呼吸机相关性肺炎诊断、预防和治疗指南（2013）——预 防

中华医学会重症医学分会

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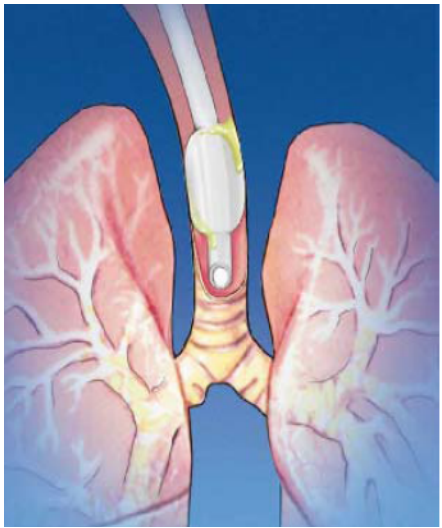


"Ventilator Bundle" Approach to Prevention of Ventilator-Associated Pneumonia

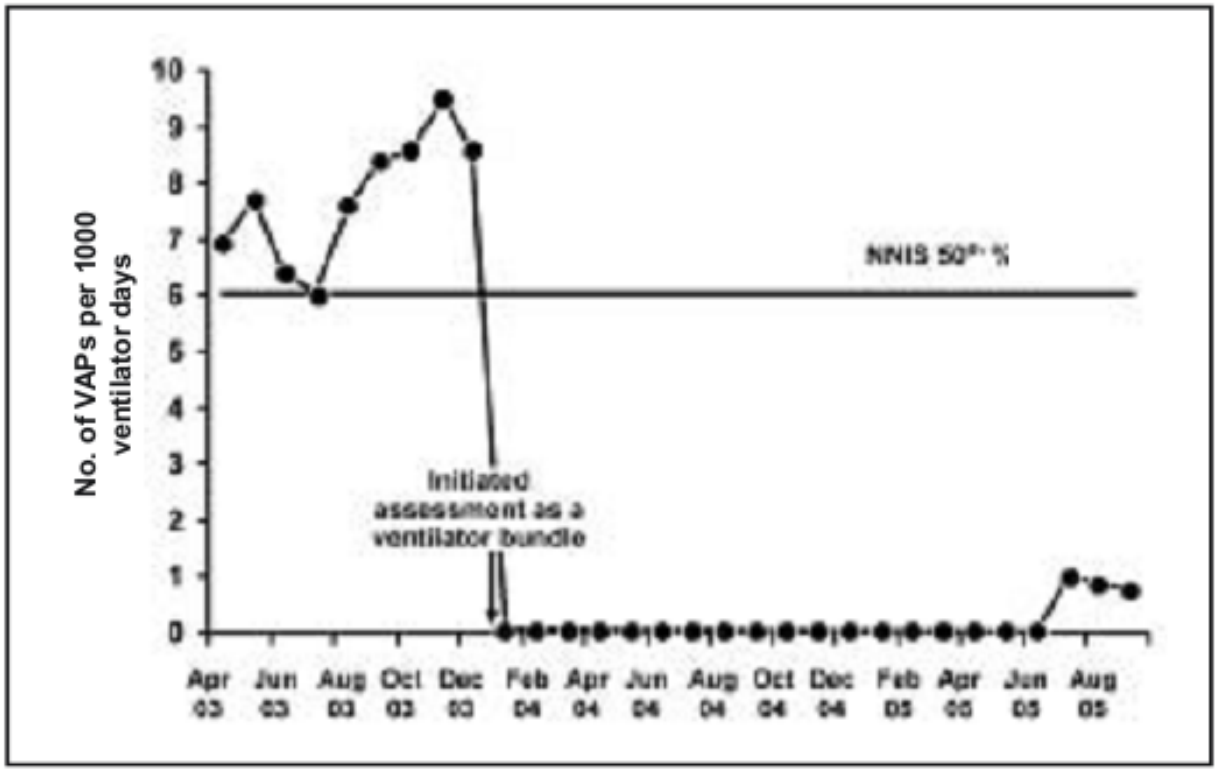


FIGURE. 1. Medical intensive care unit ventilator-associated pneumonia (VAP) rate. NNIS = National Nosocomial Infections Surveillance System.

Mayo Clin Proc. 2006;81:849-850

A world without ventilator-associated pneumonia: Time to abandon surveillance and deconstruct the bundle*

Neil A. Halpern, MD, FCCM; Kaye E. Hale, MD; Kent A. Sepkowitz, MD; Stephen M. Pastores, MD, FCCM

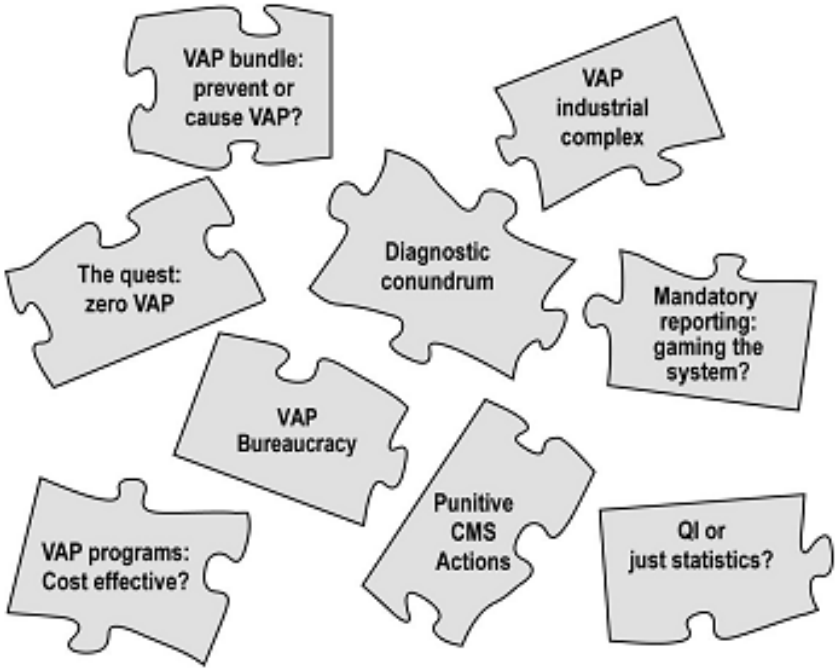
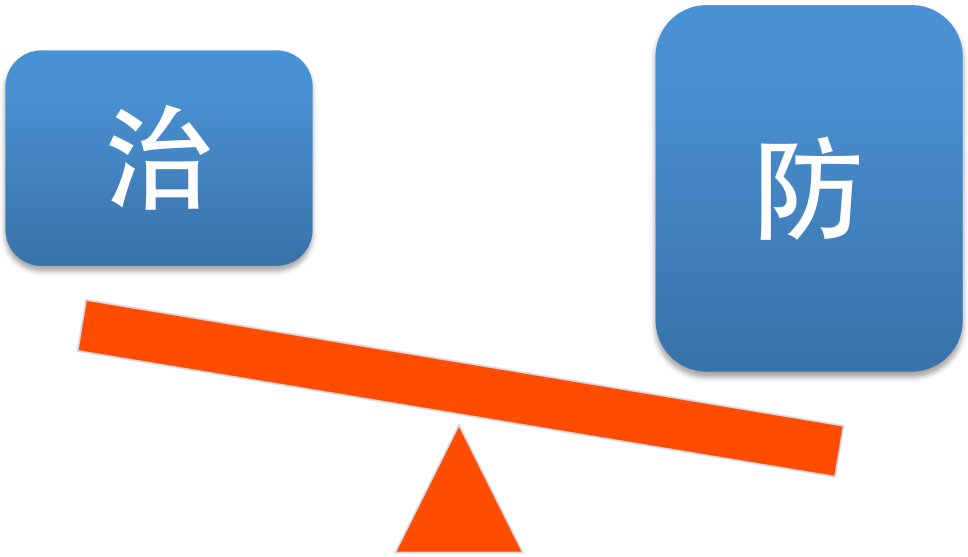


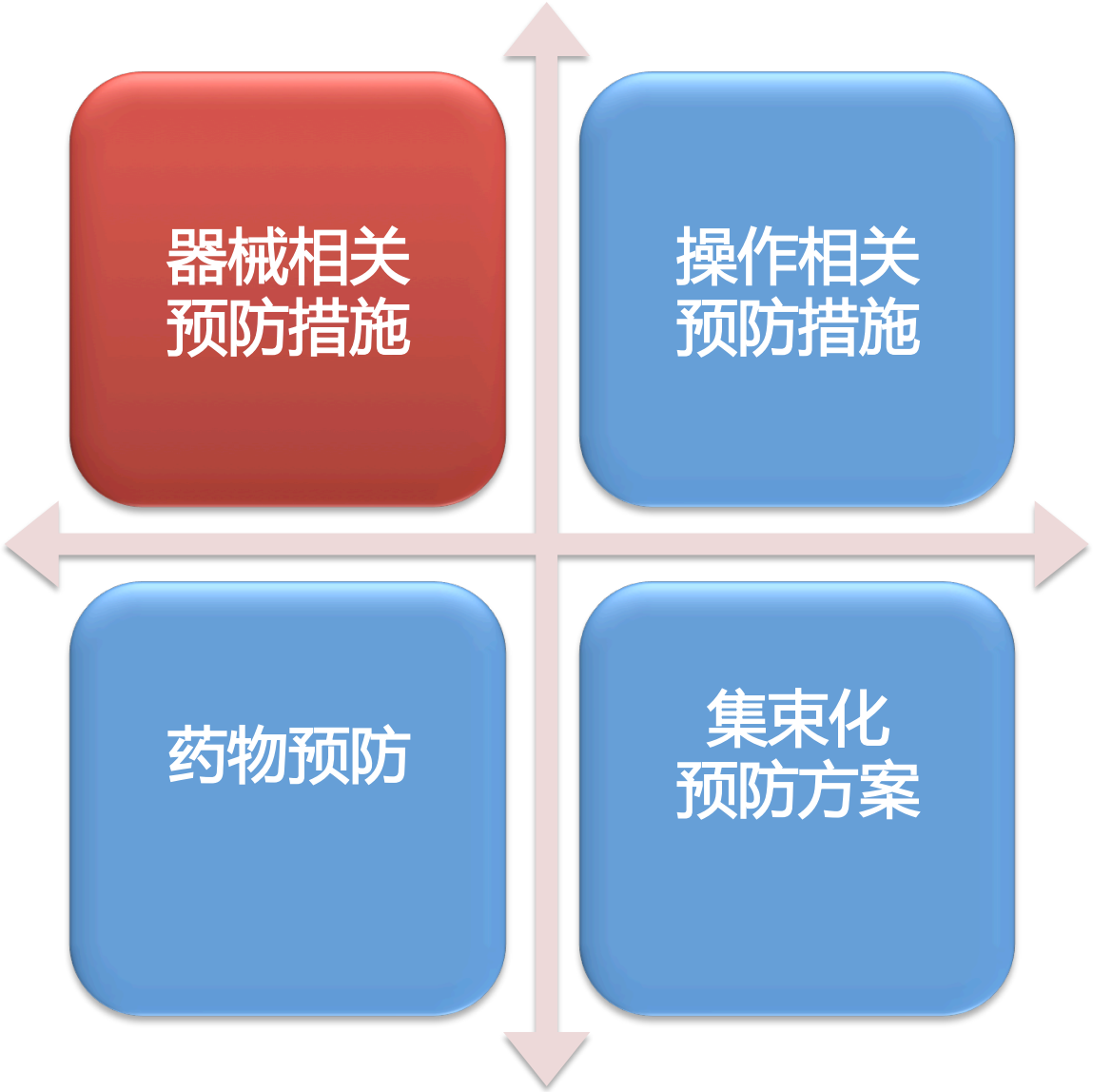
Figure 1. The ventilator-associated pneumonia puzzle: will the pieces ever fit? *VAP*, Ventilator-associated pneumonia; *CMS*, Centers for Medicare & Medicaid Services; *QI*, quality improvement.

Crit Care Med 2012; 40:267–270

VAP的防治

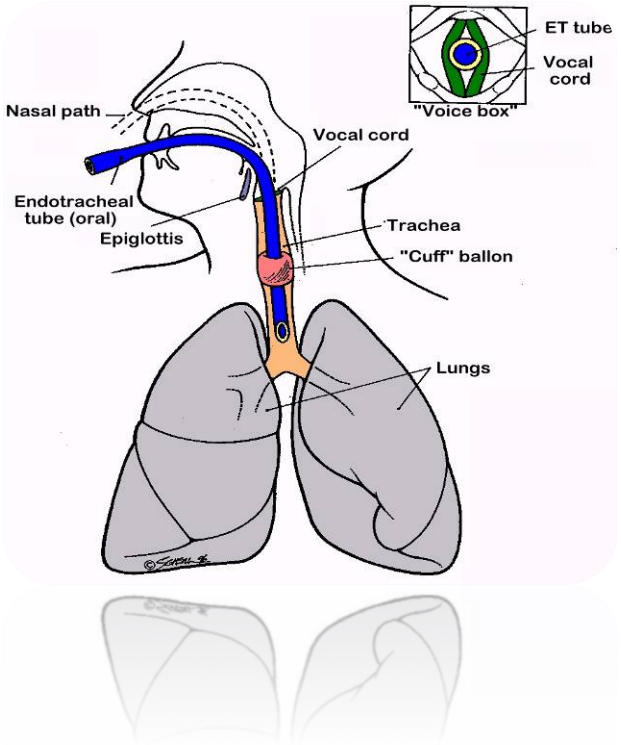


VAP的预防



与器械相关的预防措施

- 呼吸机清洁与消毒
- 呼吸机回路的更换
- 湿化器类型对VAP发生的影响
- HMEs的更换
- 细菌过滤器
- 吸痰装置及更换频率
- 纤维支气管镜



呼吸机清洁与消毒

定义：

指对呼吸整个气路系统，如呼吸回路、传感器、内部回路及机器表面消毒

实施：

应严格按照卫生行政管理部门对医疗机构的消毒管理规定和呼吸机说明书的正规程序执行

所有一次性部件使用后应按照卫生部门相关规定丢弃并保证环境安全

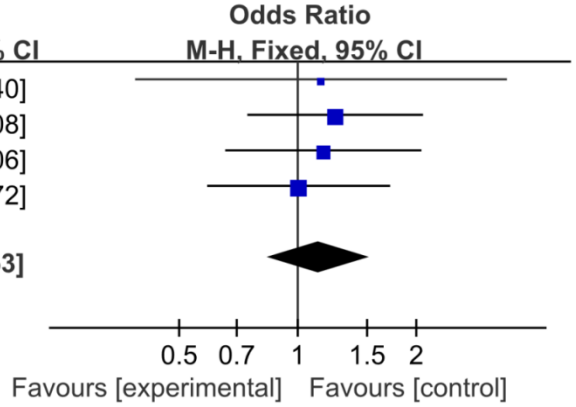
呼吸机回路的更换

- 定期更换呼吸机管路并不降低VAP的发生率，反而增加医疗费用

Study or Subgroup	更换管路组 Events	Total	常规组 Events	Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Dreyfuss 1991	11	35	8	28	7.6%	1.15 [0.39, 3.40]
Kollef 1995	44	153	36	147	32.4%	1.24 [0.74, 2.08]
Long 1996	27	213	26	234	26.8%	1.16 [0.65, 2.06]
Lorente 2004	33	143	37	161	33.2%	1.01 [0.59, 1.72]
Total (95% CI)		**544**		**570**	**100.0%**	**1.14 [0.84, 1.53]**
Total events	115		107			

Heterogeneity: Chi² = 0.33, df = 3 (P = 0.95); I² = 0%

Test for overall effect: Z = 0.83 (P = 0.41)



Author(s): LYM
Date: 2013-01-03
Question: Should MV with no routine circuits change vs 2 or 7 day circuits change be used for VAP prevention?
Settings: ICU patients
Bibliography: [1]Han J, Liu Y. Effect of ventilator circuit changes on ventilator-associated pneumonia: a systematic review and meta-analysis. Respir Care 2010;55:467-74.[2]Lorente L, Lecuona M, Galvan R, Ramos MJ, Mora ML, Sierra A. Periodically changing ventilator circuits is not necessary to prevent ventilator-associated pneumonia when a heat and moisture exchanger is used. Infect Control Hosp Epidemiol 2004;25:1077-82.[3]Long MN, Wickstrom G, Grimes A, Benton CF, Belcher B, Stamm AM. Prospective, randomized study of ventilator-associated pneumonia in patients with one versus three ventilator circuit changes per week. Infect Control Hosp Epidemiol 1996;17:14-9.[4]Kollef MH, Shapiro SD, Fraser VJ, et al. Mechanical ventilation with or without 7-day circuit changes. A randomized controlled trial. Ann Intern Med 1995;123:168-74.[5]Dreyfuss D, Djedaini K, Weber P, et al. Prospective study of nosocomial pneumonia and of patient and circuit colonization during mechanical ventilation with circuit changes every 48 hours versus no change. The American review of respiratory disease 1991;143:738-43.

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	MV with no routine circuits change	2 or 7 day circuits change	Relative (95% CI)	Absolute		
ventilator circuits change												
4	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	81/336 (24.1%)	88/331 (26.6%)	RR 0.877 (0.619 to 1.244)	33 fewer per 1000 (from 101 fewer to 65 more)	⊖⊖⊖⊖ HIGH	CRITICAL
								0%		-		

指南推荐：机械通气患者无需定期更换呼吸回路（1A）

湿化器类型对VAP发生无明显影响

- 湿化器类型：加热湿化器(HHS)和湿热交换器(HMEs)
- 2011年meta分析：纳入15项RCT研究，共2602例患者

Author(s): LYM
Date: 2013-01-03
Question: Should HMEs vs HHs be used for VAP prevention?
Settings: ICU patients
Bibliography: 7. Lorente L, Lecuona M, Jimenez A, Mora ML, Sierra A. Ventilator-associated pneumonia using a heated humidifier or a heat and moisture exchanger: A randomized controlled trial [isrctn88724583]. Crit Care 2006;10:R116. 8. Boots RJ, George N, Faoagali JL, Druery J, Dean K, Heller RF. Double-heater-wire circuits and heat-and-moisture exchangers and the risk of ventilator-associated pneumonia. Crit Care Med 2006;34:687-693. 9. Lacherade JC, Auburtin M, Cerf C, Van de Louw A, Soufir L, Rebufat Y, Rezaiguia S, Ricard JD, Lellouche F, Brun-Buisson C, Brochard L. Impact of humidification systems on ventilator-associated pneumonia: A randomized multicenter trial. Am J Respir Crit Care Med 2005;172:1276-1282. 10. Memish ZA, Oni GA, Djazmati W, Cunningham G, Mah MW. A randomized clinical trial to compare the effects of a heat and moisture exchanger with a heated humidifying system on the occurrence rate of ventilator-associated pneumonia. Am J Infect Control 2001;29:301-305. 11. Kollef MH, Shapiro SD, Boyd V, Silver P, Von Harz B, Trovillion E, Prentice D. A randomized clinical trial comparing an extended-use hygroscopic condenser humidifier with heated-water humidification in mechanically ventilated patients. Chest 1998;113:759-767. 12. Kirton OC, DeHaven B, Morgan J, Morejon O, Civetta J. A prospective, randomized comparison of an in-line heat moisture exchange filter and heated wire humidifiers: Rates of ventilator-associated early-onset (community-acquired) or late-onset (hospital-acquired) pneumonia and incidence of endotracheal tube occlusion. Chest 1997;112:1055-1059. 13. Hurni JM, Feihl F, Lazor R, Leuenberger P, Perret C. Safety of combined heat and moisture exchanger filters in long-term mechanical ventilation. Chest 1997;111:686-691. 14. Boots RJ, Howe S, George N, Harris FM, Faoagali J. Clinical utility of hygroscopic heat and moisture exchangers in intensive care patients. Crit Care Med 1997;25:1707-1712. 15. Dreyfuss D, Djedaini K, Gros I, Mier L, Le Bourdelles G, Cohen Y, Estagnasie P, Coste F, Boussougant Y. Mechanical ventilation with heated humidifiers or heat and moisture exchangers: Effects on patient colonization and incidence of nosocomial pneumonia. Am J Respir Crit Care Med 1995;151:986-992. 16. Roustan JP, Kienlen J, Aubas P, Aubas S, du Cailar J. Comparison of hydrophobic heat and moisture exchangers with heated humidifier during prolonged mechanical ventilation. Intensive Care Med 1992;18:97-100. 17. Martin C, Perrin G, Gevaudan MJ, Saux P, Gouin F. Heat and moisture exchangers and vaporizing humidifiers in the intensive care unit. Chest 1990;97:144-149.

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	HMEs	HHs	Relative (95% CI)	Absolute		
HHs and HMEs												
12	randomised trials	no serious risk of bias	serious[1]	no serious indirectness	no serious imprecision	none	165/1184 (13.9%)	182/1157 (15.7%)	RR 0.85 (0.62 to 1.16)	24 fewer per 1000 (from 60 fewer to 25 more)	⊕⊕⊕O MODERATE	
								0%		-		

指南推荐：机械通气患者可采用HMEs或含加热导丝的HHs作为湿化装置（2B）

中国呼吸与危重监护杂志.2011;10(3):241-246

HMEs的更换

Group	Day 1
HHME-24	3.1 ± 2.5
HME-120	2.7 ± 2.1
HHME-120	3.4 ± 2.5

HHME, hygroscopic heat a
Units are mean colony-for
There were no significant diffe

Table 5. Targeted population: Patients ventilated for 7 days or more

	HME, 1 Day n = 49	HME, 7 Days n = 41
APACHE II score	42 ± 14	43 ± 16
ISS	31 ± 9	33 ± 9
Overall duration of MV, days	15.6 ± 6.9	15 ± 7.2
No. of tracheal aspirations per day	7.2 ± 1.9	6.9 ± 2.3
No. of tracheal instillations per day	1.4 ± 1.3	1.5 ± 1.2
No. of patients with atelectasis		
Lobar	1	0
Segmental	1	2
Tracheal tube occlusion	0	0
No. of patients switched to a heated humidifier	0	0
Peak airway pressure, mm Hg		
Day of inclusion	31 ± 4	32 ± 5
End of study	28 ± 7	29 ± 10
No. of patients with pneumonia (%)	12 (24)	7 (17)
Pneumonia per 1,000 ventilation days	16.4	12.4
Multiple organ failure score		
Day of inclusion	2.0 ± 1.1	2.0 ± 100
End of study	0.2 ± 0.02	0.2 ± 0.02
Hospital mortality, %	32	34

HME, heat and moisture exchangers; APACHE, Acute Physiology and Chronic Health Evaluation; ISS, Injury Severity Score; MV, mechanical ventilation.

- HMEs使用1至5天，细菌
- HMEs每1天更换与每7天更换，VAP的发生率无差别

指南推荐：机械通气患者若使用HMEs，每5-7天更换1次，当HMEs受污染、气道阻力增加时应及时更换（1B）

Crit Care Med,2002,30:232-237
Crit Care Med,2000,28,1412-1418

在呼吸机吸呼气端放置细菌过滤器不降低VAP发生率

- **Objective:** To evaluate the efficacy of bacterial filters (BF) to decrease pneumonia associated with mechanical ventilation(MV).
- **Design:** Prospective, randomized study.

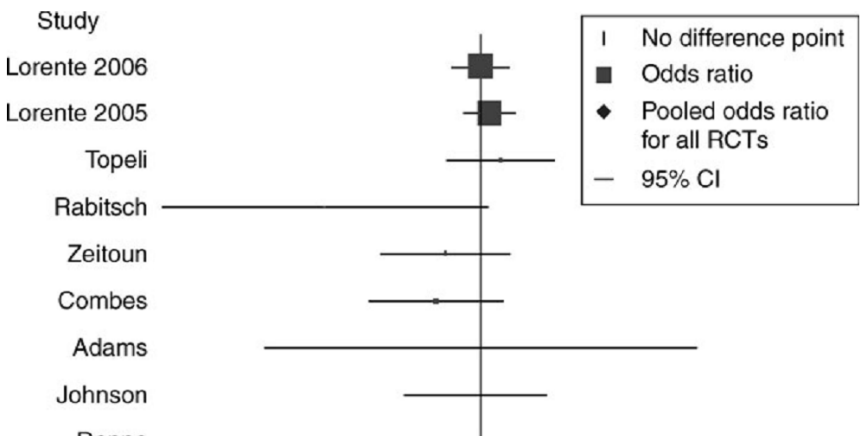
Table 6. No. of infectious events produced by each microorganism and percentage of patients who developed infectious events by a determined microorganism

Infectious Events	Microorganisms	With Filter, n = 114 (%)	Without Filter, n = 116 (%)	*p* Value
Pneumonia	*Staphylococcus aureus*	6 (5.26)	6 (5.17)	.97
	Other GPB	2 (1.75)	6 (5.17)	.15
	Enterobacteriaceae	11 (9.64)	6 (5.17)	.19
	NFGNB	3 (2.63)	4 (3.44)	.71
	Fungi	4 (3.50)	3 (2.58)	.68
	Others	3 (2.63)	5 (4.31)	.48
Respiratory infection	*S. aureus*	6 (5.26)	10 (8.62)	.31
	Other GPB	4 (3.50)	7 (6.03)	.36
	Enterobacteriaceae	15 (13.15)	7 (6.03)	.06
	NFGNB	7 (6.14)	6 (5.17)	.75
	Fungi	6 (5.26)	3 (2.58)	.29
	Others	4 (3.50)	6 (5.17)	.53
Colonization-infection	*S. aureus*	7 (6.14)	12 (10.34)	.24
	Other GPB	6 (5.26)	9 (7.75)	.44
	Enterobacteriaceae	18 (15.78)	11 (9.48)	.14
	NFGNB	9 (7.89)	12 (10.34)	.51

指南推荐：
机械通气患者不常规使用细菌过滤器（2C）

Crit Care Med 2003; 31:2126 –2130

吸痰装置对VAP发生的影响



Author(s): LYM
Date: 2012-01-23
Question: Should open tracheal suction vs closed tracheal suction be used for VAP prevention?
Settings:
Bibliography: [1] Subirana M, Solà I, Benito S. Closed tracheal suction systems versus open tracheal suction systems for mechanically ventilated adult patients. Cochrane Database Syst Rev. 2007 Oct 17;(4):CD004581. [2] Siempos II, Vardakas KZ, Falagas ME. Closed tracheal suction systems for prevention of ventilator-associated pneumonia. Br J Anaesth. 2008 Mar;100(3):299-306. [3] 董亮，于涛，杨毅等。封闭式和开放式与安全性评价的吸痰系统临床效果Meta分析。中华内科杂志，2012.

Quality assessment							No of patients		Effect			
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Open tracheal suction	Closed tracheal suction	Relative (95% CI)	Absolute	Quality	Importance
open tracheal suction vs closed tracheal suction												
9	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	128/648 (19.8%)	120/644 (18.6%)	RR 0.96 (0.72 to	7 fewer per 1000 (from 52 fewer to 52	⊕⊕⊕⊕ HIGH	

- 密闭式吸痰装置和开放式吸痰装置对机械通气患者VAP的发生率、病死率及ICU住院时间无明显差异

Br J Anaesth 2008; 100 : 299–306

吸痰装置更换频率对VAP发生的影响

TABLE 4. Estimates of Associations Between Treatment and Control Groups, by Use of a Random-Effects Model to Compare Less Frequent and More-Frequent Changes of In-Line Tracheal Suction Catheters

Study	Proportion of patients[a]		Weight, %	RR[b] (95% CI)
	Treatment group	Control group		
Kollef et al.,[16] 1997	38/258	39/263	100	0.99 (0.66-1.50)
Darvas and Hawkins,[13] 2003	0/48	0/53	...	Not estimable
All studies	306	316	100	0.99 (0.66-1.50)

NOTE. The outcome studied was ventilator-associated pneumonia. The total number of events was 38 in the treatment groups and 39 in the control groups. The test for heterogeneity was not applicable. From the test for overall effect, $Z = 0.03$ ($P = .97$). CI, confidence interval; RR, relative risk.

[a] No. of patients with ventilator-associated pneumonia/total no. of patients analyzed.

[b] RR (random) values greater than 1 favor the control group, and values less than 1 favor the treatment group.

- **Include 2 RCTs**
- **Treatment group：** participants have no routine changes of catheters 1 or routine changes every 48 hours
- **Control group：** participant have changes every 24 hours
- **Result：** Pooling of data resulted in no difference between the trial groups

指南推荐：除非破损或污染，机械通气患者的密闭式吸痰装置无需每日更换（1B）

纤维支气管镜的操作是VAP发生的独立危险因素

Factors associated with development of ventilator-associat

Factor	Incidence of VAP *N* (%)
Age (years)	
14–65	478 (18.2)
<14 or >65	390 (25.6)
Sex	
Female	208 (15.5)
Male	660 (23.5)
Coma	
No	366 (14.5)
Yes	502 (30.8)
Chronic obstructive pulmonary disease	
No	635 (18.0)
Yes	233 (36.6)
Thoracic or major abdominal surgery	
No	478 (17.4)
Yes	390 (27.8)
Use of immunosuppressant	
No	645 (19.2)
Yes	223 (27.9)
Bronchoscopy before VAP onset	
No	812 (20.5)
Yes	56 (28.7)
Tracheostomy	
No	65 (12.7)
Yes	803 (22.0)
Use of antacid	
No	233 (14.0)
Yes	635 (25.5)
Serious original diseases before VAP[a]	
No	469 (16.0)
Yes	399 (32.5)
Infections in other sites	
No	751 (19.4)
Yes	117 (41.9)
Period of antimicrobial use	
≤4 days	125 (7.0)
>4 days	743 (31.5)

COPD, chronic obstructive pulmonary disease; NS, non-signifi
[a] Including diabetes, respiratory failure, heart failure, cancer, and sepsis.

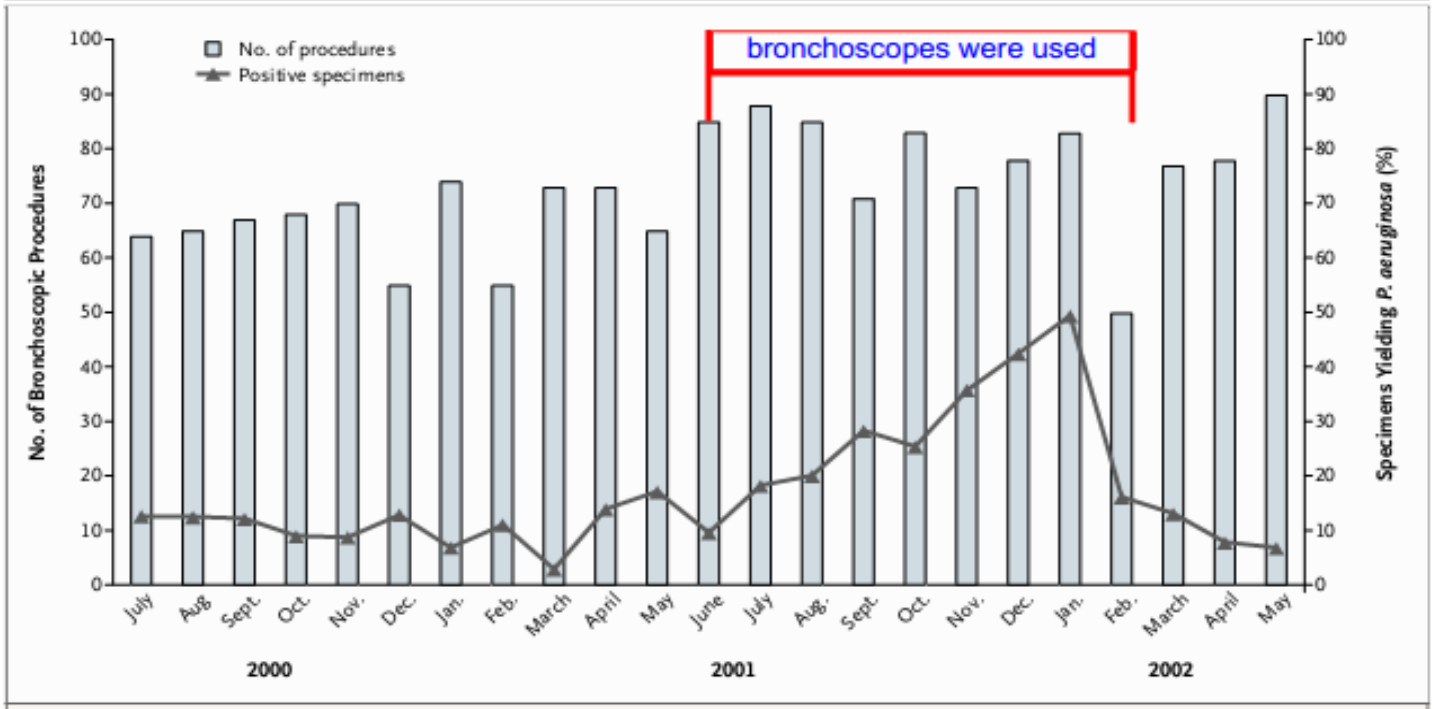


Figure 1. Rates of Recovery of *Pseudomonas aeruginosa* from Bronchoalveolar-Lavage Specimens.

Two of the recalled bronchoscopes were put into service in mid-June 2001. All recalled bronchoscopes were removed from service on February 6, 2002.

铜绿假单胞菌感染暴发与纤支镜的使用密切相关，患者分泌物与纤支镜病原学培养两者同源性一致

指南建议：
严格管理内镜的消毒、灭菌和维护具有重要临床意义

N Engl J Med 2003;348:221-7.

VAP的预防

与操作相关的预防措施

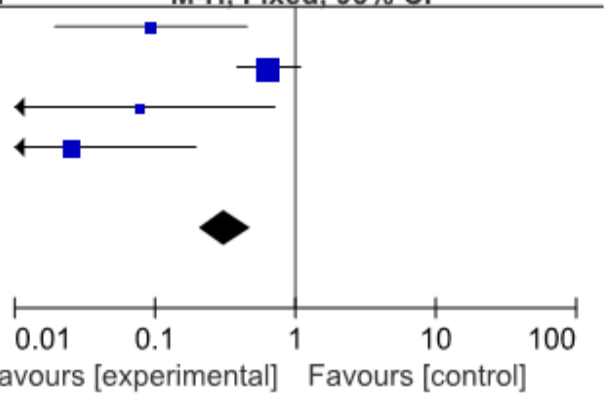
- 气管插管路径与鼻窦炎防治
- 声门下分泌物引流
- 气管切开的时机
- 动力床治疗
- 抬高床头使患者保持半卧位
- 俯卧位通气
- 肠内营养
- 气管内导管套管压力
- 控制外源性感染
- 口腔卫生
- 呼吸机相关性气管支气管炎

经鼻气管内插管增加鼻窦炎的发生率

Study or Subgroup	经口气管插管 Events	Total	经鼻气管插管 Events	Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Bach 1992	2	32	15	36	16.6%	0.09 [0.02, 0.45]
Laurent 1993	33	151	45	149	44.4%	0.65 [0.38, 1.09]
Rouby 1994	1	20	8	20	9.5%	0.08 [0.01, 0.71]
Salord 1990	1	53	25	58	29.4%	0.03 [0.00, 0.20]
Total (95% CI)		**256**		**263**	**100.0%**	**0.32 [0.21, 0.49]**
Total events	37		93			

Heterogeneity: Chi² = 16.86, df = 3 (P = 0.0008); I² = 82%

Test for overall effect: Z = 5.27 (P < 0.00001)



Author(s): LYM
Date: 2012-01-23
Question: Should orotracheal vs nasotracheal be used for VAP prevention?
Settings:
Bibliography: [1] Salord F, Gaussorgues P, Marti-Flich J, et al. Nosocomial maxillary sinusitis during mechanical ventilation: a prospective comparison of orotracheal versus the nasotracheal route for intubation. Intensive Care Med 1990;16(6):390-3. [2] Bach A, Boehrer H, Schmidt H, et al. Nosocomial sinusitis in ventilated patients. Nasotracheal versus orotracheal intubation. Anaesthesia 1992;47 (4):335-9. [3] Holzapfel L, Chevret S, Madinier G, et al. Influence of long-term oro- or nasotracheal intubation on nosocomial maxillary sinusitis and pneumonia: results of a prospective, randomized, clinical trial. Crit Care Med 1993;21:1132-8

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Orotracheal	Nasotracheal	Relative (95% CI)	Absolute		
sinusitis												
3	randomised trials	serious[1]	no serious inconsistency[1,2]	serious[1,2]	no serious imprecision	none	36/236 (15.3%)	85/243 (35%)	RR 0.34 (0.22 to 0.53)	231 fewer per 1000 (from 164 fewer to 273 fewer)	⊕⊕OO LOW	2
								0%		-		

[1] not blinded
[2] outcome not for VAP

疑似鼻窦炎存在应行影像学检查

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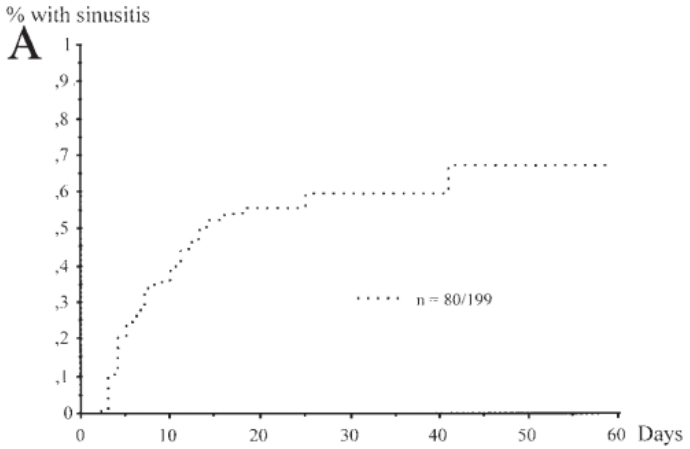

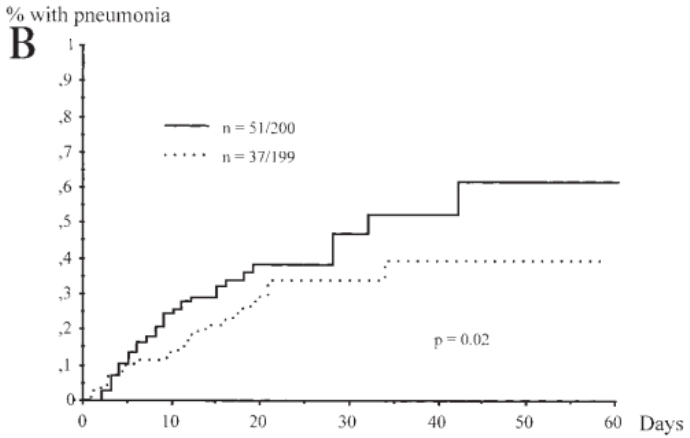

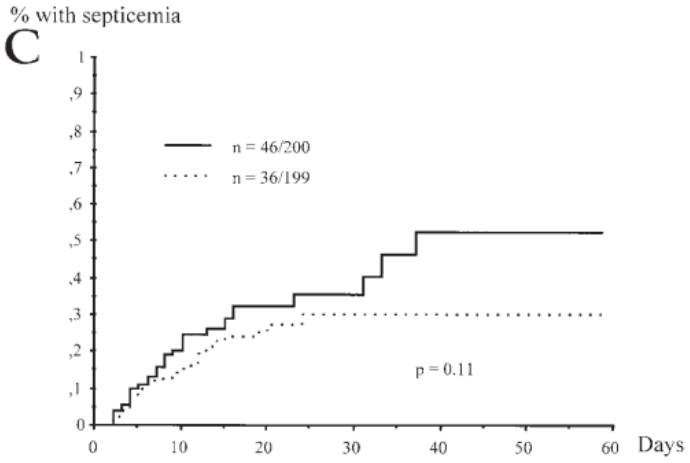

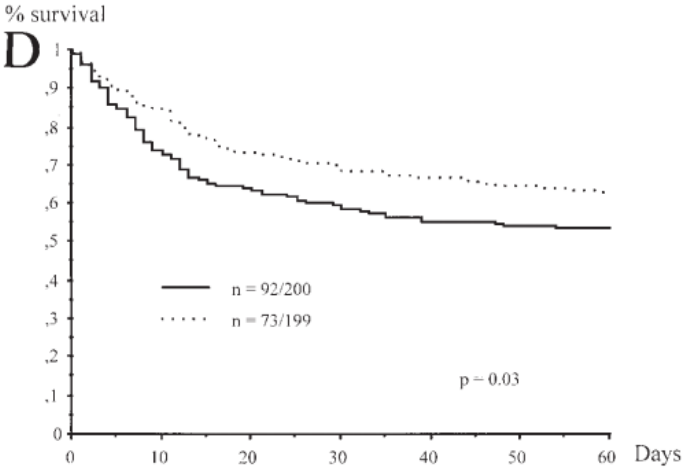

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指南建议：

经鼻气管插管患者出现难以解释的发热，需行影像学检查评估是否患有鼻窦炎，并及时治疗(2B)

Am J Respir Crit Care Med 1999;159:695–701

药物可预防鼻窦炎，但不降低VAP的发生率

Table 2 Number of cases of radiological maxillary sinusitis (*RMS*) and infectious maxillary sinusitis (*IMS*) diagnosed during each period

Period (days)	NDCA RMS	NDCA IMS	Control RMS	Control IMS
0–2	2	0	7	0
4–7	3	0	8	2
7–14	10	2	13	4
>14	6	1	7	2
Total	21	3	33	8

Table 3 Microbiological results from positive quantitative cultures ($>10^3$ cfu/ml) in 11 patients with infectious maxillary sinusitis (*IMS*) and in 17 patients with ventilator-associated pneumonia (*VAP*)

	IMS		VAP	
	NDCA	Control	NDCA	Control
Gram negative bacilli				
Acinetobacter	2	4	1[a]	1[a]
Pseudomonas	1	3	–	1[a]
Escherichia coli	1	–	–	1
Serratia	–	–	–	2
Haemophilus	–	1	–	–
Klebsiella	–	–	2	3
Enterobacter	–	1	2	2 (1[a])
Citrobacter	–	–	–	1
Proteus	–	–	–	1
Gram-positive cocci				
Staphylococcus aureus	1	3	2 (1[a])	1[a]
Staphylococcus epidermidis	–	–	–	–
Streptococcus	1	–	1	–
Anaerobes				
Prevotella melaninogenica	–	2	–	–
Fusobacterium nucleatum	–	1	–	–
Bacteroides ovatus	–	1	–	–
Yeasts	–	–	–	–

[a] Micro-organisms isolated by quantitative cultures both in IMS patients and in VAP patients (see text for details)

- **NDCA group**:局部使用塞洛唑啉滴鼻液及布地奈德预防鼻窦炎
- **Control group** ：使用安慰剂

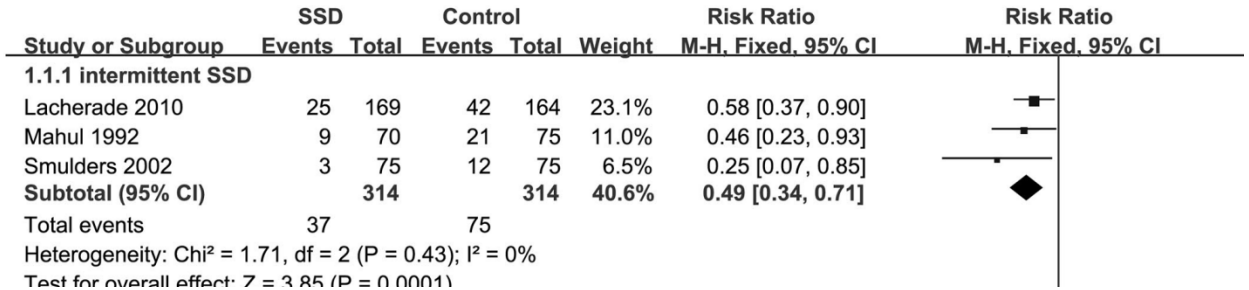
- **RMS:** NDCA group vs control group= 53.8% vs 82.5%， $p < 0.01$
- **IMS:** NDCA group vs control group= 7.7% vs 20%， $p = 0.11$
- **VAP:** NDCA group vs control group= 15.4% vs 27.5%， NS

指南建议：
应用药物可预防鼻窦炎，但不降低VAP的发生率(2C)

Intensive Care Med. 2006 ;32(4):532-7

声门下分泌物引流可降低VAP的发生率

- 纳入10项RCT的meta分析，共2213 例患者



Study or Subgroup	SSD Events	SSD Total	Control Events	Control Total	Weight	Risk Ratio M-H, Fixed, 95% CI
1.1.1 intermittent SSD						
Lacherade 2010	25	169	42	164	23.1%	0.58 [0.37, 0.90]
Mahul 1992	9	70	21	75	11.0%	0.46 [0.23, 0.93]
Smulders 2002	3	75	12	75	6.5%	0.25 [0.07, 0.85]
Subtotal (95% CI)		**314**		**314**	**40.6%**	**0.49 [0.34, 0.71]**
Total events	37		75			

Heterogeneity: Chi² = 1.71, df = 2 (P = 0.43); I² = 0%

Test for overall effect: Z = 3.85 (P = 0.0001)

Author(s): LYM
Date: 2012-01-26
Question: Should subglotti secretion drainage be used for VAP prevention?
Settings:
Bibliography: [1] Leasure AR, Stirlen J, Lu SH. Prevention of ventilator-associated pneumonia through aspiration of subglottic secretions: a systematic review and meta-analysis. Dimens Crit Care Nurs. 2012 Mar-Apr;31(2):102-17. [2] Wang F, Bo L, Tang L, et al. Subglottic secretion drainage for preventing ventilator-associated pneumonia: An updated meta-analysis of randomized controlled trials. J Trauma Acute Care Surg. 2012 May;72(5):1276-85.

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Subglotti secretion drainage	Control	Relative (95% CI)	Absolute		
subglottic secretion drainage												
12	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	126/1142 (11%)	243/1286 (18.9%)	RR 0.45 (0.35 to 0.57)	104 fewer per 1000 (from 81 fewer to 123 fewer)	⊕⊕⊕O MODERATE	
								0%		-		

[1] not blinded

指南建议：
建立人工气道患者应行声门下分泌物引流(1B)

J Trauma. 2012;72: 1276 –1285

气管切开的早晚对VAP的发生率无影响

- 早切：机械通气8天以内
- 晚切：机械通气13天以上
- 纳入7项RCT研究，共1044例患者行meta分析

Study or Subgroup	ET Events	ET Total	LT Events	LT Total	Weight	Risk Ratio M-H, Random, 95% CI	Risk Ratio M-H, Random, 95% CI
Barquist 2006	28	29	28	31	22.0%	1.07 [0.93, 1.22]	
Blot 2008	30	61	31	62	13.7%	0.98 [0.69, 1.40]	

Author(s): LYM
Date: 2012-01-23
Question: Should early tracheostomy vs late tracheostomy be used for VAP prevention?
Settings:
Bibliography: [1] Wang F, Wu Y, Bo L, et al. The timing of tracheotomy in critically ill patients undergoing mechanical ventilation: a systematic review and meta-analysis of randomized controlled trials. Chest. 2011 Dec;140(6):1456-65.

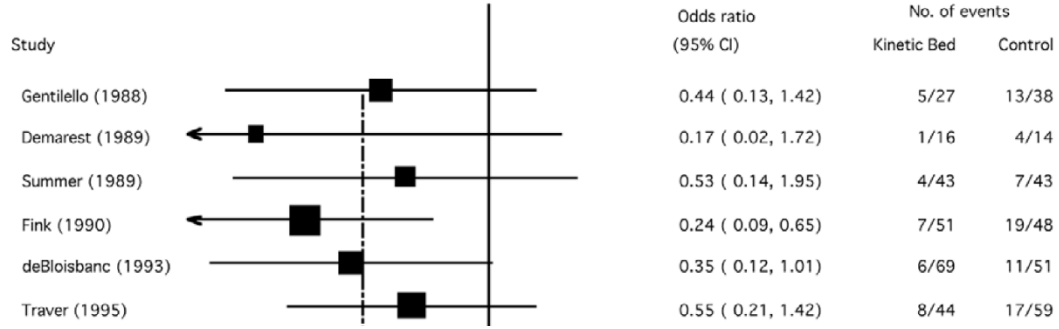
Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Early tracheostomy	Late tracheostomy	Relative (95% CI)	Absolute		
ET or LT for VAP prevention												
7	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	180/520 (34.6%)	206/524 (39.3%)	RR 0.94 (0.77 to 1.15)	24 fewer per 1000 (from 90 fewer to 59 more)	⊕⊕⊕⊕ HIGH	
								0%		-		

指南建议：
机械通气患者早期气管切开不影响VAP的发生率(2B)

CHEST 2011; 140(6):1456–1465

动力床治疗可降低VAP 的发生率

- 纳入10项关于动力床治疗与常规治疗的RCTs



Author(s): LYM
Date: 2012-01-24
Question: Should kinetic bed be used for VAP prevention ?
Settings:
Bibliography: [1]Delaney A, Gray H, Laupland KB, Zuege DJ.Kinetic bed therapy to prevent nosocomial pneumonia in mechanically ventilated patients: a systematic review and meta-analysis. Crit Care. 2006;10(3):R70.

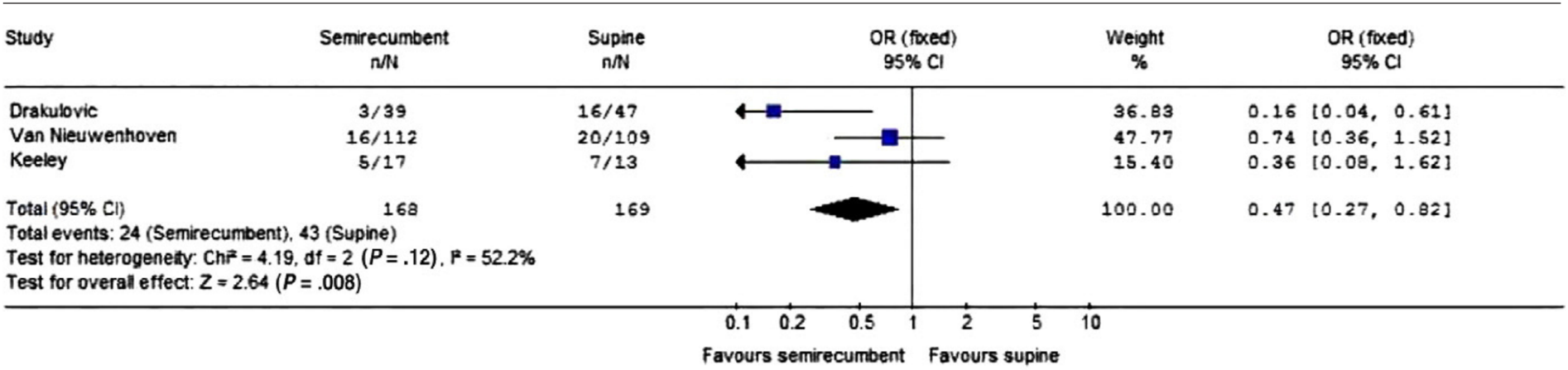
Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Kinetic bed	Control	Relative (95% CI)	Absolute		
kinetic bed for VAP prevention												
10	randomised trials[1]	serious[2]	no serious inconsistency	no serious indirectness	no serious imprecision	none	67/470 (14.3%)	153/497 (30.8%)	RR 0.38 (0.28 to 0.53)	191 fewer per 1000 (from 145 fewer to 222 fewer)	⊖⊖⊖O MODERATE	
								0%		-		

[1] including pseudo-randomised trails
[2] it is not feasible to implement "blind"

指南建议：
机械通气患者应用动力床治疗可降低VAP 的发生率(2B)

Critical Care 2006, 10:R70

抬高床头以降低VAP的发生率



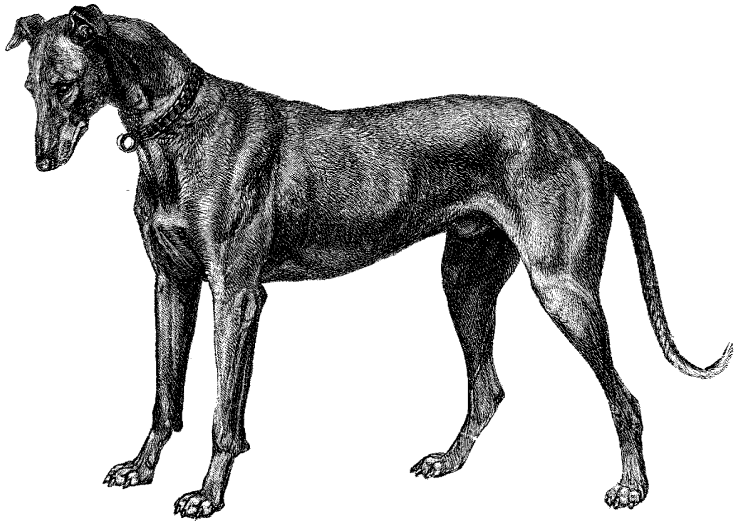
Author(s): LYM
Date: 2012-01-24
Question: Should semirecumbent position be used for VAP prevention ?
Settings:
Bibliography: [1] Niël-Weise BS, Gastmeier P, Kola A, Vonberg RP, Wille JC, van den Broek PJ; Bed Head Elevation Study Group. An evidence-based recommendation on bed head elevation for mechanically ventilated patients. Crit Care. 2011;15(2):R111.

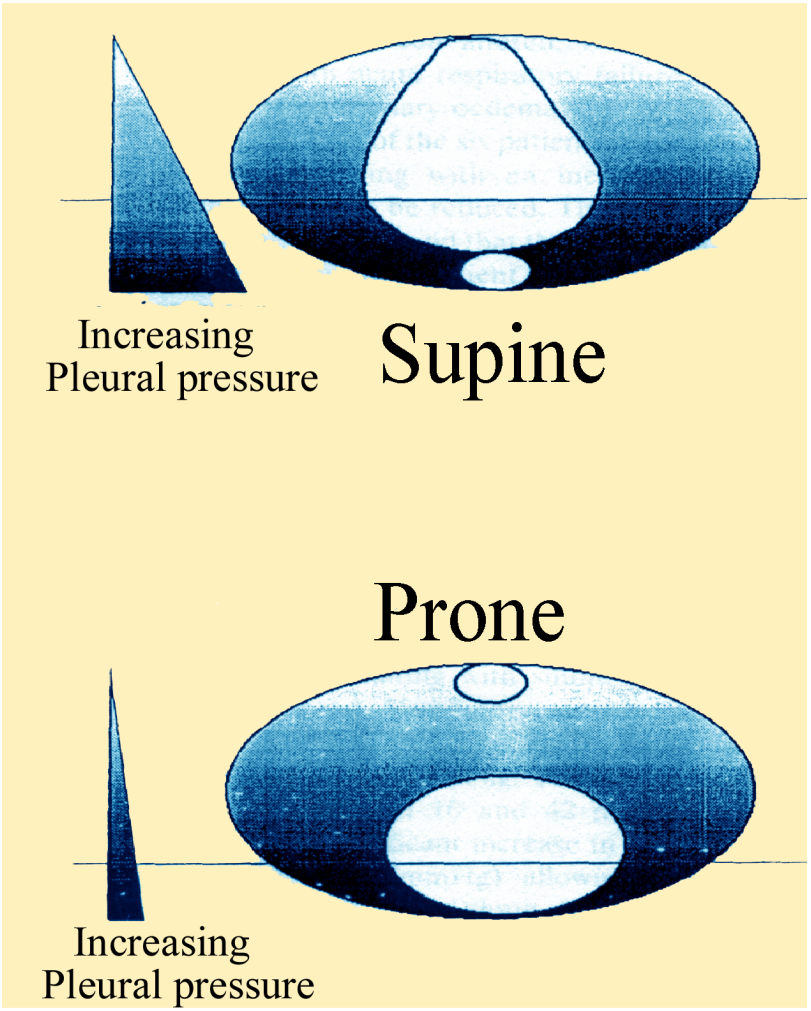
Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Semirecumbent position	Control	Relative (95% CI)	Absolute		
semirecumbent position for VAP prevention												
3	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	20/168 (11.9%)	38/169 (22.5%)	RR 0.47 (0.19 to 1.17)	119 fewer per 1000 (from 182 fewer to 38 more)	⊕⊕⊕⊕ HIGH	
								0%		-		

指南建议：
机械通气患者应抬高床头以降低VAP的发生率(1C)

Critical Care 2011, 15:R111

俯卧位




Increasing
Pleural pressure
Supine
Prone
Increasing
Pleural pressure

俯卧位通气不能降低VAP发生率

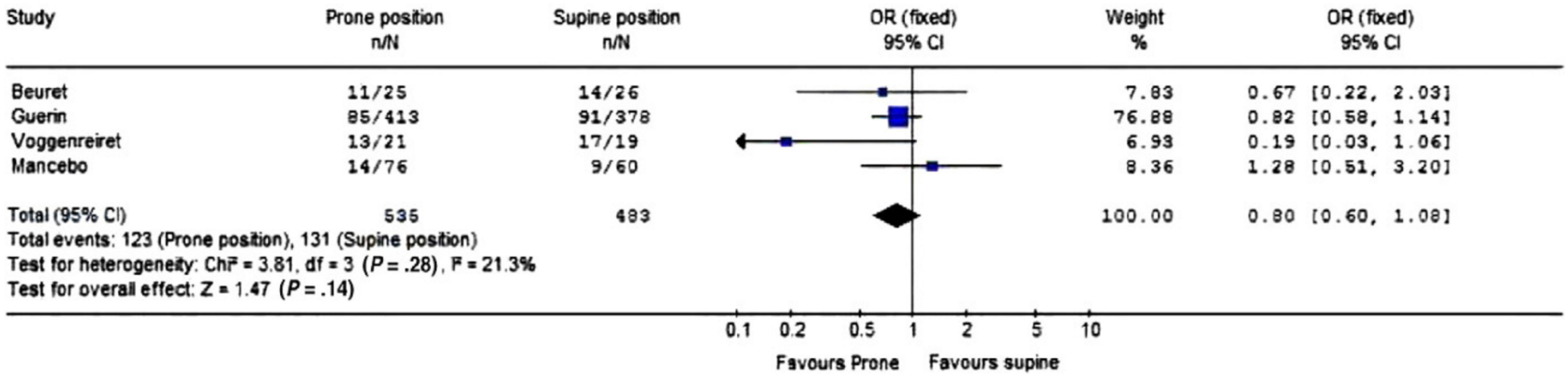


Fig. 2 Odds ratios of the incidence of clinically diagnosed VAP for the individual randomized controlled trials and pooled analyses comparing semirecumbent (treatment) to supine position (control) and prone (treatment) to supine position (control).

Author(s): LYM
Date: 2012-01-24
Question: Should prone position be used for VAP prevention ?
Settings:
Bibliography: [1] Alexiou VG, Ierodiakonou V, Dimopoulos G, Falagas ME.Impact of patient position on the incidence of ventilator-associated pneumonia: a meta-analysis of randomized controlled trials.J Crit Care. 2009 Dec;24(4):515-22.

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Prone position	Control	Relative (95% CI)	Absolute		
prone position for VAP prevention												
4	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	123/535 (23%)	131/483 (27.1%)	RR 0.8 (0.6 to 1.08)	54 fewer per 1000 (from 108 fewer to 22 more)	⊕⊕⊕⊕ HIGH	
								0%		-		

J CritlCare .2009; 24, 515–522

经鼻肠营养 vs 经鼻胃营养

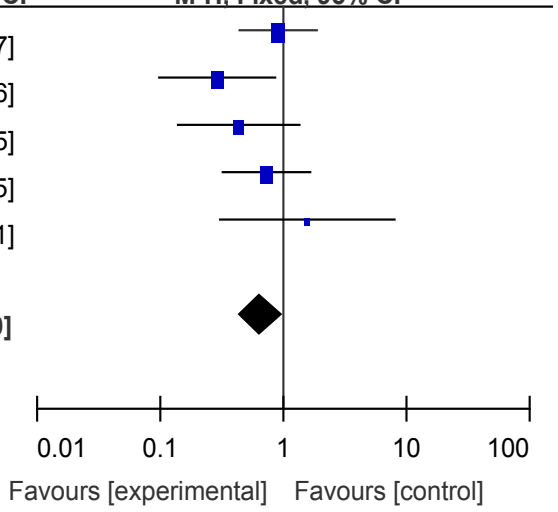
□背景：肠内营养可减少胃肠道细菌的定植，增强机体免疫力

□鼻饲方法：经鼻胃管、经鼻十二指肠管及经鼻空肠管

	鼻空肠管肠内营养		鼻胃管肠内营养			Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI
Andrew 2012	18	91	19	89	28.5%	0.91 [0.44, 1.87]
Chien 2009	5	59	15	62	24.7%	0.29 [0.10, 0.86]
Hayden 2009	5	50	11	54	17.6%	0.43 [0.14, 1.35]
Juan 2002	16	50	20	51	24.9%	0.73 [0.32, 1.65]
Patrick 2000	4	21	3	23	4.3%	1.57 [0.31, 8.01]
Total (95% CI)		**271**		**279**	**100.0%**	**0.66 [0.43, 1.00]**
Total events	48		68			

Heterogeneity: Chi² = 4.62, df = 4 (P = 0.33); I² = 13%

Test for overall effect: Z = 1.96 (P = 0.05)



指南建议：

机械通气患者选择经鼻肠管进行营养支持可降低VAP的发生率(2B)

气管内导管套囊压力与VAP
持续监测 VS 间断监测

- Methods:

  Prospective RCT

  Single medical ICU.
- Patients： 122 pats were included
- Groups ：

  Intervention group, n= 61： continuous control of Pcuff

  control group, n =61：

  routine care of Pcuff

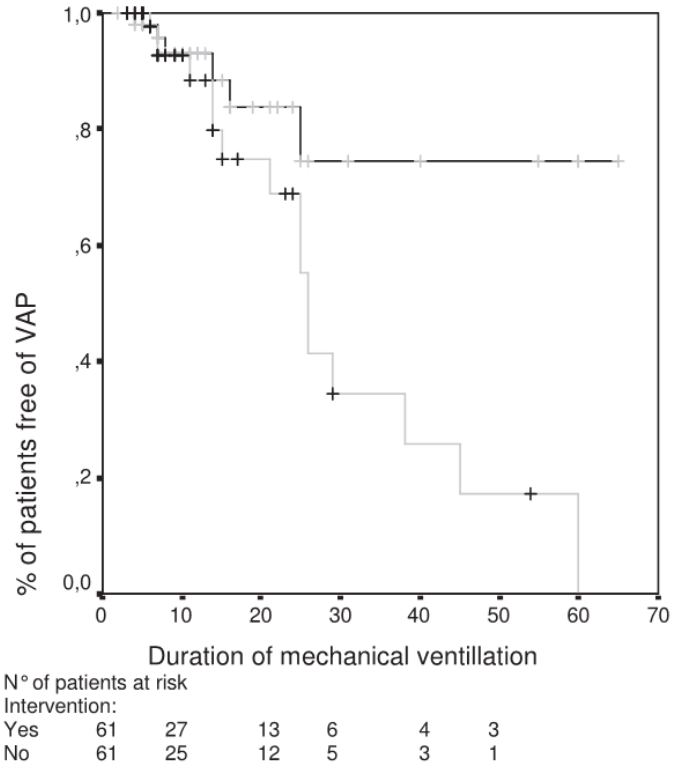


Figure 2. Cumulative rates of remaining free of ventilator-associated pneumonia (VAP) in the two groups examined by the Kaplan-Meier

指南建议：

机械通气患者应定期监测气管内导管套囊压力(2C)

持续控制气管内导管套囊压力可降低VAP的发生率(2B)

Am J Respir Crit Care Med . 2011; 184: 1041–1047

控制外源性感染与VAP

- 医护人员手卫生

  研究显示：医护人员手上定植有G-菌、金黄色葡萄球菌等

  回顾性研究显示：洗手及酒精消毒可降低VAP的发生率

- 医务人员宣教

  回顾性研究发现：对医护人员宣教可显著降低VAP的发生率并缩短机械通气时间

- 环境卫生
- 保护性隔离
- ……

院感控制重要措施

指南建议：
加强医护人员手卫生可降低VAP的发生率(1C)

2-119
-780
-227
Arch Bronconeumol,2010,46:188-195

口腔护理可降低VAP的发生率

- 建立人工气道破坏了机械通气患者口鼻腔对细菌的天然屏障作用，口腔护理是对气道的重要保护
- 口护方法：使用生理盐水、洗必泰、聚维酮碘冲洗，用牙刷刷洗牙齿和舌面

Author(s): LYM
Date: 2012-01-24
Question: Should oral hygiene be used for VAP prevention ?
Settings:
Bibliography: [1] Labeau SO, Van de Vyver K, Brusselaers N, et al. Prevention of ventilator-associated pneumonia with oral antiseptics: a systematic review and meta-analysis. Lancet Infect Dis. 2011 Nov;11(11):845-54.

Author(s): LYM
Date: 2012-01-24
Question: Should chlorhexidine
Settings:
Bibliography: [1] Labeau SO, V
2011 Nov;11(11):845-54.

No o studi	
oral hy	
14	

[1] not bli

No of studies	Design	Risk bias
chlorhexidine for VAP preve		
12	randomised trials	seriou

[1] not blinded

Author(s): LYM
Date: 2012-01-24
Question: Should povidone-iodine be used for VAP prevention ?
Settings:
Bibliography: [1] Labeau SO, Van de Vyver K, Brusselaers N, et al. Prevention of ventilator-associated pneumonia with oral antiseptics: a systematic review and meta-analysis. Lancet Infect Dis. 2011 Nov;11(11):845-54.

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Povidone-iodine	Control	Relative (95% CI)	Absolute		
povidone-iodine for VAP prevention												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	9/58 (15.5%)	33/82 (40.2%)	RR 0.39 (0.11 to 1.36)	245 fewer per 1000 (from 358 fewer to 145 more)	⊕⊕⊕O MODERATE	
								0%		-		

[1] not blinded

用聚维酮碘行口腔护理不能降低VAP的发生率

用洗必泰行口腔护理可降低VAP的发生率

指南建议：
机械通气患者使用洗必泰行口腔护理可降低VAP的发生率(1C)

呼吸机相关性气管支气管炎

呼吸机相关性气管支气管炎(VAT):

- 是患者肺部感染最终发展为VAP的重要原因
- 发病率1.4-10%

诊断：

- 不明原因的发热(>38℃)
- 脓性分泌物
- 气管抽吸物或纤支镜检测标本培养结果阳性
- 插管48h后，常规X线胸部影像学显示无新的或进行性加重的肺部侵润影

治疗VAT能降低VAP的发生

- Methods: Prospective RCT; Patients： 58 pats were included
- Groups ： Antibiotic group, n= 22 vs No antibiotic group, n= 36

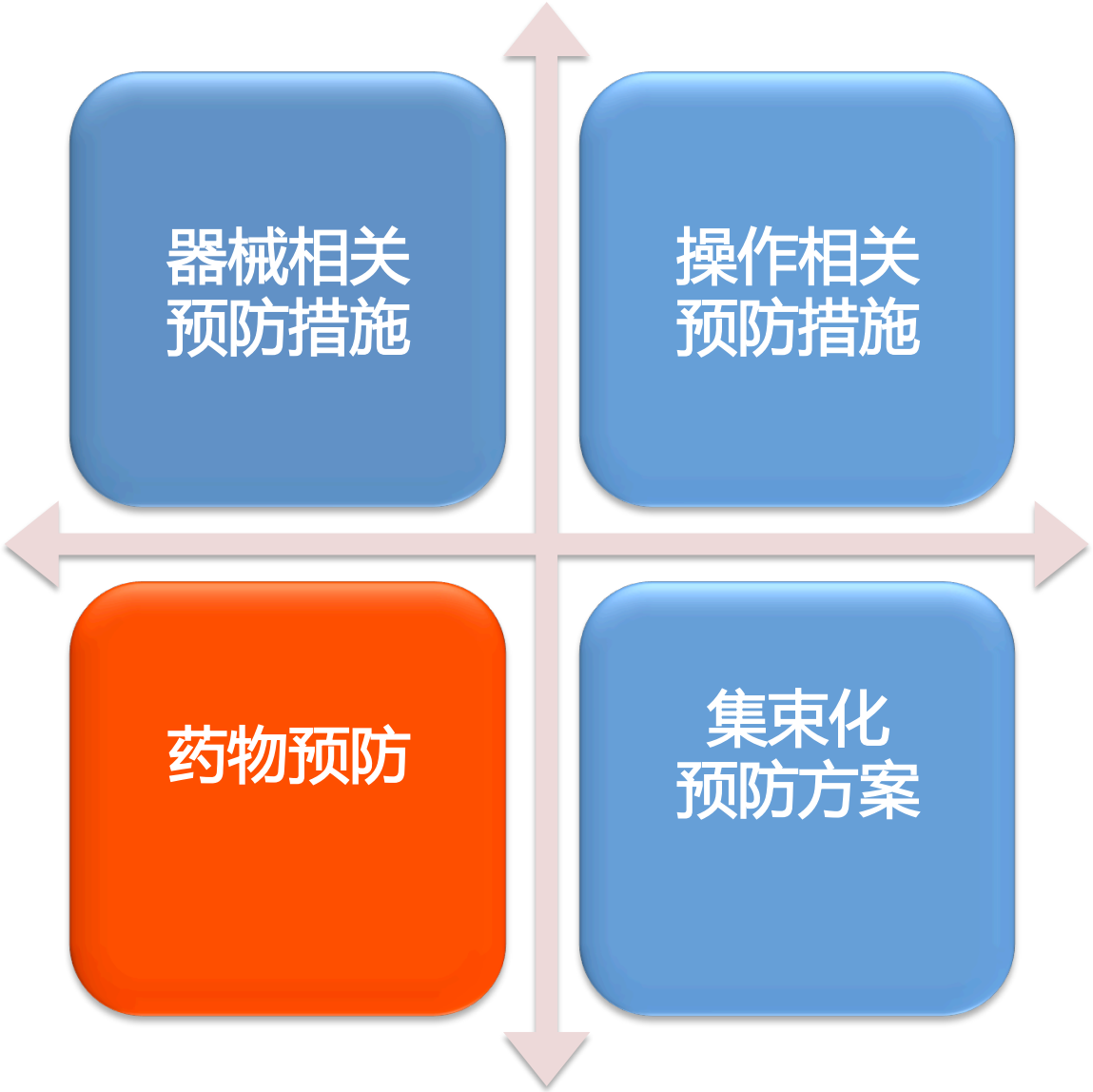
Outcomes of study patients

	Intention to treat			Modified intention to treat		
	Antibiotic treatment n = 22	No antibiotic treatment n = 36	*P* value	Antibiotic treatment n = 18	No antibiotic treatment n = 26	*P* value
Duration of mechanical ventilation, days	29 ± 17	26 ± 15	0.816	26 ± 15	24 ± 15	0.952
Mechanical ventilation-free days, median (interquartile range)	12 (8–24)	2 (0–6)	<0.001	16 (9–25)	4 (2–10)	0.001
Length of ICU stay, days	40 ± 23	36 ± 21	0.558	37 ± 21	33 ± 20	0.445
Ventilator-associated pneumonia	3 (13)	17 (47)	0.011[a]	2 (11)	12 (46)	0.021[a]
ICU mortality[b]	4 (18)	17 (47)	0.047[a]	0 (0)	11 (42)	0.001[a]

指南建议：治疗VAT可有效降低VAP的发生率(2C)

Crit Care 2008, 12:R62

VAP的预防



药物预防

- 雾化吸入抗菌药物
- 静脉使用抗菌药物
- 选择性消化道去污染(SDD)/选择性口咽部去污染(SOD)
- 益生菌
- 预防应激性溃疡

雾化吸入抗菌药物

- 原理：雾化吸入抗菌药物可使呼吸道局部达到较高药物浓度，对全身影响小，理论上可作为预防VAP的措施

Aerosolized Ceftazidime Prophylaxis against Ventilator-Associated Pneumonia in High-Risk Trauma Patients: Results of a Double-Blind Randomized Study

JEFFREY A. CLARIDGE,[1]* NORMA M. EDWARDS,[1] JOSEPH SWANSON,[2]
TIMOTHY C. FABIAN,[1] JORDAN A. WEINBERG,[1]
CHRISTOPHER WOOD,[2] and MARTIN A. CROCE[1]

- 实验设计：2003-2005，单中心、随机、双盲临床实验
- 实验措施：雾化吸入头孢他啶 VS 雾化吸入安慰剂，疗程7天
- 主要观察终点：14天和30天VAP发生率
- 结果：

14天VAP发生率：治疗组：24/52(46%);对照组：21/53(40%)
30天VAP发生率：治疗组：26/52(50%);对照组：26/53(49%)
两组结果间无统计学差异

指南建议：
机械通气患者不常规使用雾化吸入抗菌药物预防VAP(2C)

Surg Infect (Larchmt). 2007 ;8(1):83-90

静脉使用抗菌药物

□文献检索结果：一共有三项关于静脉用药预防VAP的RCT研究，三项研究结果均显示预防性静脉应用抗菌药物可降低VAP发生率，但其中两项是创伤病人也未对耐药性进行评价

Protective Effect of Intravenously Administered Cefuroxime Against Nosocomial Pneumonia in Patients

Intensive Care Med (2005) 31:510–516
DOI 10.1007/s00134-005-2585-5

ORIGINAL

JOSÉ M. SIRVENT
JORDI de BATLLE

A. Acquarolo
T. Urli
G. Perone
C. Giannotti
A. Candiani
N. Latronico

Antibiotic prophylaxis of early onset pneumonia in critically ill comatose patients. A randomized study

[redacted]

Christian van Delden
Thilo Köhler
Françoise Brunner-Ferber
Bruno François
Jean Carlet
Jean-Claude Pechère

Azithromycin to prevent *Pseudomonas aeruginosa* ventilator-associated pneumonia by inhibition of quorum sensing: a randomized controlled trial

指南建议：

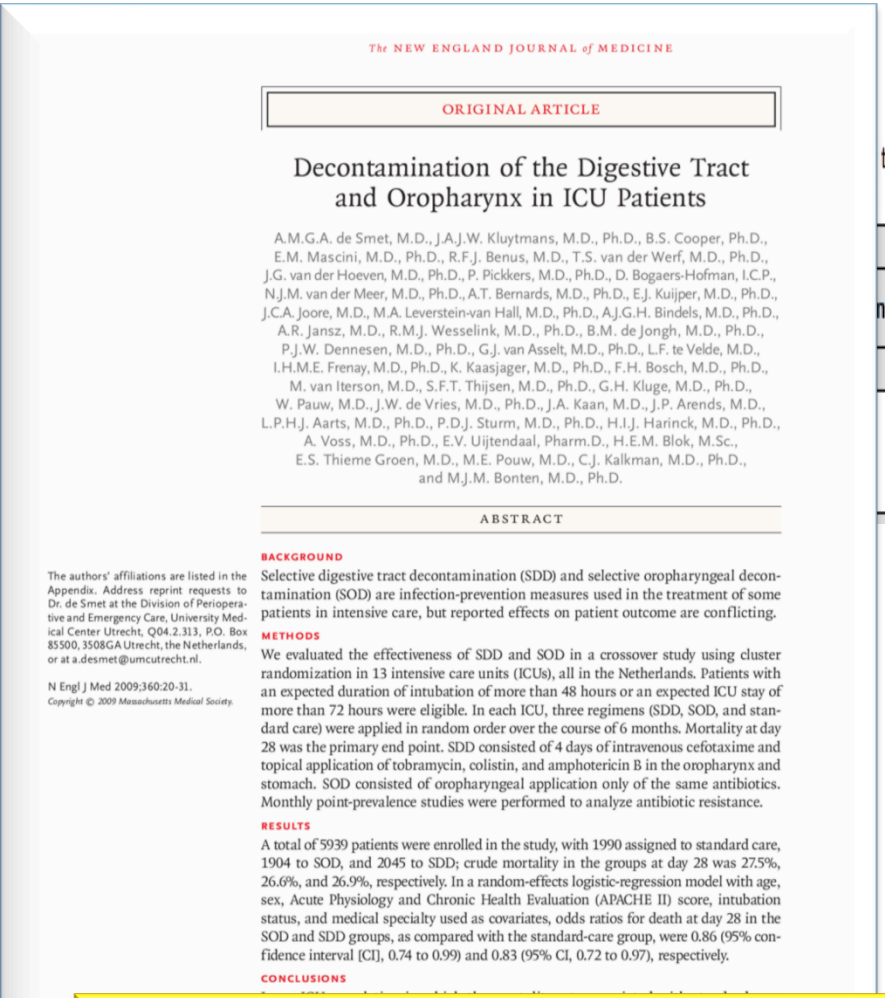
机械通气患者不常规静脉使用抗菌药物预防VAP，如头部外伤或创伤患者需要应用时，应考虑细菌耐药问题

选择性消化道去污染(SDD)/选择性口咽部去污染(SOD)

- 定义：
  - SDD：通过清除患者消化道内可能引起继发性感染的潜在病原体，从而达到预防严重呼吸道感染或血流感染的目的
  - SOD：是SDD的一部分，主要清除口咽部潜在病原体
  - 常见病原体包括：G-杆菌、甲氧西林敏感的金葡菌及酵母菌等

- 经典SDD包括以下方面：
  - 静脉使用抗菌药物，预防早发的内源性感染
  - 口咽和胃肠道局部应用不易吸收的抗菌药物（P:多粘菌素E、T:妥布霉素、A:两性霉素B），预防晚发的内源性二重感染
  - 严格的卫生制度预防潜在的病原体的传播
  - 每周两次咽喉和肠道标本病原学监测，以评估治疗有效性并早期发现耐药菌

SDD/SOD可降低VAP的发生率、病死率



The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Decontamination of the Digestive Tract and Oropharynx in ICU Patients

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ABSTRACT

BACKGROUND

Selective digestive tract decontamination (SDD) and selective oropharyngeal decontamination (SOD) are infection-prevention measures used in the treatment of some patients in intensive care, but reported effects on patient outcome are conflicting.

METHODS

We evaluated the effectiveness of SDD and SOD in a crossover study using cluster randomization in 13 intensive care units (ICUs), all in the Netherlands. Patients with an expected duration of intubation of more than 48 hours or an expected ICU stay of more than 72 hours were eligible. In each ICU, three regimens (SDD, SOD, and standard care) were applied in random order over the course of 6 months. Mortality at day 28 was the primary end point. SDD consisted of 4 days of intravenous cefotaxime and topical application of tobramycin, colistin, and amphotericin B in the oropharynx and stomach. SOD consisted of oropharyngeal application only of the same antibiotics. Monthly point-prevalence studies were performed to analyze antibiotic resistance.

RESULTS

A total of 5939 patients were enrolled in the study, with 1990 assigned to standard care, 1904 to SOD, and 2045 to SDD; crude mortality in the groups at day 28 was 27.5%, 26.6%, and 26.9%, respectively. In a random-effects logistic-regression model with age, sex, Acute Physiology and Chronic Health Evaluation (APACHE II) score, intubation status, and medical specialty used as covariates, odds ratios for death at day 28 in the SOD and SDD groups, as compared with the standard-care group, were 0.86 (95% confidence interval [CI], 0.74 to 0.99) and 0.83 (95% CI, 0.72 to 0.97), respectively.

CONCLUSIONS

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N Engl J Med 2009;360:20-31.

tract infections and mortality in adults receiving intensive care. Cochrane Database Syst Rev 2009:CD000022.

		No of patients			Effect		
n	Other considerations	SDD	Control	Relative (95% CI)	Absolute	Quality	Importance
	none	287/1501 (19.1%)	603/1523 (39.6%)	OR 0.28 (0.2 to 0.38)	41 fewer per 1000 (from 197 fewer to 280 fewer)	⊕⊕⊕⊕ HIGH	CRITICAL
			0%		-		

- 降低患者病死率，SDD降3.5%;SOD降2.9%
- 降低呼吸道耐药菌的定植率

指南建议：

机械通气患者可考虑使用SDD或SOD策略预防VAP(2B)

益生菌对VAP发生率的影响

- **危重患者肠道菌群失调**：危重病人常因肠蠕动减弱、应激性激素增加、药物、营养摄取的变化等原因，伴有肠道微生物菌群的改变，表现为潜在致病菌的优势生长
- **益生菌的作用**：可调节胃肠道菌群，对胃肠道的结构和功能产生有益的影响

Author(s): LYM
Date: 2013-01-03
Question: Should probiotics be used for vap prevention?
Settings: icu patients
Bibliography: 1. Gu WJ, Wei CY, Yin RX. Lack of efficacy of probiotics in preventing ventilator-associated pneumonia: A systematic review and meta-analysis of randomized controlled trials. Chest 2012. 2. Oudhuis GJ, Bergmans DC, Dormans T, Zwaveling JH, Kessels A, Prins MH, Stobberingh EE, Verbon A. Probiotics versus antibiotic decontamination of the digestive tract: Infection and mortality. Intensive Care Med 2011;37:110-117. 3. Siempos, Il, Ntaidou TK, Falagas ME. Impact of the administration of probiotics on the incidence of ventilator-associated pneumonia: A meta-analysis of randomized controlled trials. Crit Care Med 2010;38:954-962. 4. Morrow LE, Kollef MH, Casale TB. Probiotic prophylaxis of ventilator-associated pneumonia: A blinded, randomized, controlled trial. Am J Respir Crit Care Med 2010;182:1058-1064. 5. Barraud D, Blard C, Hein F, Marcon O, Cravoisy A, Nace L, Alla F, Bollaert PE, Gibot S. Probiotics in the critically ill patient: A double blind, randomized, placebo-controlled trial. Intensive Care Med 2010;36:1540-1547. 6. Knight DJ, Gardiner D, Banks A, Snape SE, Weston VC, Bengmark S, Girling KJ. Effect of synbiotic therapy on the incidence of ventilator associated pneumonia in critically ill patients: A randomised, double-blind, placebo-controlled trial. Intensive Care Med 2009;35:854-861. 7. Giamarellos-Bourboulis EJ, Bengmark S, Kanellakopoulou K, Kotzampassi K. Pro- and synbiotics to control inflammation and infection in patients with multiple injuries. The Journal of trauma 2009;67:815-821. 8. Klarin B, Molin G, Jeppsson B, Larsson A. Use of the probiotic lactobacillus plantarum 299 to reduce pathogenic bacteria in the oropharynx of intubated patients: A randomised controlled open pilot study. Crit Care 2008;12:R136. 9. Forestier C, Guelon D, Cluytens V, Gillart T, Sirot J, De Champs C. Oral probiotic and prevention of pseudomonas aeruginosa infections: A randomized, double-blind, placebo-controlled pilot study in intensive care unit patients. Crit Care 2008;12:R69.

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Probiotics	Control	Relative (95% CI)	Absolute		
vap incidence												
7	randomised trials	no serious risk of bias	serious[1]	no serious indirectness	no serious imprecision	none	98/576 (17%)	112/566 (19.8%)	RR 0 (0.55 to 1.24)	198 fewer per 1000 (from 89 fewer to 47 more)	⊕⊕⊕O MODERATE	CRITICAL
								0%		-		
ICU mortality												
4	randomised trials	no serious risk of bias	serious[1]	no serious indirectness	no serious imprecision	none	89/373 (23.9%)	91/354 (25.7%)	RR 0.9 (0.65 to 1.27)	26 fewer per 1000 (from 90 fewer to 69 more)	⊕⊕⊕O MODERATE	CRITICAL
								0%		-		
hospital mortality												
4	randomised trials	no serious risk of bias	serious[1]	no serious indirectness	no serious imprecision	none	57/257 (22.2%)	73/256 (28.5%)	RR 0.71 (0.48 to 1.07)	83 fewer per 1000 (from 148 fewer to 20 more)	⊕⊕⊕O MODERATE	CRITICAL
								0%		-		
urinary tract infections												
2	randomised trials	no serious risk of bias	serious[1]	no serious indirectness	no serious imprecision	none	34/220 (15.5%)	12/204 (5.9%)	RR 2.2 (0.5 to 9.71)	71 more per 1000 (from 29 fewer to 512 more)	⊕⊕⊕O MODERATE	IMPORTANT
								0%		-		
catheter-related bloodstream infections												
2	randomised trials	no serious risk of bias	serious[1]	no serious indirectness	no serious imprecision	none	19/220 (8.6%)	27/204 (13.2%)	RR 0.51 (0.13 to 2.01)	65 fewer per 1000 (from 115 fewer to 134	⊕⊕⊕O MODERATE	IMPORTANT

严格筛选纳入标准，最终纳入6项RCT，结果显示：**应用肠道益生菌不能降低VAP的发生率和病死率**

指南建议：
机械通气患者不建议常规使用肠道益生菌预防VAP(2B)

预防应激性溃疡对VAP发生率的影响

- 预防应激性溃疡的药物：

  胃粘膜保护剂：硫糖铝

  胃酸抑制剂：抗酸剂、PPI、H2RA

硫糖铝 VS H2RA　　硫糖铝 降低VAP的发生率

Author(s): LYM
Date: 2012-01-26
Question: Sh
Settings:
Bibliography:
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No of studies	
H2RA vs sucl	
8	ra tri

硫糖铝 VS H2RA　　硫糖铝 增加消化道出血的发生风险

A COMPARISON OF SUCRALFATE AND RANITIDINE FOR THE PREVENTION OF UPPER GASTROINTESTINAL BLEEDING IN PATIENTS REQUIRING MECHANICAL VENTILATION

DEBORAH C
RICHARD HALL,
G(

PPI VS H2RA　　两者对VAP发生率的影响无明显差异

Iranian Journal of Clinical Infectious Diseases
2009;4(3):177-180

BRIEF REPORT

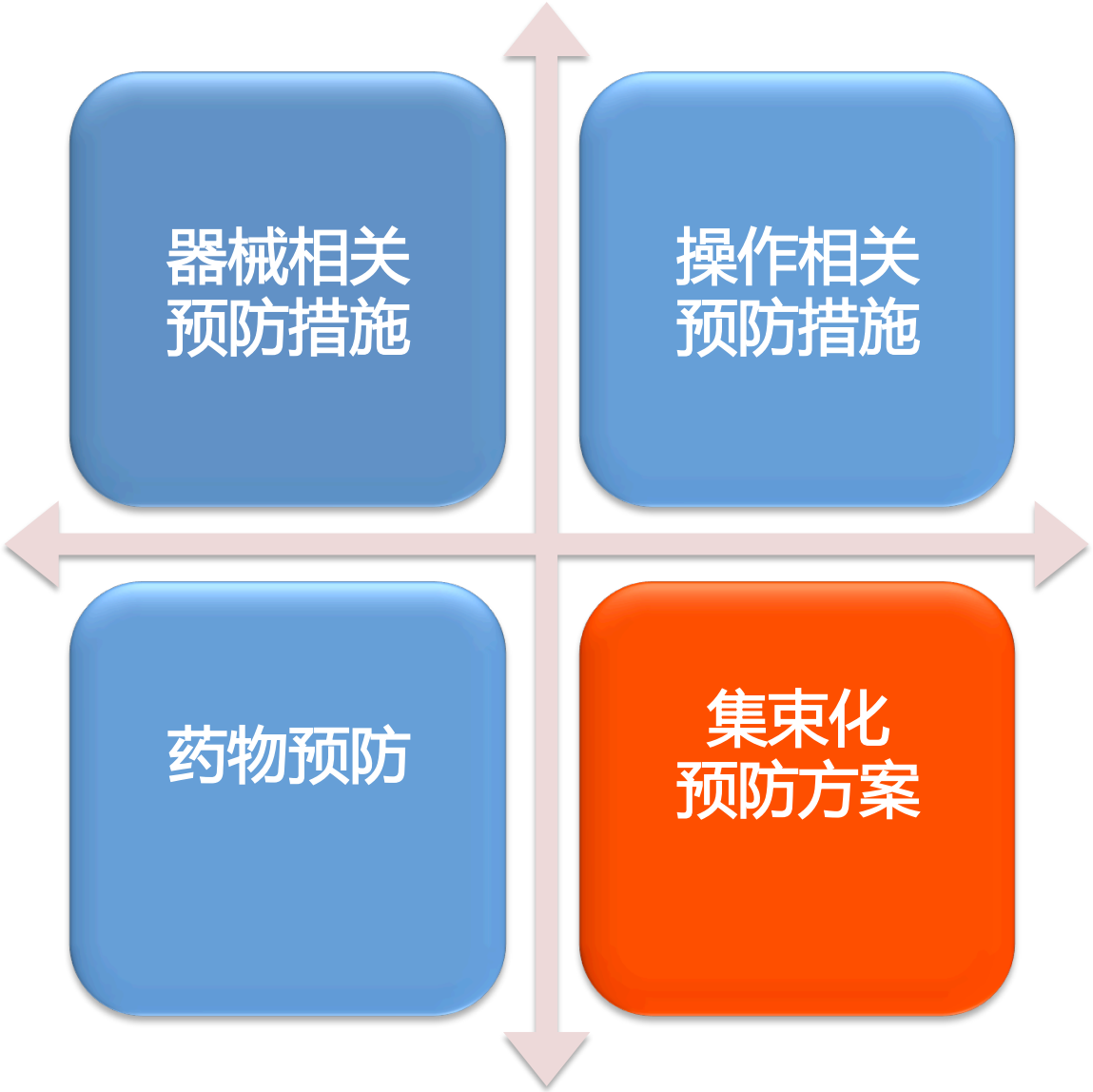
ER, M.B.,
LLAN, M.D.,

Ventilator-associated pneumonia among ICU patients receiving

指南建议：

预防机械通气患者的应激性溃疡，选用硫糖铝可降低VAP的发生率，但需评估消化道出血的风险。

VAP的预防



集束化方案 (ventilator care bundles，VCB)

- 美国健康促进研究所(IHI)提出VCB主要包括以下四点：

- 近年来，口腔护理、清除呼吸机管路的冷凝水、手卫生、戴手套、翻身等也被加入到VCB中

集束化方案明显降低VAP的发生率

Table 2. Outcomes

Author	Year of Publication	Country	Bundle Adherence	VAP Incidence (per 1000 MV days)
Resar[a]	2005	US and Canada	21 of 35 participating centers achieved 95% adherence	Before: 6.6 After: 2.7 (1.8–5.9)
Berriel-Cass	2006	US	Not reported	Before: 8.2 After: 3.3
Youngquist[b]	2007	US	100% compliance achieved by 1/04 (~6 mo into the intervention phase)	Before: 6.01 and 2.66 After: 2.7 and 0.0
Unahalekhaka	2007	Thailand	Not reported	Baseline: 13.3 End of intervention: 8.3

- 实施前 ：2.7-13.3%例/1000机械通气日
- 实施后：0-9.3 %例/1000机械通气日

指南建议：机械通气患者应实施VCB(1C)。

VAP指南推荐汇总

预防	机械通气患者无需定期更换呼吸机管路	1A
	机械通气患者可采用HMEs或含加热导丝的HHs作为湿化装置	2B
	若使用HMEs，每5-7天更换一次，当热湿交换器受污、气道阻力增加或阻塞时应及时更换	1B
	机械通气患者不常规使用细菌过滤器	2C
	除非破损或污染，密闭式吸痰装置无须每日更换	1B
	经鼻气管插管可增加鼻窦炎的发病率	1B
	经鼻气管插管患者出现难以解释的发热，需行影像学检查评估是否患有鼻窦炎，并及时治疗	2B
	药物可预防鼻窦炎，但不降低VAP发病率	2C
	建立人工气道患者应行声门下分泌物引流	1B
	机械通气患者早期气管切开不影响VAP发病率	2B

VAP指南推荐汇总

接上表

预防	机械通气患者应用动力床疗法可降低VAP发病率	2B
	机械通气患者应抬高床头以降低VAP发病率	1C
	与经鼻胃管相比，经鼻肠管营养可降低VAP发病率	2B
	机械通气患者应定期监测气管内导管的套囊压力	2C
	持续控制气管内导管的套囊压力可降低VAP的发病率	2B
	加强手卫生可降低VAP的发病率	1C
	洗必泰口腔护理可降低VAP的发病率	1C
	治疗VAT可有效降低VAP的发病率	2C
	机械通气患者不常规使用雾化抗菌药物	2C
	机械通气患者可考虑使用SDD或SOD方案策略预防VAP	2B
	机械通气患者不建议常规应用肠道益生菌	2B
	机械通气患者应实施集束化方案	1C

谢谢！