

# MEDUMAT Standard<sup>2</sup>

## Step-by-step instructions

- Start ventilation by height
- NIV therapy
- Resuscitation (CPR) with IPPV
- Resuscitation (CPR) with CCSV
- Anesthesia induction (RSI)

Important:  
This document  
does not replace the  
instructions for use.  
Complete information  
can be found in  
the instructions  
for use.



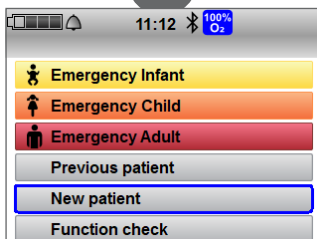
# Operating steps

1



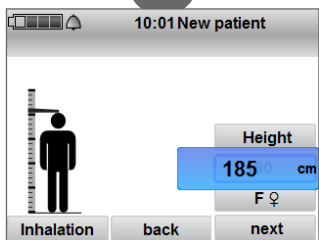
Switch on ventilator

2



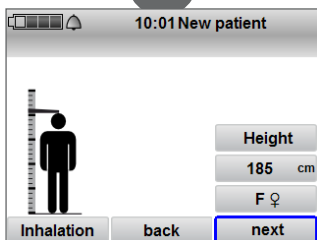
Select "New patient"

3



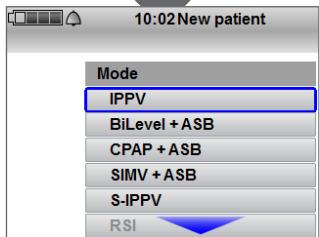
Select patient height and gender

4



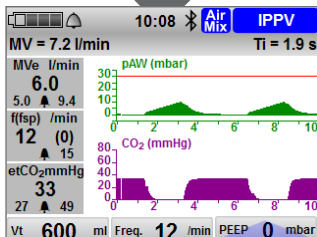
Select "next"

5



Select the ventilation mode and check the displayed ventilation parameters

6



Start ventilation

# Start ventilation by height

## Start faster and ventilate more precisely

From now on you don't have to think long about which tidal volume (Vt) is best for your patient. With MEDUMAT Standard<sup>2</sup>, you can now initiate ventilation even more precisely and quickly. By entering the patient's height and gender, your ventilator automatically calculates all ventilation parameters for the ideal body weight (IBW). The IBW serves as an important indicator for setting the ventilation parameters<sup>1</sup>. MEDUMAT Standard<sup>2</sup> enables you to start ventilation more quickly and far more precisely – giving you more time for all the other important tasks.

## Use presets and work according to guidelines

By using the setting option of the Vt/kg body weight (BW) 4-10 ml/kg BW to be applied, you will be working according to guidelines and determining the calculated tidal volume for volume-controlled ventilation.

The ideal body weight and thus also the tidal volume to be applied are calculated differently for male and female patients. The following formulas are used for this purpose:

$$\text{IBW female (in kg)} = 45 + 2.3 \times \left( \frac{\text{Height in cm}}{2.54} - 60 \right)^{\text{iii}}$$

$$\text{IBW male (in kg)} = 50 + 2.3 \times \left( \frac{\text{Height in cm}}{2.54} - 60 \right)^{\text{iii}}$$

With a male patient 185 cm tall and a setting of 6 ml/kg BW, this results in the following tidal volume:

$$\text{IBW (in kg)} = 50 + 2.3 \times \left( \frac{185}{2.54} - 60 \right) = 79.51 \text{ kg} \sim 80 \text{ kg}$$

The tidal volume results accordingly:

$$V_t = 80 \text{ kg} \times 6 \text{ ml/kg KG} = 480 \text{ ml}$$

<sup>i</sup>Gajic, O. et al. Ventilator-associated lung injury in patients without acute lung injury at the onset of mechanical ventilation. Critical care medicine, 2004, no. 32, p. 1817-1824.

<sup>ii</sup>Deakin, C. D. et al. Advanced life support Section 4 of the European Resuscitation Council Guidelines on Resuscitation 2010. Emergency + Rescue Medicine, 2010, No. 7, p. 578.

<sup>iii</sup>Devine, Ben J. Gentamicin therapy. The Annals of Pharmacotherapy. 1974, 8. year, no. 11, p. 650-655

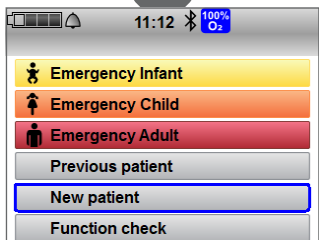
# NIV therapy

1



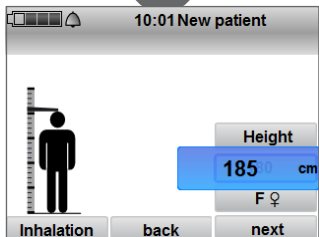
Switch on ventilator.

2



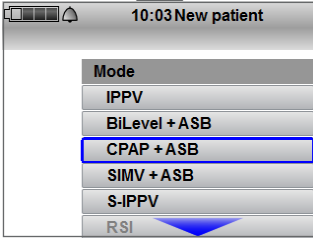
Select "New patient" in the start menu.

3



Set the patient's height and gender or select the appropriate patient group: Adult, Child, Infant.

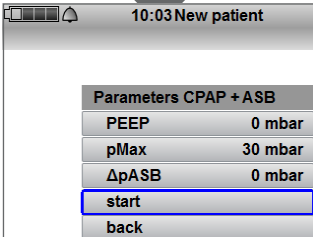
4



Select one of the following ventilation modes: CPAP\* or CPAP + ASB (if available).

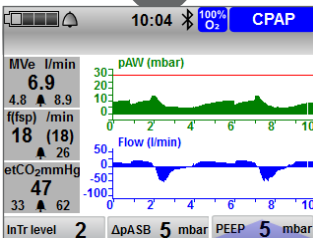
\*pure CPAP is the ventilation form CPAP + ASB with a  $\Delta p_{ASB}$  of 0 mbar

5



Select the desired CPAP therapy using the navigation button: PEEP, pMax,  $\Delta p_{ASB}$ . After adjusting the values, begin the ventilation via "start".

6



Now connect the patient to MEDUMAT Standard<sup>2</sup>. It is possible to adjust the values using the navigation button while the ventilation is running. You can find other ventilation parameters in the user menu on the right navigation button. If it is necessary to switch the ventilation mode, this is done using the "user menu" function button on the right side.

# SOP NIV

## (Standard Operating Procedure) Non-invasive ventilation (NIV) by the EMS

Modified by Prof. Dr. med. Thoralf Kerner

### Logistical requirements

- Oxygen supply: at least a 2-l bottle, filled ..... Check
- Emergency medical team familiar with NIV ..... Check

### Clinical requirements

- Alert, cooperative (GCS > 12) ..... Check
- breathing spontaneously ..... Check
- If applicable, light sedation of agitated patients e.g. morphine (5-10 mg i.v. titrated) or a short-acting benzodiazepine

### Indications

- Dyspnea ..... Check
- Respiratory rate > 25/min (count!) ..... Check
- SpO<sub>2</sub> < 90 % despite O<sub>2</sub> administration ..... Check

### Contraindications

- Absolute contraindications: ..... Check
- Absence of spontaneous respiration, gasping, airway obstruction, gastrointestinal bleeding or ileus

- Relative contraindications: ..... Check
- Coma, massive agitation, hemodynamic instability, severe hypoxemia

(SpO<sub>2</sub> < 75% despite O<sub>2</sub>), problems with airway access, status post gastrointestinal surgery

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NIV sequence: Adjust device, place mask on patient's face (explain measure!), connect mask to breathing circuit while device is running. Aim: Synchronization of patient and device

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### Pulmonary edema

#### Primary device settings

- Ventilation mode: ..... CPAP
- PEEP (according to comfort and oxygenation): ..... 5 / 10 / (12) mbar
- FiO<sub>2</sub>: ..... Initial 100 %, then AirMix if necessary

#### Target and success criteria

- Target SpO<sub>2</sub>: > 90 % ..... Check
- Decrease in dyspnea ..... Check
- Falling respiratory and heart rate ..... Check
- If applicable, improved vigilance ..... Check

This instruction might not be valid in your country. Please check local guidelines.

### Escalation levels

In the event of imminent respiratory muscle fatigue, set pressure support (ASB). Immediate intubation in the absence of clinical improvement or the occurrence of contraindications!

### Caution

- Continuous clinical observation and close patient contact
- No delay in pharmacological therapy or necessary intubation
- Prepared for intubation at any time
- Timely advance information to the receiving hospital

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## Exacerbated COPD

### Primary device settings

Ventilation mode: ..... CPAP + ASB

PEEP: .....3/6 mbar

$\Delta p_{ASB}$  (according to comfort and oxygenation): ..... increase slowly,  
peak pressure max. 25 mbar

Inspiration trigger: as low as .....possible

Pressure ramp: .....steep

$FiO_2$ : ..... as required

### Target and success criteria

Target  $SpO_2$ : > 85 % ..... Check

Decrease in dyspnea ..... Check

Decrease respiratory and heart rate ..... Check

If applicable, improved vigilance ..... Check

### Escalation levels

In the event of imminent respiratory muscle fatigue, if available, set ventilation mode BiLevel + ASB (e.g. PEEP: 5 mbar,  $p_{l\text{ns}}p$ : 20 mbar).

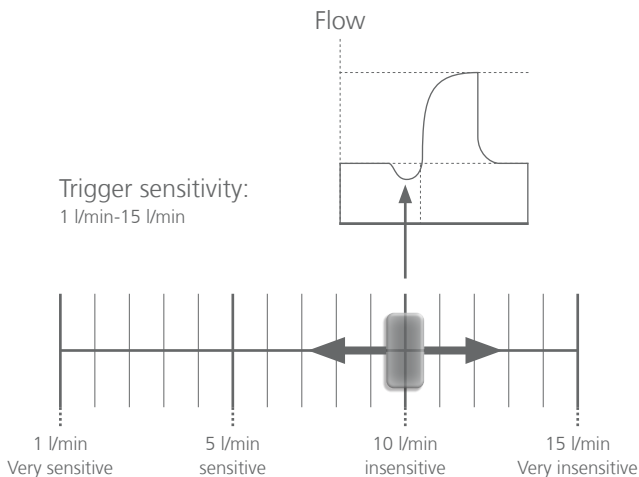
Immediate intubation in the absence of clinical improvement or the occurrence of contraindications!

### Caution

- Continuous clinical observation and close patient contact
- No delay in pharmacological therapy or necessary intubation
- Prepared for intubation at any time
- Timely advance information to the receiving hospital

# Inspiratory trigger

The inspiratory trigger triggers a pressure support or a mechanical breath as soon as inhalation effort is detected.



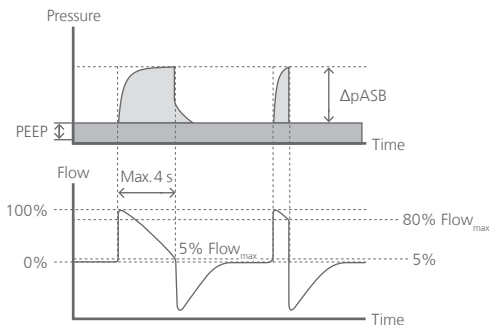
## Setting the levels of the inspiration trigger:

(If “3 levels” has been chosen as the trigger setting in the operator menu)

Trigger level	Corresponding unit value
Level 1 (sensitive)	Approx. 3 l/min
Level 2 (medium)	Approx. 6 l/min
Level 3 (insensitive)	Approx. 10 l/min



# Pressure support and the expiration trigger



## Pressure support $\Delta p_{ASB}$

The pressure support is always given as a value above PEEP. In addition to the set PEEP, a patient receives this as soon as the inspiration trigger has been detected.

Example calculation:

PEEP = 5 mbar,  $\Delta p_{ASB}$  = 10 mbar  $\rightarrow$  inspiration pressure in the inhalation phase = 15 mbar

## Expiratory trigger

Initiate expiration as soon as the flow to the patient is only the set value (in %) with respect to the maximum flow. The length of the pressure support is set with the expiratory trigger.

Trigger sensitivity: 5-80% of max. flow. In principle, the following applies: the smaller the % value, the longer the pressure support lasts.

## Setting the levels of the expiration trigger:

(If "3 levels" has been chosen as the trigger setting in the operator menu)

Trigger level	Corresponding unit value
Level 1 (long)	Approx. 10% Flow max
Level 2 (medium)	Approx. 35 % Flow max
Level 3 (Short)	Approx. 70 % Flow max


## Pressure ramp (pressure increase time)


A pressure ramp (or the pressure increase time) defines the time in which the pressure increases from the PEEP to the inspiration pressure. This pressure increase time can be set by the shape of the ramp: flat, medium and steep.


< 0.2 seconds:  
steep

Approx. 0.2 seconds:  
medium

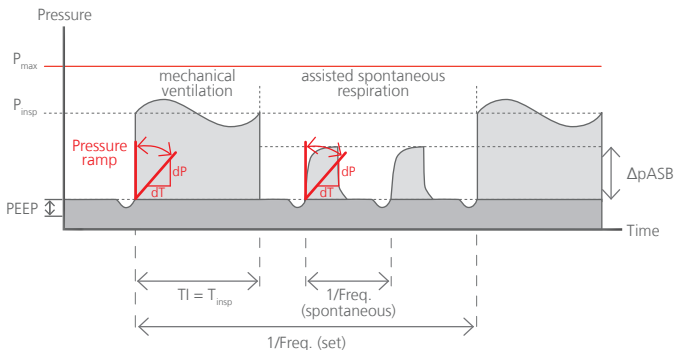
Approx. 0.4 seconds:  
flat

**Pressure ramp** 

**Pressure ramp** 

**Pressure ramp** 

## Pressure ramps using the example of a BiLevel + ASB curve





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local guidelines.

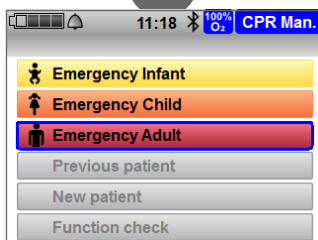
# Resuscitation (CPR) with IPPV

1



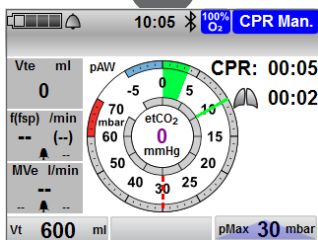
Switch on the device.

2



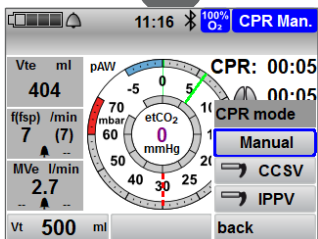
Press the CPR button and select the patient group.

3



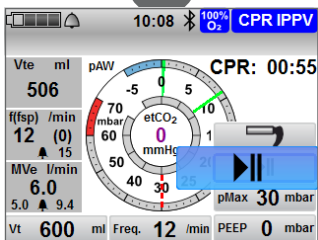
Check the ventilation parameters. In the ventilation phase of 30:2 or 15:2 resuscitation, press the mask with the "Double C grip" over the patient's mouth and nose. Then hold down the MEDUtrigger key until two mechanical breaths have been administered.

4



Following successful intubation, switch to continuous ventilation “CPR IPPV”. Check the ventilation parameters.

5

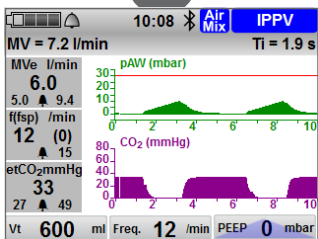


During the cardiac rhythm analysis or defibrillation, select “pause” to pause the ventilation.

- No movement artifacts
- Reduction of thoracic impedance
- No oxygen enrichment of ambient air

Following successful defibrillation, if applicable, press “pause” again to restart the ventilation. The ventilation will start automatically after at most 50 seconds.

6



Once ROSC is achieved, press the CPR key again to exit the CPR mode. Then check the ventilation parameters and select, if applicable, the Air Mix key to lower the FiO<sub>2</sub> to < 1.0.

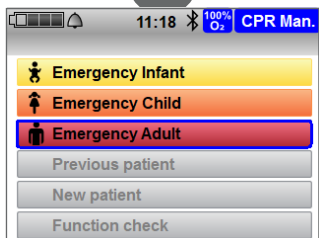
# Resuscitation (CPR) with CCSV

1



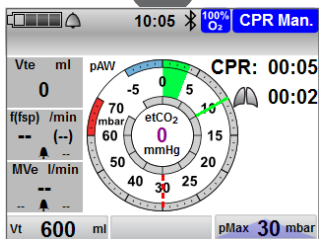
Switch on the device.

2



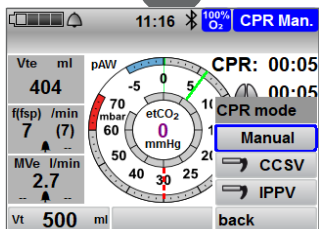
Press the CPR button and select the patient group

3



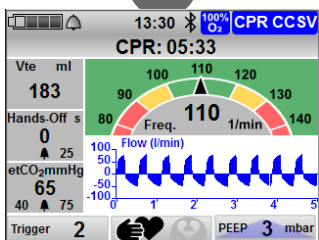
Check the ventilation parameters. In the ventilation phase of 30:2 or 15:2 resuscitation, press the mask with the "Double C grip" over the patient's mouth and nose. Then hold down the MEDUtrigger key until two mechanical breaths have been administered.

4



Following successful intubation, switch to continuous ventilation "CPR CCSV".

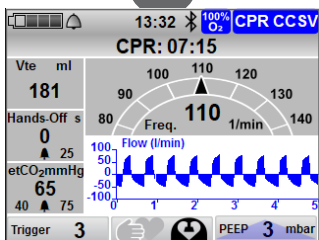
5



Perform chest compressions continuously. MEDUMAT Standard<sup>2</sup> will deliver a mechanical breath synchronously to each compression.

You can use the frequency tachometer shown above to determine the frequency of the compressions.

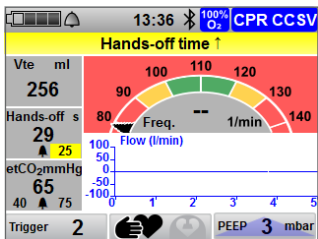
6



If a chest compression device is brought to the patient, this must be indicated via the middle navigation button.

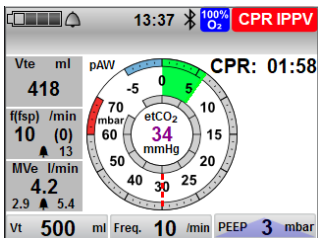
With machine compressions the compression frequency alarm is deactivated and the frequency tachometer turns gray.

The triggers are optimized by the device and the trigger level is automatically set to "3".



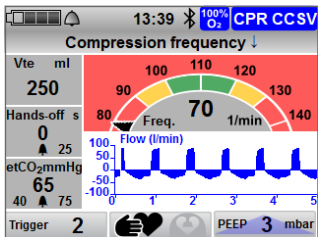
7

In the absence of chest compressions, the hands-off time is displayed. When the alarm limit is reached, the device outputs a hands-off time alarm. If this is not answered with compressions, the device automatically switches to "CPR IPPV" ventilation.



8

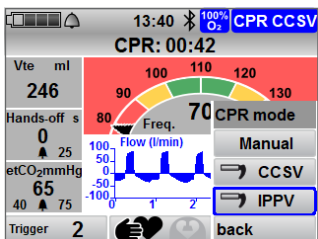
If chest compressions are detected again by MEDUMAT Standard² during "CPR IPPV" apnea ventilation, the device automatically switches back to "CPR CCSV".



9

If less or no compressions are detected by MEDUMAT Standard² despite correctly performed compressions, please perform the following escalation steps:

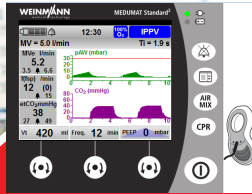
- Reduce the set trigger
- Increase the set PEEP



10

If these two measures do not lead to success, CCSV is not applicable to this patient. Please switch to "CPR IPPV" via the right navigation button.



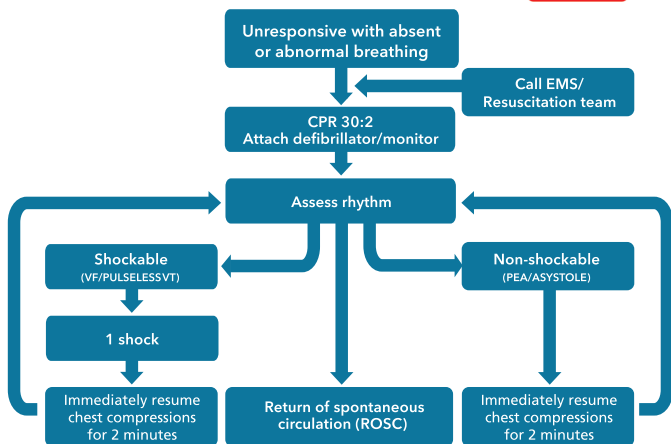


## Interactive Simulation

Operate MEDUMAT Standard<sup>2</sup> live on your computer with our free simulation software.

You can find more information at:  
[WEINMANN-Emergency.com](http://WEINMANN-Emergency.com)





#### Give high-quality chest compressions and

- Give oxygen
- Use waveform capnography
- Continuous compressions if advanced airway
- Minimise interruptions to compressions
- Intravenous or intraosseous access
- Give adrenaline every 3-5 min
- Give amiodarone after 3 shocks
- Identify and treat reversible causes

#### Identify and treat reversible causes

- Hypoxia
  - Hypovolaemia
  - Hypo-/hyperkalemia/metabolic
  - Hypo-/hyperthermia
  - Thrombosis - coronary or pulmonary
  - Tension pneumothorax
  - Tamponade- cardiac
  - Toxins
- Consider ultrasound imaging to identify reversible causes

#### Consider

- Coronary angiography/percutaneous coronary intervention
- Mechanical chest compressions to facilitate transfer/treatment
- Extracorporeal CPR

#### After ROSC

- Use an ABCDE approach
- Aim for SpO<sub>2</sub> of 94-98% and normal PaCO<sub>2</sub>
- 12 Lead ECG
- Identify and treat cause
- Targeted temperature management



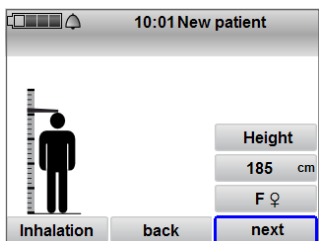
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# Anesthesia induction (RSI)



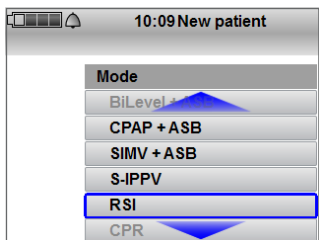
1

Switch on the device



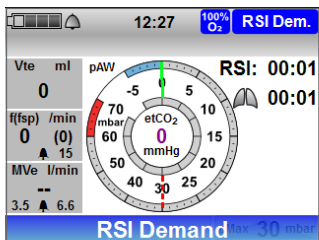
2

Select "New patient" on the home screen and set the patient's height and gender. Or select the appropriate patient group: Adult, Child, Infant



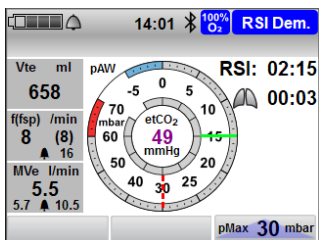
3

Select "RSI" in the "mode" submenu



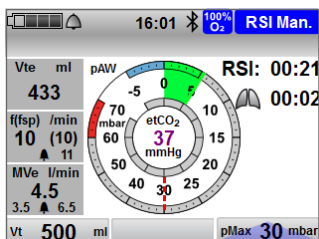
4

MEDUMAT Standard<sup>2</sup> begins the therapy in demand mode. In this mode, the spontaneously breathing patient is pre-oxygenated. The total RSI time and the time since the last spontaneous breath are shown on the display.



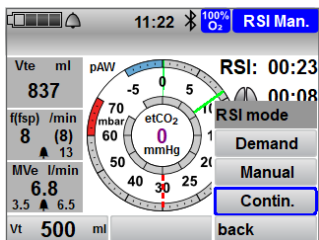
5

To check the tube position following successful intubation or as a fallback position for a difficult airway, switch to the Manual mode.



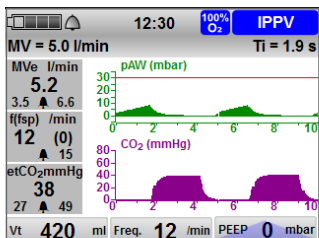
6

Check the ventilation parameters. Connect the patient hose system to the tube or press the mask with the "Double C grip" over the patient's mouth and nose and trigger the mechanical breath with the MEDUtrigger.



7

Following successful intubation, switch to continuous ventilation to ventilate the patient in a controlled manner.



8

The device switches to controlled IPPV or BiLevel + ASB ventilation depending on availability and setting. Please check the ventilation parameters and adjust them if necessary.

# Excerpt from the S1 guideline

"Prehospital Emergency Anaesthesia in Adults" of the DGAI

## Indications for prehospital emergency anaesthesia

- Acute respiratory insufficiency (hypoxia and/or respiratory rate\* < 6 or > 29/min) and contraindications for or failure of non-invasive ventilation
  - Loss of consciousness/neurological deficit with risk of aspiration  
Multiple trauma/severe trauma with
    - i) hemodynamic instability, systolic BP < 90 mmHg or
    - ii) hypoxia with SpO<sub>2</sub> < 90% despite = 2 l/min O<sub>2</sub> administration or
    - iii) traumatic brain injury with GCS < 9
- \* in the presence of not rapidly reversible causes

Indication: patient-, mission-, and user-related factors, experience of the emergency medical team, situation at the scene, transport times, air and ground rescue

Communication in the team: Site of anesthesia induction, clear allocation of tasks, selection of medicines, other important notes and agreements

Optimal positioning: "Light, space, warmth" concept, ideal for upper body elevation in the ambulance (caution: not with spinal immobilization or hemodynamically unstable patients), head in "sniffing" position.

Pre-oxygenation:  
For a spontaneously breathing patient, at least 3-4 min O<sub>2</sub> insufflation with 12-15 l/min via a face mask with reservoir or demand valve, if applicable, NIV or mask ventilation.

parallel

Standardized preparation:  
Anaesthesia and emergency medications, respiratory alternatives, suction, capnography.

Monitoring: Pulse oximetry, ECG, blood pressure, capnography.

Two peripheral venous accesses: In case of difficult puncture conditions, consider intraosseous puncture in a time-critical manner.

## Rapid Sequence Induction (RSI)

Continuous monitoring: Anesthesia management and monitoring

If required  
Management of complications

## Rapid Sequence Induction (RSI)

- If applicable, remove the cervical spine immobilization and begin manual in-line stabilization
- Announcement of the Anaesthesia medication with active substance and dosage, step-by-step application
- Wait for loss of consciousness and relaxation effect
- Airway management without intermediate ventilation in normoxic patients\*
- Tube position check (capnography, auscultation, insertion depth)
- If applicable, stop manual in-line stabilization and close the cervical spine immobilization brace again

\* In individual cases, despite the increased risk of aspiration, intermediate ventilation may be necessary in order to maintain oxygenation.

Please note that these are excerpts from the S1 guideline  
"Pre-hospital emergency anesthesia in adults".

Source: AnästH Intensivmed 2015;56:317-335 Aktiv Druck & Verlag GmbH



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