Ventrain®

Redefining Ventilation

Airway Innovation

IES MEDICAL
Innovation for better care

Ventrain®
Flow Controlled Ventilation (FCV®)

Ventrain is a manual ventilator that allows complete ventilation by active control of both inspiratory and expiratory flow through a small lumen diameter (2 mm ID).

This revolutionary technology, which for the first time allows complete control of the entire ventilatory cycle, is called **Flow Controlled Ventilation** (**FCV®**).

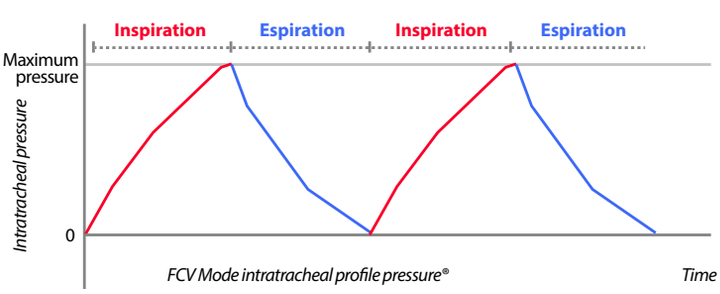
It combines a source of oxygen that generates the pressure necessary to overcome the inspiratory flow resistance of a small-bore airway with sufficient subatmospheric pressure to facilitate active expiration.

Traditional alternatives to small-bore catheter ventilation (e.g., jet ventilation) are inherently dangerous if the airway is not sufficiently open. Insufficient exhalation of gas during expiration will lead to auto-PEEP, with deleterious consequences on the patient's hemodynamic status.

If ventilation is maintained it can lead to an increase in intrathoracic pressure within a few cycles, resulting in barotrauma and/or circulatory collapse.

Unlike manual high-pressure (jet ventilation) ventilators, in which inspiratory pressure is adjusted but inspiratory volume can hardly be estimated, **Ventrain®** is a flow-controlled device, so inspiratory tidal volumes can be easily estimated from the adjusted flow and inspiratory time [Table 1].

Ventrain® in combination with a **Cricath®** transtracheal catheter or a **Tritube®** ultrathin endotracheal tube is the device of choice in the management of the emergency front of neck access (eFONA) "cannot ventilate, cannot intubate" (NVNI) or elective process; difficult airway, pediatric airway, upper airway or tracheal surgery with bronchial blockers or through the working channel of flexible or rigid bronchoscopes.



FCV Mode intratracheal profile pressure®

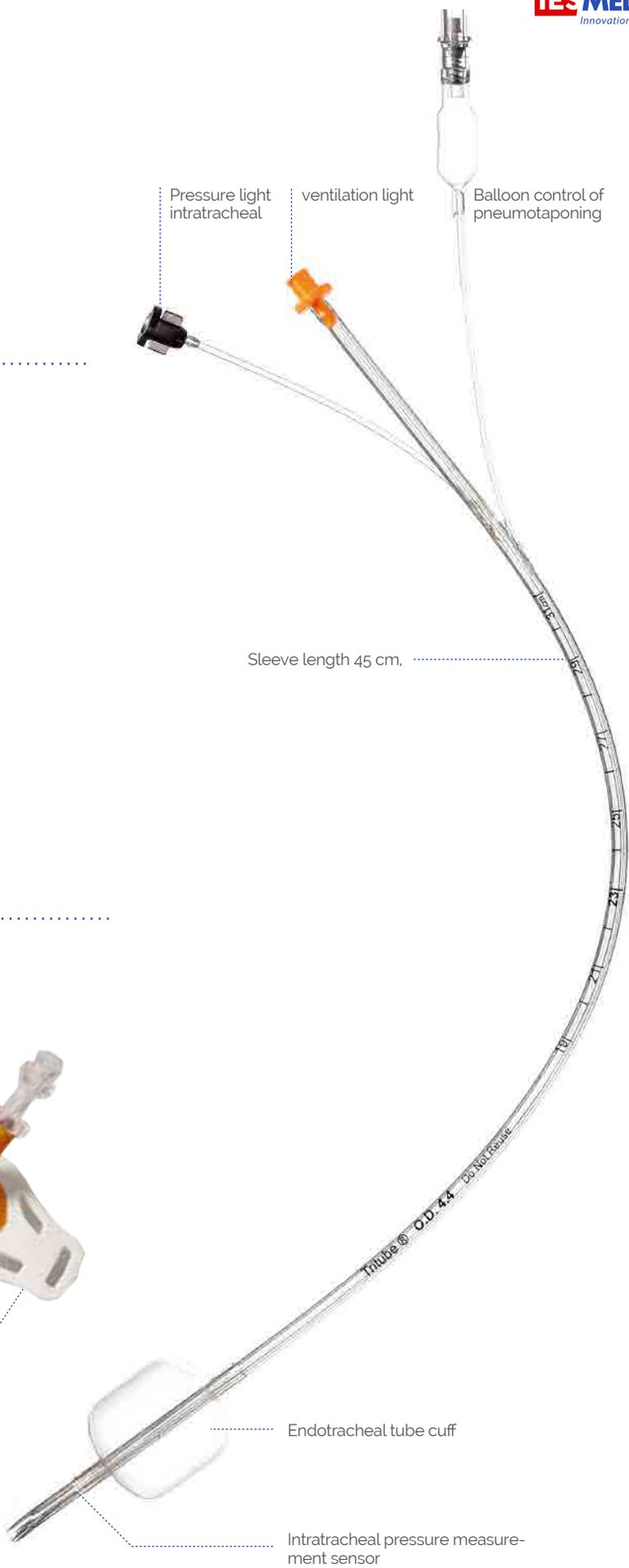
TABLE 1 - Flow rate and volume administered

Flow (Liter/min)	Volume administered (ml) in 1 sec of inspiration.	Volume administered (ml) in 2 sec of inspiration.
2	33	66
3	50	100
6	100	200
9	150	300
12	200	400
15	250	500

Tritube®

Ultra-thin endotracheal tube

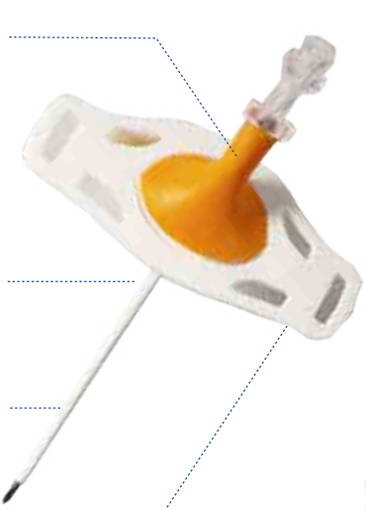
ID = 2,4 mm ∅
OD = 4,4 mm ∅



Cricath®

Cricothyroidotomy catheter

ID = 2 mm ∅



INDICATIONS

In emergencies,

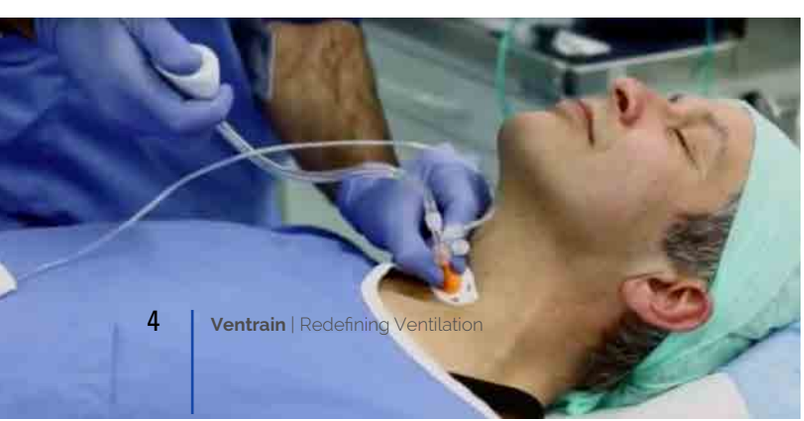
«Cannot ventilate, cannot intubate» (NVNI)

"Cannot ventilate, cannot intubate" patients represent an emergency that may require immediate access to the airway by a cricothyroidotomy technique.

Ventrain® in combination with the Cricath® Transtracheal Catheter is the first and only emergency ventilation device on the market that uses a 2 mm internal diameter catheter inserted through the cricothyroid membrane:

- Allows control of the entire ventilatory cycle (inspiration and expiration) by means of **FCV®** technology.
- It offers a minute volume (MV) greater than 6 L/min and an I/E ratio of 1:1, when using a flow rate of 15L/min.
- Cricath, the smart choice.
  - Anti-tilting mechanism: reduces the risk of kinking
  - Small caliber: minimally invasive
  - Curved needle: easy insertion.

The **Ventrain®** Emergency Kit is the solution in emergency airway situations. It includes the **Ventrain®** ventilation device and the **Cricath®** cricothyroidotomy catheter.



Full video demonstration Cricath

https://youtu.be/TyeTtwtL0Jo


Ventrain

INDICATIONS

Upper airway surgery

Ventrain® ventilation during upper airway surgery combines the physical advantages of using a small-bore catheter with the benefits of **Ventrain®** ventilation:

> Improves the vision of the surgical field, facilitating surgery and reducing its duration.

- Complete ventilation (oxygenation and CO_2 elimination)
- Minute volume up to 7 l/min.
- No vibration of the vocal cords.
- Minimally invasive.
- Increases the surgical field
- Better vision for the surgeon.

Examples of difficult airway access with Ventrain®, Tritube® and Cricath®.

Use of the **Tritube®**: a considerable improvement of the vision of the surgical field during access to the difficult airway is appreciated.



YouTube : Tritube® video
https://goo.gl/fY1RHn

Patient with airway obstruction due to a polyp. Achieves complete ventilation during the procedure thanks to the use of **Ventrain®** and **Cricath®**.



YouTube : Ventrain® polyp
https://goo.gl/ud8Fv1

Complete ventilation with **Ventrain®** during obstructed airway surgery



YouTube : Ventrain®
https://goo.gl/8eQFUS

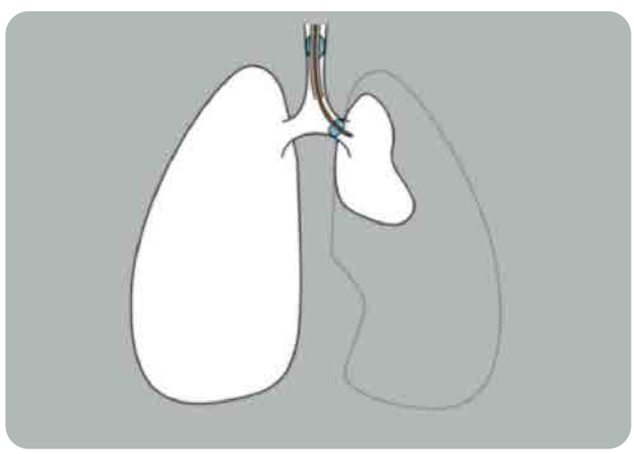
INDICATIONS

Selective pulmonary ventilation

The surgeon requires an adequate surgical field to perform optimal surgery. One-lung isolation techniques have been developed to increase this crucial working space by collapsing one lung and ventilating the other.

Complications associated with this ventilation include increased risk of hypoxemia due to impaired ventilation-perfusion and dissociation of O2 from hemoglobin (Bohr effect).

Oxygenation of the collapsed lung may require the use of continuous positive airway pressure (CPAP). However, this is not always sufficient and may result in unwanted re-expansion of the lung.

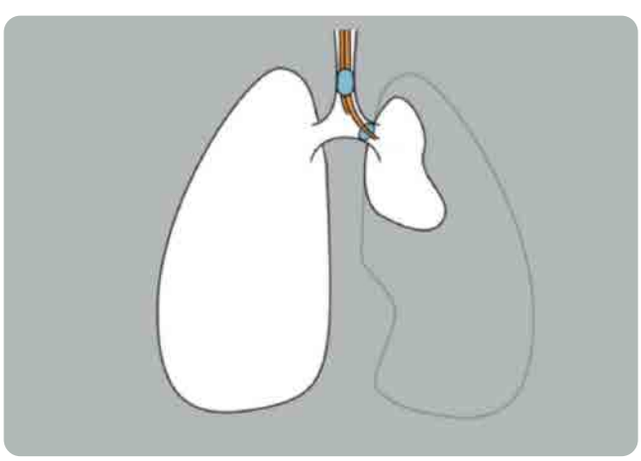


Ventrain® *together with a bronchial blocker*

In addition, with **FCV®** ventilation, collapse of the non-dependent lung is achieved more quickly and maintained more effectively throughout the surgery, preventing the procedure from being delayed or prolonged.

Ventrain® can be used in conjunction with a double-lumen tube or bronchial blocker during single-lung isolation procedures.

Ventrain® is extremely useful when additional ventilation through a double-lumen tube is required.



Ventrain® *together with double light tube*

A small endotracheal tube (e.g., tube exchange catheter or intubation introducer; ID 2-3 mm) is inserted into the bronchial lumen of the double-lumen tube, connecting it to the Ventrain®.

Moderate flow ventilation (2-6 l/min; 100% O2) will prevent or resolve hypoxemia, while the lung remains collapsed.

If a lung needs to be collapsed in a patient who already has breathing difficulties, a bronchial blocker can be used to isolate the lung. The FCV® technology used in Ventrain® will allow complete ventilation through the small bore blockers. The non-dependent lung will remain collapsed with this method of ventilation.

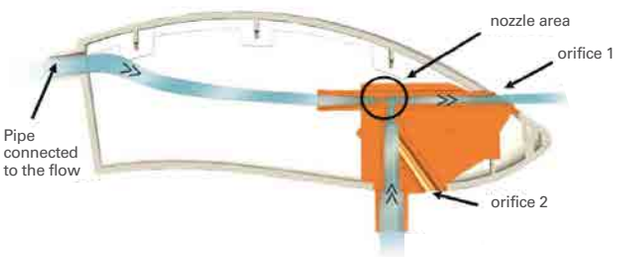
Advantages of Ventrain® in lung isolation techniques:

- Complete ventilation (oxygenation and active CO2 removal)
- No re-expansion of non-dependent lung.
- Minimally invasive insertion
- Radically shortened lung collapse time.
- Good mobilization of bronchial secretions.
- Improved vision of the surgical field facilitating surgery and decreasing surgery time.

How does Ventrain® work?

Figure 1 shows how the narrow area of the nozzle increases the gas velocity creating a negative pressure or Venturi effect (Bernoulli's Law) when orifice 2 is closed and orifice 1 is open.

figure 1



How is Ventrain® used?

Inspiration

Close orifices 1 and 2. Oxygen flows into the lungs.

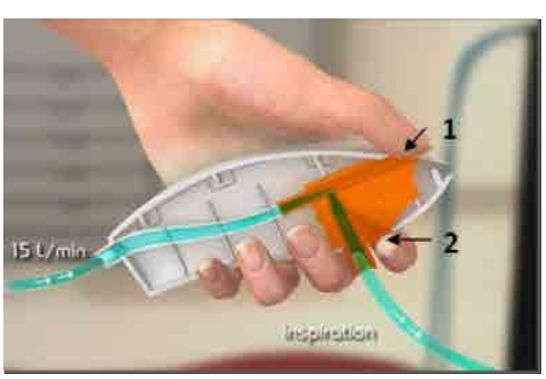


Figure A3a: Ventrain in inspiration position

Espiration

Open orifice 1 and close orifice 2. The gas will be actively aspirated from the lungs.

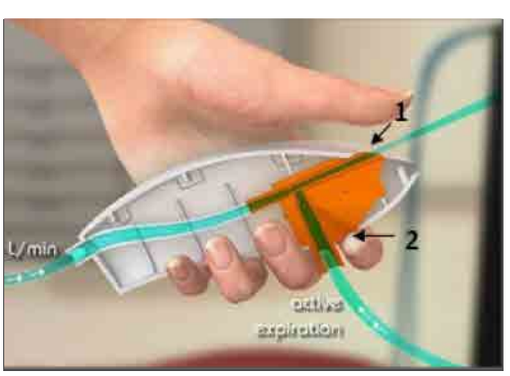


Figure A3b: Ventrain in exhalation position .

Inspiration

Espiration

Balancing

What happens when Ventrain® orifices 1 and 2 are kept open?

This is called the equilibrium position. When orifices 1 and 2 are held open, there is (almost) no gas entering the lungs.

The equilibrium position can be used for two purposes:

- On / off button:
The equilibrium position functions as an "on / off button". When orifice 2 (no matter what is being done with orifice 1) is open, there is no inspiration and no active expiration.

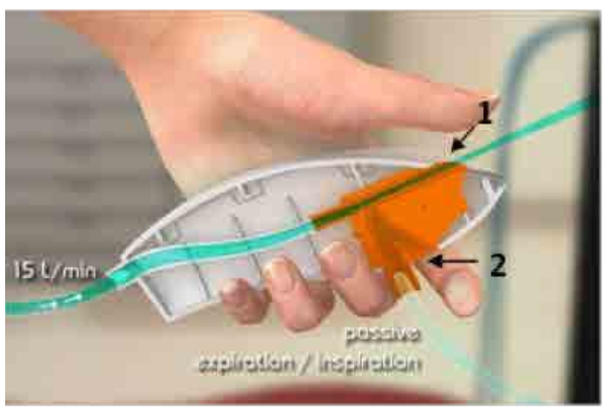


Figure A4: Ventrain in equilibriumposition / "off" position

There will only be a minimal negative pressure of ~ 6.5 mbar, but it is not effective enough to generate an expiration. For more details see Ventrain: an ejector for emergency use, AEW Hamaekers et al, Department of Anesthesia, MUMC.

- Bring the positive or negative pressure in the lungs back to zero:
This so-called equilibrium position can also be used if the user does not see clear chest excursions (upward and downward movement of the chest) or has doubts about the current pressure in the lungs. When hole 2 is held open for at least 5 seconds (no matter what is being done with hole 1), the pressure in the lungs equilibrates with the pressure in the environment:

3There is only a slight positive pressure of ~ 2.3 mbar*1, but not effective enough to create significant inspiration. For more details, see "Ventrain: an ejector for emergency use", AEW Hamaekers et al, Department of Anesthesia, MUMC.

What happens when only orifice 1 is closed?

When only orifice 1 is closed (almost 3) no flow goes into the lungs and no air is actively sucked out of the lungs.
During this position **Ventrain®** makes a much louder noise (easily recognizable) and does not work (off position).

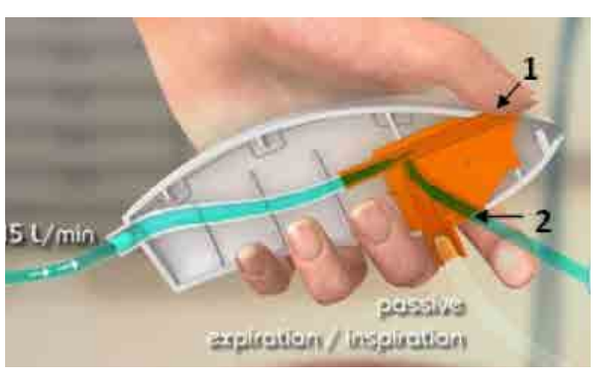


Figure A5: Ventrain "off" position

Ventrain®

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ORDER INFORMATION

PRODUCT	REF
Ventrain Emergency Kit: Ventrain® + Cricath® 	#2618300
Ventrain® Ventrain® 	#2618200
Tritube® 	#7001870

Ventrain®

Redefining Ventilation

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