Con il Patrocinio di:

OMCeO Milano

AIPO Associazione Italiana Pneumologi Ospedalieri

Ospedale San Giuseppe MultiMedica S.p.A.

Sistema Sanitario Regione Lombardia

PNEUMOLOGIA 2018

Milano, 14 – 16 giugno 2018 · Centro Congressi Palazzo delle Stelline

SESSIONI PLENARIE

Sabato, 16 giugno 2018

INFEZIONI RESPIRATORIE: COSA C'È DI NUOVO

Moderatori: *Antonio Spanevello (Tradate), Massimo Puoti (Milano)*

09.00 - 09.30	**Lettura Le infezioni micotiche polmonari** *Paolo Grossi (Varese)*
09.30 - 09.50	Le micobatteriosi non tubercolari *Maurizio Ferrarese (Milano)*
09.50 - 10.10	I batteri multiresistenti *Massimo Puoti (Milano)*
10.10 - 10.50	**Lettura La terapia delle VAP** *Roberto Fumagalli (Milano)*

ASST Grande Ospedale Metropolitano

Niguarda Ca' Granda, Milan

Università Milano Bicocca

Ospedale Niguarda

Regione Lombardia

UNIVERSITÀ DEGLI STUDI DI MILANO BICOCCA

DEFINITION

	CDC National Healthcare Safety Network[8]	American Thoracic Society and Infectious Disease Society of America[2]
Time line	Pneumonia in persons who had a device to assist or control respiration continuously through a tracheostomy or by endotracheal intubation within the 48-hour period before the onset of infection, inclusive of the weaning period	Pneumonia that occurs more than 48-72 hours after intubation
Clinical signs	Change in pulmonary secretions or impaired gas exchange and systemic signs of infection	Change in pulmonary secretions or impaired gas exchange and systemic signs of infection
Radiographic evidence	New or progressive opacities	New or progressive opacities
Microbiologic evidence	None required	None required

Am J Infect Control. 2008;36 (5):309-332.
Am J Respir Crit Care Med. 2005;171(4):388-416.

It’s complicated!

- Overlap with other lower respiratory infections
- Surveillance strategy
- Case mix/ case definition
- Diagnostic procedure
- Rate expression

EPIDEMIOLOGY

It's complicated!

- Over
- infect
- Surve
- Case
- Diagn
- Rate expression

ratory

9-27%

- ↑ Length of ICU stay
- ↑ Hospital Costs
- ↑ Mortality?

Limitations of VAP diagnosis

VAP criteria

- Inaccurate and Non-specific

  If compared to autopsy findings (Klompas, JAMA 2007)

- Subjective

  Poor inter-observer agreement, not comparable among centers (Klompas AJIC 2010)

- Low attributable mortatlity

  Intervention targeted to decrease VAP incidence may not decease significant outcomes: days on MV, ICU LOS, mortality (Kollef, JAMA 2008)

Rationale for the VAE definition

- Designed to **overcome**
  the disadvantages of VAP definition:
  - Complexity
  - Subjectivity
  - Low attributable mortality

- **Improvement** of interventions to prevent VAP

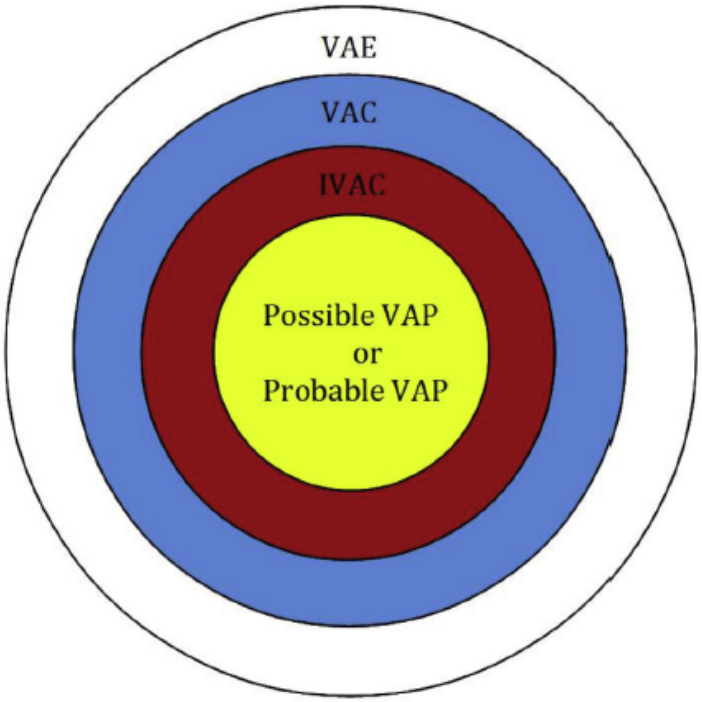
DOES NOT TARGET INCREASE IN ACCURACY

New VAE algorithm

"Sustained raise in daily minimum PEEP ≥ 3 cmH_2O or FiO_2 ≥ 20 points after a period of stable or improving daily minimum PEEP or FiO_2"

- Based on alterations of **ventilator** parameters:
  i. Implies a two-day period of ventilator "**stability or improvement** "
  ii. At least one of the following changes:
    - **FiO_2 increase of ≥ 20%** over baseline that remains at or above this level **for two or more days**
    - **PEEP increase of ≥ 3 cmH_2O** over baseline that remains at or above this level **for two or more days**

DAILY MINIMUM PEEP and FiO_2: The lowest value of PEEP and FiO_2 during a calendar day that is set on the ventilator and *maintained for at least 1 hour*.



VAC

Ventilator-Associated Conditions

≥2 calendar days of stable or decreasing daily minimum PEEP or FIO_2 followed by rise in PEEP ≥3 cm H_2O or rise in FIO_2 ≥20 points sustained for ≥2 d

IVAC

Infection-related Ventilator-Associated Complications

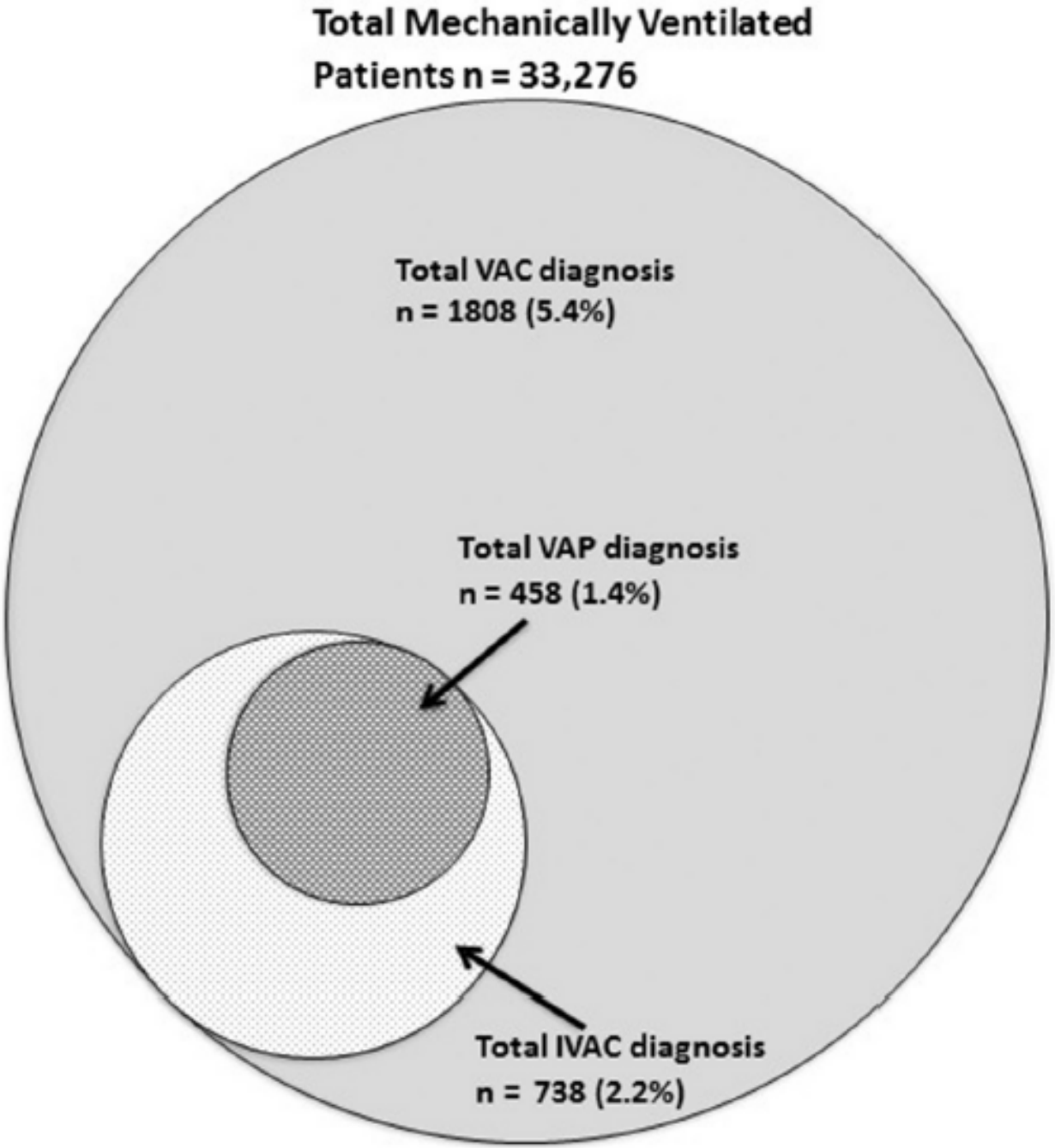
VAC plus temp <36 or >38°C OR leukocyte count ≤4 or ≥12 x 10^3 cells/mm^3
AND one or more new antibiotics continued for ≥4 d
WITHIN 2 d before or after VAC onset
EXCLUDING the first 2 d of mechanical ventilation

Possible Pneumonia

IVAC plus sputum/BAL with ≥25 neutrophils/field OR positive culture for pathogenic organism

Probable Pneumonia

IVAC plus sputum/BAL with ≥25 neutrophils/field AND positive quantitative/semi-quantitative culture for pathogenic organism


Total Mechanically Ventilated
Patients n = 33,276
Total VAC diagnosis
n = 1808 (5.4%)
Total VAP diagnosis
n = 458 (1.4%)
Total IVAC diagnosis
n = 738 (2.2%)

Conclusions - 1

- **VAP definition** is inaccurate, subjective & is affected by poor attributable mortality.

- **VAE algorithm** was recently proposed to improve VAP definitions.

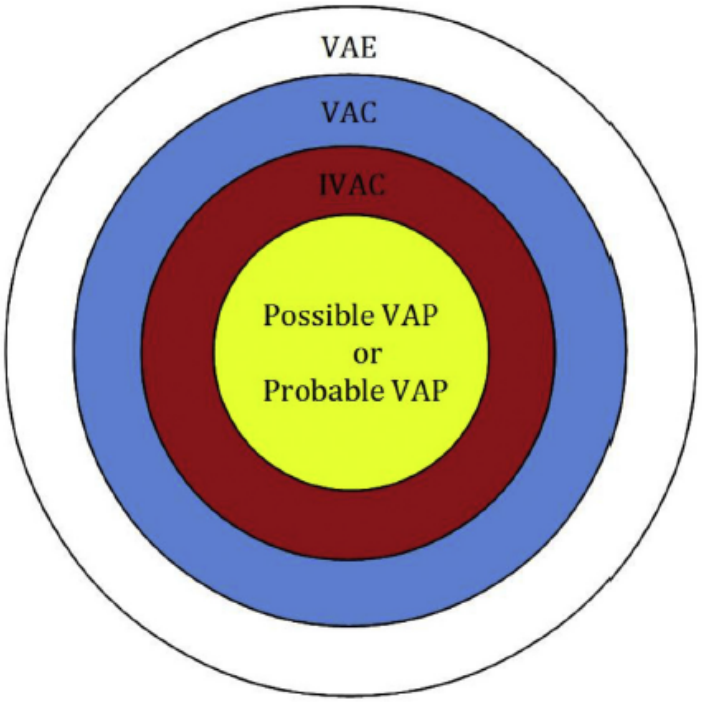
  VAE algorithm is now under validation by several excellent research groups. At this time only partial conclusions can be drawn on its efficacy as a quality indicator and usefulness.

Conclusions - 2

- The **rationale** of the VAE algorithm is to improve VAP definitions by:
  - Decreasing complexity of diagnosis
  - Decrease subjectivity
  - Increased correlation to major outcomes
- However VAE definition:
  - is in accurate in many occasions. It captures all sustained ventilator changes not exclusively related to respiratory conditions
  - has a low sensitivity to detect VAP.

Thus VAE captures sustained ventilator changes and can not replace the VAP definitions

- At **bedside** VAE algorithm can not guide the physician and RRTs because it is by definition post-event diagnosis and has no immediate benefits for patient's treatment.
- As an **indicator of quality**: VAE is not always associated increased morbidity ("the VAE paradox").



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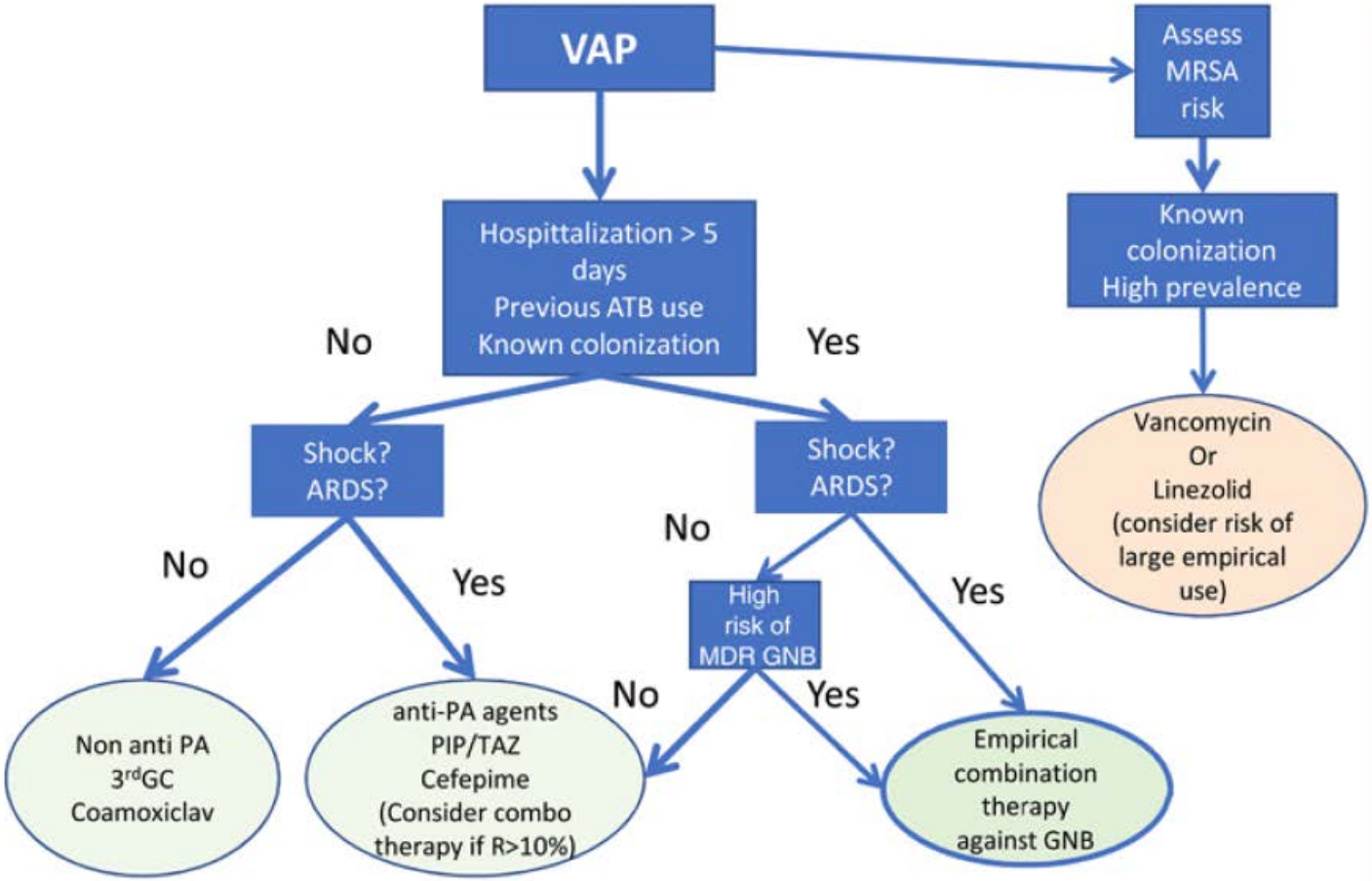
Probable Pneumonia

IVAC plus sputum/BAL with ≥25 neutrophils/field AND positive quantitative/semi-quantitative culture for pathogenic organism

Table 2. Empirical treatment of hospital-acquired pneumonia/ventilator-associated pneumonia.

Not at high risk of mortality and no risk factors[a]	Not at high risk of mortality but with factors increasing the likelihood of Gram-negative bacteria	High risk of mortality or receipt of intravenous antibiotics during the prior 90 days
One of the following: Piperacillin-tazobactam 4.5 g IV q6h OR Cefepime 2 g IV q8h Levofloxacin 750 mg IV daily	Piperacillin-tazobactam 4.5 g IV q6h OR Cefepime or ceftazidime 2 g IV q8h OR Levofloxacin 750 mg IV daily Ciprofloxacin 400 mg IV q8h OR Imipenem 1g IV q8h Meropenem 1 g IV q6h	Piperacillin-tazobactam 4.5 g IV q6h OR Cefepime or ceftazidime 2 g IV q8h OR Levofloxacin 750 mg IV daily Ciprofloxacin 400 mg IV q8h OR Imipenem 1g IV q8h Meropenem 1 g IV q6h AND Amikacin 25 (30) mg/kg IV daily OR Gentamicin 5–7 mg/kg IV daily OR Tobramycin 5–7 mg/kg IV daily
	Vancomycin 15 mg/kg IV q8–12h with goal to target 15–20 mg/mL trough level (consider a loading dose of 25–30 mg/kg × 1 for severe illness) OR Linezolid 600 mg IV q12h	Vancomycin 15 mg/kg IV q8–12h with goal to target 15–20 mg/mL trough level (consider a loading dose of 25–30 mg/kg × 1 for severe illness) OR Linezolid 600 mg IV q12h



Master rules for empirical therapy

1- Start antibiotic therapy as early as possible
2- Use the ecological data of your country, your hospital and your unit
3- Use previous known colonization of the patient
4- Collect systematically samples of respiratory secretions for bacteriological exam before therapy
5- Do not use antimicrobials that has been already used in the past few days
6- Use combination therapy to increase the spectrum of antimicrobial therapy
7- Optimize pharmacokinetic by using loading dose, and prolonged or continuous infusion if appropriate

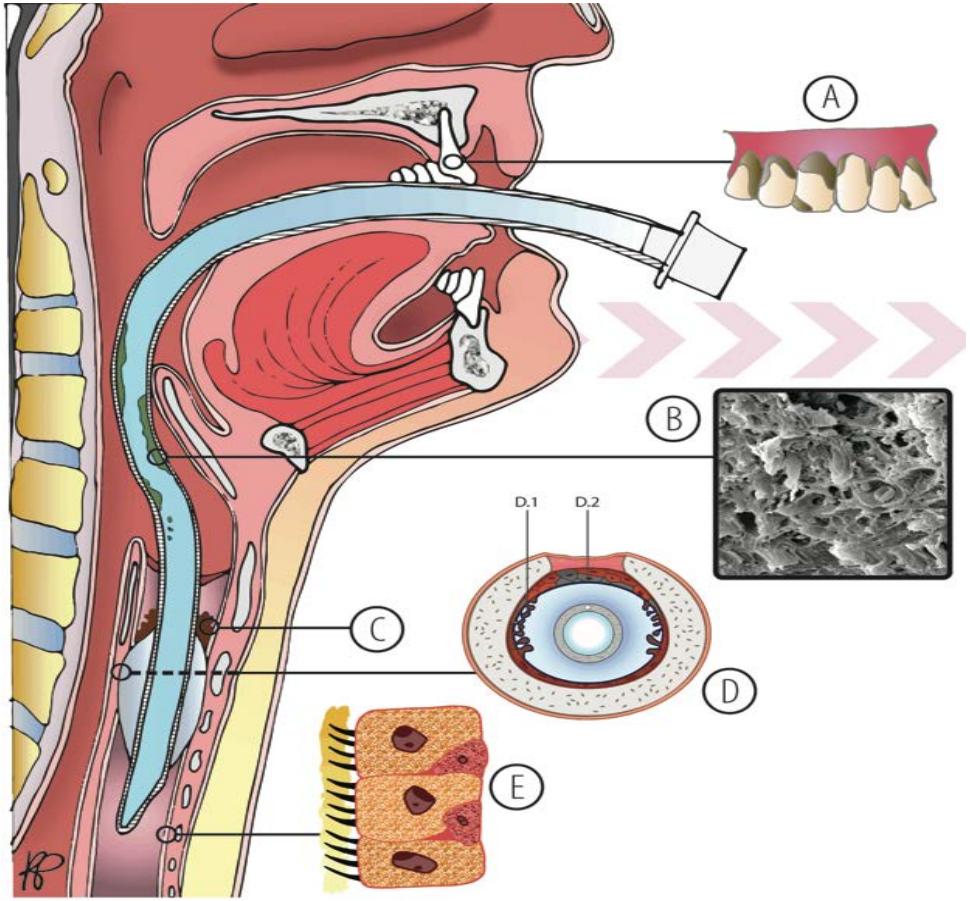
F1000Research 2017, 6(F1000 Faculty Rev):2061 Last updated: 15 DEC 2017

Ventilator-Associated Pneumonia (VAP)

- Serious ICU-acquired infection

(estimated attributable mortality 13%) Melsen WG, Lancet Infect Dis 2013

- 48~72 hrs. after endotracheal intubation



Pathogenesis:

A. Dental Plaque

B. Biofilm

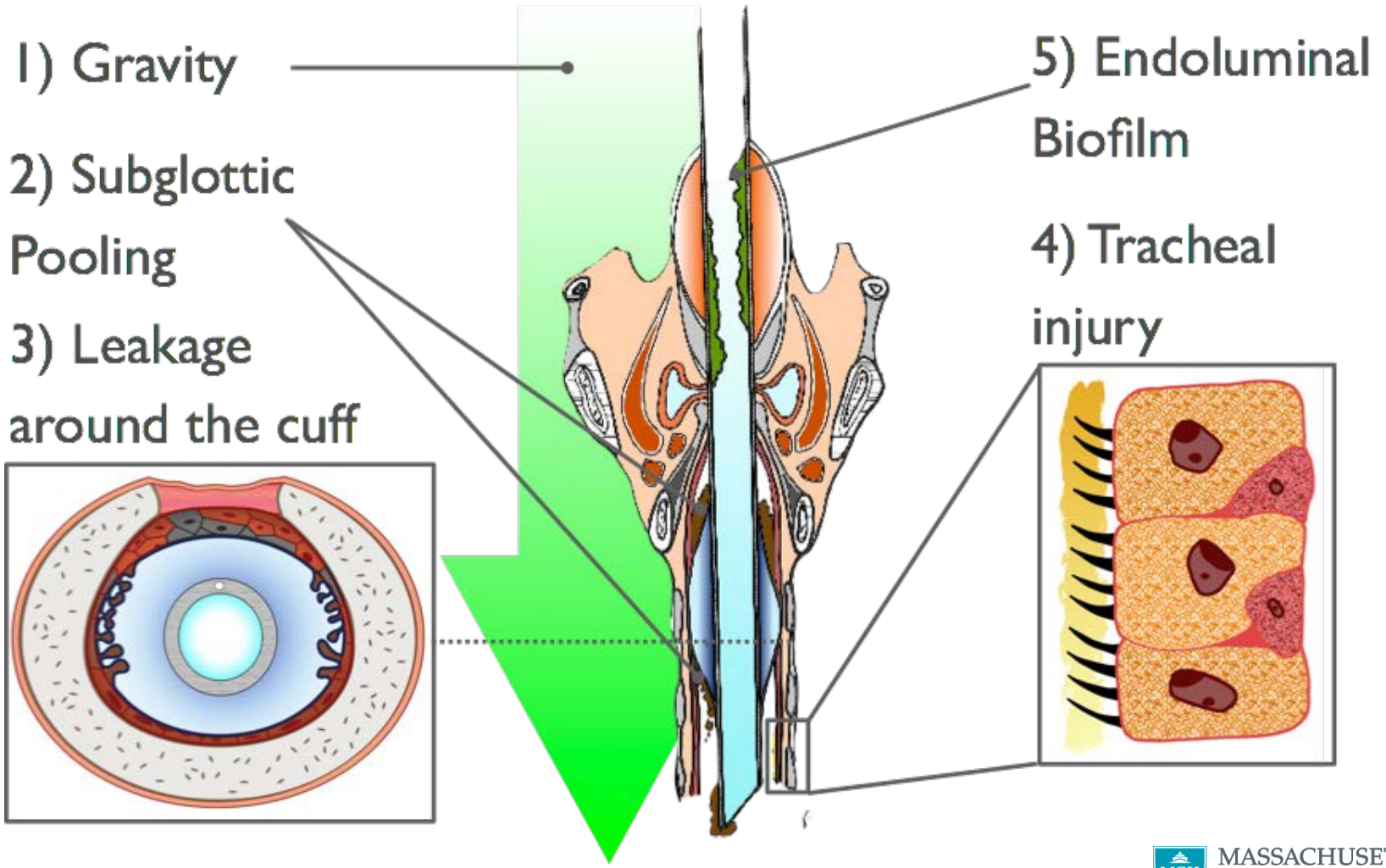
C. Secretions above the cuff

D. Cuff's Leakage

E. Impaired muco-ciliary clearance

Pirrone M, Current Opin Inf Dis 2016

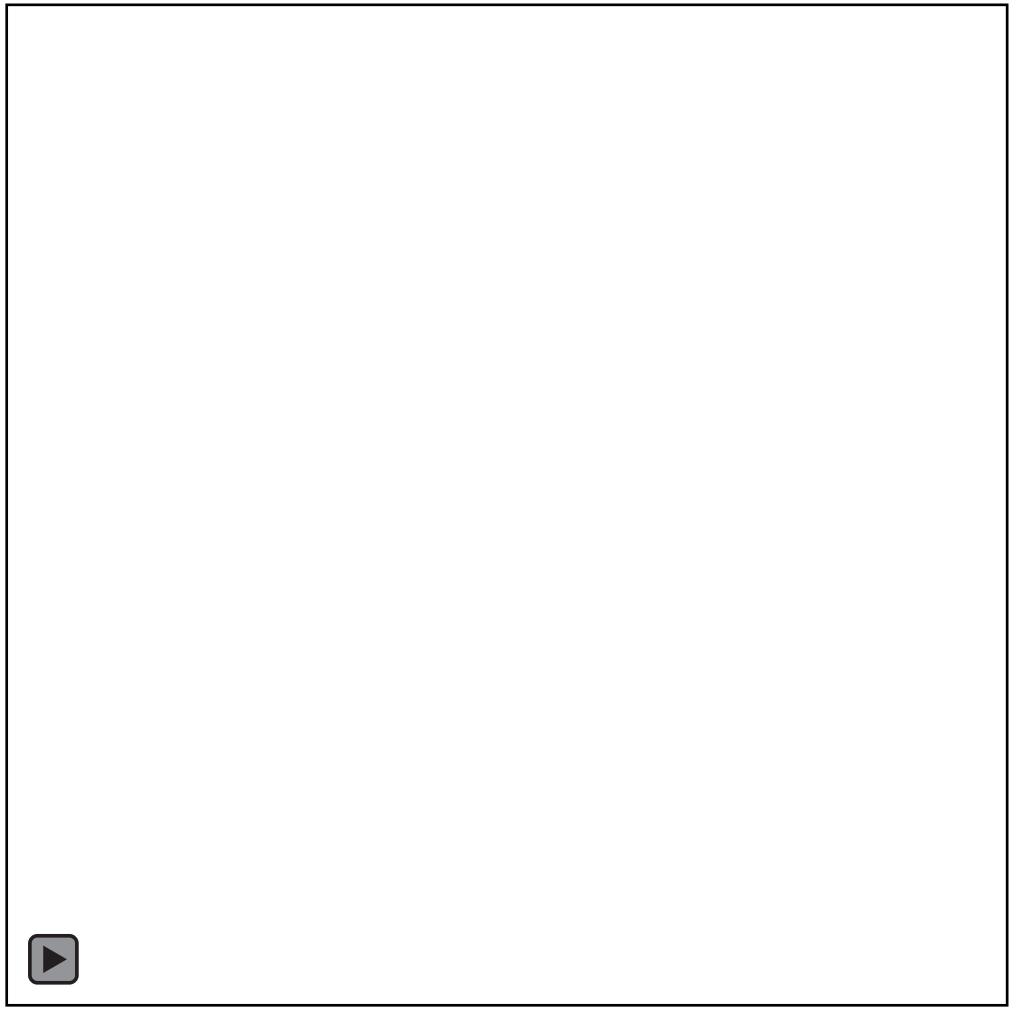
VAP Today: Pathophysiology



With permission from Pinciroli R, et al. Curr Op Inf Dis, 2013

Patophysiology: Biofilm

Time-lapse microscopy of *Pseudomonas aeruginosa* expressing green fluorescent protein. Bacteria were grown in continuous-culture-flow cells, and quickly form a biofilm.



8 Hours Observation

Singh P.K. Nature 2002

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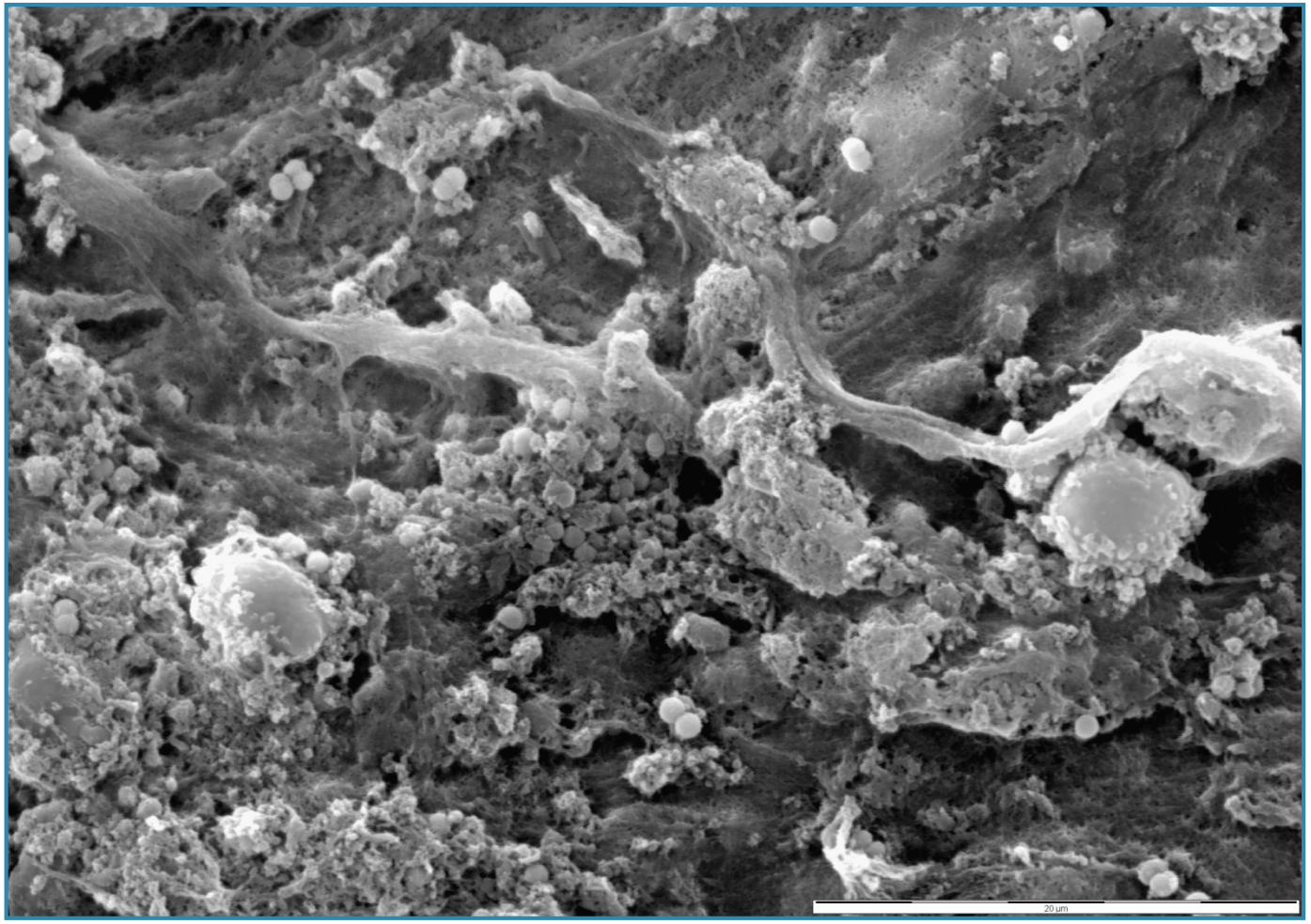
Patophysiology: Biofilm



Berra L et al. Intensive Care Med. 2008 Jun;34(6):1030-7.

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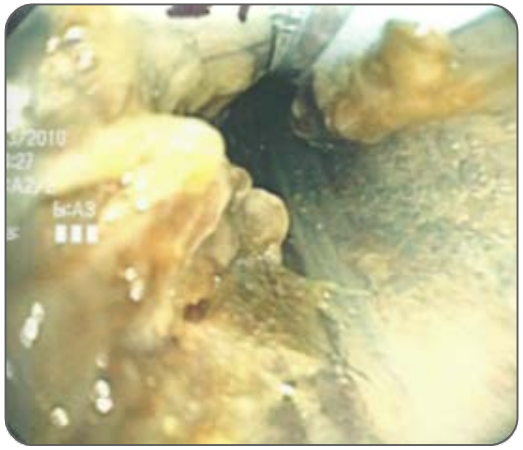
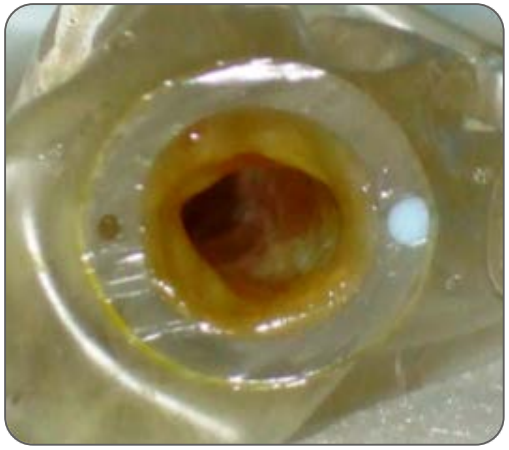
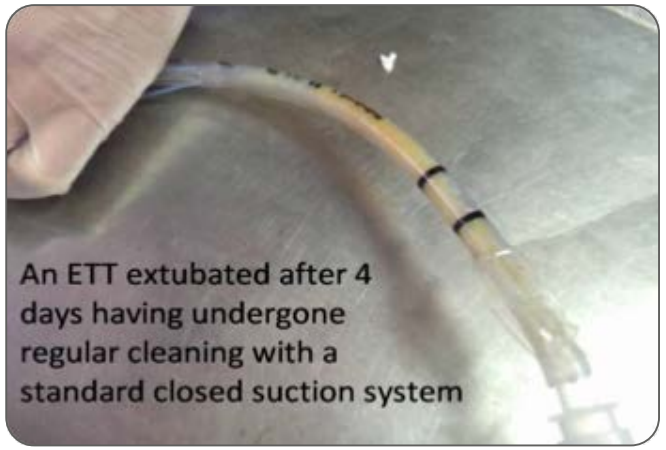
Bioflim

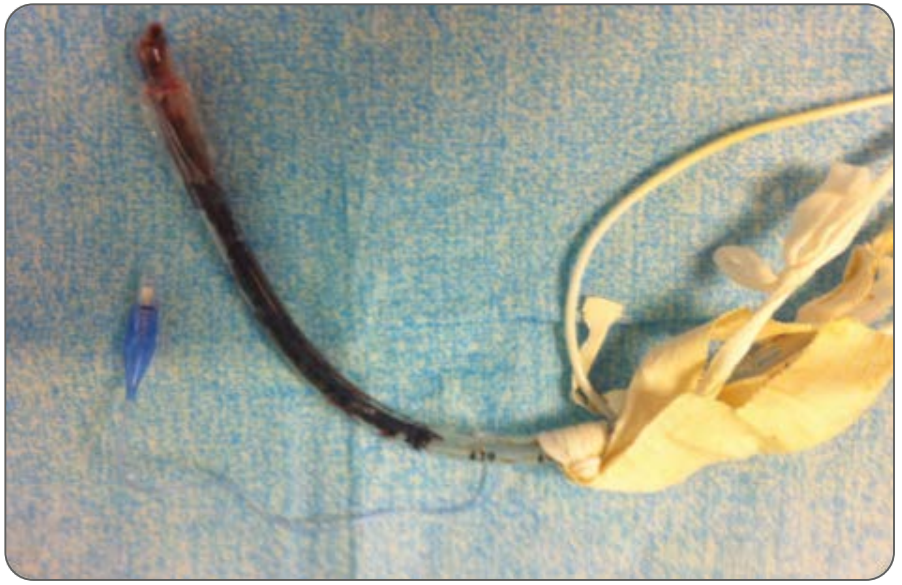
- A complex thriving microbial community attached to surfaces and interspaced in extracellular matrix
- Bacteria living in a bioflim are physiologically different from their planktonic counterpart by means of different gene expressions
- Bioflim is an adaption to a low-nutrient, stressful environment

Patophysiology: Biofilm

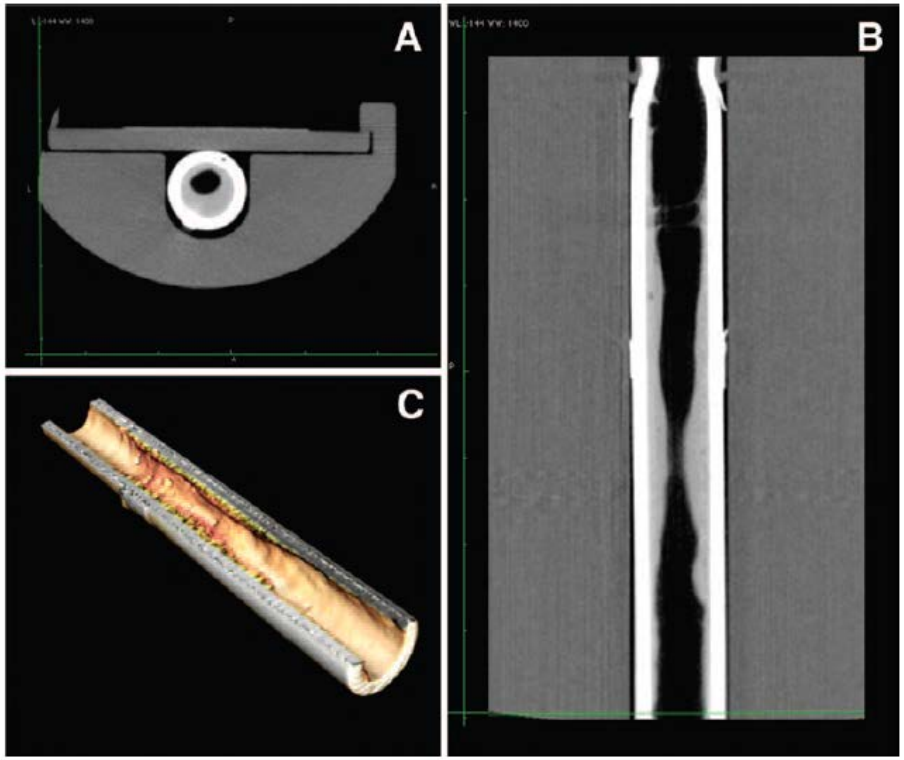








Endotracheal Tube Obstruction in Mechanically Ventilated Patients Assessed by High Resolution Computed Tomography



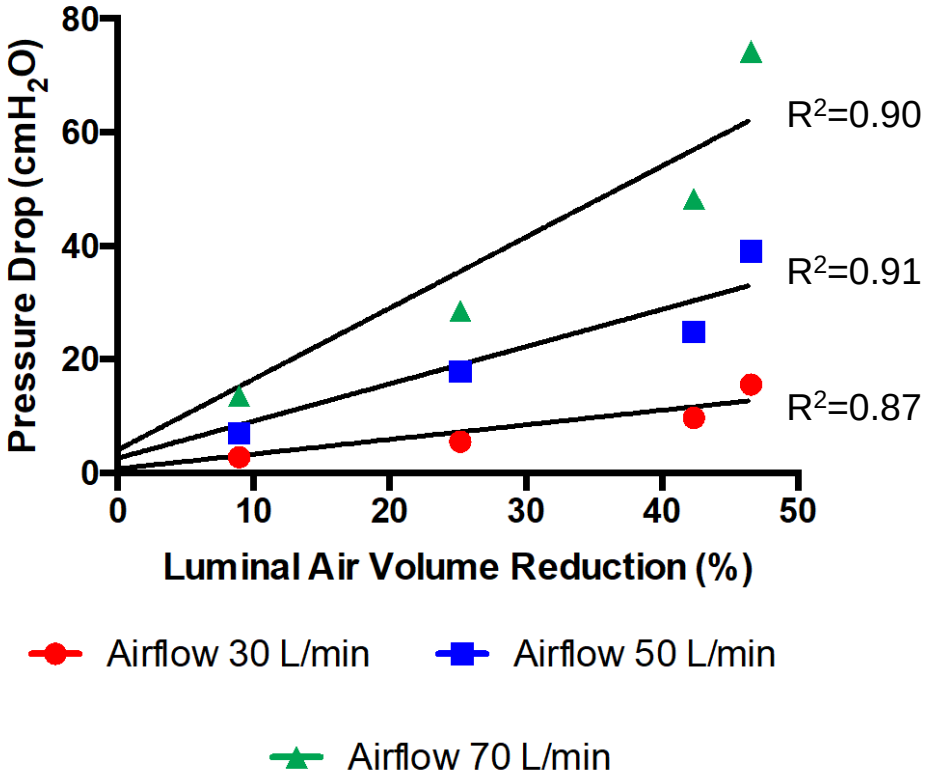
R. Pinciroli et at. Anesthesioly 2013

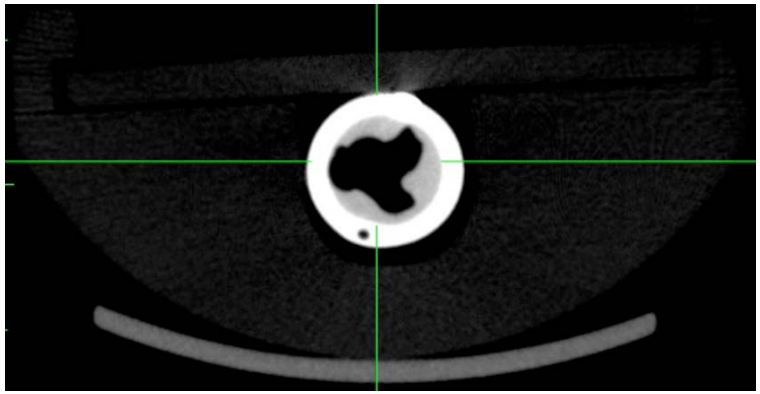
Preliminary data from CT scan

A Teaching Affiliate of Harvard Medical School

2. HRCT findings correspond to expected increase in resistance associated to ETT obstruction

5 new ETT partially filled with silicone to simulate mucus

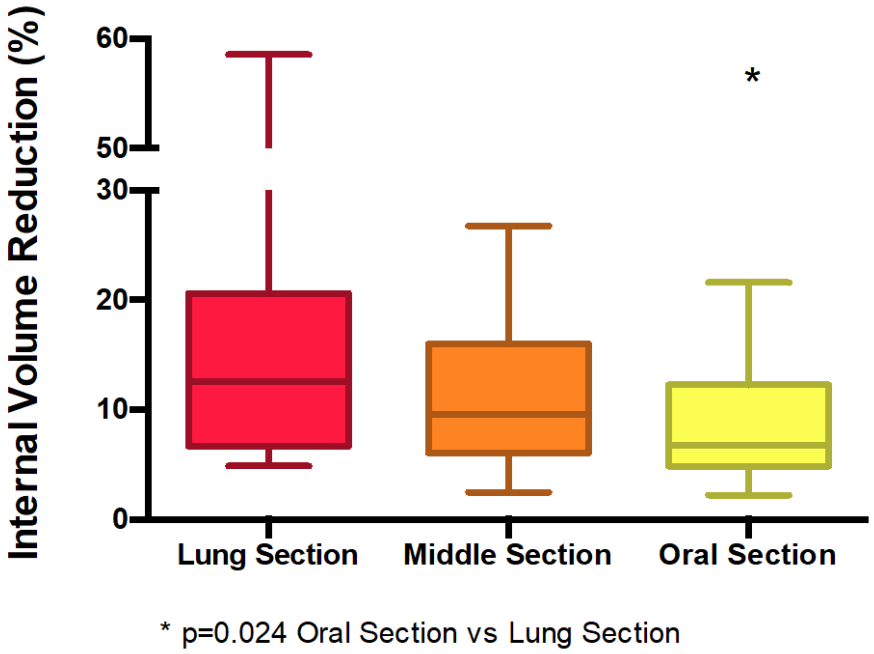




Mietto et al., Anesthesiology 2014

1. **HRCT scan can precisely quantify the amount of secretions inside the ETT and measure the effective cross sectional area available to ventilation**

- 20 ETTs, collected throughout all ICUs at MGH
- Inclusion criteria: intubation time ≥ 48 h



Luminal air volume reduction:
8.2±7.1% (p=0.013)
range 0 - 23.7%

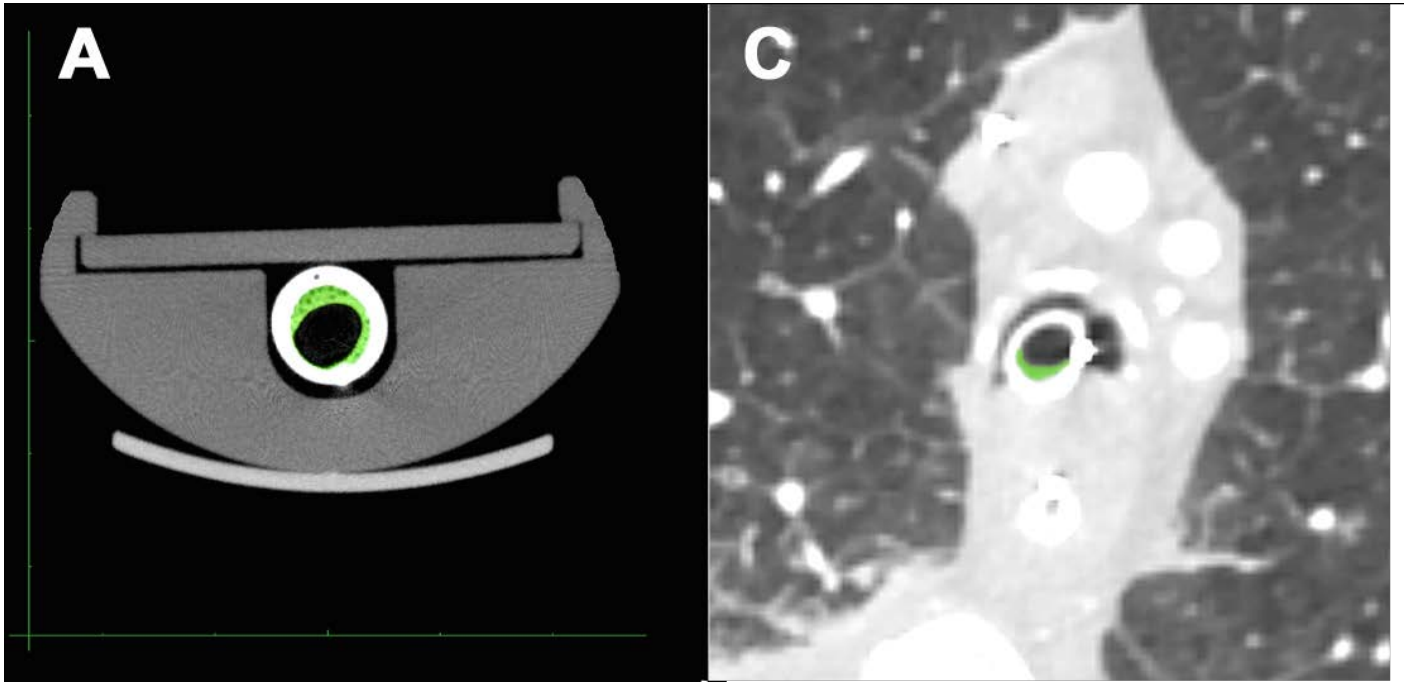
Mietto et al., Anesthesiology 2014

Preliminary data from CT scan

A Teaching Affiliate of Harvard Medical School

3. Post-extubation HRCT images mirror the clinical scenario

- 20 patients that uderwent chest CT scan for clinical reasons after 48 h of intubation
- 6 ETTs showed secretions, average CSA reduction 24.0±3.9%



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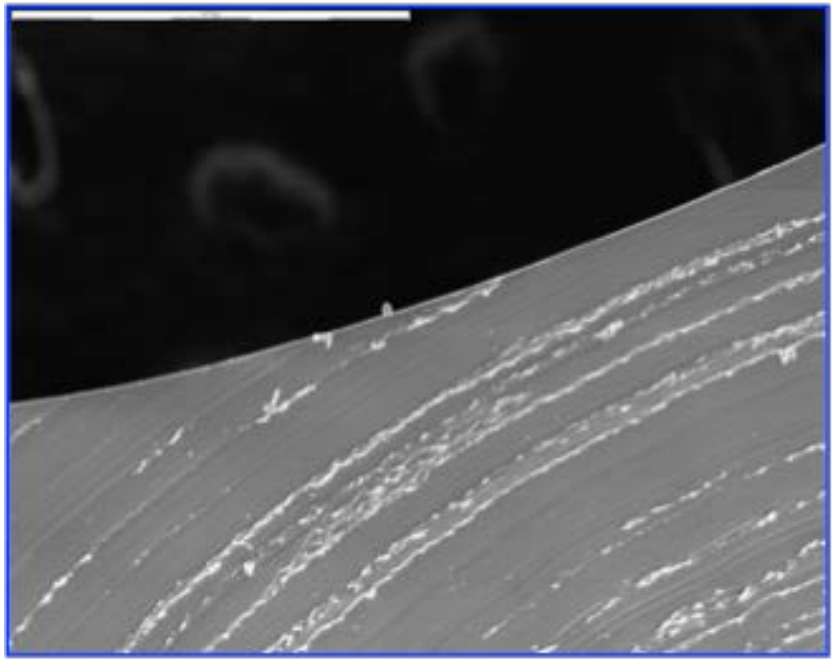
Mietto et al., Anesthesiology 2014

Prevention and Removal of Bioflim

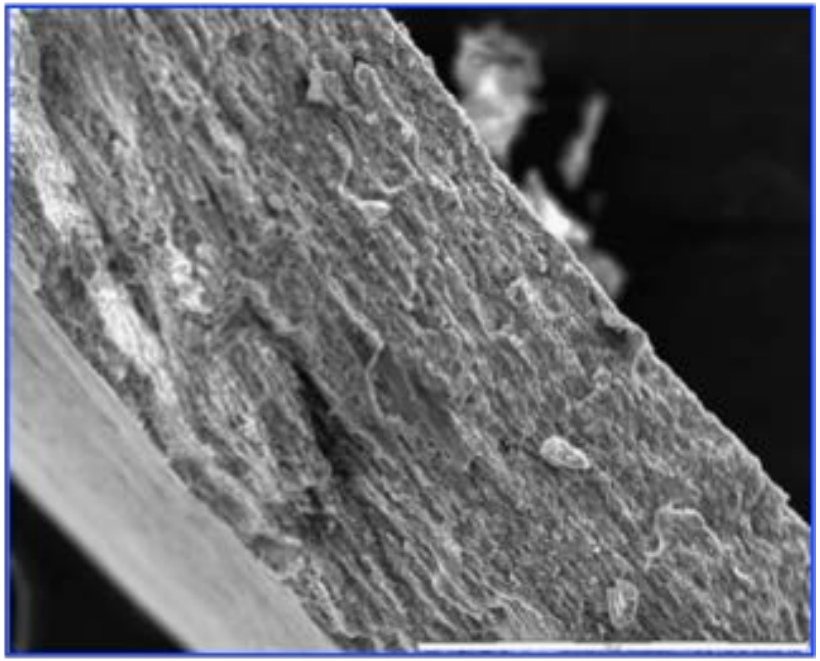
- Elimination of aspiration?
- Costing/impregnating ETT with antibacterial material?
- Altering the surface of the ETT avoiding adherence of secretions?
- Active removal of the Bioflim?

Biofilm Prevention

Standard ETT - Never Used



Standard ETT - At Extubation



Berra L et al. Intensive Care Med. 2008 Jun;34(6):1030-7.

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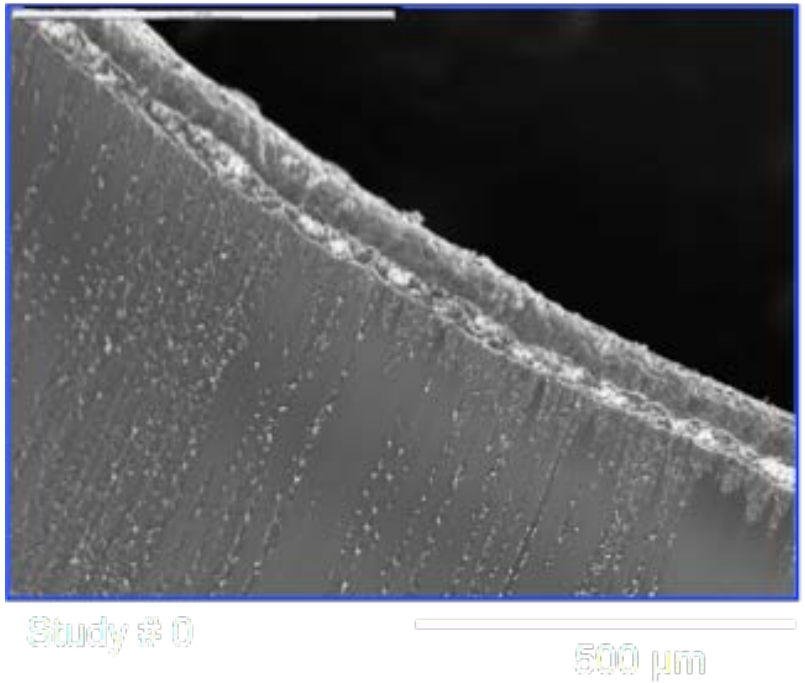
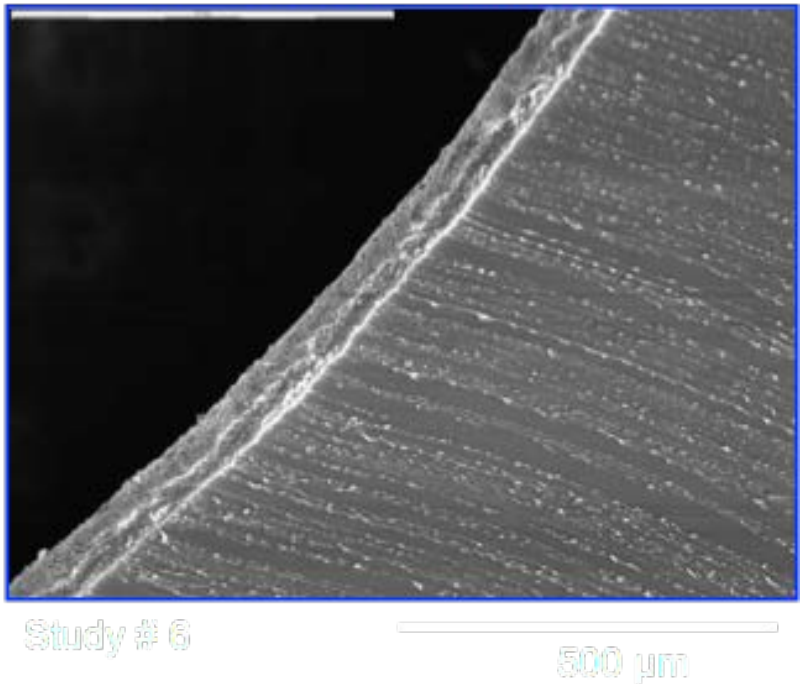
Biofilm Prevention

Coated ETT – Never used



Coated ETT – At extubation



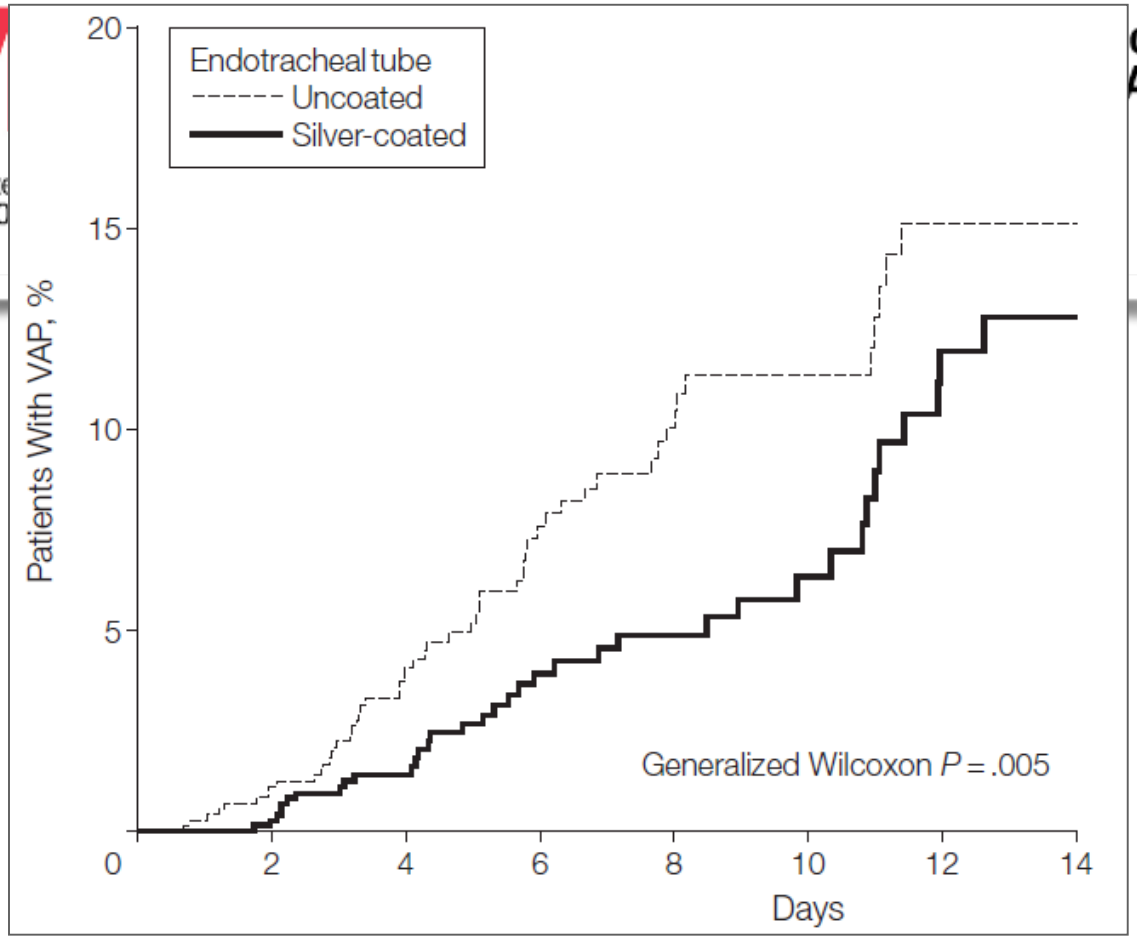
Berra L et al. Intensive Care Med. 2008 Jun;34(6):1030-7.

Biofilm Prevention

JAM

Online article and relate
current as of August 20

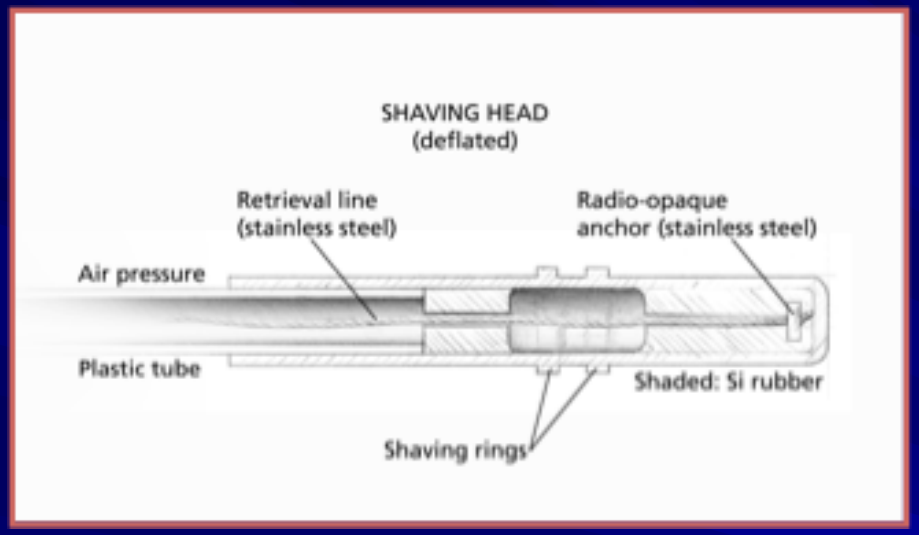
cidence of
ASCENT

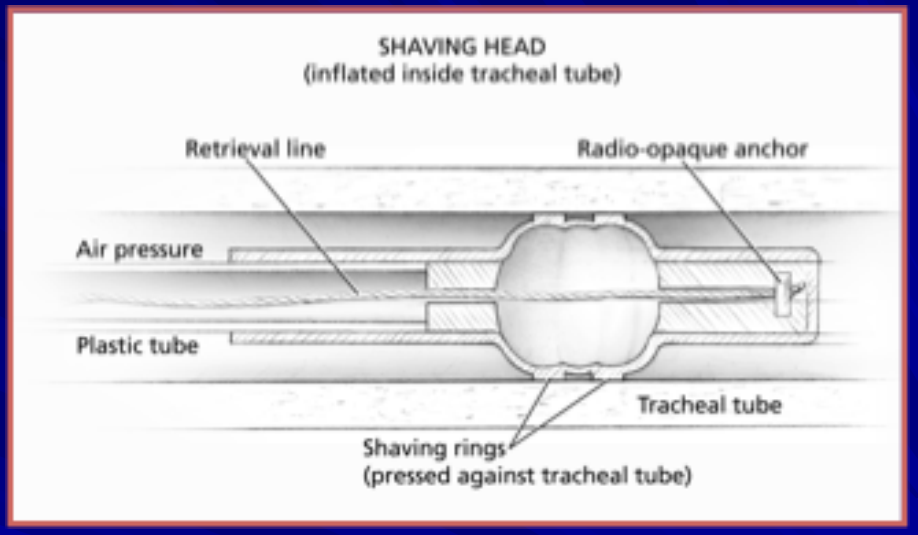


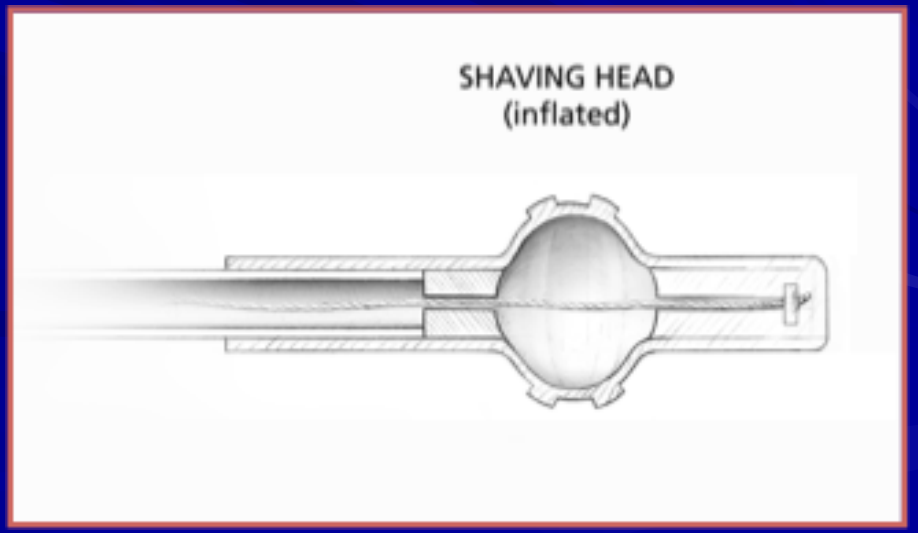
Kollef JAMA 2008;300:805

- RCT Pts intubated and ventilated for > 24 hours, Standard ETT vs. Silver coated ETT, 54 Centers US
- Silver tube VAP rate 4.8%, 37/766
- Standard tube VAP rate 7.5%, 56/743, p > 0.03
- However, no difference in length of intubation, ICU and Hospital stay, mortality and adverse events
- More COPD pts in control group
- Definition of VAP, > 10^4 colony forming units, does not necessarily translate into disease

5. Biofilm Removal - ETT cleaning devices

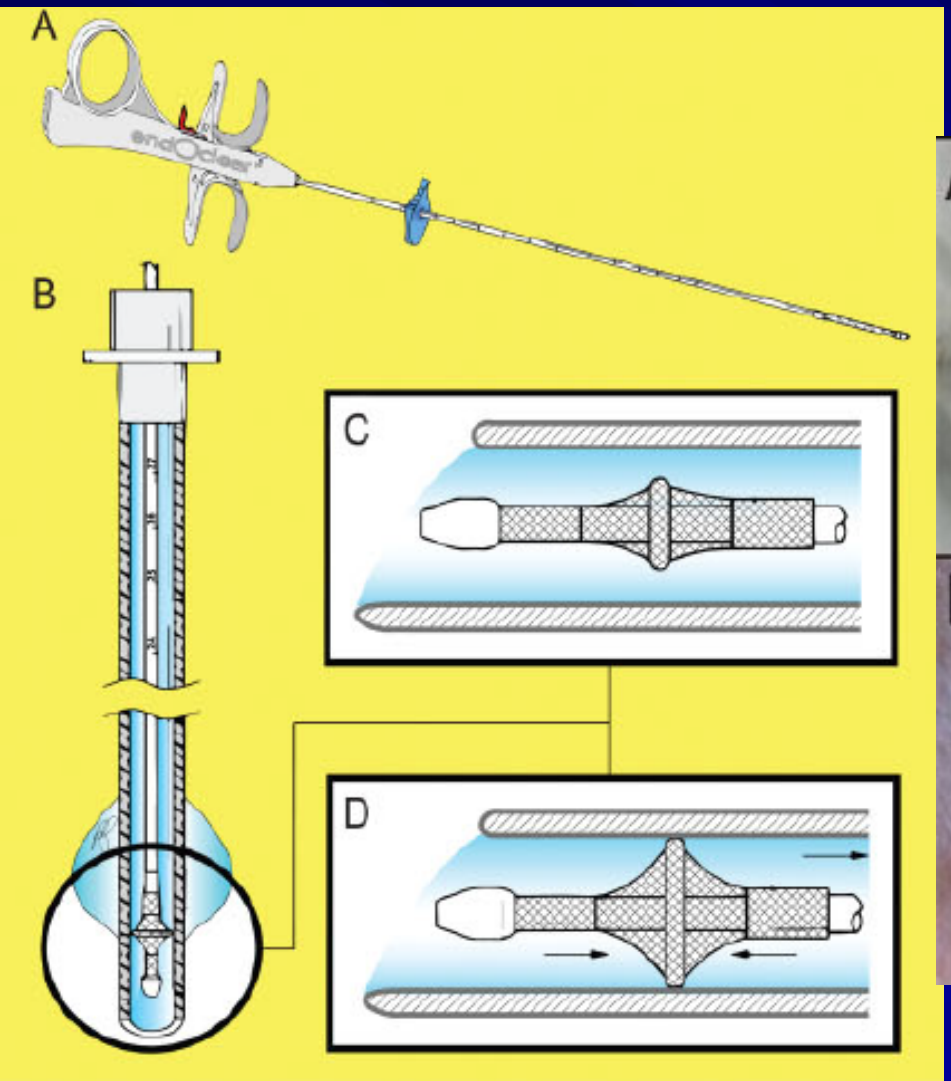


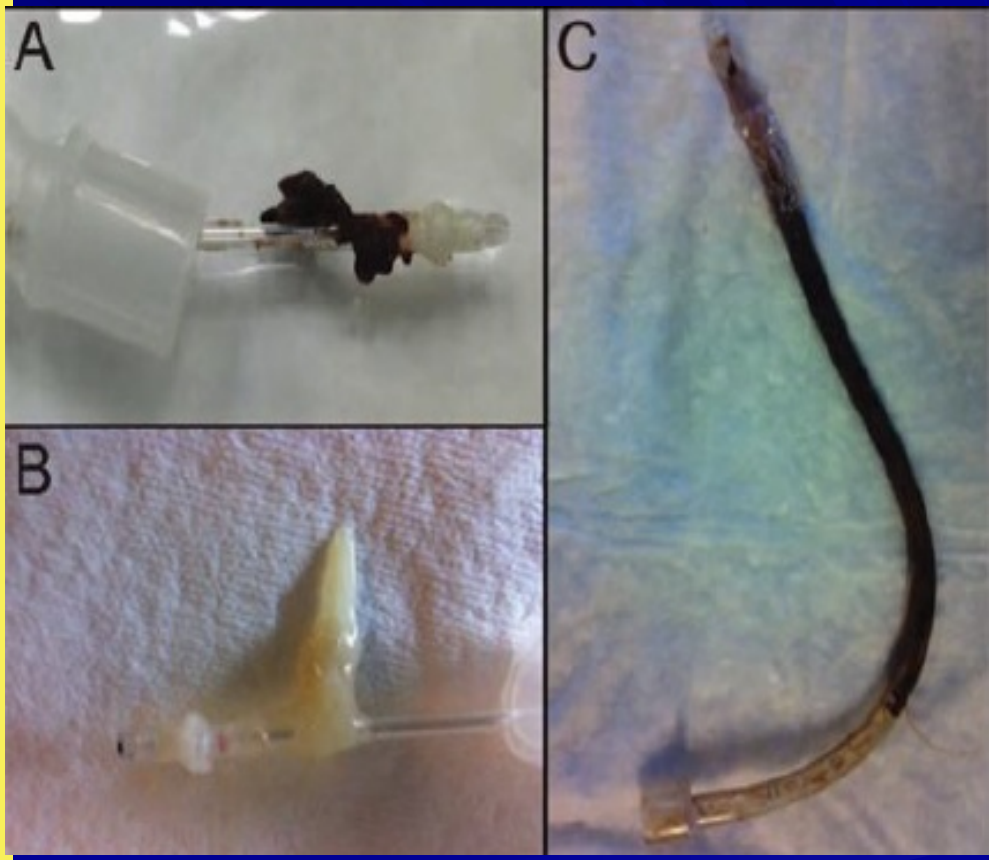




Kolobow, T et al. Novel system for complete removal of secretions within the endotracheal tube: the Mucus Shaver. Anesthesiology, 2005.

Pinciroli et al RC 2016;61(11):1431
Mieto et al RC 2014:59(9):e122





PREVENTION: BIOFILM REMOVAL

Endotracheal Tubes Cleaned With a Novel Mechanism for Secretion Removal: A Randomized Controlled Clinical Study

Riccardo Pinciroli MD, Cristina Mietto MD, Annop Piriyapatsom MD, Christopher T Chenelle, John G Thomas PhD, Massimiliano Pirrone MD, Lynn Bry MD PhD, Gregory R Wojtkiewicz MSc, Matthias P Nahrendorf MD PhD, Robert M Kacmarek PhD RRT FAARC, and Lorenzo Berra MD

Overwiew

- 5 ICUs
- 74 Patients (77 ETTs). March to August, 2013
- Expected MV > 48h
- Endoclear q8h vs Standard of care (blind suction)
- Primary endpoint: **ETT occlusion (HRCT)**
- Secondary endpoints:
  - Microbiology
  - Respiratory mechanics
  - Clinical outcomes
  - Staff Survey

Pinciroli R, et al. Res Care 2016

Pinciroli et al RC 2016;61(11):1431

- RCT standard blind suction vs standard blind suction plus muscus shaver q8hrs.
- Rx 37 ETT vs. Control 40 ETT

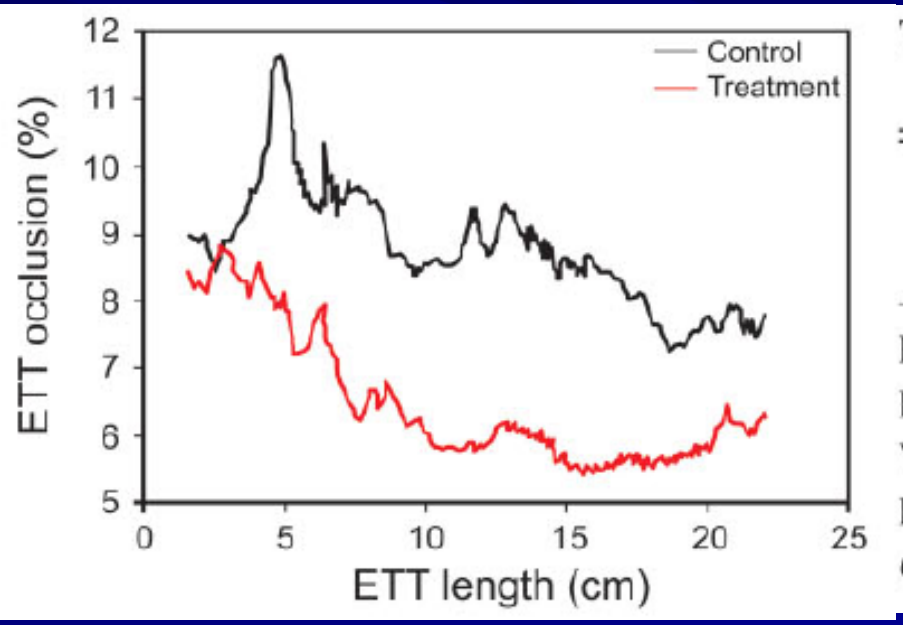
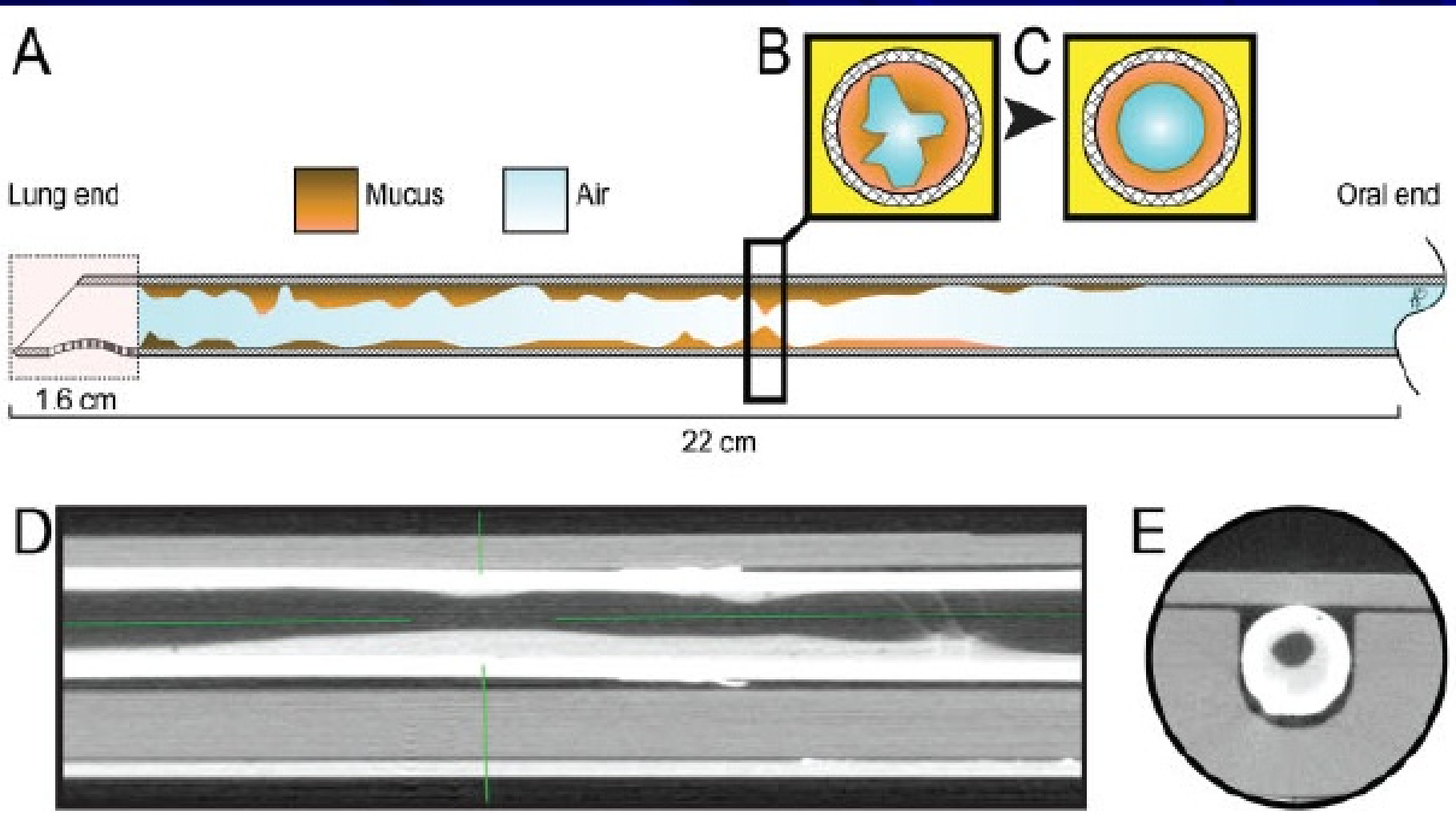


Table 3. Colonization of Collected ETTs by Bacterial and *Candida* Species

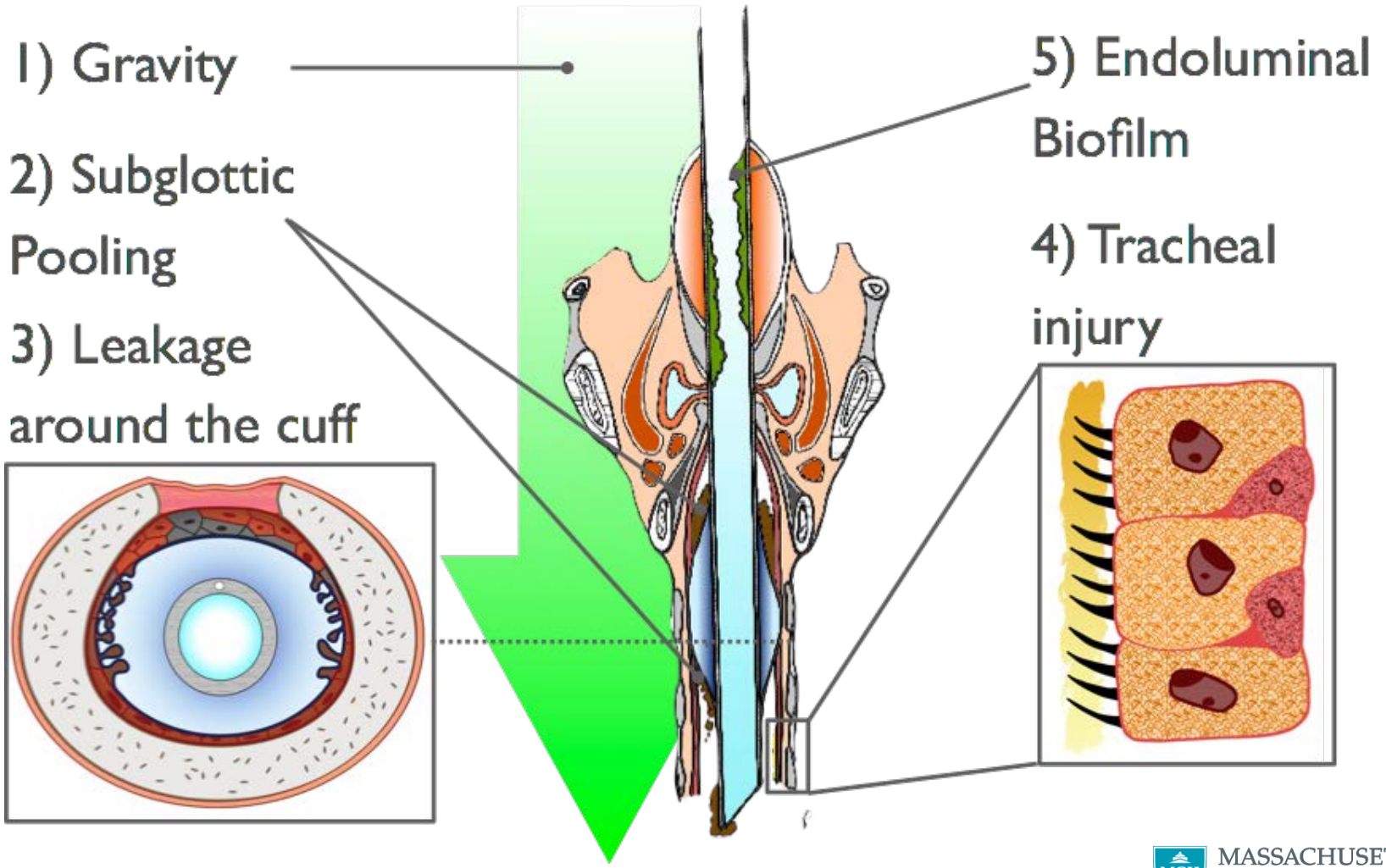
	Control no. ETTs (%)	Treatment no. ETTs (%)	Frequency, breaths/min (95% CI)	*P*
No growth	1 (3)	6 (16)	6.49 (0.81–51.36)	.07
Pathogens[a]	21 (53)	14 (38)	0.72 (0.43–1.2)	.2
VAP causatives[†]	15 (38)	7 (19)	0.50 (0.23–1.1)	.08
MDR	10 (25)	8 (22)	0.86 (0.38–1.95)	.72
Candida spp.	21 (53)	16 (43)	0.82 (0.51–1.32)	.4



Pinciroli et al RC 2016;61(11):1431

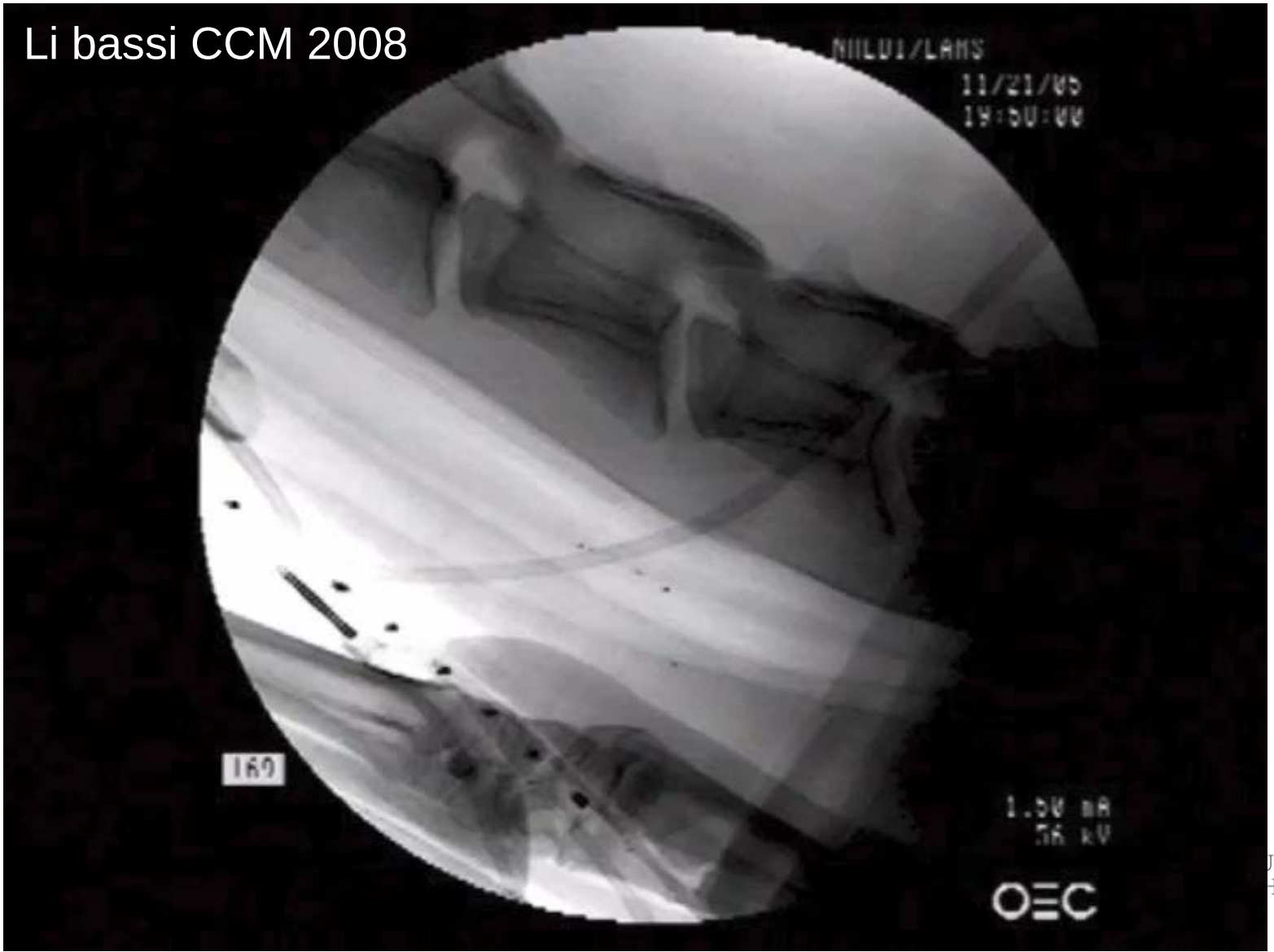
FUTURE DIRECTIONS

VAP Today: Patophysiology



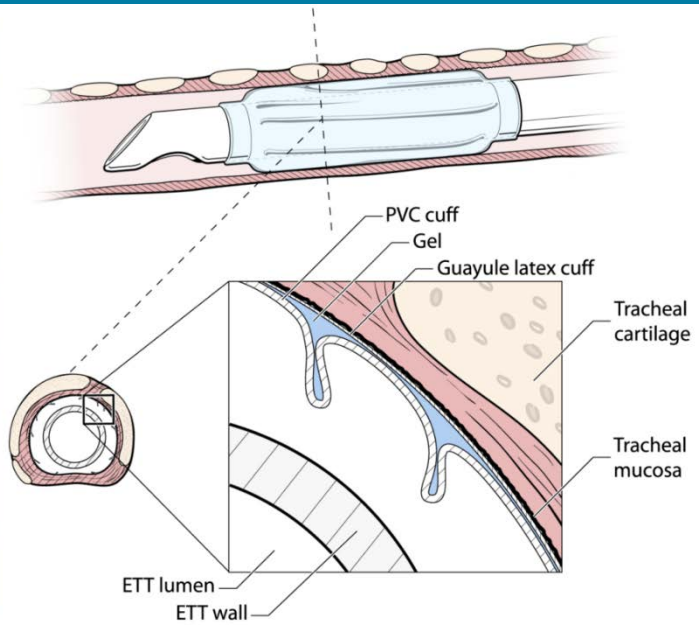
With permission from Pinciroli R, et al. Curr Op Inf Dis, 2013

Effects of GRAVITY



New generation ETT cuffs

A Teaching Affiliate of Harvard Medical School



LATEX PROTOTYPE ETT

Intracuff Pressure: 30 cmH_2O, ID: 8

Zanella A, et al. Intensive Care Med. 2008 Jun;34(6):1145-9

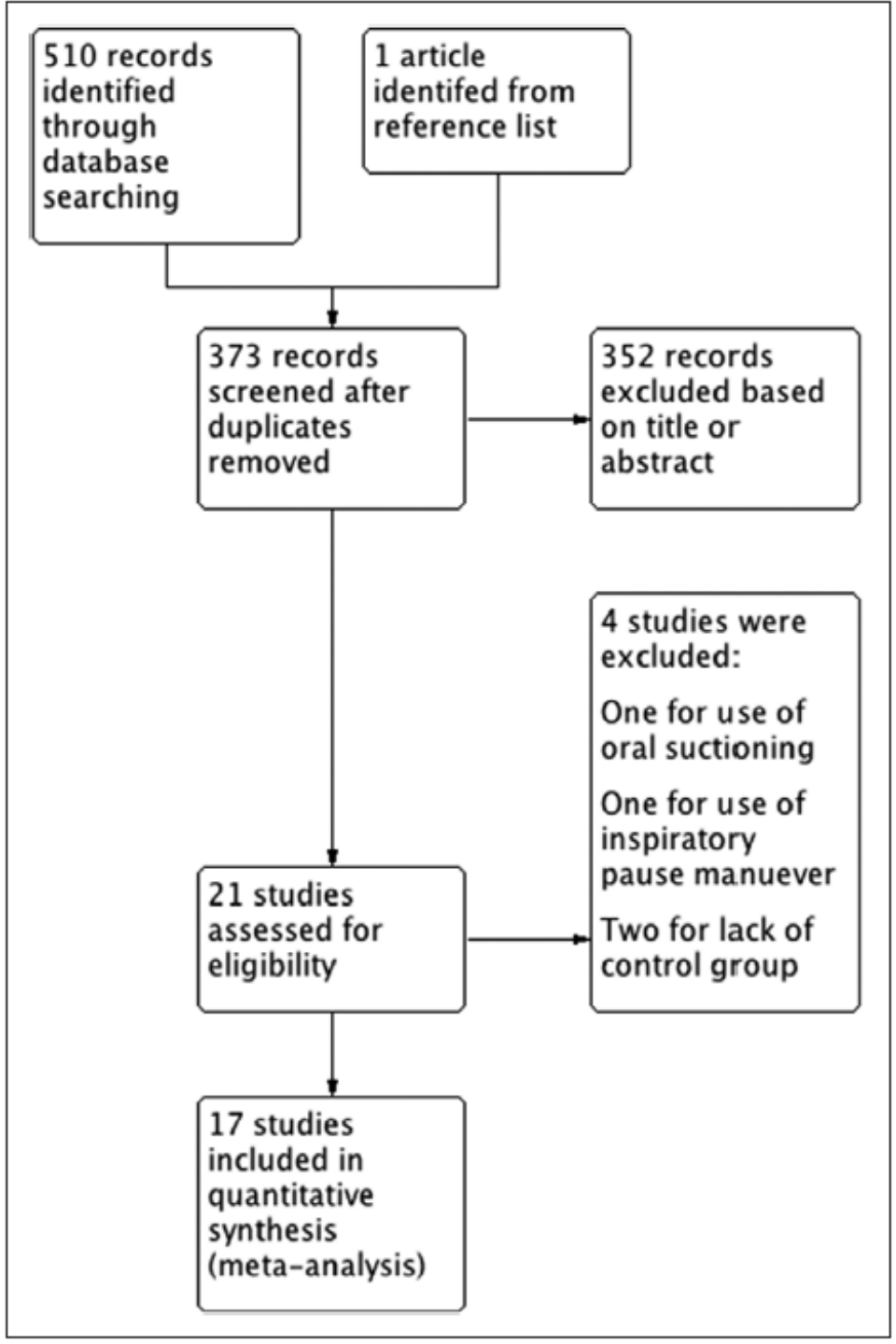
1 HOUR | 3 HOURS | 6 HOURS | 12 HOURS | 24 HOURS

Subglottic Secretion Drainage

- Mahul et al ICM 1992;18:20-25
- Valles et al Ann Intern Med 1995;122:179-186
- Kollef et al Chest 1999;116:1339-1346
- Bo et al Zhonghua Jie He He Hu Xi Za Zhi 2000;23:472-474
- Smulders et al Chest 2002;121:858-862
- Lorente et al AJRCCM 2007;176:1079 (Also with a ultrathin polyurethane cuff)
- Bouza et al Chest 2008;134:938

Caroff, Klompas et al CCM 2016;44(4):830

Meta- analysis SSD and VAP

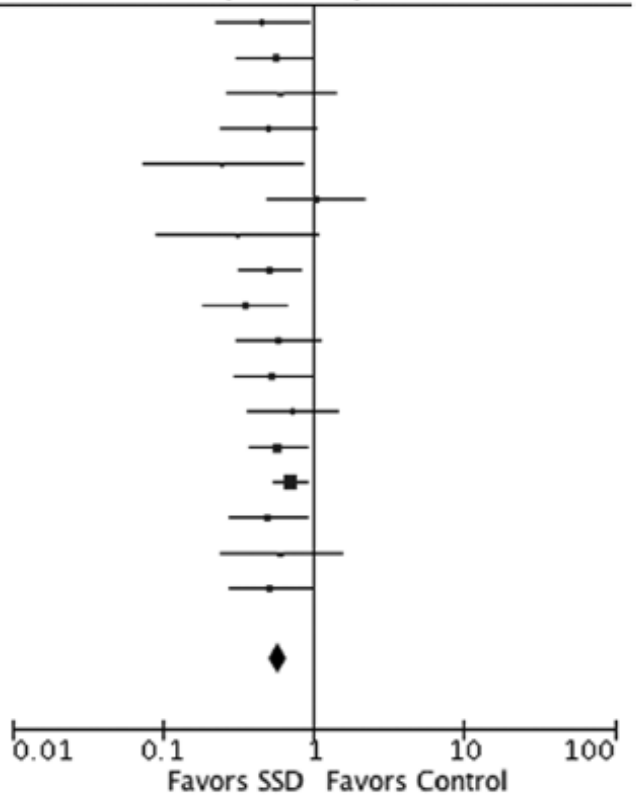


Caroff, Klompas et al CCM 2016;44(4):830

Study or Subgroup	SSD Events	SSD Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Mahul 1992	9	70	21	75	3.8%	0.46 [0.23, 0.93]	1992
Valles 1995	14	95	25	95	5.5%	0.56 [0.31, 1.01]	1995
Kollef 1999	8	160	15	183	2.8%	0.61 [0.27, 1.40]	1999
Bo 2000	8	35	15	33	3.7%	0.50 [0.25, 1.03]	2000
Smulders 2002	3	75	12	75	1.3%	0.25 [0.07, 0.85]	2002
Girou 2004	5	8	6	10	3.5%	1.04 [0.50, 2.18]	2004
Liu S 2006	3	48	10	50	1.3%	0.31 [0.09, 1.07]	2006
Liu Q 2006	14	41	30	45	8.5%	0.51 [0.32, 0.82]	2006
Lorente 2007	11	140	31	140	4.6%	0.35 [0.19, 0.68]	2007
Zheng 2008	9	30	16	31	4.6%	0.58 [0.31, 1.11]	2008
Yang 2008	12	48	20	43	5.6%	0.54 [0.30, 0.97]	2008
Bouza 2008	13	345	19	369	4.0%	0.73 [0.37, 1.46]	2008
Lacherade 2010	25	169	42	164	9.6%	0.58 [0.37, 0.90]	2010
Tao 2014	52	102	34	47	28.3%	0.70 [0.54, 0.91]	2014
Damas 2014	15	170	32	182	5.7%	0.50 [0.28, 0.89]	2014
Koker 2014	5	23	10	28	2.3%	0.61 [0.24, 1.53]	2014
Gopal 2015	13	120	25	120	5.0%	0.52 [0.28, 0.97]	2015
Total (95% CI)		**1679**		**1690**	**100.0%**	**0.58 [0.51, 0.67]**	
Total events	219		363				

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 12.12$, df = 16 (P = 0.74); $I^2 = 0\%$

Test for overall effect: Z = 7.71 (P < 0.00001)



Caroff, Klompas et al CCM 2016;44(4):830

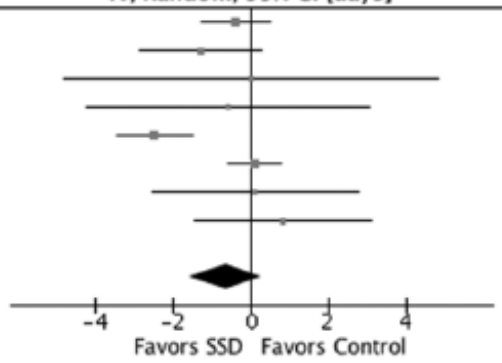
Duration of Mechanical Ventilation

A

Study or Subgroup	SSD Mean [days]	SSD SD [days]	SSD Total	Control Mean [days]	Control SD [days]	Control Total	Weight	Mean Difference IV, Random, 95% CI [days]	Year
Kollef 1999	1.5	3.3	160	1.9	5.1	183	19.5%	-0.40 [-1.30, 0.50]	1999
Smulders 2002	5.8	4.4	75	7.1	5.4	75	14.2%	-1.30 [-2.88, 0.28]	2002
Liu S 2006	15	14	48	15	10	50	3.2%	0.00 [-4.83, 4.83]	2006
Lorente 2007	10.5	15.91	140	11.1	15.19	140	5.2%	-0.60 [-4.24, 3.04]	2007
Zheng 2008	7.9	2.6	30	10.4	0.9	31	18.8%	-2.50 [-3.48, -1.52]	2008
Bouza 2008	2	5.3	345	1.9	3.8	369	21.1%	0.10 [-0.58, 0.78]	2008
Lacherade 2010	10.9	10.6	169	10.8	14	164	8.1%	0.10 [-2.57, 2.77]	2010
Damas 2014	11.71	11.87	170	10.87	9.79	182	9.8%	0.84 [-1.44, 3.12]	2014
Total (95% CI)			**1137**			**1194**	**100.0%**	**-0.65 [-1.59, 0.28]**	

Heterogeneity: $Tau^2 = 0.96$; $Chi^2 = 21.22$, df = 7 (P = 0.003); $I^2 = 67\%$

Test for overall effect: Z = 1.37 (P = 0.17)

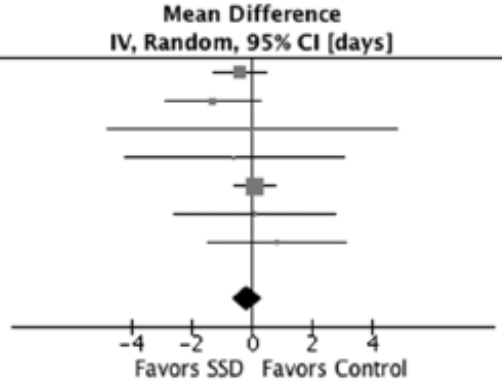


B

Study or Subgroup	SSD Mean [days]	SSD SD [days]	SSD Total	Control Mean [days]	Control SD [days]	Control Total	Weight	Mean Difference IV, Random, 95% CI [days]	Year
Kollef 1999	1.5	3.3	160	1.9	5.1	183	29.1%	-0.40 [-1.30, 0.50]	1999
Smulders 2002	5.8	4.4	75	7.1	5.4	75	9.5%	-1.30 [-2.88, 0.28]	2002
Liu S 2006	15	14	48	15	10	50	1.0%	0.00 [-4.83, 4.83]	2006
Lorente 2007	10.5	15.91	140	11.1	15.19	140	1.8%	-0.60 [-4.24, 3.04]	2007
Bouza 2008	2	5.3	345	1.9	3.8	369	50.8%	0.10 [-0.58, 0.78]	2008
Lacherade 2010	10.9	10.6	169	10.8	14	164	3.3%	0.10 [-2.57, 2.77]	2010
Damas 2014	11.71	11.87	170	10.87	9.79	182	4.5%	0.84 [-1.44, 3.12]	2014
Total (95% CI)			**1107**			**1163**	**100.0%**	**-0.16 [-0.64, 0.33]**	

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 3.68$, df = 6 (P = 0.72); $I^2 = 0\%$

Test for overall effect: Z = 0.64 (P = 0.52)

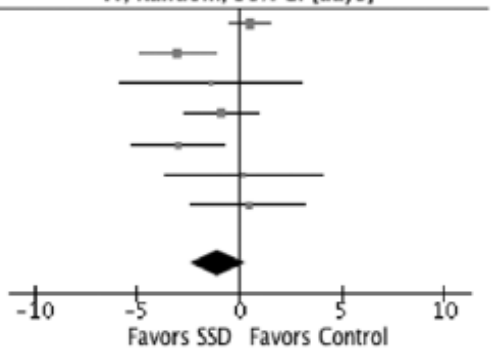


ICU Length-of-Stay

A

Study or Subgroup	SSD Mean [days]	SSD SD [days]	SSD Total	Control Mean [days]	Control SD [days]	Control Total	Weight	Mean Difference IV, Random, 95% CI [days]	Year
Kollef 1999	3.7	4.6	160	3.2	4.5	183	22.5%	0.50 [-0.47, 1.47]	1999
Smulders 2002	9.3	7.4	75	12.3	3.6	75	17.3%	-3.00 [-4.86, -1.14]	2002
Lorente 2007	14.1	17.91	140	15.5	19.93	140	6.9%	-1.40 [-5.84, 3.04]	2007
Bouza 2008	5.6	10.7	345	6.5	14.2	369	17.4%	-0.90 [-2.74, 0.94]	2008
Zheng 2008	9.3	2.9	30	12.3	5.7	31	15.0%	-3.00 [-5.26, -0.74]	2008
Lacherade 2010	15.9	14.4	169	15.7	20.4	164	8.6%	0.20 [-3.60, 4.00]	2010
Damas 2014	16.2	13.52	170	15.76	13.15	182	12.3%	0.44 [-2.35, 3.23]	2014
Total (95% CI)			**1089**			**1144**	**100.0%**	**-1.04 [-2.40, 0.33]**	

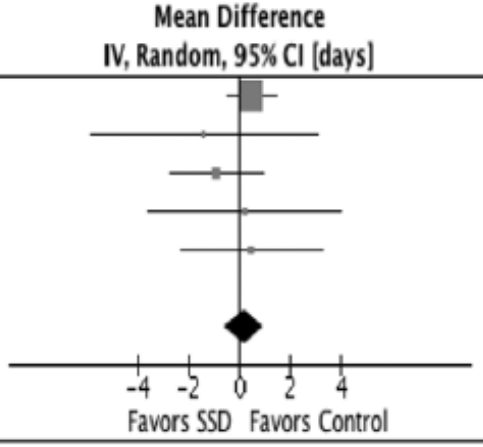
Heterogeneity: $Tau^2 = 1.92$; $Chi^2 = 16.62$, df = 6 (P = 0.01); $I^2 = 64\%$
Test for overall effect: Z = 1.49 (P = 0.14)



B

Study or Subgroup	SSD Mean [days]	SSD SD [days]	SSD Total	Control Mean [days]	Control SD [days]	Control Total	Weight	Mean Difference IV, Random, 95% CI [days]	Year
Kollef 1999	3.7	4.6	160	3.2	4.5	183	66.3%	0.50 [-0.47, 1.47]	1999
Lorente 2007	14.1	17.91	140	15.5	19.93	140	3.1%	-1.40 [-5.84, 3.04]	2007
Bouza 2008	5.6	10.7	345	6.5	14.2	369	18.3%	-0.90 [-2.74, 0.94]	2008
Lacherade 2010	15.9	14.4	169	15.7	20.4	164	4.3%	0.20 [-3.60, 4.00]	2010
Damas 2014	16.2	13.52	170	15.76	13.15	182	8.0%	0.44 [-2.35, 3.23]	2014
Total (95% CI)			**984**			**1038**	**100.0%**	**0.17 [-0.62, 0.95]**	

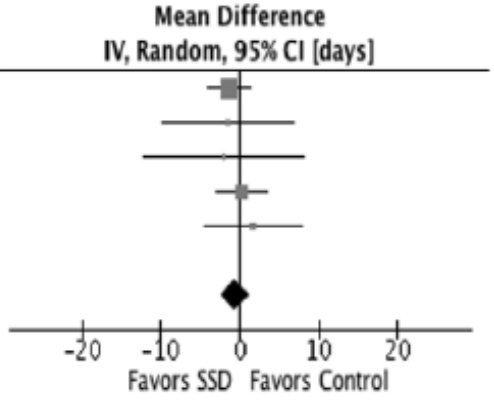
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 2.27$, df = 4 (P = 0.69); $I^2 = 0\%$
Test for overall effect: Z = 0.41 (P = 0.68)



Hospital Length-of-Stay

Study or Subgroup	SSD Mean [days]	SSD SD [days]	SSD Total	Control Mean [days]	Control SD [days]	Control Total	Weight	Mean Difference IV, Random, 95% CI [days]	Year
Kollef 1999	11	11.2	160	12.4	14.2	183	48.5%	-1.40 [-4.09, 1.29]	1999
Smulders 2002	26.8	23.3	75	28.3	28.2	75	5.1%	-1.50 [-9.78, 6.78]	2002
Liu S 2006	30	31	48	32	19	50	3.4%	-2.00 [-12.23, 8.23]	2006
Bouza 2008	14	25.4	345	13.7	17.4	369	34.0%	0.30 [-2.91, 3.51]	2008
Damas 2014	34.92	32.56	170	33.27	26.36	182	9.1%	1.65 [-4.56, 7.86]	2014
Total (95% CI)			**798**			**859**	**100.0%**	**-0.57 [-2.44, 1.30]**	

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 1.26$, df = 4 (P = 0.87); $I^2 = 0\%$
Test for overall effect: Z = 0.60 (P = 0.55)



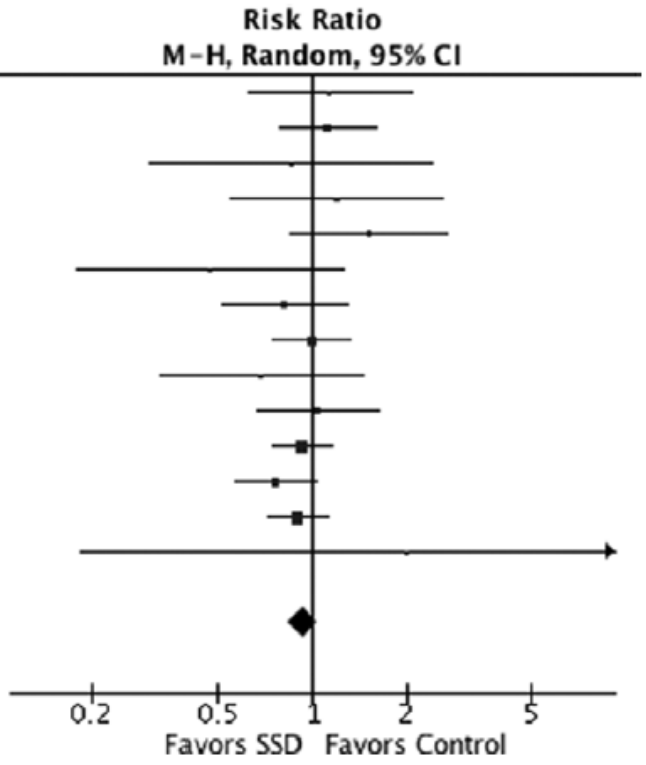
Caroff, Klompas et al CCM 2016;44(4):830

Mortality

Study or Subgroup	SSD Events	SSD Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Mahul 1992	17	70	16	75	3.0%	1.14 [0.62, 2.07]	1992
Valles 1995	39	95	35	95	8.3%	1.11 [0.78, 1.59]	1995
Kollef 1999	6	160	8	183	1.0%	0.86 [0.30, 2.42]	1999
Smulders 2002	12	75	10	75	1.8%	1.20 [0.55, 2.61]	2002
Liu Q 2006	18	41	13	45	3.2%	1.52 [0.86, 2.70]	2006
Liu S 2006	5	48	11	50	1.1%	0.47 [0.18, 1.26]	2006
Lorente 2007	26	140	32	140	5.0%	0.81 [0.51, 1.29]	2007
Yang 2008	32	48	29	43	12.8%	0.99 [0.74, 1.32]	2008
Zheng 2008	8	30	12	31	1.9%	0.69 [0.33, 1.44]	2008
Bouza 2008	34	345	35	369	5.3%	1.04 [0.66, 1.63]	2008
Lacherade 2010	80	169	84	164	22.3%	0.92 [0.74, 1.15]	2010
Tao 2014	48	102	29	47	11.4%	0.76 [0.56, 1.03]	2014
Damas 2014	78	170	93	182	22.7%	0.90 [0.72, 1.11]	2014
Gopal 2015	2	120	1	120	0.2%	2.00 [0.18, 21.76]	2015
Total (95% CI)		**1613**		**1619**	**100.0%**	**0.93 [0.84, 1.03]**	
Total events	405		408				

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 9.99$, df = 13 (P = 0.69); $I^2 = 0\%$

Test for overall effect: Z = 1.31 (P = 0.19)



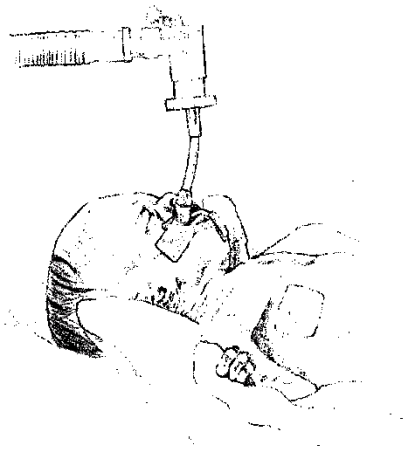
Caroff, Klompas et al CCM 2016;44(4):830

- Significant less antibiotic use SSD
  - Damas et al CCM 2015;43(1):22
  - Bouza et al Chest 2008;134(4):934
- No difference in antibiotic use
  - Lacherade AJRCCM 2010;182(8):910
- No difference in VAE
  - Damas et al CCM 2015;43(1):22
- No differences in any study regarding strider or reintubation

Randomized, Controlled Trial on Tracheal Colonization of Ventilated Infants: Can Gravity Prevent Ventilator-Associated Pneumonia?

Hany Aly, MD[a], Magda Badawy, MD[b], Amany El-Kholy, MD[c], Reem Nabil, MD[b], Afaf Mohamed, MD[b]

[a]Department of Newborn Services, George Washington University and Children's National Medical Center, Washington, DC; [b]Department of Neonatology, Children's Hospital, and [c]Department of Microbiology, School of Medicine, Cairo University, Cairo, Egypt



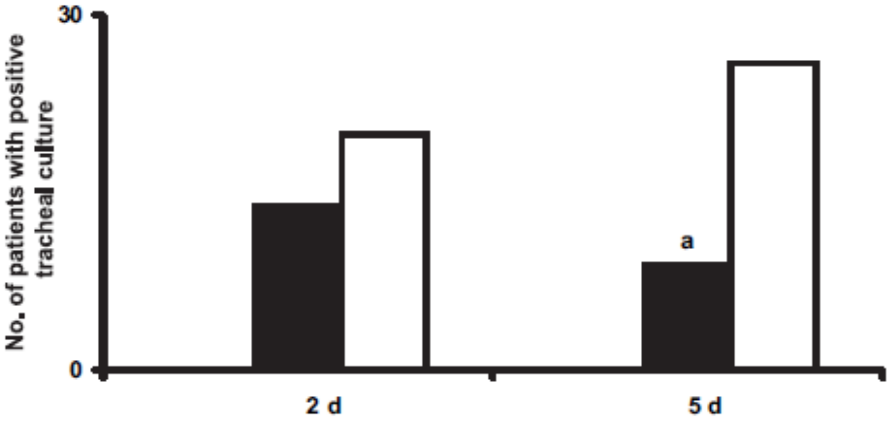
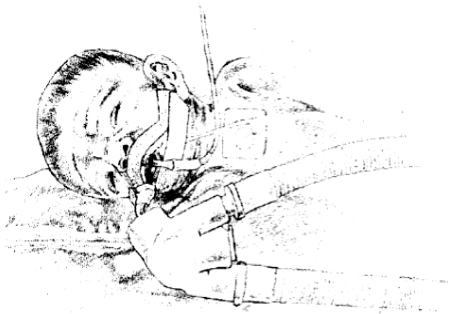


FIGURE 2
Changes in microbial colonization recovered from the trachea after 2 and 5 days of mechanical ventilation in the supine (□) and lateral (■) groups. [a] $P < .01$.



Pediatrics 2008;122;770-774

PATOPHYSIOLOGY: GRAVITY

Gravity VAP-Trial

Prospective, Randomized, Multi-Center Trial of Lateral Trendelenburg versus Semi-Recumbent Body Position in Mechanically Ventilated Patients For The Prevention of Ventilator-Associated Pneumonia

Designed by the Gravity-VAP network

Project endorsed by:

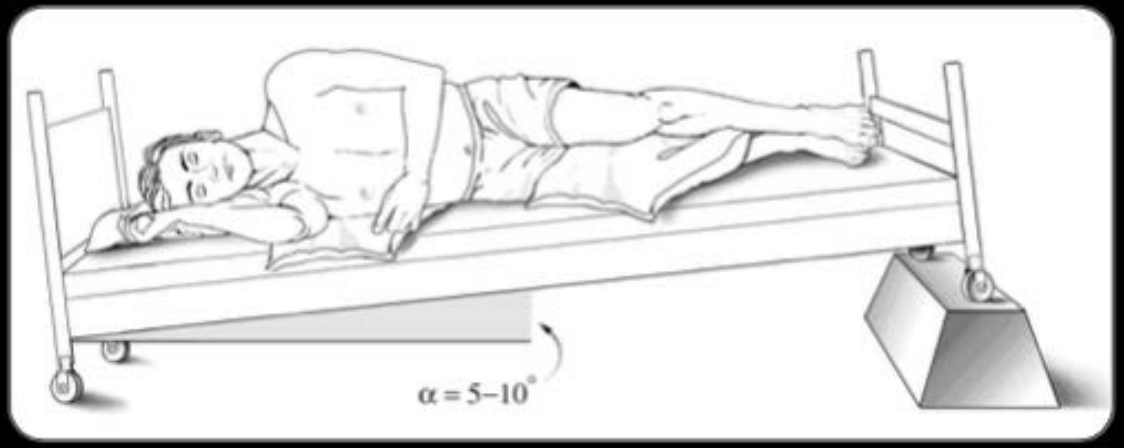
EUROPEAN SOCIETY OF INTENSIVE CARE MEDICINE

EUROPEAN CRITICAL CARE RESEARCH NETWORK ECCRN

Mauro Panigada, MD

PATOPHYSIOLOGY: GRAVITY

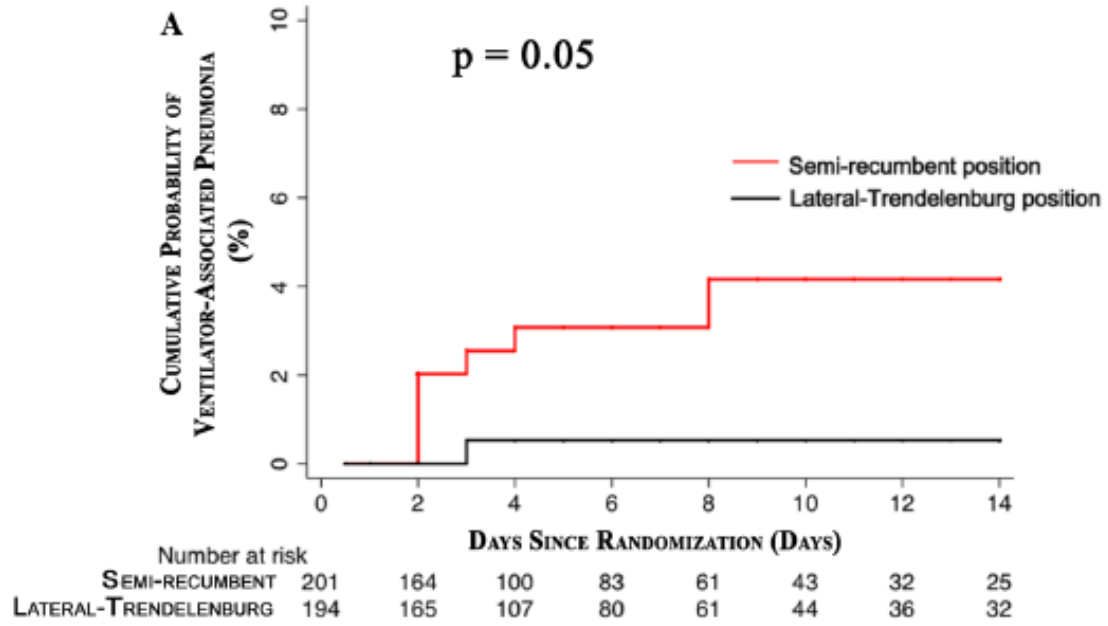
Semi-Recumbent



Lateral-Trendelenburg

BACKGROUND

Intensive Care Med (2017) 43:1572–1584
DOI 10.1007/s00134-017-4858-1



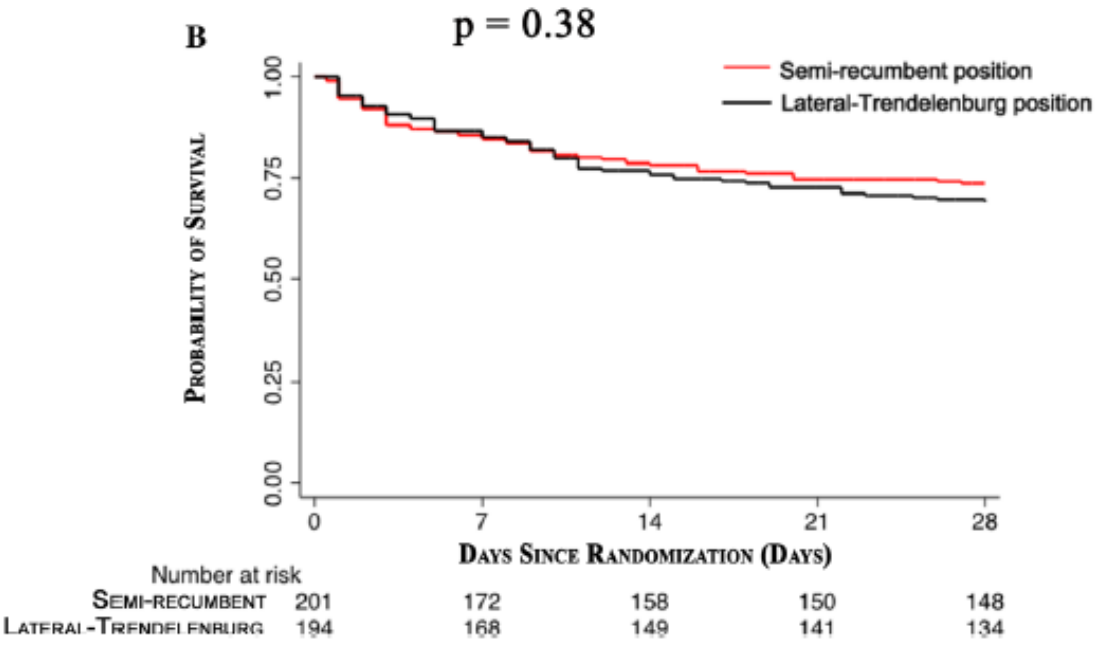


Fig. 4 Incidence of ventilator-associated pneumonia and 28-day survival. Cumulative incidence of ventilator-associated pneumonia from random assignment to day 14 (**a**) and Kaplan–Meier plot for probability of survival from random assignment to day 28 (**b**) in patients allocated to the lateral Trendelenburg position group (*red line*) and the semirecumbent position group (*black line*)

Sánchez-Ramírez *et al. Critical Care* (2018) 22:141
https://doi.org/10.1186/s13054-018-2057-2

Critical Care

RESEARCH Open Access

Long-term use of selective digestive decontamination in an ICU highly endemic for bacterial resistance

Catalina Sánchez-Ramírez[1*], Silvia Hípola-Escalada[1], Miriam Cabrera-Santana[1], María Adela Hernández-Viera[1], Liliana Caipe-Balcázar[1], Pedro Saavedra[2], Fernando Artiles-Campelo[3], Nayra Sangil-Monroy[4], Carlos Federico Lübbe-Vázquez[1] and Sergio Ruiz-Santana[1]

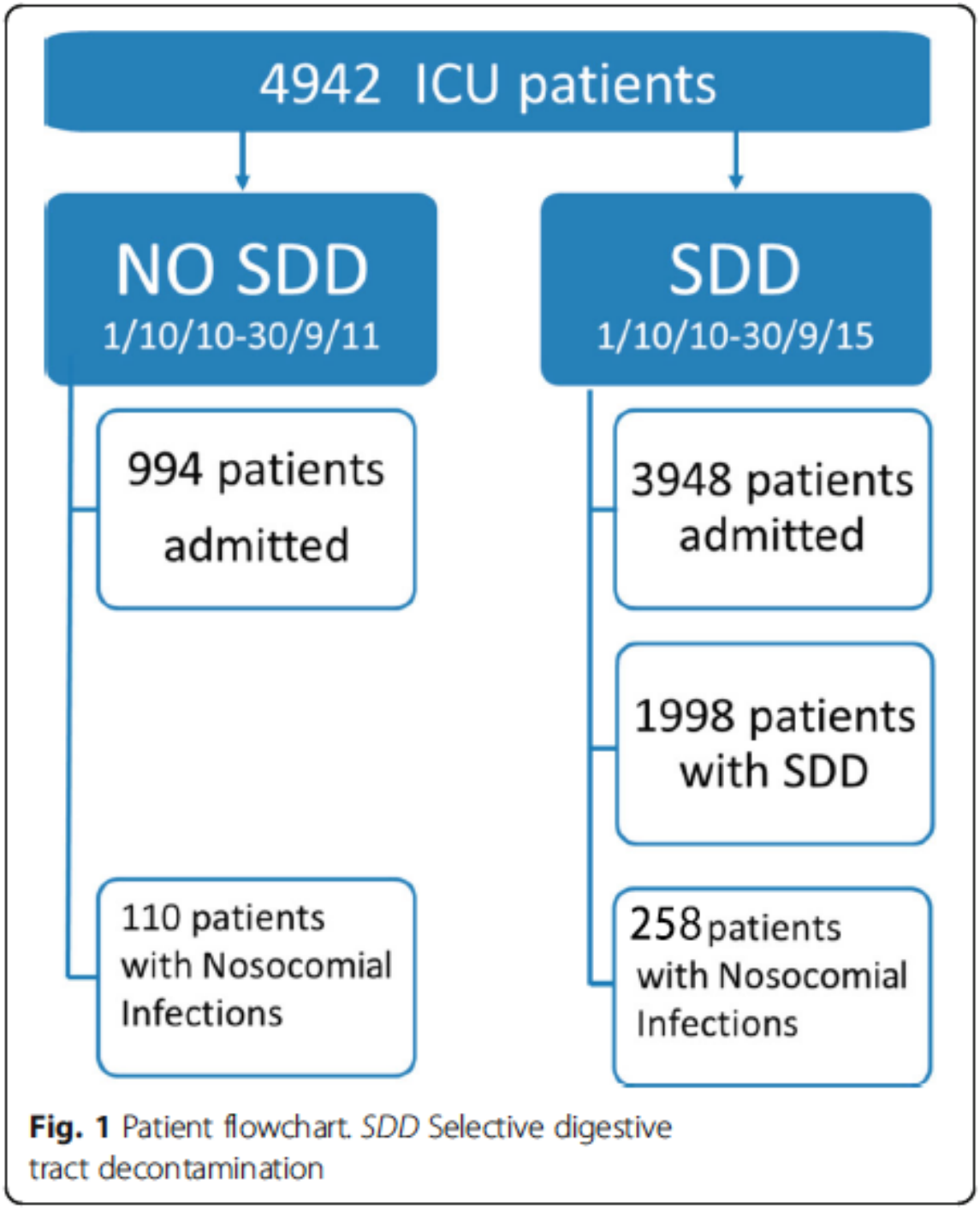


Fig. 1 Patient flowchart. *SDD* Selective digestive tract decontamination

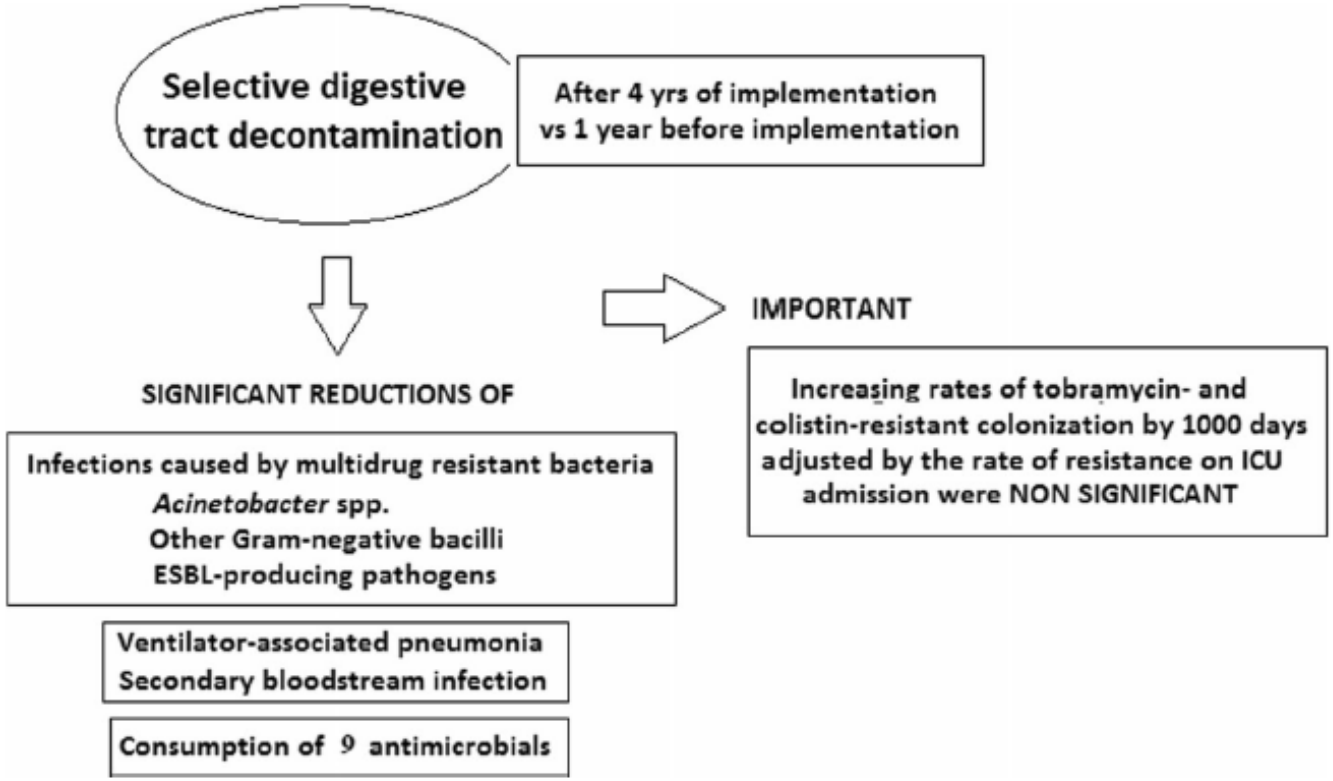


Fig. 2 Summary of study findings. *ESBL* Extended-spectrum β-lactamase

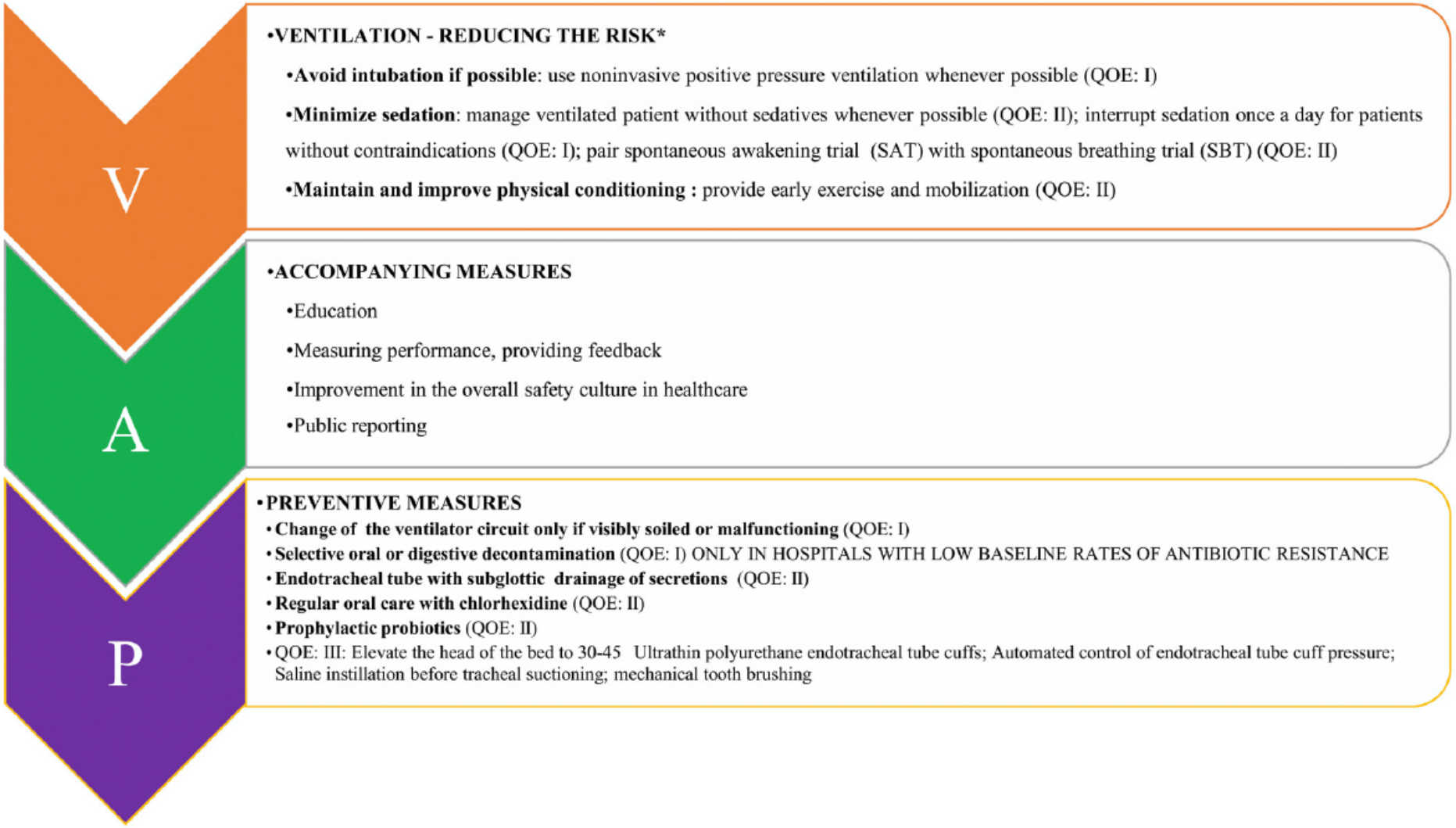


Figure 1. Preventive measures of ventilator-associated pneumonia. Adapted from 37,39. QOE, quality of evidence.

THANKS