Respiratory filters

SM Copotoiu

Conflict of interest

…the 26 mechanical ventilators we use cumulated 41443.23 hours of duty, which correspond roughly to 113.54 years of continuing functioning with an arithmetical mean of 4.73years/device.

The champion cumulated 6.61 years of continuous functioning while the smallest figure was of 2.37 years

Letter to the Editor,

Copotoiu SM, Golubeanu Eliza JCCM 2018

Why should we need RF?

We by pass the normal

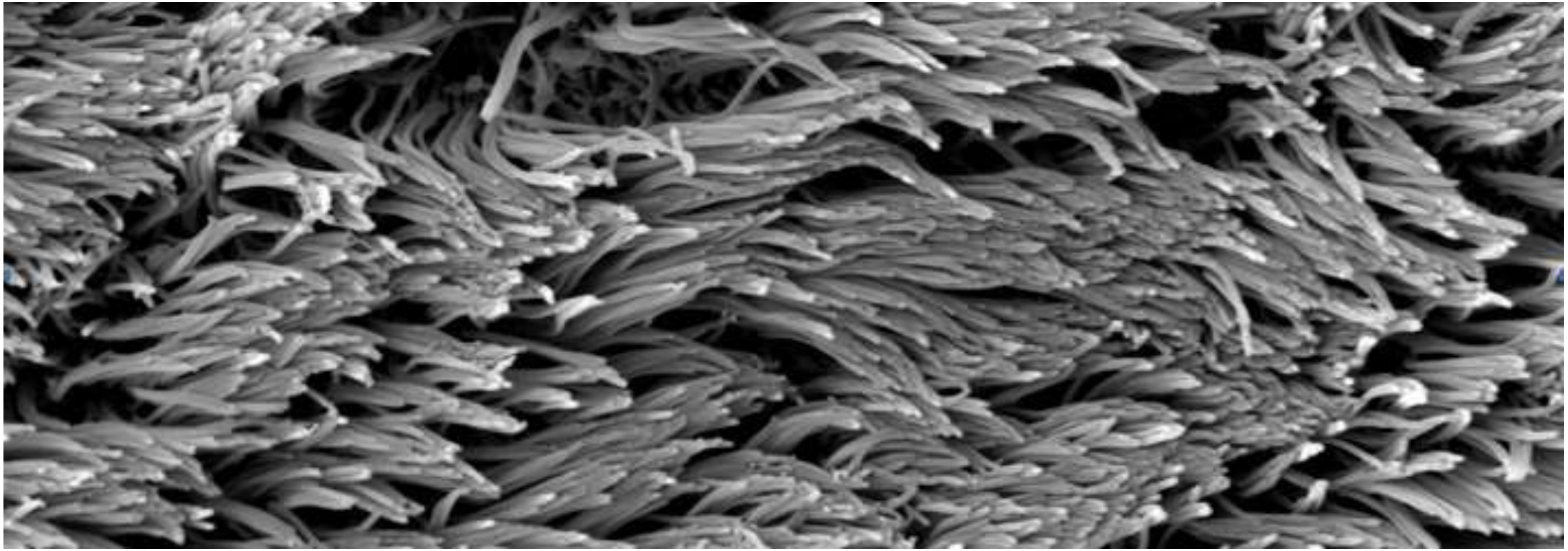
- heat & moisture exchange function of the upper airway!!!

  2 options:

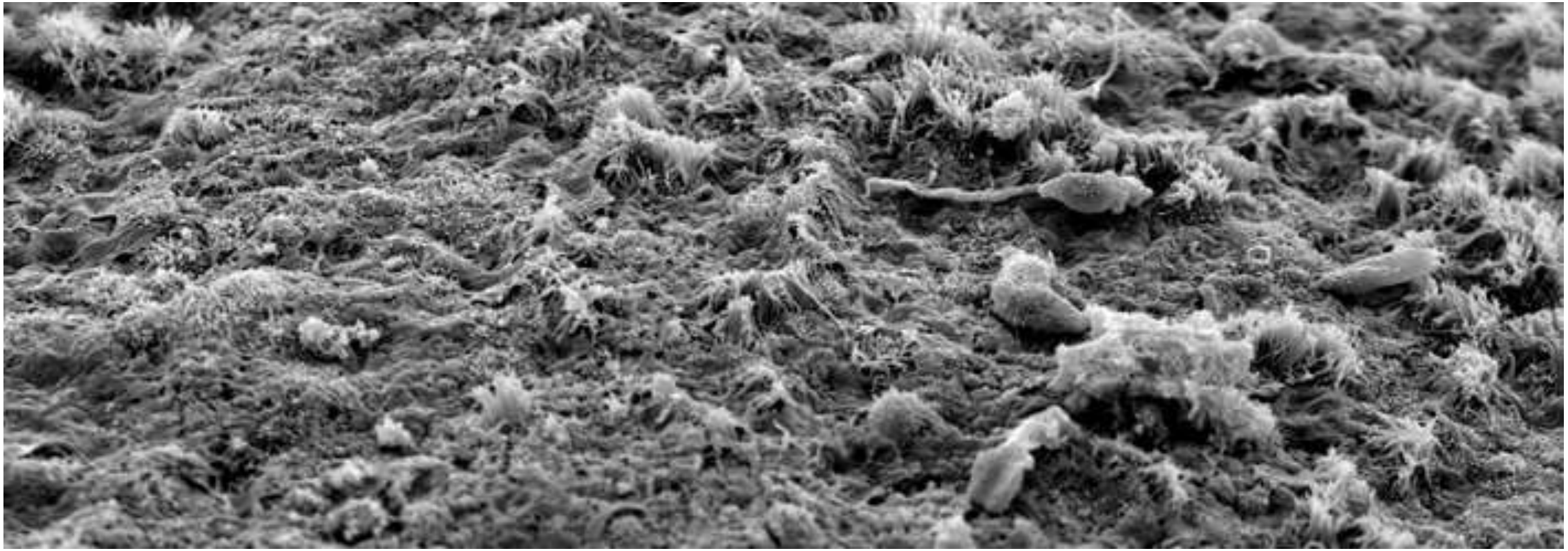
  1. Add actively heat & humidity
  2. Passively retain heat & humidity using a HME

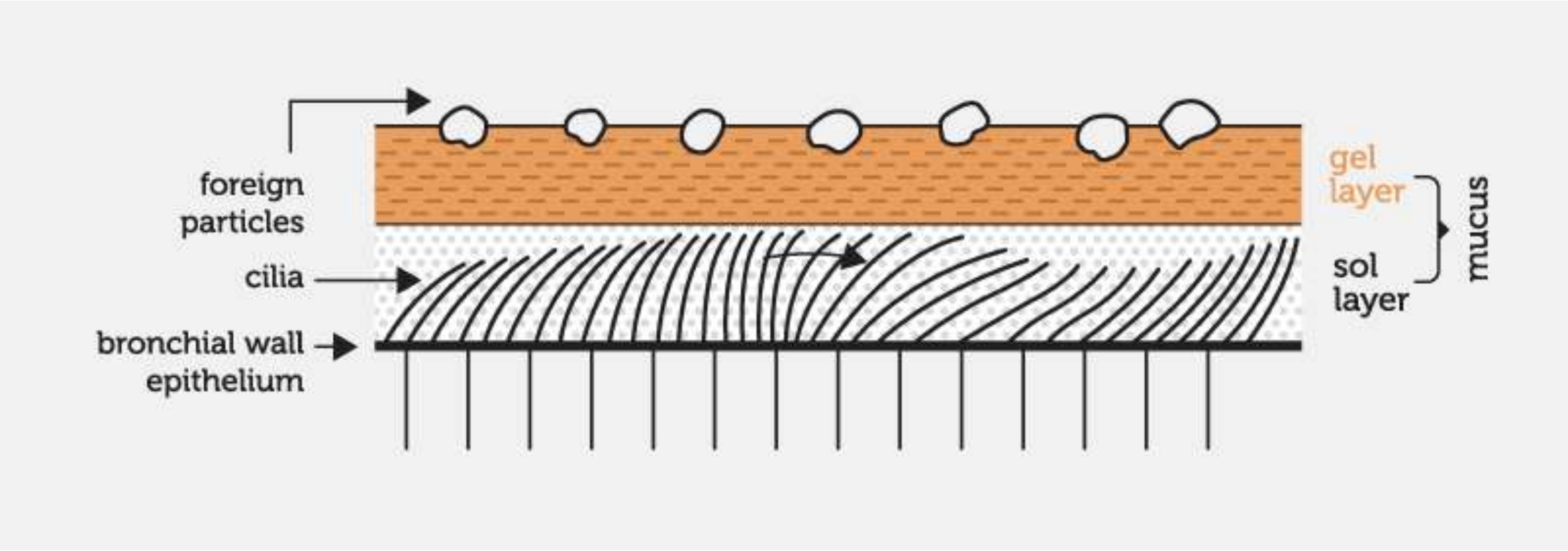
- Clearance
- HME = HMEF

Nose cilia American Rhinologic Society J.A.Alt N.Cohen



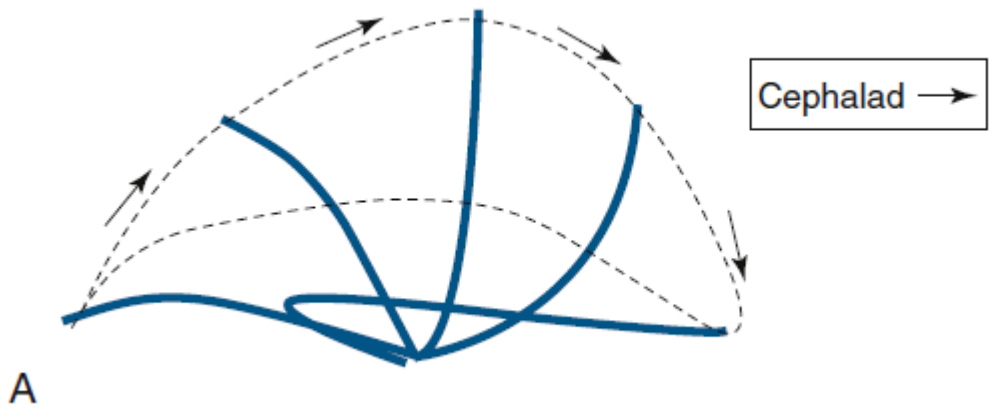
Clotted cilia



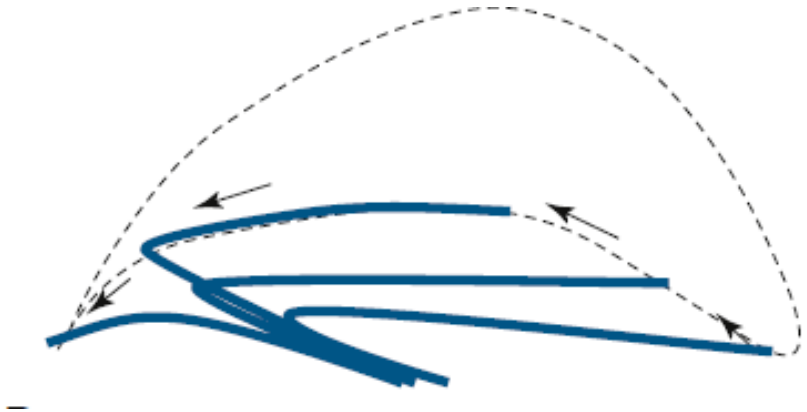

foreign particles
cilia
bronchial wall epithelium
gel layer
sol layer
mucus

Cilial beat cycle

Effective stroke

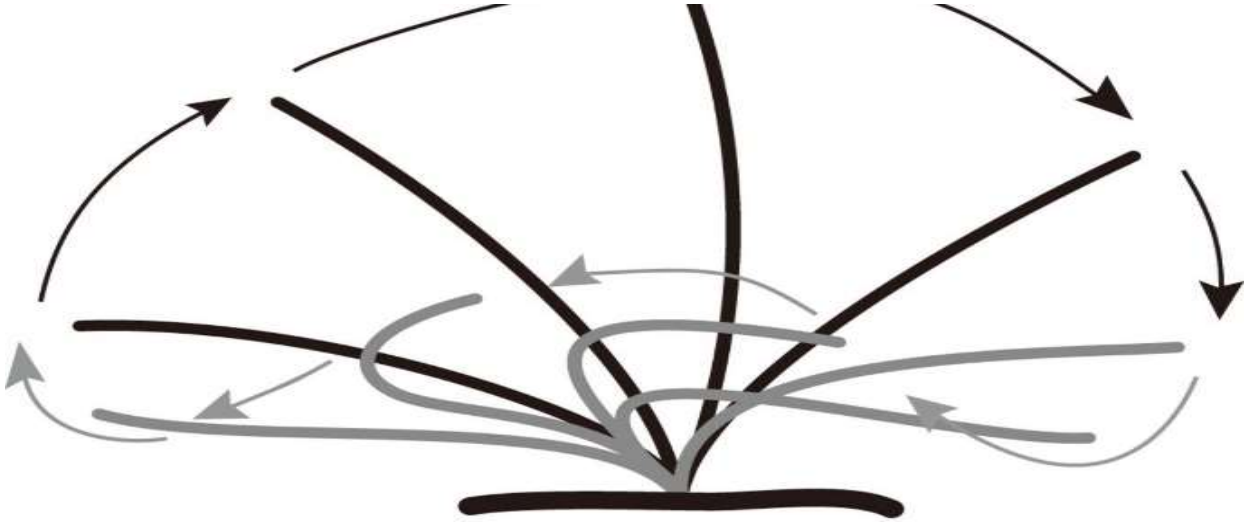


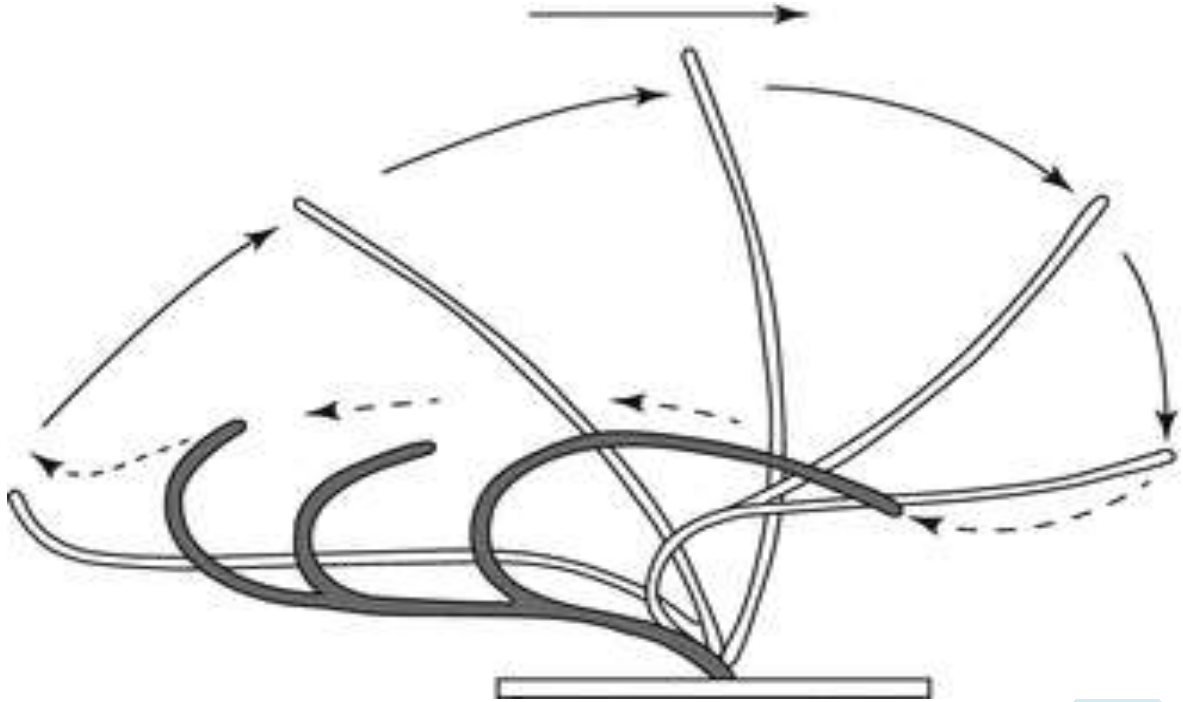
Recovery stroke



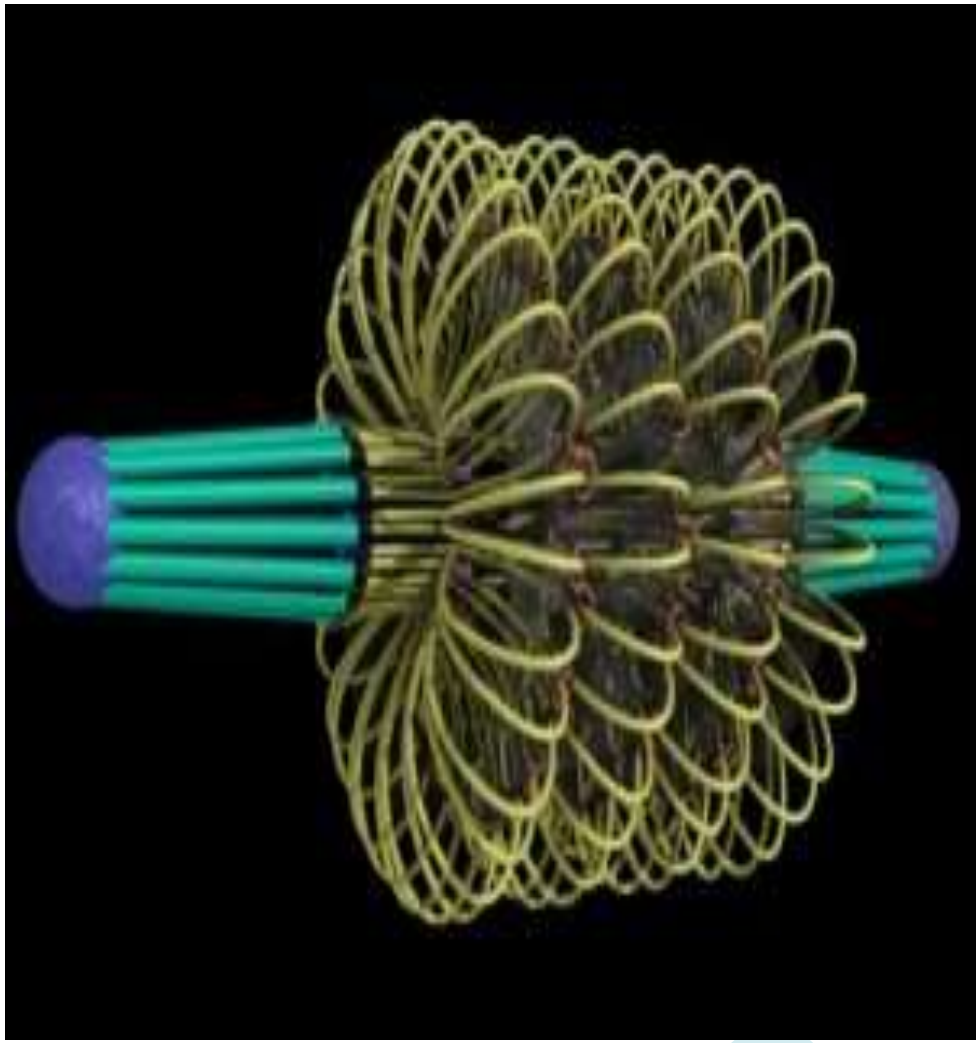
Maire Shelly • Craig Spencer

Mucociliary elevator





Centriole and PI



Where do we need to use them?

Risk of bacterial contamination

- Breathing tubes
- Mechanical ventilators
- Anesthesia circuits
- Nebulizers

Optimal function of filters

- ✓ **Humidity**
- ✓ **Airflow rate**
- ✓ **Filter drying**
- ✓ **Obstruction**
- ✓ **Decreased performance with anesthetic gases**
- ✓ **Build up of toxic gases in closed anesthesia circuits**

Clinical foundations, Hylton J. 2011

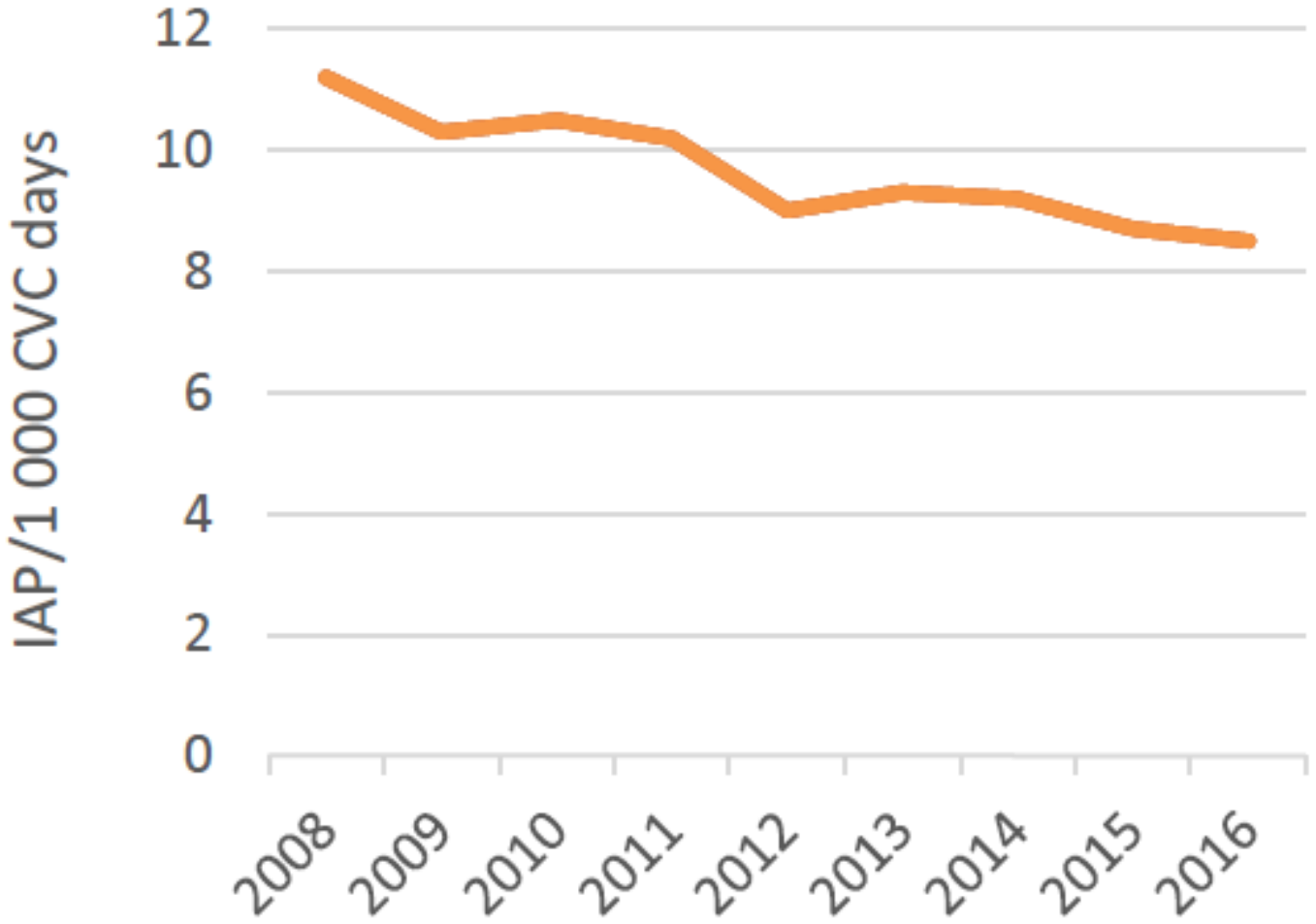
2 types of filters for breathing gases

Mechanical

Electrostatic

Electrostatic filters

ECDC annual report 2015



ECDC Regulations on HMEFS

The minimal physics that explain humidification

Relative humidity

Eg: saturated air 20^0C holds 17mg/l water

37^0C 44mg/l

The magic place = mid trachea

34^0C 34-38mg/l water = rel humidity 95-100%

37^0C 44 distal airways

The minimal physics that explain humidification

Relative
Eg: satura

Daily loss of water and energy of a healthy adult breathing spontaneously is 250ml water + 250kCal

The magic place = mid trachea

34^0C		34-38mg/l water = real humidity 95-100%
37^0C	44	distal airways

If the humidity and T of inspired gases are not optimal, this happens

Williams R et a. Crit Care Med , 1996; 24:1920-9

Humidity deficit

No deficit at BTPS conditions, but

The lowest tolerated deficit without clinical significant dysfunction = -11g/m^3 ∞ 33g/m^3

Anaesthesia conditions

Mean T 30.8^{0}C H 85.8% = 27.3g/m^3

nt

Anesthesia 1969
Chamney AR

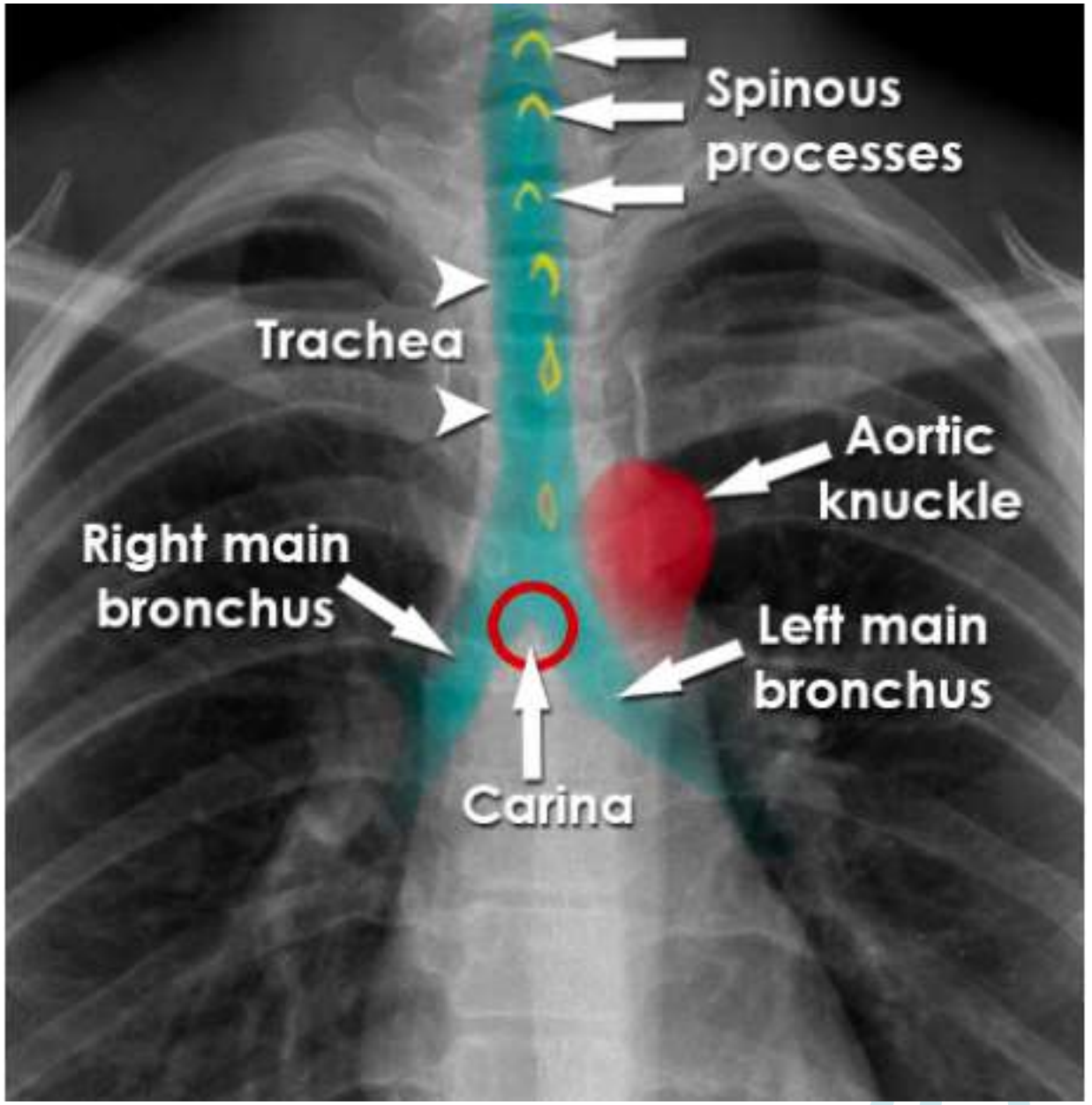
Recommendation

Air that bypasses the upper airways should be warmed at 30^0C and humidified to at least 30g/m^3 ➔➔ ISO 1997 33g/m^3

ISB = isotermic saturation boundary

= inspired air 37^{0}C and

100% relative humidity



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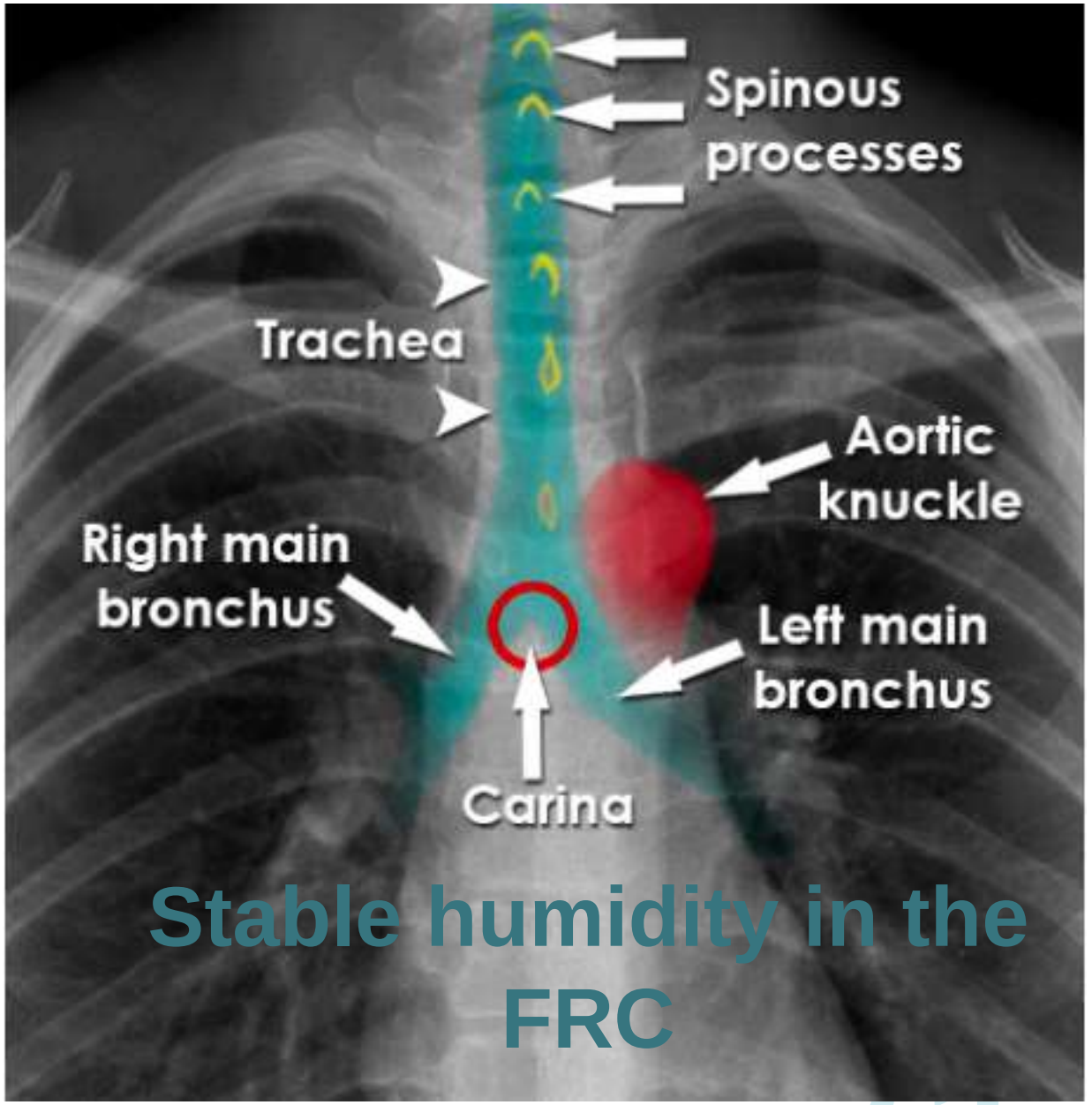
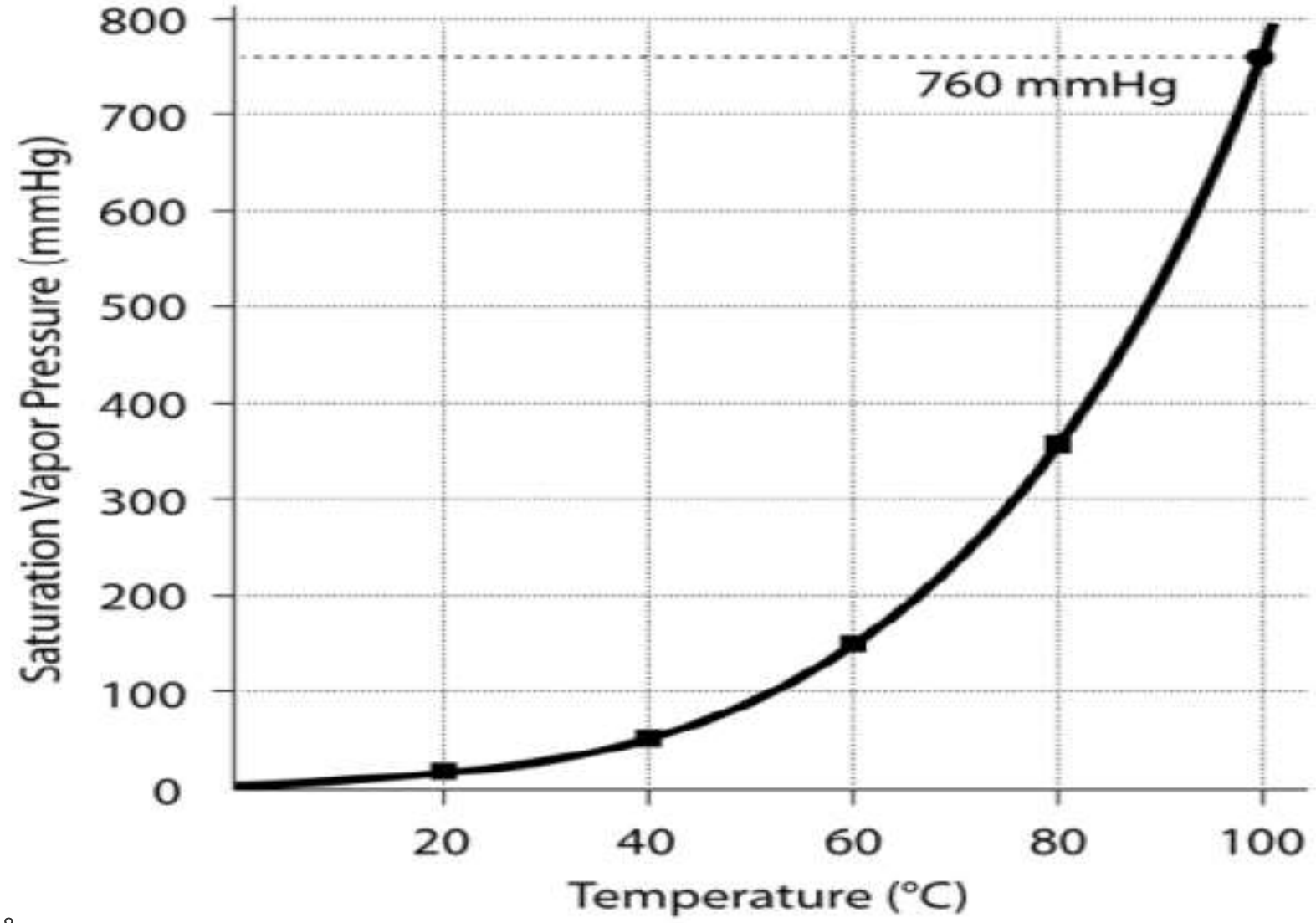


The effect of T on SVP



The effect of T on absolute humidity

Temperature (°C)	Absolute humidity (g/m^3)
0	5
20	17
37	44

Consequences of overhumidification

Water condensation
Water intoxication

Particle deposition

Eisenkraft : 182

1. Inertial impaction
2. Interception
3. Brownian motion
4. Gravitational settling
5. Electrostatic deposition

Particle deposition

Eisenkraft : 182

Aerosols > 10µm

1. Inertial impaction
2. Interception
3. Brownian motion
4. Gravitational settling
5. Electrostatic deposition

Humidification devices

- **Passive = HME**
  - **Hygrosopic**
  - **Hydrophobic**

- **Active = HH**

AIM = absolute humidity levels of 30 – 35mg/l in the trachea.

ISO 9360

Active humidification

Sampath Shenow www.worldanaestheia.org

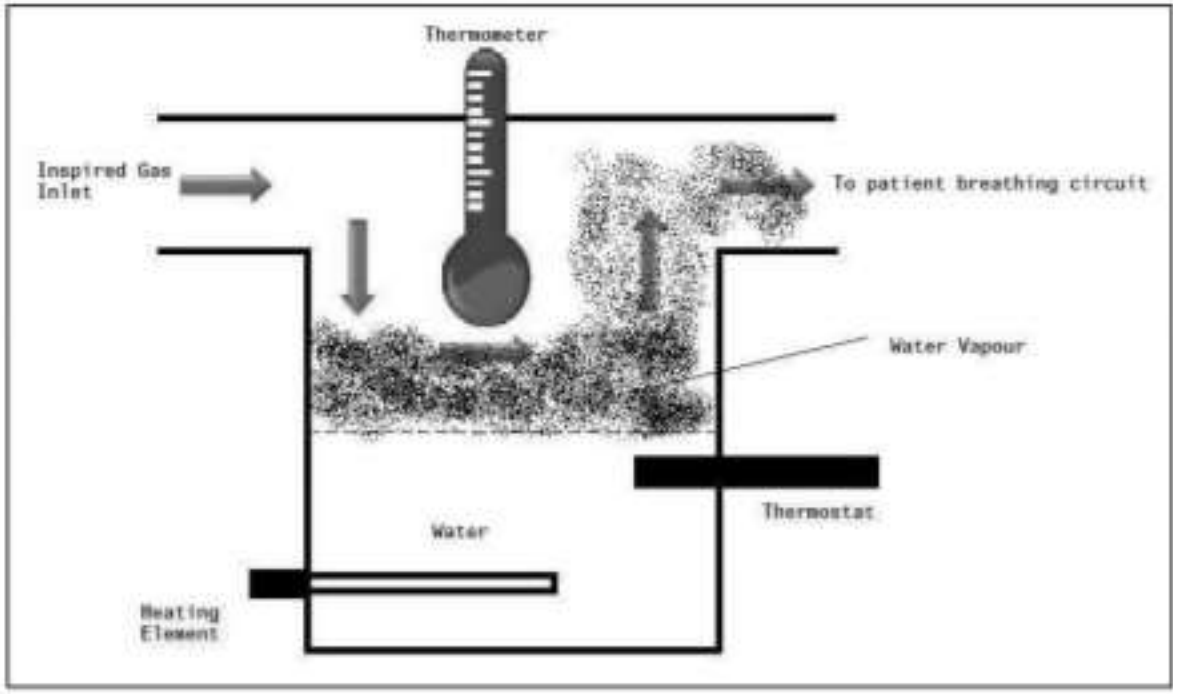


Figure 2. *Hot water bath humidifier*

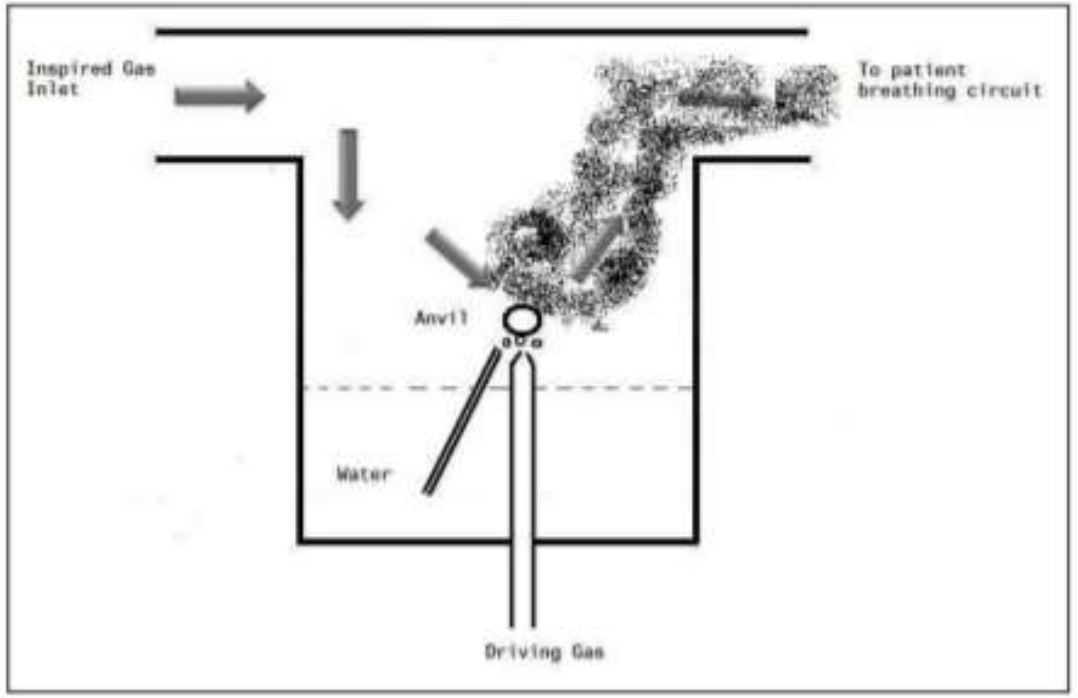
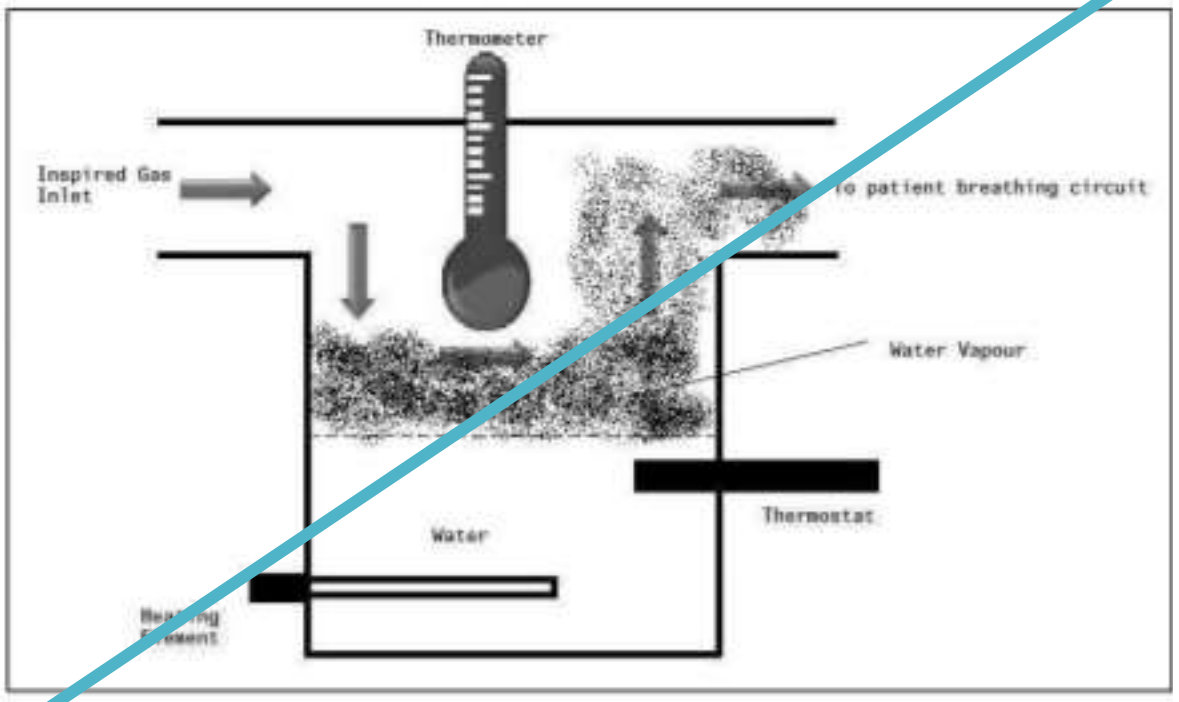


Figure 3. *A nebuliser*

Active humidification

Sampath Shenow www.worldanaestheia.org



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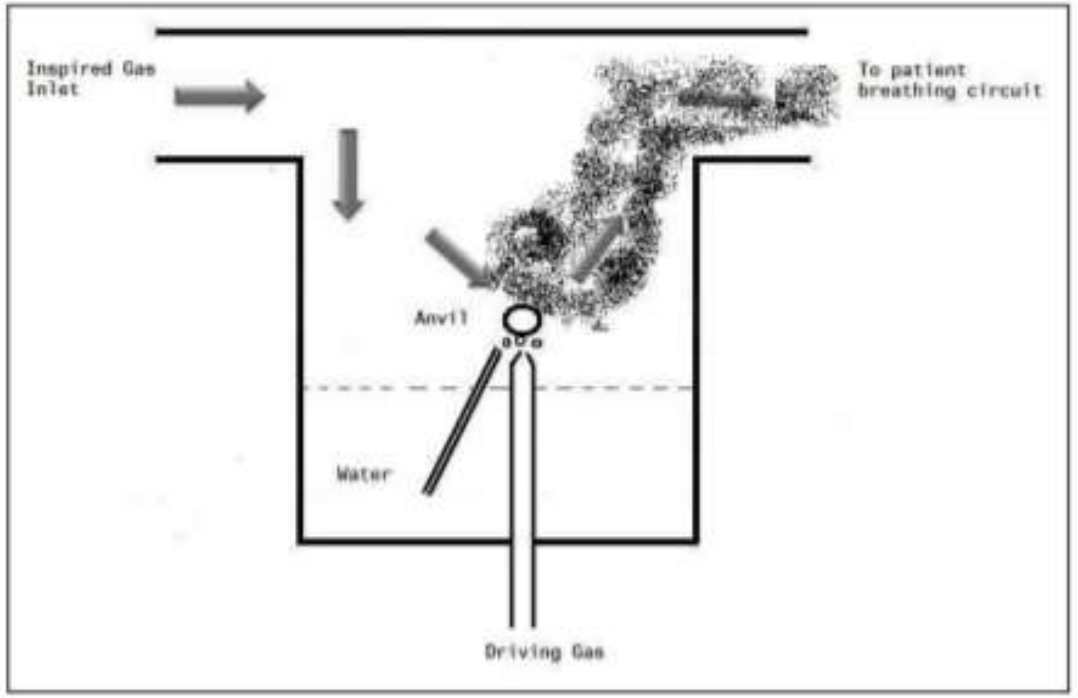


Figure 3. *A nebuliser*

ISO 9360-2:2001(en) Anaesthetic and respiratory equipment — Heat and moisture exchangers (HMEs) for humidifying respired gases in humans — Part 2: HMEs for use with tracheostomized patients having minimum tidal volumes of 250 ml

Buy

Table of contents

Available in: en fr

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Clinical Foundations
A Patient-focused Education Program for Respiratory Care Professionals

Free Continuing Education for Respiratory Therapists (CRCE)
See Page 12

Filtration of breathing gases

By Joe Hylton, BSRT, RRT-NPS, FAARC

Midcalf B. Pharmaceutical Isolators: A Guide to their Application, Design and Control. 2004; Pharmaceutical Press, Gregslake, IL.

Type	Filter Class	Efficiency	Penetration
HEPA	H 10	85%	15%
HEPA	H 11	95%	5%
HEPA	H 12	99.5%	0.5%
HEPA	H 13	99.95%	0.05%
HEPA	H 14	99.995%	0.005%

Dyer ED, Peterson DE. How far do bacteria travel from the exhalation valve of IPPB equipment? Anesth Analg 1972;51:516-519.

32 feet = 9.7536m

Artificial filters

MPPS 0.3µm

- electrostatic
- pleated

Properties of filters

- **Filtration efficiency**
  BFE (bacterial)
  VFE (viral) aprox 3.0µm

- **Salt test 0.3µmNaCl**

Humidification devices

- **Passive = HME**
  - **Hygrosopic**
  - **Hydrophobic**

  Modified HMEs = HMEFs
- **Active = HH**

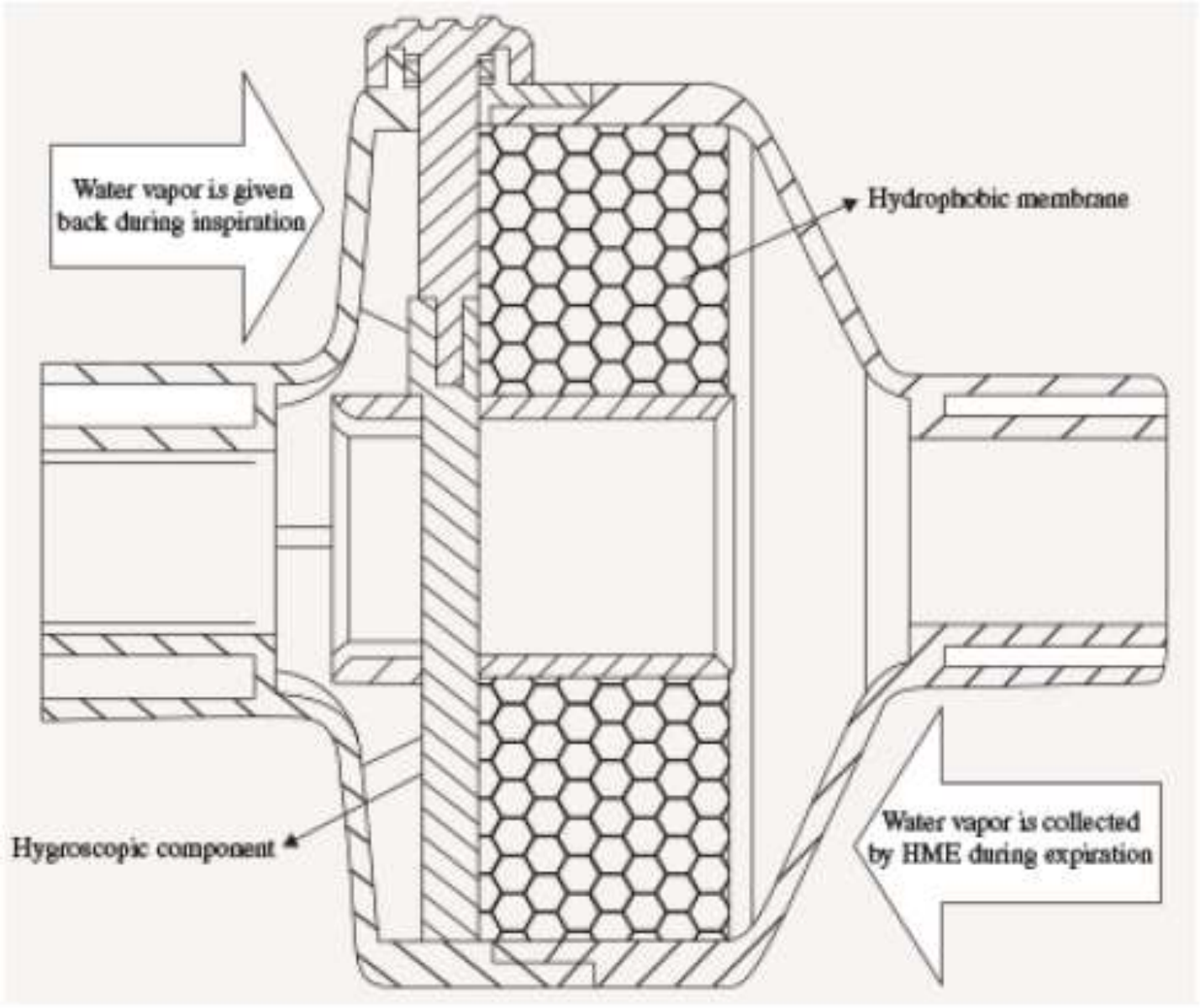
AIM = absolute humidity levels of 30 – 35mg/l in the trachea.

ISO 9360

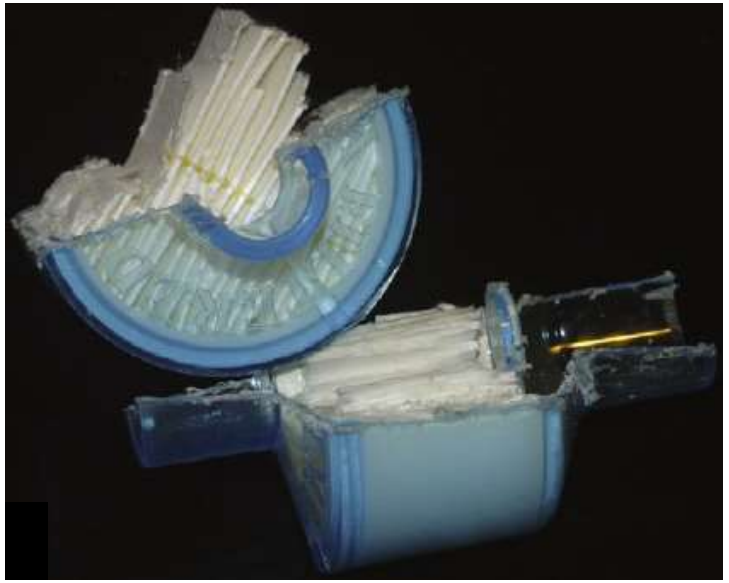
HMEFs pore size<0.2µ

- reduce or remove liquid or solid particles = aerosols
- they help the expiratory limb stay relatively dry, cool & bacteria free
- Avoid condensation of water

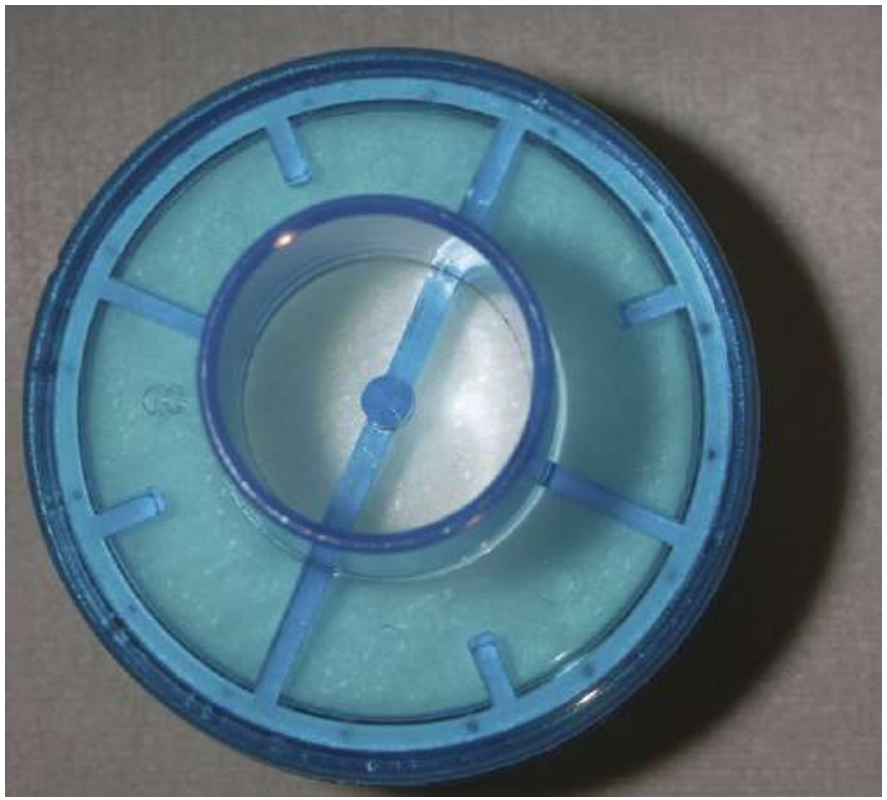
HMEF


Water vapor is given back during inspiration
Hydrophobic membrane
Hygroscopic component
Water vapor is collected by HME during expiration

Portex HMEF



Portex Bacterial Viral Respiratory Filter without HME



Designed for Anesthesia circuits

Polypropylene electrostatically charged membrane

HMEs variations & connectors

HMEFs

HEPASHIELD

LUERSAFE

VENTISHIELD

THERMOSHIELD

NEONATAL HME AND HMEF

THERMOTRACH

PULMONARY FUNCTION TEST FILTER

STERILE FILTERS

INTERSURGICAL
COMPLETE RESPIRATORY SYSTEMS

Quality, innovation and choice in respiratory care

Select your local website International English

Home | About | Products | News | Events | Careers | Support | Contact us | Your route to respiratory care | Product search

Airway Management

Breathing Filters, HMEs and HMEFs

A range of breathing filters, HMEs and combined HMEF products for patient protection and humidification designed for use in anaesthesia and intensive care.

Breathing filters

- Filta-Guard™ range - high efficiency
- Inter-Guard™ range - sterile
- Clear-Guard™ range - medium efficiency
- Hydro-Guard™ range - pleated membrane filter
- Flo-Guard - low resistance breathing filter for CPAP and Bilevel
- Air-Guard - for use in respiratory systems and oxygen concentrators
- Pulmo-Protect™ lung function filter

Heat and moisture exchangers (HMEs)

- Hydro-Trach™ T range
- Hydro-Therm™ HME range
- Hydro-Therm™ 3 HME range

Heat and moisture exchanging filters (HMEFs)

- Filta-Therm™ range - high efficiency
- Inter-Therm™ range - sterile
- Clear-Therm™ range - medium efficiency

Device filtration

- Filters for respirators, ventilators and gas lines
- Suction unit filters
- HEPA filters, foam pre-filters and accessories for oxygen concentrators
- Foam pre-filters and filters for CPAP/bilevel equipment
- Foam pre-filters and filters for ventilators

One offer does not fit all!

Things come in different sizes and configurations!

HH Heating T of the inspired gas 34 - 40^0C

Humidity in Anaesthesia

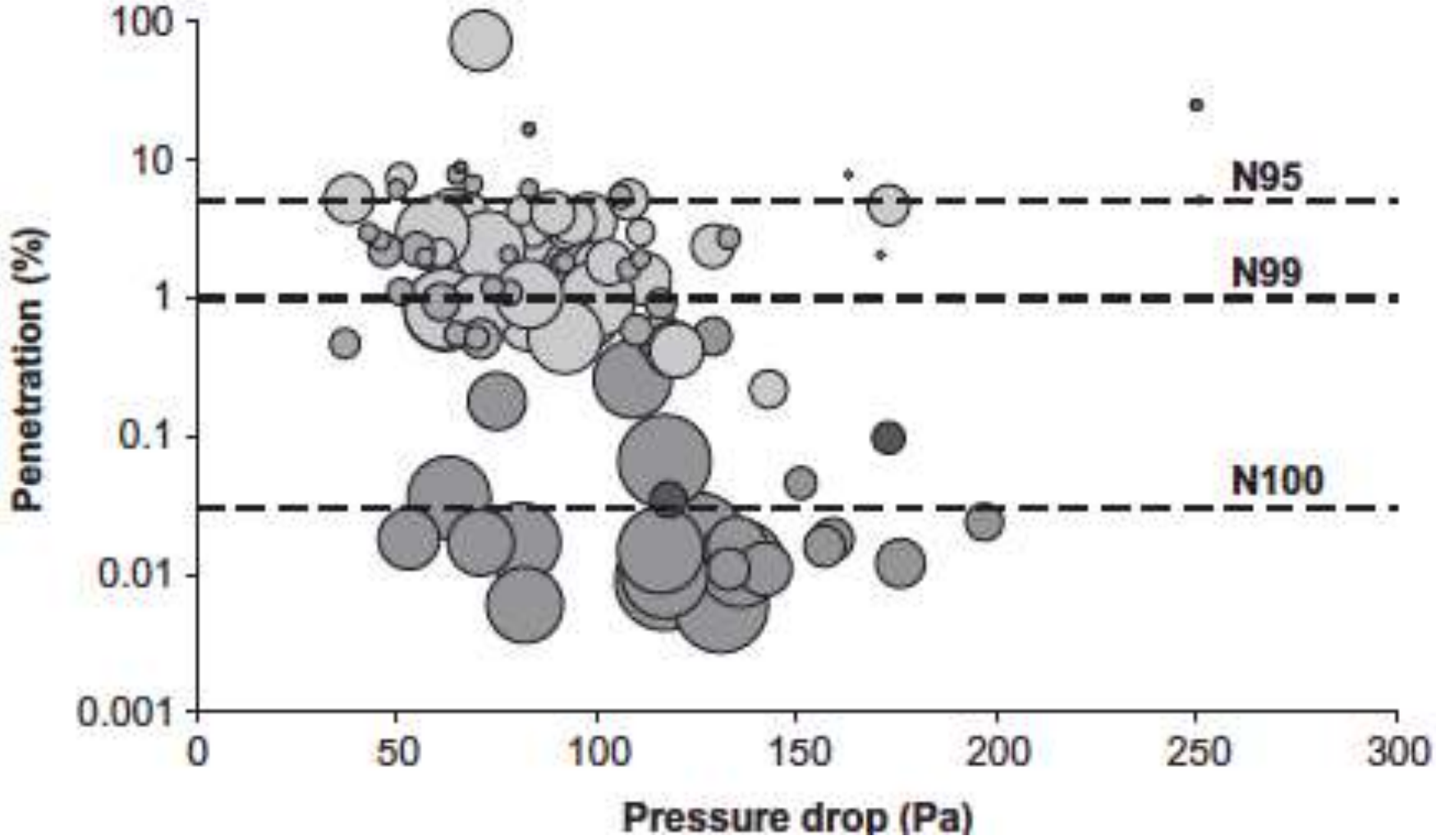
Dr. James Sylvester
CT2 Anaesthetics, Doncaster Royal Infirmary, UK

Edited by
Dr Alex Konstantatos
Consultant, The Alfred, Australia

Correspondence to atotw@wfsahq.org

ANAESTHESIA
TUTORIAL OF THE WEEK
www.wfsahq.org
19th Sept 2017

Penetration through filters against pressure drop



Canakis Anne-Marie et al. Do in-line respiratory filters protect patients? Comparing bacterial removal efficiency of six filters Pediatric Pulmonology 34:336-341 (2002)

6 filters in saturated states compared as to their BRE

Challenged with 1 x 10^4CFU/ml suspension of Pseudomonas aeruginosa

✓There was no difference between saturated and nonsaturated states

✓Or after application of a peak flow

✓Filter thresholds significantly different 10^8 ➔➔10^4

When all filters exposed to the same extreme challenges, significant differences exist in their ability to remove bacteria.

Rules

1. Use either HMEs or HHs! HMEF or HH + a respiratory filter

2. In children, when using HMEs, prioritize low-dead space. Be aware that that they retain less moisture.

3. There are no HMEs licensed for neonates < 3kg, who require active humidification.

Medisize Hygrovent Child

Technical Data

Viral retention	99.9%
Bacterial retention	99.9%
Mode of filtration	electrostatic / mechanical
Humidity inspiration	32 mg H2O/L air Vt 50 ml
Resistance	< 2.0 cm H2O at 10L/min
Connectors	22M/15F and 15M CO2 measurement via luer lock
Weight	12 g (angled) 9 g (straight)
Internal volume	15 ml (angled) 12 ml (straight)
Sterilisation method	Ethylene oxide
User duration	OR: Per patient ICU: max. 24 hours
Shelf life	5 years sterile
Quality System	ISO 13485:2003
Filter housing	transparent, allowing visual inspection
Material	latex free, DEHP free

Product description

The Medisize Hygrovent Child HMEF is a breathing filter with an integrated HME (Heat & Moisture Exchanger) and protects pediatric patients against bacterial and viral infections.

The Medisize Hygrovent Child creates an optimal balance for resistance, compressible volume and filtration efficency. The HME effectively warms and moistens the air to be inhaled.

The Medisize Hygrovent Child is available with two different tube connections. Because of the rotating top positioning is made very easy. CO2-measurement via Luer Lock connector.

The Medisize Hygrovent Child is equipped with a pastel blue ring, indicating a pediatric HME product.

Utilization

- Can be used for children with a breathing volume from 50 to 250 ml.
- Disposable, use once only.
- The Medisize Hygrovent Child can, in consultation with the physician, replace the active humidifier.
- The Medisize Hygrovent Child is mounted close to the patient, at the end of the breathing system and thus protects the breathing system as well as the apparatus against bacterial and viral contamination.

ITEM	CODE
Medisize Hygrovent Child Angled	300 510 000
Medisize Hygrovent Child Straight	300 520 000

DISTRIBUTED BY

Children offer

hnical Data

retention	99.9%
rial retention	99.9%
of filtration	electrostatic / mechanical
dity inspiration	32 mg H2O/L air Vt 50 ml
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life	5 years sterile

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Positioning of HMEs in a breathing circuit for mechanical ventilation

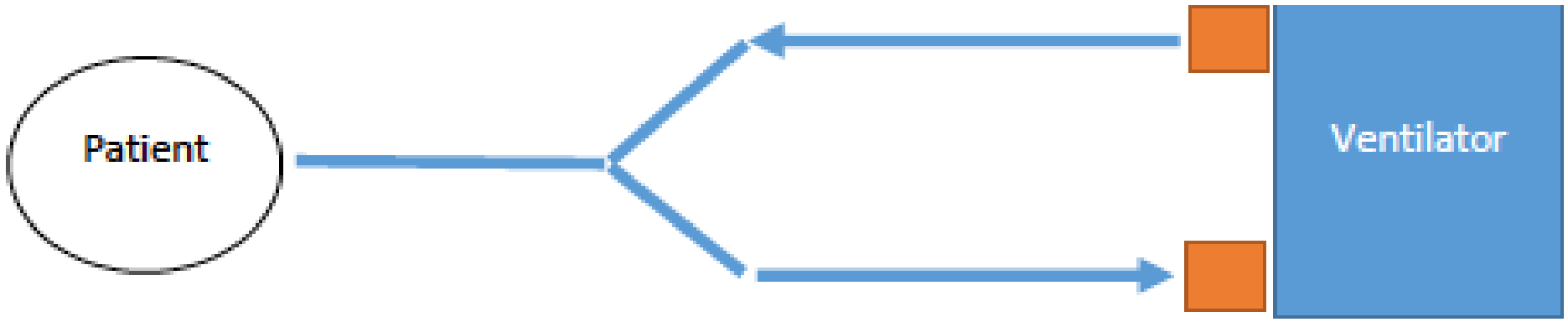
Positions of filters in a breathing circuit for MV

French Regulations & approach

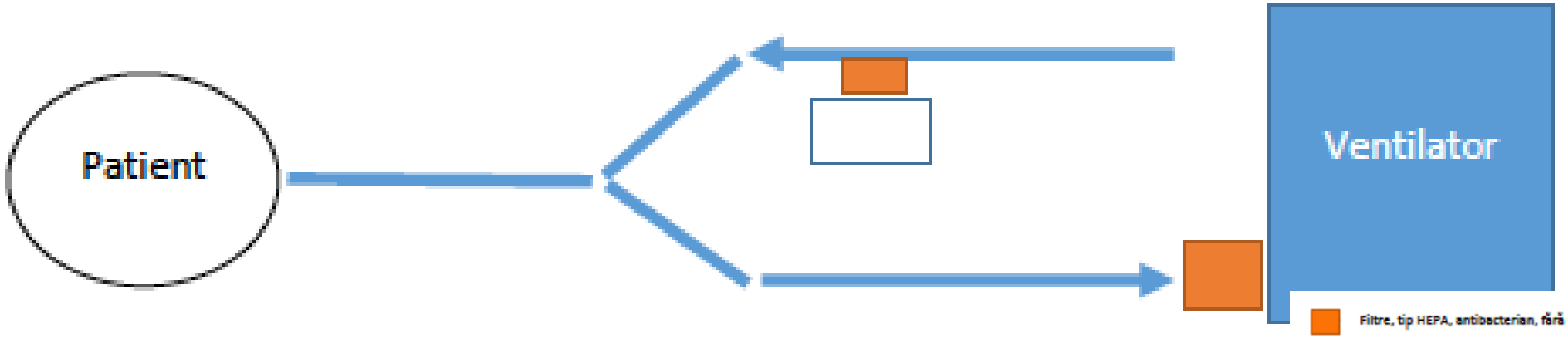
Saire-Maufrey AM et al, Arnette, Hygiene en Anesthesie, 2010

4. Positioning of HMEs in a breathing circuit for mechanical ventilation

Schema 1



Schema 2



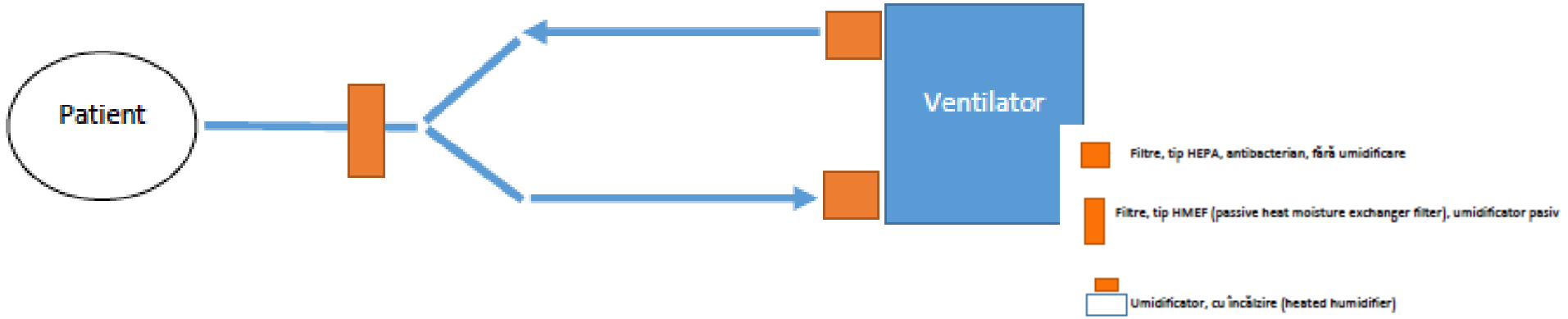
Filtre, tip HEPA, antibacterian, fără umidificare

Filtre, tip HMEF (passive heat moisture exchanger filter), umidificator pasiv

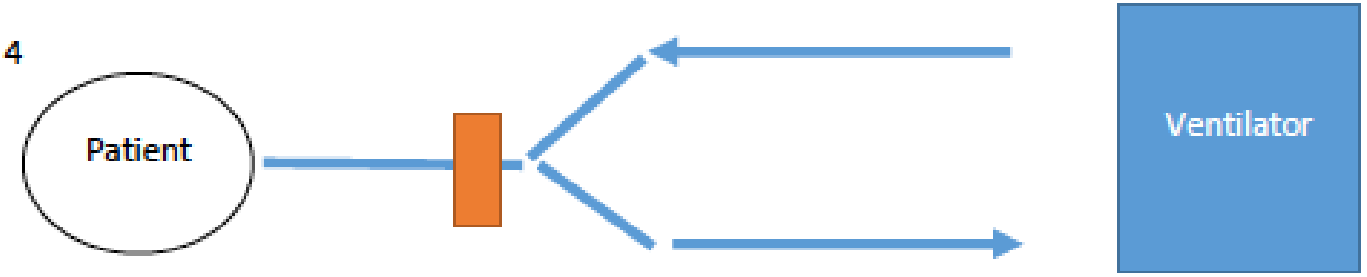
Umidificator, cu încălzire (heated humidifier)

4. Positioning of HMEs in a breathing circuit for mechanical ventilation

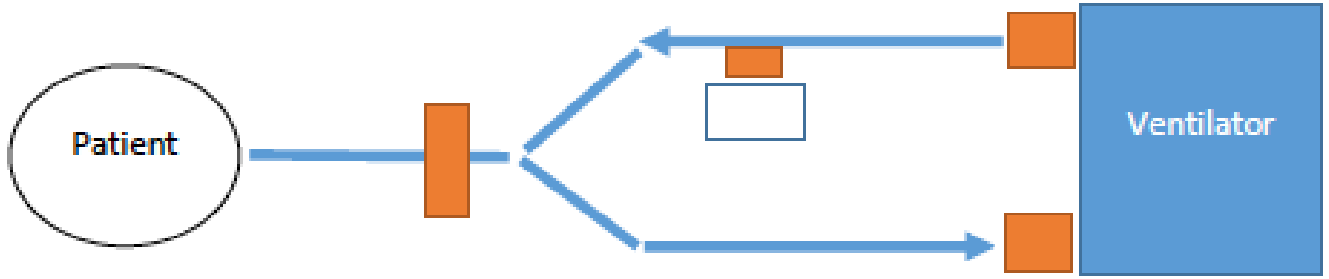
Schema 3



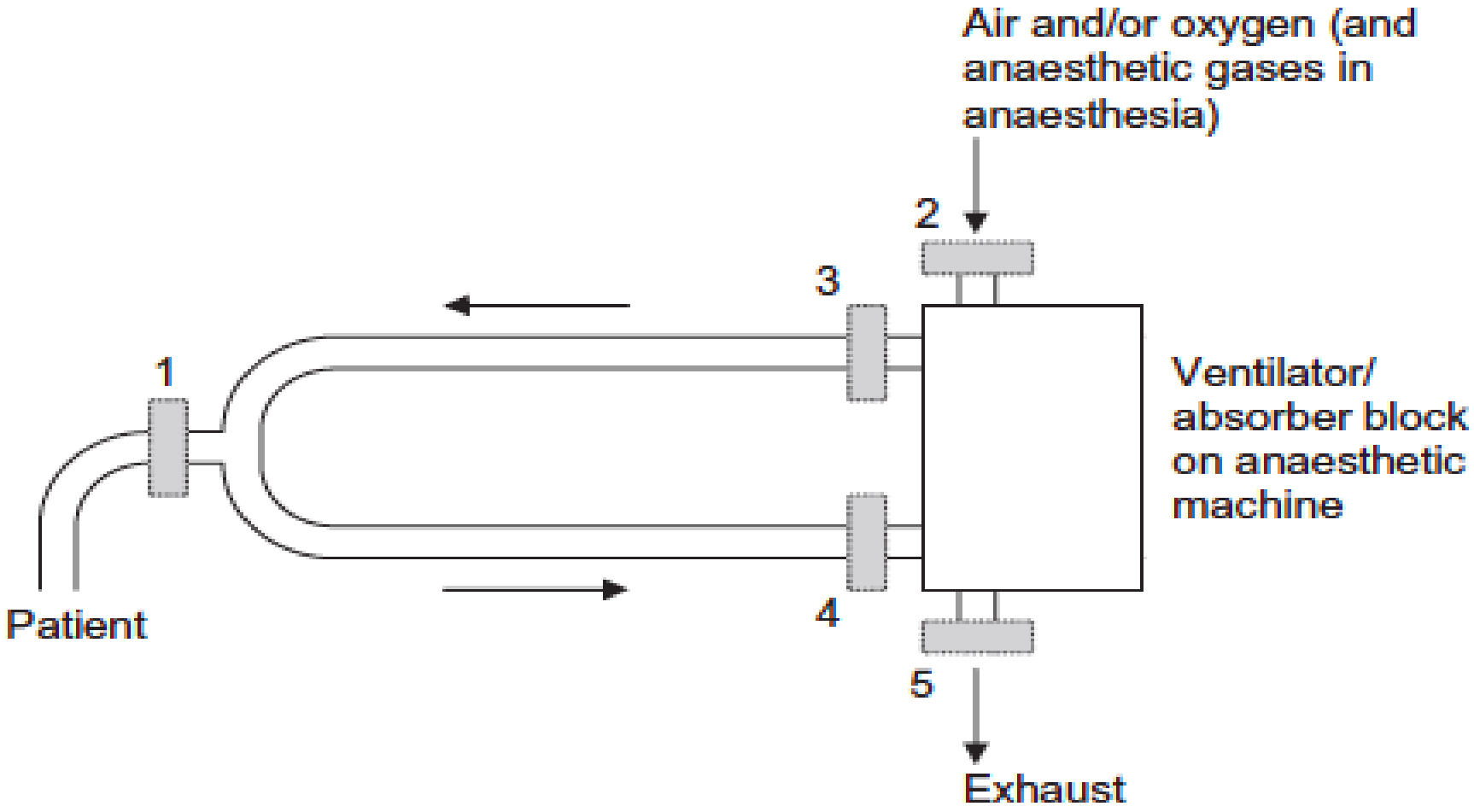
Schema 4



Schema 5



Wilkes 2011

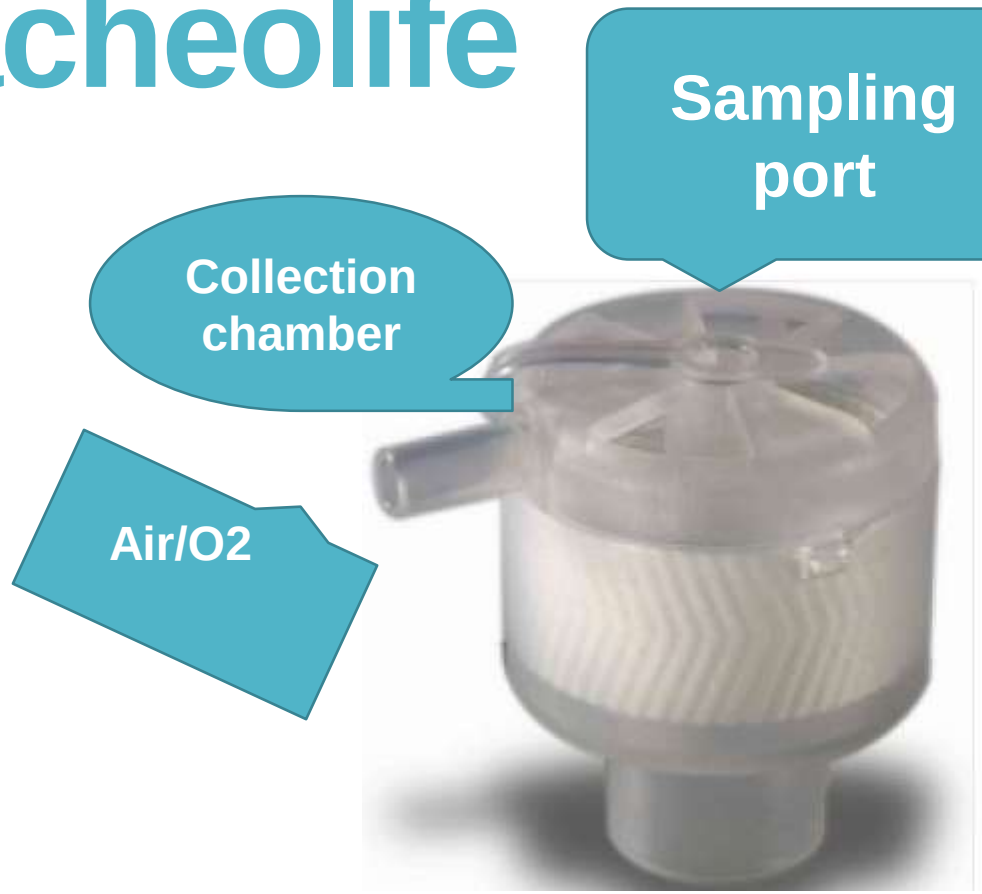

Air and/or oxygen (and anaesthetic gases in anaesthesia)
2
3
1
Ventilator/ absorber block on anaesthetic machine
Patient
4
5
Exhaust

HMEF IN OUR ICU

Condensation of water at the dew point

Tracheolife

Sweedish nose



SWEDISH NOSE TRACHEOLIFE II HME FILTER BX25

Email to a Friend

Be the first to review this product

3

Call For Price

SWEDISH NOSE TRACHEOLIFE II HME FILTER BX25

Rules

1. Use either HMEs or HHs! HMEF or HH + a respiratory filter

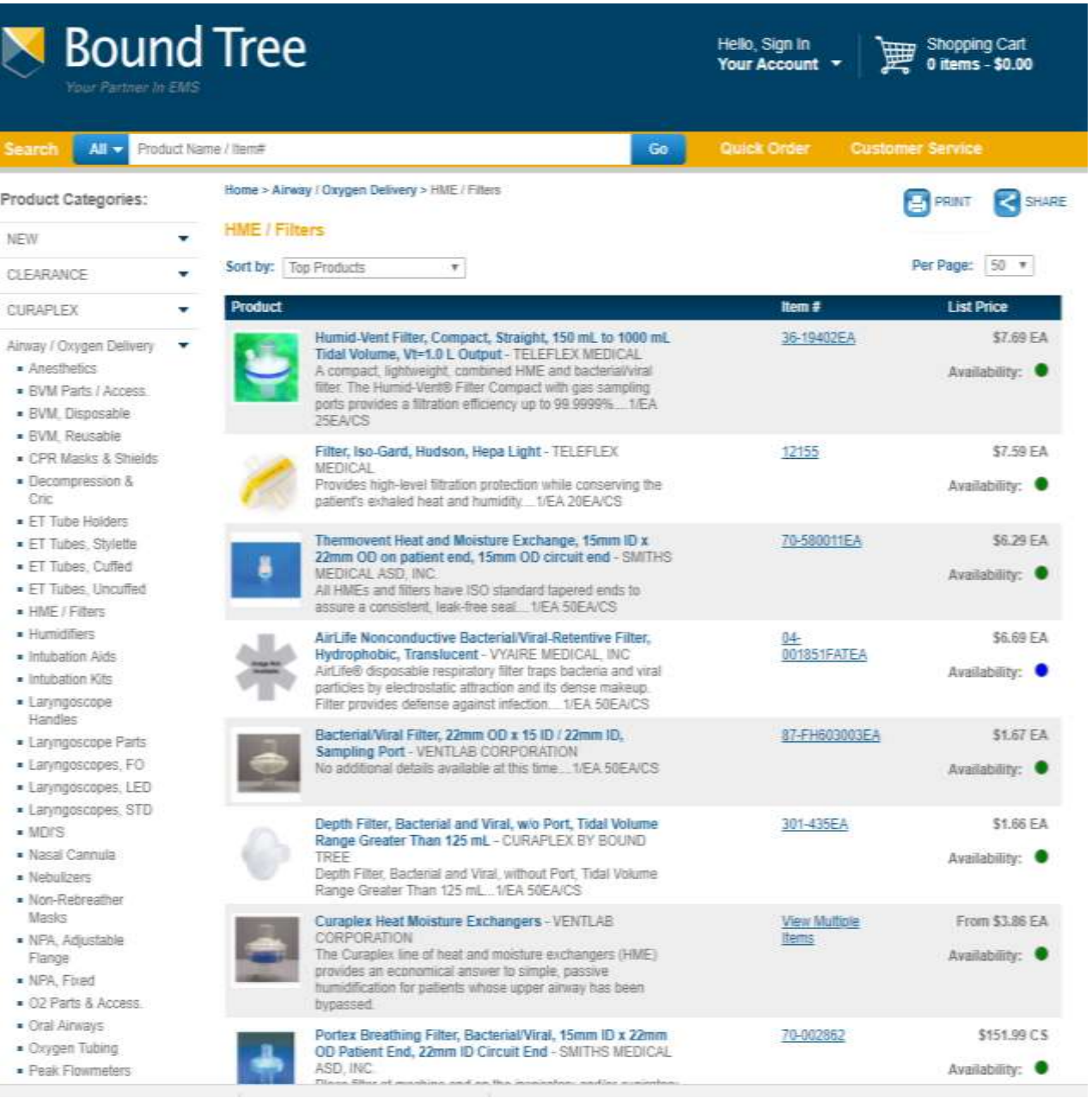
2. In children, when using HMEs, prioritize low-dead space. Be aware that that they retain less moisture.

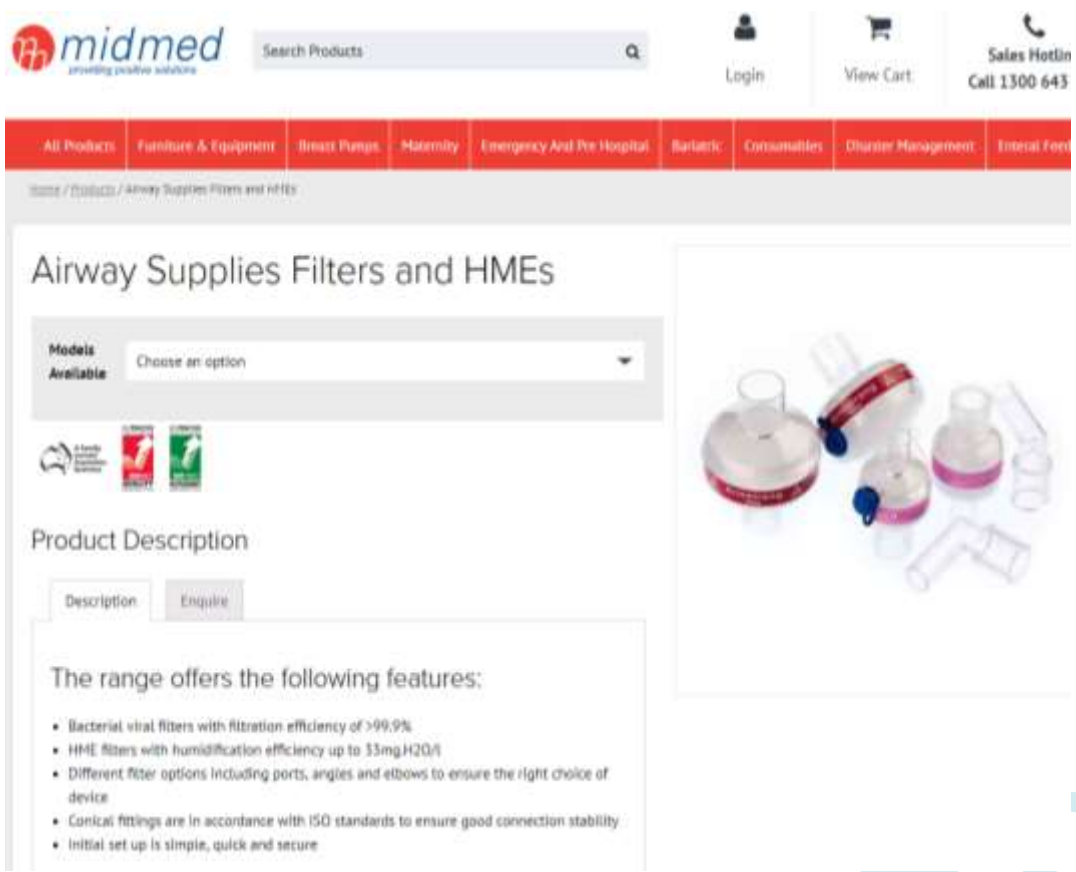
3. There are no HMEs licensed for neonates < 3kg, who require active humidification.

4. Position the respiratory filter as close to the airways as possible.

5. Consider advantageous filters for TS!

Huge offer


Bound Tree
Your Partner in EMS
Hello, Sign In
Your Account
Shopping Cart
0 items - $0.00
Search
All
Product Name / Item#
Go
Quick Order
Customer Service
Product Categories:
NEW
CLEARANCE
CURAPLEX
Airway / Oxygen Delivery
Anesthetics
BVM Parts / Access.
BVM, Disposable
BVM, Reusable
CPR Masks & Shields
Decompression & Cric
ET Tube Holders
ET Tubes, Stylette
ET Tubes, Cuffed
ET Tubes, Uncuffed
HME / Filters
Humidifiers
Intubation Aids
Intubation Kits
Laryngoscope Handles
Laryngoscope Parts
Laryngoscopes, FO
Laryngoscopes, LED
Laryngoscopes, STD
MDI'S
Nasal Cannula
Nebulizers
Non-Rebreather Masks
NPA, Adjustable Flange
NPA, Fixed
O2 Parts & Access.
Oral Airways
Oxygen Tubing
Peak Flowmeters
Home > Airway / Oxygen Delivery > HME / Filters
PRINT
SHARE
HME / Filters
Sort by: Top Products
Per Page: 50
Product
Item #
List Price
Humid-Vent Filter, Compact, Straight, 150 mL to 1000 mL Tidal Volume, Vt=1.0 L Output - TELEFLEX MEDICAL
A compact, lightweight, combined HME and bacterial/viral filter. The Humid-Vent® Filter Compact with gas sampling ports provides a filtration efficiency up to 99.9999%... 1/EA 25EA/CS
36-19402EA
$7.69 EA
Availability:
Filter, Iso-Gard, Hudson, Hepa Light - TELEFLEX MEDICAL
Provides high-level filtration protection while conserving the patient's exhaled heat and humidity... 1/EA 20EA/CS
12155
$7.59 EA
Availability:
Thermovent Heat and Moisture Exchange, 15mm ID x 22mm OD on patient end, 15mm OD circuit end - SMITHS MEDICAL ASD, INC.
All HMEs and filters have ISO standard tapered ends to assure a consistent, leak-free seal... 1/EA 50EA/CS
70-580011EA
$6.29 EA
Availability:
AirLife Nonconductive Bacterial/Viral-Retentive Filter, Hydrophobic, Translucent - VYAIRE MEDICAL, INC
AirLife® disposable respiratory filter traps bacteria and viral particles by electrostatic attraction and its dense makeup. Filter provides defense against infection... 1/EA 50EA/CS
04-001851FATEA
$6.69 EA
Availability:
Bacterial/Viral Filter, 22mm OD x 15 ID / 22mm ID, Sampling Port - VENTLAB CORPORATION
No additional details available at this time... 1/EA 50EA/CS
87-FH603003EA
$1.67 EA
Availability:
Depth Filter, Bacterial and Viral, w/o Port, Tidal Volume Range Greater Than 125 mL - CURAPLEX BY BOUND TREE
Depth Filter, Bacterial and Viral, without Port, Tidal Volume Range Greater Than 125 mL... 1/EA 50EA/CS
301-435EA
$1.66 EA
Availability:
Curaplex Heat Moisture Exchangers - VENTLAB CORPORATION
The Curaplex line of heat and moisture exchangers (HME) provides an economical answer to simple, passive humidification for patients whose upper airway has been bypassed.
View Multiple Items
From $3.86 EA
Availability:
Portex Breathing Filter, Bacterial/Viral, 15mm ID x 22mm OD Patient End, 22mm ID Circuit End - SMITHS MEDICAL ASD, INC.
70-002862
$151.99 CS
Availability: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All Products
Furniture & Equipment
Breast Pumps
Maternity
Emergency And Pre Hospital
Bariatric
Consumables
Disaster Management
Airway Supplies Filters and HMEs
Models Available
Choose an option
Product Description
Description
Enquire
The range offers the following features:
Bacterial viral filters with filtration efficiency of >99.9%
HME filters with humidification efficiency up to 33mgH2O/l
Different filter options including ports, angles and elbows to ensure the right choice of device
Conical fittings are in accordance with ISO standards to ensure good connection stability
Initial set up is simple, quick and secure

profusion levels.

Humid-Vent® Filter Pedi - TELEFLEX MEDICAL
The Humid-Vent® Pedi combined filter/HME is for children weighing 16-80lbs.

36-11012 — $257.99 CS — Availability:

Teleflex Humid-Vent 2S HME, Flexible - TELEFLEX MEDICAL
The Teleflex Humid-Vent 2 is a hygroscopic condensing humidifier designed for use in anesthesia and i

660866 — $6.09 EA — Availability:

Iso-Gard HEPA Light, Weight: 34 g., 80 mL Dead Space - TELEFLEX MEDICAL
Features HME properties: 26 mg H2O/L air at Vt 500, can be used on pediatric to adult patients, bacterial/viral filtration efficiency: 99.9999+%, and has 22mm I.D. x 22mm O.D./15mm I.D. connectors....1/CS

28022 — $191.99 CS — Availability:

Bacteria Filter, Clear, 22mm Male x 22mm Female - ALLIED HEALTHCARE PRODUCTS INC
Bacterial filtration efficiency ? 99.8%. Mean particle size 3.1 micron, lab report #18112. 22 mm Male x 22 mm Female, 50/case....1/EA 50EA/CS

21-64020EA — $3.89 EA — Availability:

Heat Moisture Exchanger Filters (HMEF), Electrostatic Filter - CURAPLEX BY BOUND TREE
Heat moisture exchanger filters (HMEF) Aero-Sat™ Filter Compact Straight are designed to help improve patient outcomes while reducing the overall cost of care.

View Multiple Items — From $6.09 EA — Availability:

Humid-Vent Filter, Compact, Angled, 150 mL to 1000 mL Tidal Volume, Vt=1.0 L Output - TELEFLEX MEDICAL
A compact, lightweight, combined HME and bacterial/viral filter. The Humid-Vent® Filter Compact with gas sampling ports provides a filtration efficiency up to 99.9999%....1/BX

36-18402 — $180.99 CS — Availability:

Hydrophobic Filter, 1/8 NPT and Ferrule Connection, Threaded At One End, for Easy Go Vac Aspirator - PRECISION MEDICAL
Hydrophobic filter, 1/8 NPT and ferrule connection, threaded at one end, for Easy Go Vac Aspirator.

715-502438 — $17.49 EA — Availability:

Tracheolife II Heat Moisture Exchanger HME, with Oxygen Port, Disposable - COVIDIEN
Single use device, complete with oxygen port positioned to allow heating and humidification of all inspired gases.

2358-90453 — $50.99 CS — Availability:

Pall Filter with Elbow - WESTMED, INC.
No additional details are available at this time.

963-F300AEA — $10.19 EA — Availability:

Iso-gard HEPA Small, Angled, Child/Adult *Discontinued* - TELEFLEX MEDICAL
This item has been discontinued. There is no suggested replacement at this time.

028052 — $162.99 CS — Availability:

CAREvent Air Intake Filter & Cover for ATV, ATV+ & MRI - O-TWO MEDICAL TECHNOLOGIES INC
Filter and cover come complete. Filter and cover are replaced when using 60% oxygen and pulling in ambient air....1/CS

674-17MP7327-CS — $73.99 CS — Availability:

- Apparel / Uniforms
- Diagnostics
- Equipment Bags
- First Aid
- Immobilization
- Infection Control
- Instruments / Personal
- Inventory Management
- IV / Drug Delivery
- Kits
- MCI / Triage
- Monitoring / Defibrillation
- Oxygen Equipment
- Patient Handling
- Pharmaceuticals
- Public Safety
- Recertified Products
- Reference / Reporting
- Service Plans
- Specialized Rescue
- Splinting
- Suction
- Tactical Medicine
- Trauma / Wound Care
- Training Products
- Browse All Products »
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Main Flow Bacterial / Viral Filter - TELEFLEX MEDICAL
Features 22 mm I.D. x 15 mm I.D./22 mm O.D., bacterial filtration efficiency: 99.999+%, viral filtration efficiency: 99.99+%, dead space: 42 mL, and flow resistance: approx 1.5 cmH2O at 60 LPM.

2358-01605 — $2.19 EA — Availability:

Hygroboy, DAR Combined Filter/HME, Electrostatic, Tidal Volume 70-250ml, Pediatric - COVIDIEN
Single patient, combined Filter/HME, pediatric, for use on anesthetized patients and respiratory care patients who require a breathing circuit. Standard 15mm and 22mm fitting. Replace every 24 hours....1/EA 50EA/CS

2358-43035 — $6.79 EA — Availability:

Exhalometer Bacterial/Viral Filter, for MRDs w/19mm Expiratory Ports - VENTLAB CORPORATION
Accepts 19 mm-30 mm PEEP Valve...1/EA 50EA/CS

87-BF102EA — $2.01 EA — Availability:

Ballard HME filter, 1500 Tidal Volume, 22m/15F x 15M - HALYARD HEALTH
Heat and Moisture Exchangers (HME) can be used in Respiratory and Anesthesia. Single patient use. Tidal Volume Range, up to 1500ml

108-153 — $227.99 CS — Availability:

Curaplex FENEM CO2 Indicator - CURAPLEX BY BOUND TREE
The FENEM® CO2 indicators are a simple, convenient way to monitor a patient's endotracheal tube placement and profusion levels.

View Multiple Items — From $25.29 EA — Availability:

Humid-Vent® Filter Pedi - TELEFLEX MEDICAL
The Humid-Vent® Pedi combined filter/HME is for children weighing 16-80lbs.

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36-18402 — $180.99 CS — Availability:

Aerosols and RF, HMEFs

- intermittent to be prioritized (breath actuated)

- *7 x > antibiotics in the airways vs continuous*

- *Humidity ➔➔🡻 efficiency of aerosol delivery by 40 – 50% when compared to dry circuits*

Dhand J Am J Resp Crit Care Med 168;2003: 1148-1149

Aerosols and RF, HMEFs = unregulated

- intermittent to be prioritized (breath actuated)

- *7 x > antibiotics in the airways vs continuous*

- *Humidity ➔➔🡻 efficiency of aerosol delivery by 40 – 50% when compared to dry circuits*

Dhand J Am J Resp Crit Care Med 168;2003: 1148-1149

Albuterol Delivery by 4 Different Nebulizers Placed in 4 Different Positions in a Pediatric Ventilator In Vitro Model

Ariel Berlinski MD and J Randy Willis RRT-NPS

Respiratory Care 2013; 58(7):1124-1131

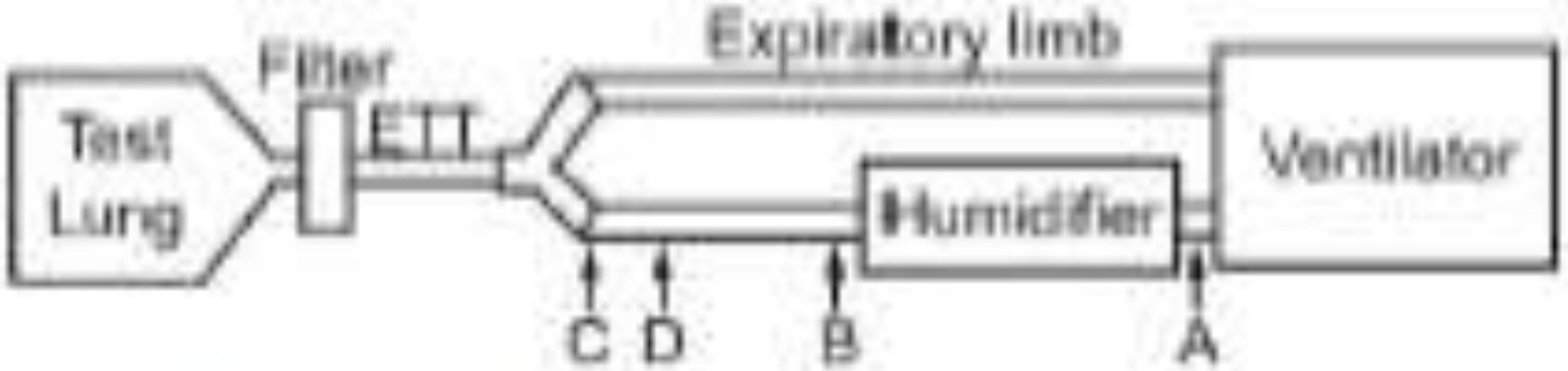

Fig. 2. Testing set-up. Position A: At the ventilator on the inspiratory side. Position B: Between the humidifier and the inspiratory limb. Position C: Between the inspiratory limb and the Y-piece. Position D: In the inspiratory limb, 30 cm before the Y-piece. ETT = endotracheal tube.

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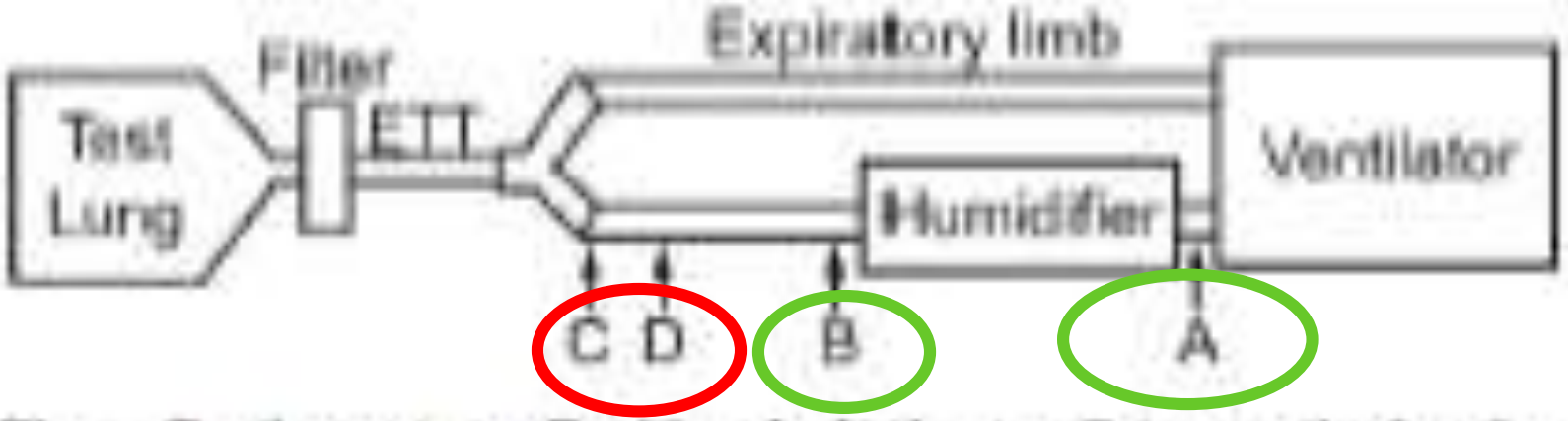

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Effect of Tidal Volume and Nebulizer Type and Position on Albuterol Delivery in a Pediatric Model of Mechanical Ventilation

Ariel Berlinski MD and J Randy Willis RRT-NPS

Increasing VT during nebulization did not increase the lung dose/delivery efficiency.

Resc Care 2015; 60 (10): 1424-1434

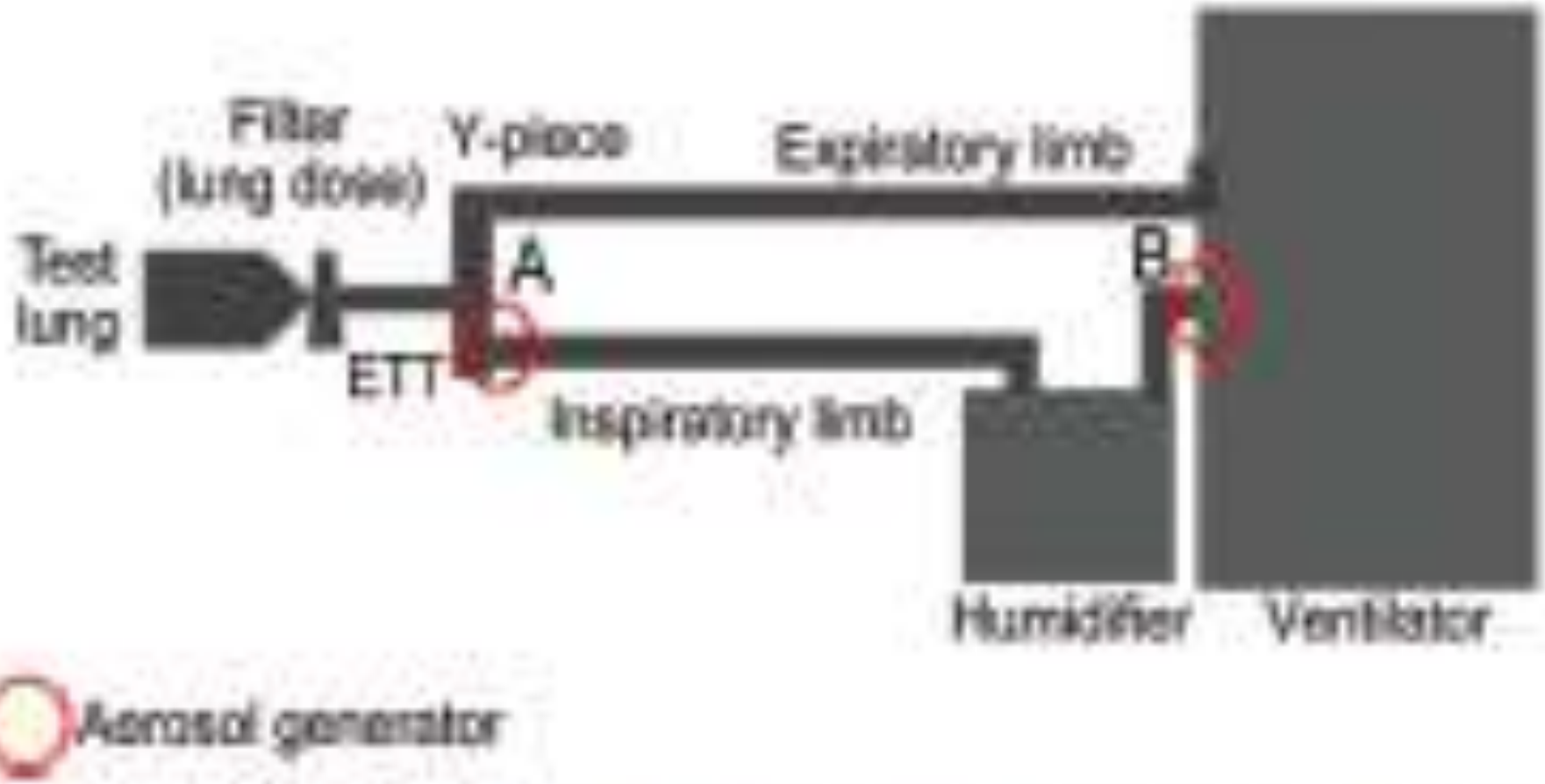
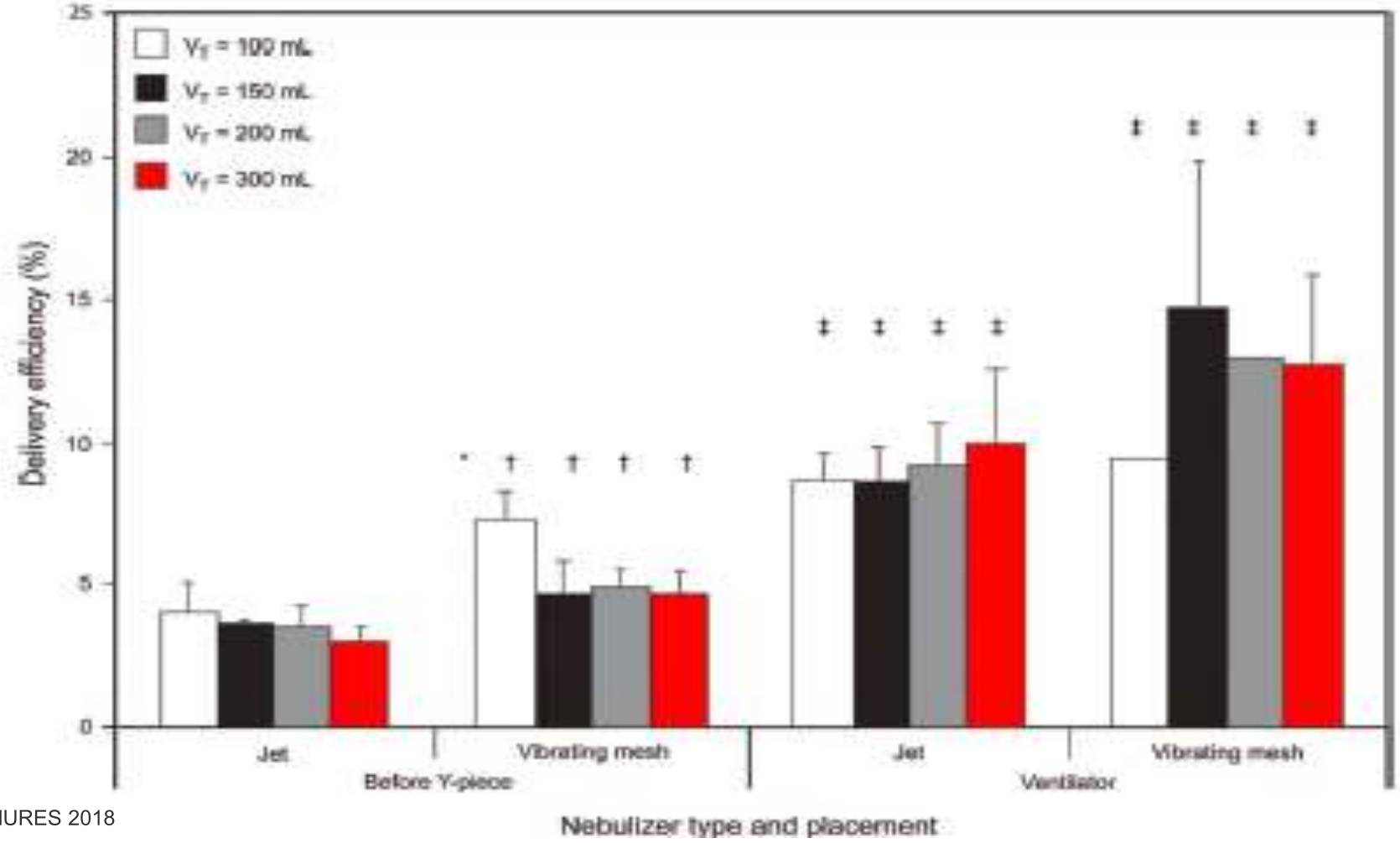


Fig. 1. Experimental setup. Position A is at the inspiratory limb, before the Y-piece, and position B is at the ventilator. ETT = endotracheal tube.

Albuterol delivery



British Journal of Anaesthesia **94** (5): 675–82 (2005)
doi:10.1093/bja/aei091 Advance Access publication February 25, 2005

BJA

Performance of breathing filters under wet conditions: a laboratory evaluation†

D. Turnbull[1]*, P. C. Fisher[2], G. H. Mills[1] and N. J. Morgan-Hughes[3]

How do filters perform under wet conditions?

- 14 types of filters tested HMEF
- pressure across at a flow of 60l/min
- ceramic pleated hydrophobic filters did not absorb saline & their resistance did not change
- composite filters (polyurethane foam, cellulose) absorbed saline ➔↑ resistance of 70 – 480%

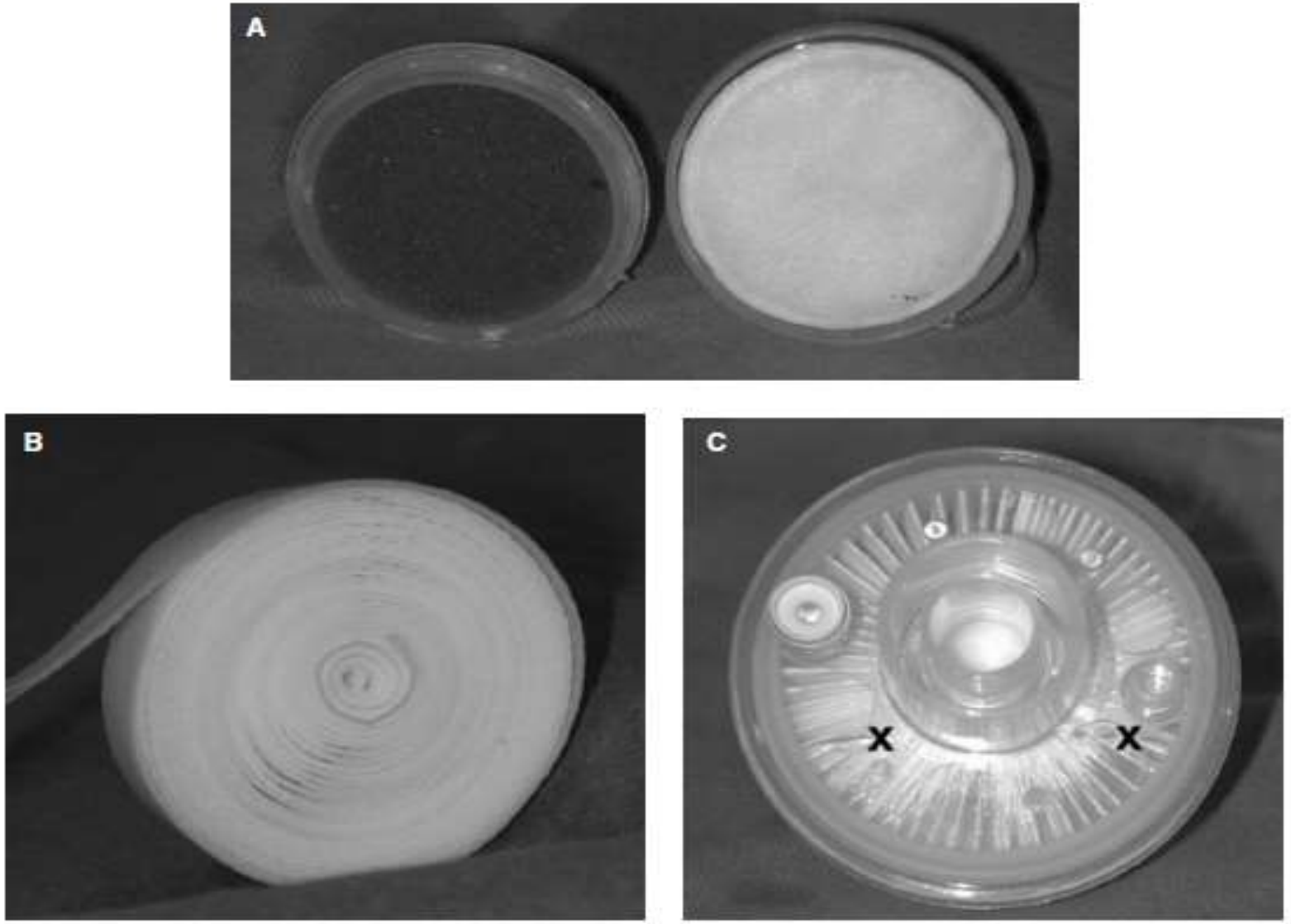


Fig 1 (A) Composite filter divided in two parts to illustrate polyurethane foam HME (left) and the polypropylene viral/bacterial filter (right). (B) Coiled corrugated cellulose paper HME removed from the HMEF housing. (C) An example of a pleated ceramic filter (Airsafety Maxipleat). Fluid level at '×' indicated visible excess fluid within filter housing.

British Journal of Anaesthesia 94 (5): 675–82 (2005)
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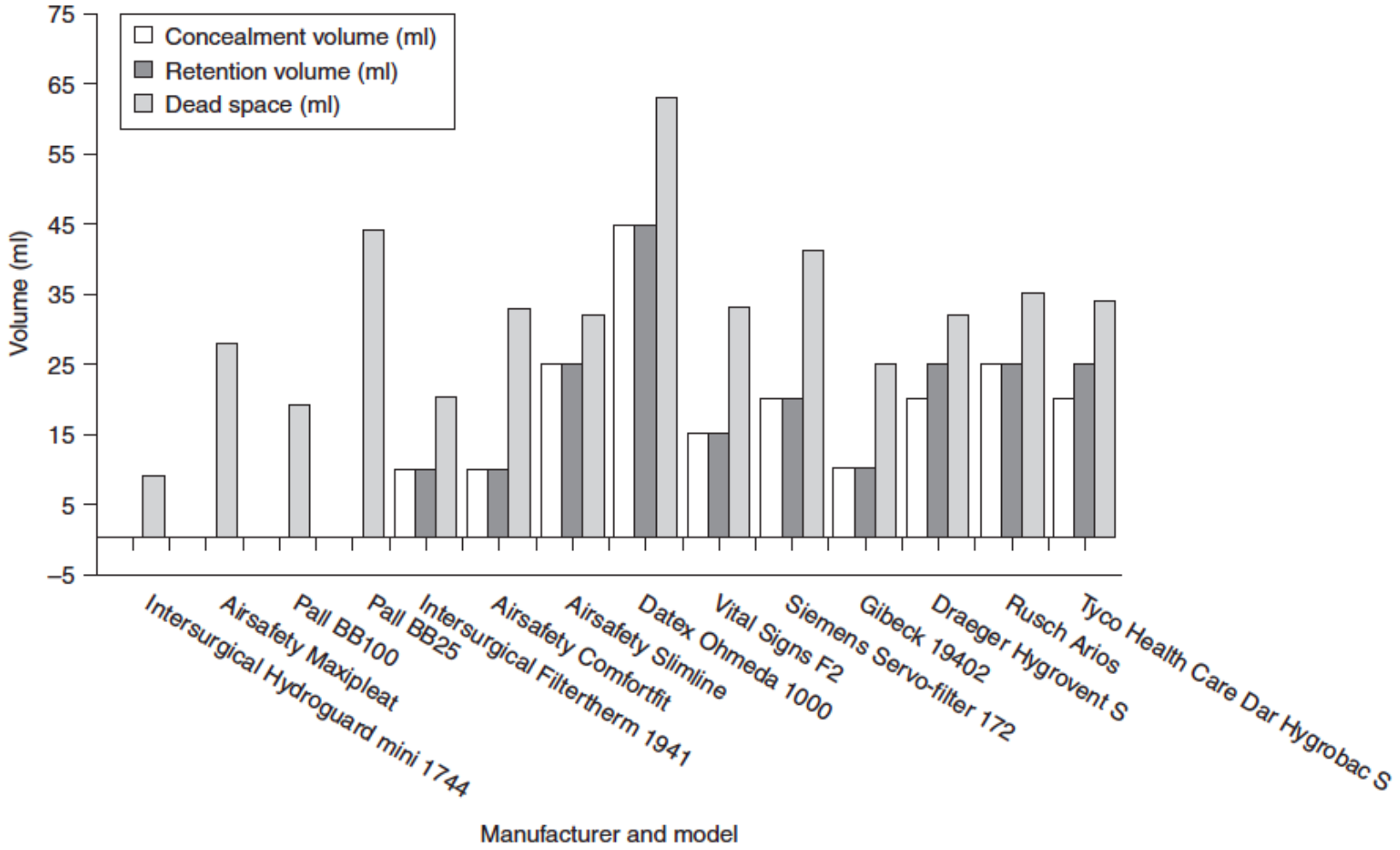

Fig 2 Graphical representation of the patient-side dead space, the concealment volume and the retention volume. No bar visible indicates zero measured volume.

British Journal of Anaesthesia 94 (5): 675–82 (2005)
doi:10.1093/bja/aei091 Advance Access publication February 25, 2005

BJA

Performance of breathing filters under wet conditions: a

D. Turnbull[1]*, P. C.

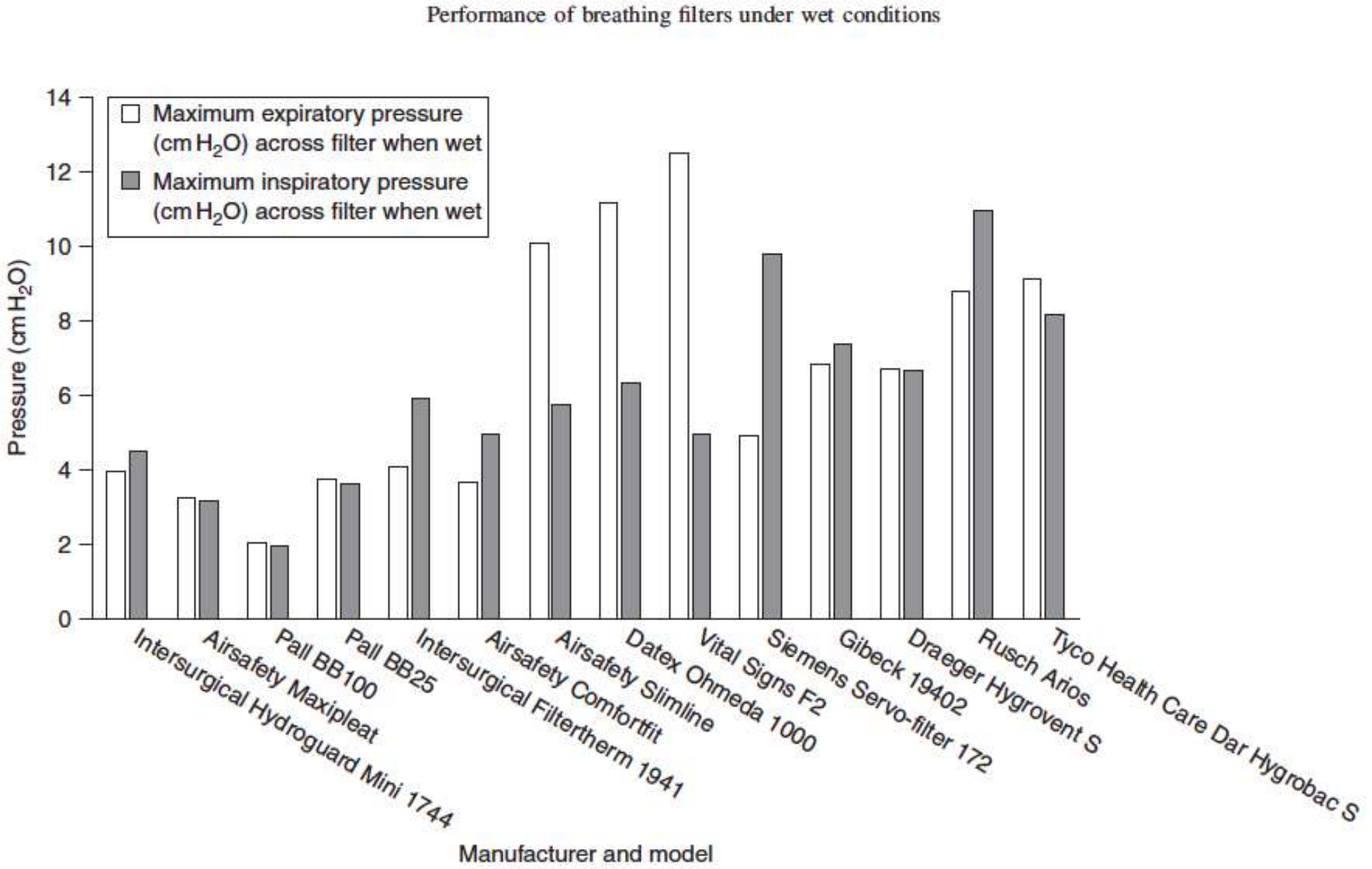

Fig 4 Expiratory and inspiratory pressure across the HMEF at maximum capacity for saline. Air flow, 60 litre min^{-1}.

THE IDEAL HMEF DURING GA

- Should prevent passage of viral, bacterial and prion material
- Should provide filtration performance even under wet conditions
- Should supplement humidification of the inspired air and anesthetic gases
- Should should not increase respiratory work

- **For short duration anesthesia the user may consider prevention of patient cross contamination more important than humidification, and a pleated ceramic filter may be appropriate.**

Do anesthetic vapors influence respiratory filters' performance?

Organic oils can reduce the performance of certain types of filters.

Desflurane penetration of electrostatic filters 2.6 x >>>

Poonawala Y et al. Anaesthesia 2010, 65:831-835

Rule nr 6

Change the HMEF when an unexpected elevation of breathing resistance develops.

Case report Anaesthesia 2011; 66:390-402
Davies JBS, Bromilov J

Bacterial filter obstruction with the use of ultrasonic nebulization

- Epoprostenol nebulized Intersurgical filter to protect the expiratory ventilator block
- repeatedly saturated with water
- ultrasonic nebulizer achieve supersaturated gas in the region 90-200g/m^3
- ➔➔🡅 airway resistance, 🡇TV progressively, hypercapnia in 4 hrs

Rule 7

“ In the case of glycine-containing nebulized solutions, the consensus is to recommend filter changes every 2 hrs, mainly to protect the expiratory valve block”.


RESPIRATORY THERAPY CONVENTION
I COME HERE TO HEAR THE VARIOUS OPINIONS PEOPLE HAVE.
AH, FOR THE BREATH-TAKING VIEWS!
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E-mail: ThavesOne@aol.com
9-1
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