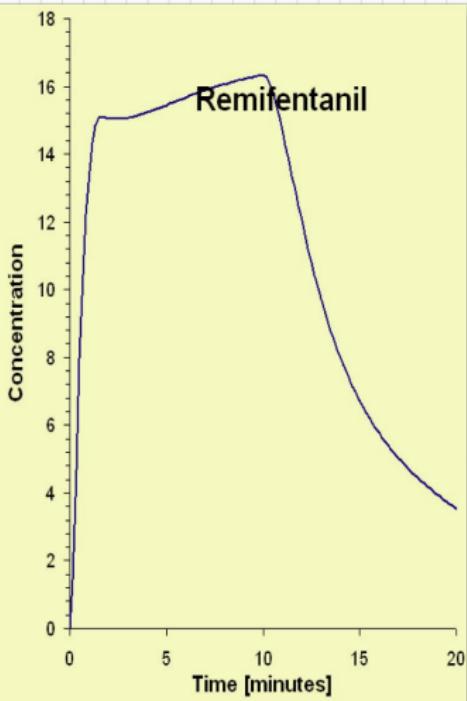
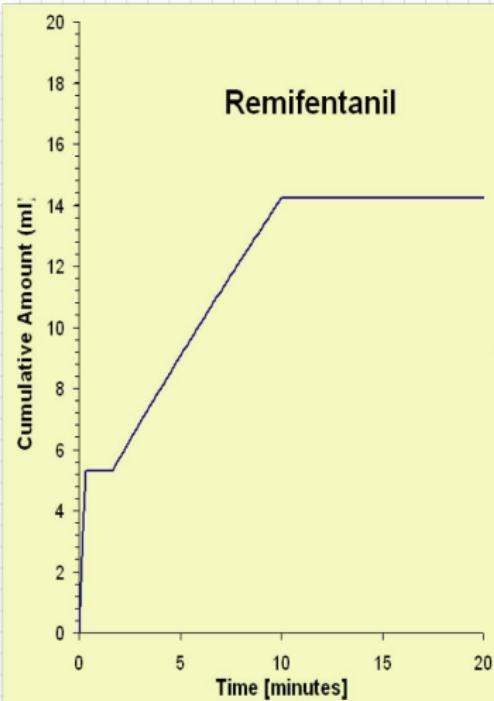
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- ... and in general!

As a reminder:

The setting was:

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If you believe that things can go wrong:

## Precautions

- Do not use a remifentanil concentration  $> 50 \frac{\mu g}{ml}$
- Do not use a propofol concentration  $> 10 \frac{mg}{ml}$
- Institutional policy for setting up the pumps.
- Reduce the number of available TCI protocols in the pump.

# Systemic setup of pumps

Reduce the No. of the options in your institution



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# The vigilant anaesthetist!

... who understands the equipment and its limits!

