



Atélectasies sous ventilation artificielle

Pr Armand MEKONTSO DESSAP

Dr Sébastien JOCHMANS

Réanimation Médicale, Hôpitaux Universitaires Henri Mondor
Groupe de Recherche Clinique CARMAS, Université Paris Est Créteil

reamondor.aphp.fr

Atélectasies au cours de la ventilation mécanique

Table 1. Clinical Events Associated with Ventilator-associated Events

	Klompas <i>et al.</i> (15)* (n = 44)	Hayashi <i>et al.</i> (17) (n = 153)	Klein Klouwenberg <i>et al.</i> (12)* (n = 81)	Boyer <i>et al.</i> (20) (n = 67)	All Studies Combined* (n = 345)
Pneumonia and/or aspiration	10 (23%)	66 (43%)	28 (35%)	21 (31%)	125 (36%)
Pulmonary edema, pleural effusion, and/or heart failure	8 (18%)	40 (26%)	39 (48%)	10 (15%)	97 (28%)
Atelectasis	5 (11%)	25 (16%)	12 (15%)	6 (9.0%)	48 (14%)
Acute respiratory distress syndrome	7 (16%)	10 (6.5%)	—	14 (21%)	31 (9.0%)
Mucous plugging	1 (2%)	—	—	—	1 (0.3%)
Abdominal distension/compartiment syndrome	1 (2%)	2 (1.3%)	9 (11%)	—	12 (3.5%)
Pulmonary embolus	1 (2%)	3 (2.0%)	—	—	4 (1.2%)
Pneumothorax	—	—	2 (2.5%)	2 (3.0%)	4 (1.2%)
Radiation pneumonitis	1 (2%)	—	—	—	1 (0.3%)
Sepsis syndrome/extrapulmonary infection	1 (2%)	—	9 (11%)	3 (4.5%)	13 (3.8%)
Poor pulmonary toilet	1 (2%)	—	—	—	1 (0.3%)
Acute neurological event	—	—	10 (12%)	—	10 (2.9%)
Transfusion-associated lung injury	—	—	—	2 (3.0%)	2 (0.6%)
Other	—	—	—	9 (13%)	9 (2.6%)
No apparent pulmonary complication	18 (41%)	17 (11%)	10 (12%)	—	45 (13%)

*Some ventilator-associated events were attributed to multiple etiologies; hence the percentages exceed 100%.

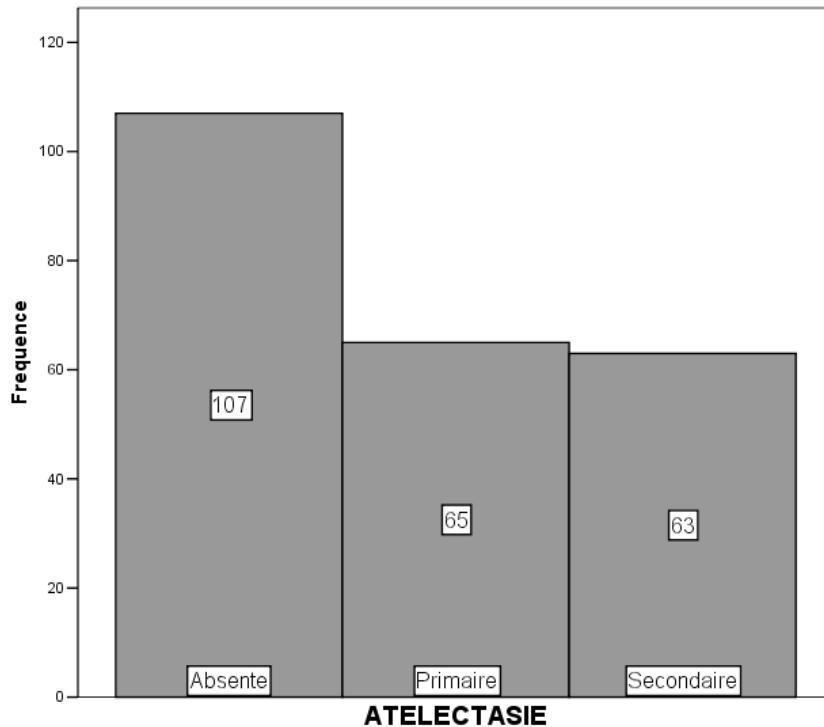
Atélectasies sous ventilation mécanique

- Epidémiologie mal connue
 - Fréquent en anesthésie, mais très peu de données en réanimation
- Mécanismes multiples
 - Obstruction
 - Compression, épanchement pleural
- Plusieurs outils diagnostiques
 - Radiographie
 - Ultrasons
 - Scanner

Etude ACTIVE

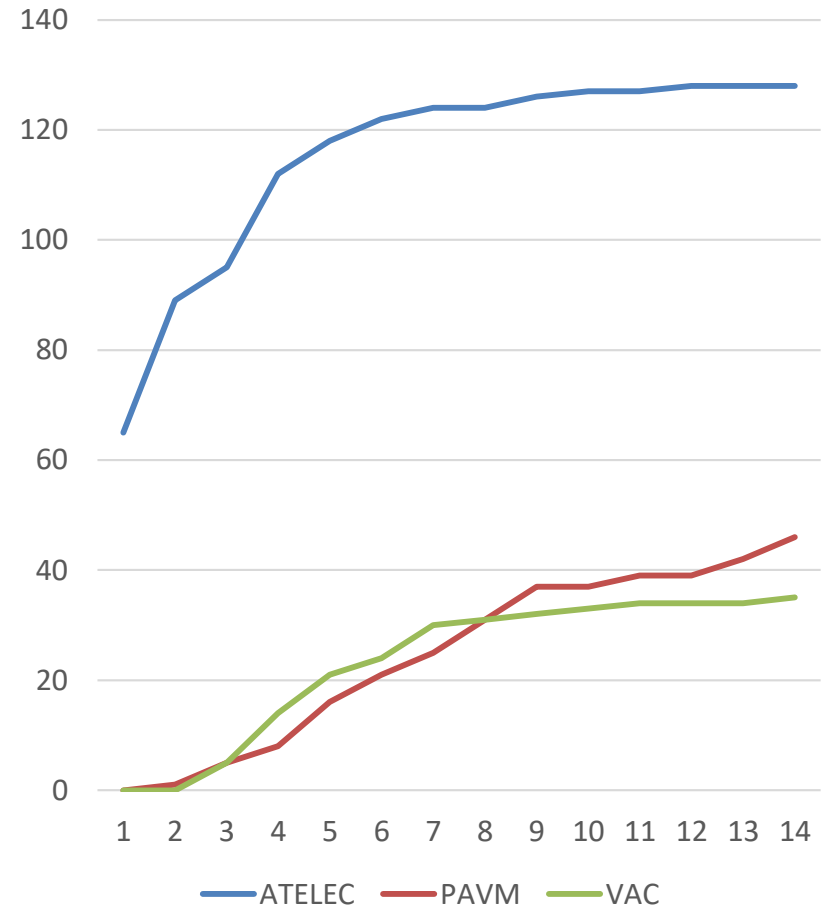
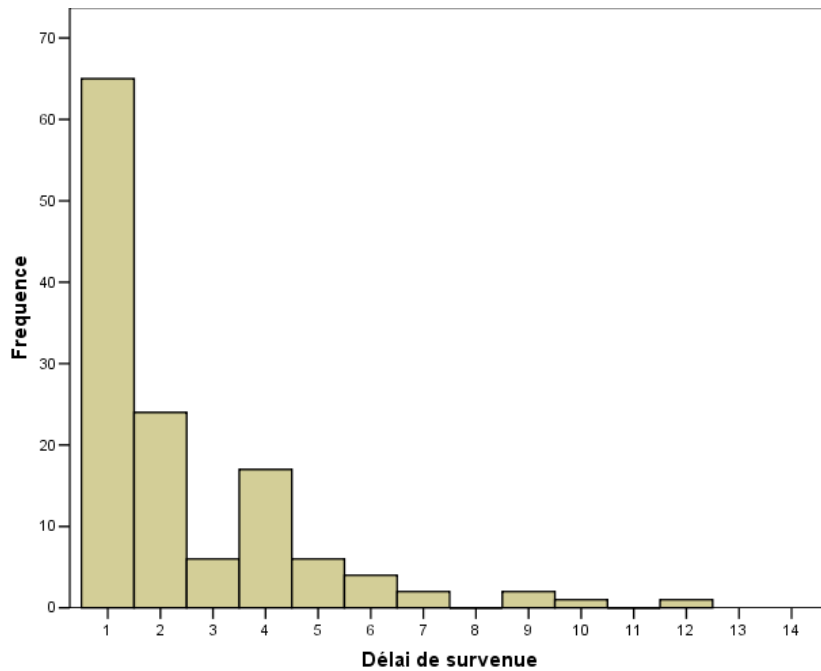
- Etude prospective, monocentrique, non randomisée, observationnelle.
- Critères d'inclusion : patients sous ventilation artificielle invasive.
- Suivi 14 jours
- Objectifs
 - Incidence
 - Pronostic
 - Facteurs de risque
- N=235

Incidence

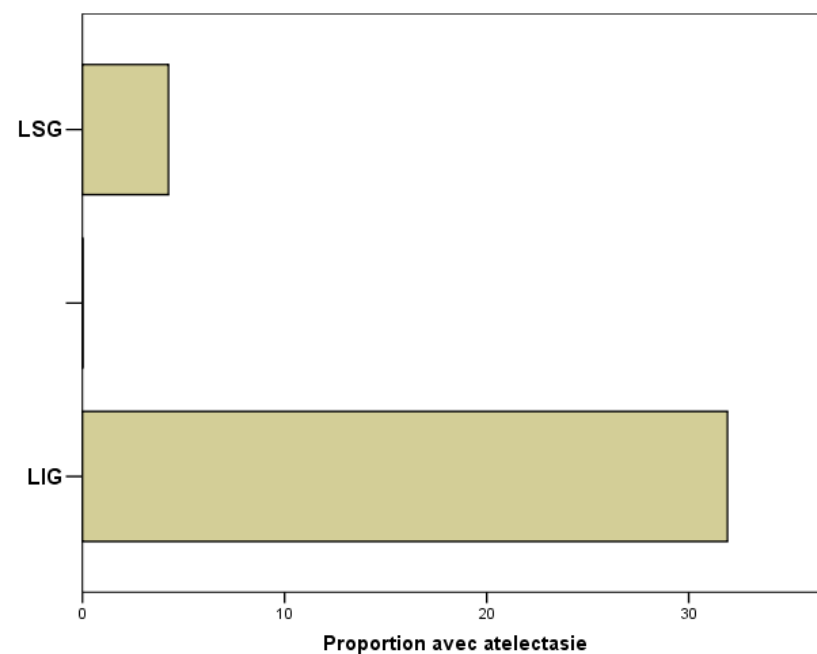
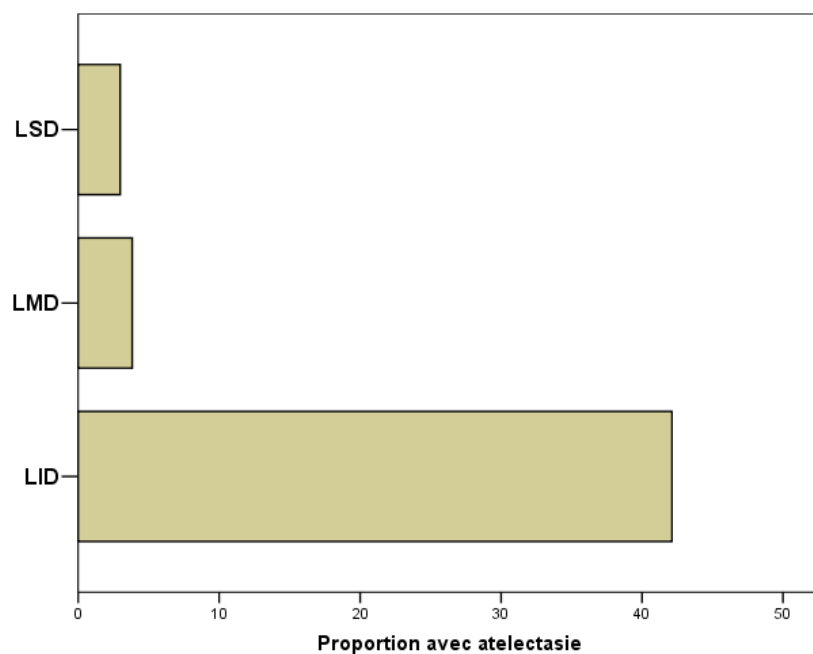


- Incidence = 55%
(1^{er} épisode)
- Densité d'incidence =
144/1000 jours
ventilation

Délai de survenue



Distribution des atélectasies



Facteurs de risque d'atélectasie

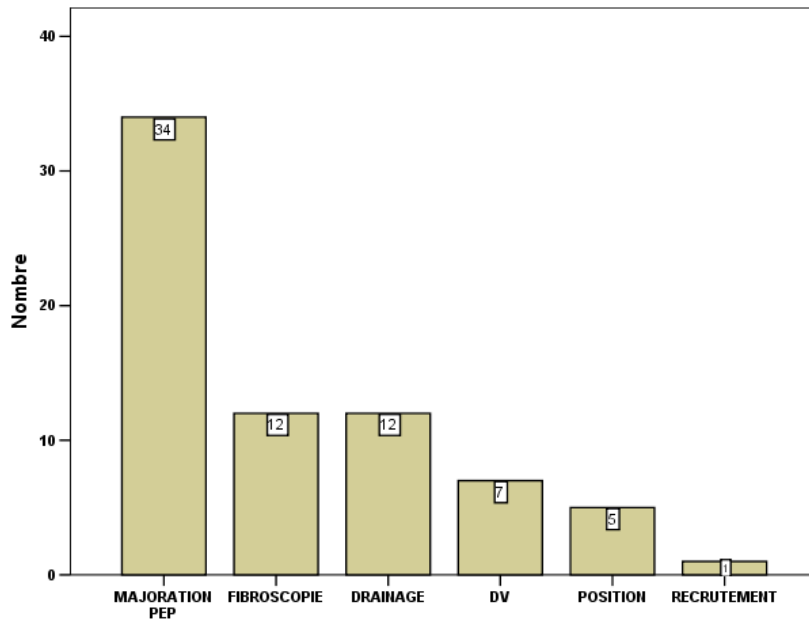
	Absente (n=107)	Primaire (n=65)	Secondaire (n=63)	p
Age (années)	56,1 [46,3-65,2]	66,0 [52,1-79,3]	61,6 [55,3-75,1]	<0,001
BMI (kg/m2)	24,7 [22,1-27,8]	26,0 [22,8-33,1]	26,6 [23,7-30,4]	0,028
Masculin	60 (56,1%)	36 (55,4%)	47 (74,6%)	0,033
ATCD pulmonaire	31 (29,0%)	34 (52,3%)	26 (41,3%)	0,009
ATCD neuromusculaire	51 (47,7%)	26 (40,0%)	22 (34,9%)	0,25
SOFA	7,0 [5,0-10,0]	9,0 [6,0-11,0]	9,0 [7,0-11,0]	0,08
IGSII	48,0 [39,0-63,0]	51,0 [39,5-69,5]	58,0 [43,0-70,0]	0,17
Chirurgie	8 (7,5%)	7 (10,8%)	17 (27,0%)	0,001
Epanchement pleural	2 (1,9%)	25 (38,5%)	23 (36,5%)	<0,001
Ascite	2 (1,9%)	3 (4,6%)	5 (7,9%)	<0,16

Facteurs de risque d'atélectasie

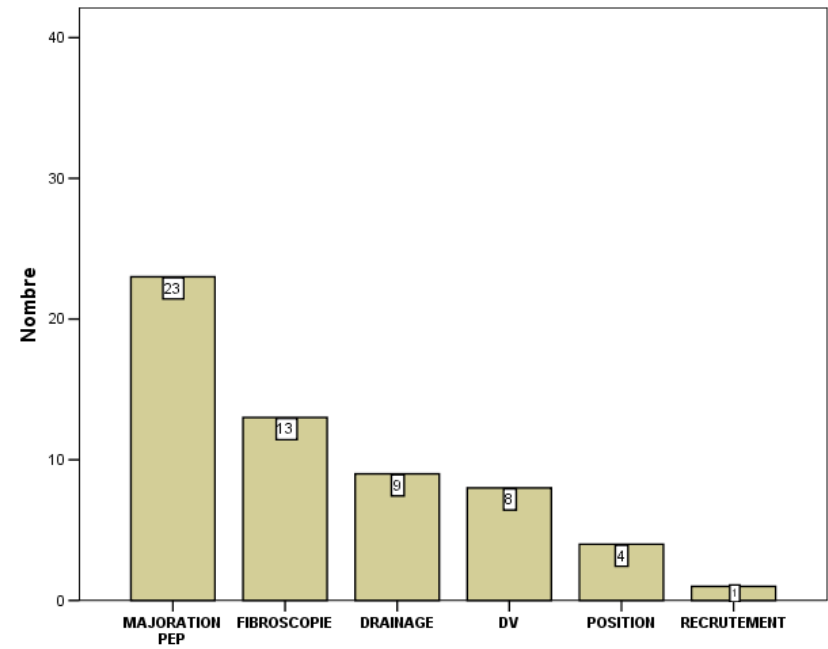
VALEUR A J1	Absente (n=107)	Primaire (n=65)	Secondaire (n=63)	p
Natrémie (mM)	139 [137-142]		138 [135-142]	0,08
Vt minimal (mL/kg)	394 [360-418]		375 [333-424]	0,37
PEP minimale (cmH ₂ O)	5 [5-5]		5 [5-5]	0,02
FiO ₂ maximale (%)	100 [60-100]		100 [60-100]	0,07
FiO ₂ minimale (%)	40 [35-50]		50 [40-60]	0,003
Nombre aspirations	5 [4-6]		6 [4-7]	0,149
Température minimale (°C)	36,0 [35,1-36,7]		36,2 [35,3-36,8]	0,40
RASS minimal	-5 [-5 à -5]		-5 [-5 à -5]	0,19
VAC	83 (78%)		49 (78%)	0,98
Humidificateur chauffant	25 (24%)		17 (27%)	0,62
Curarisation	17 (16%)		24 (38%)	<0,001
Sédation	90 (84%)		58 (92%)	0,14

Traitements

J1

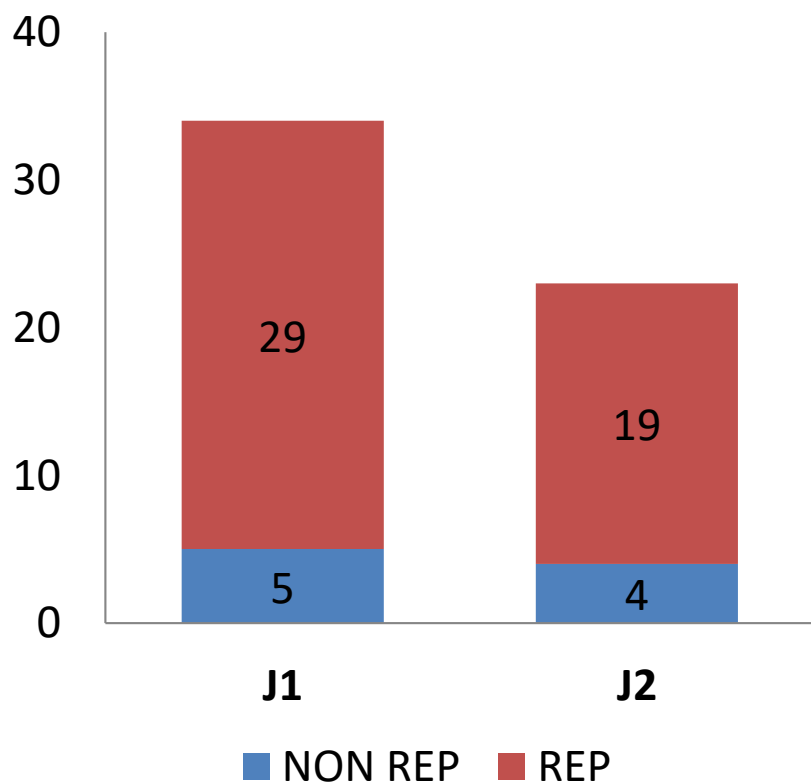


J2

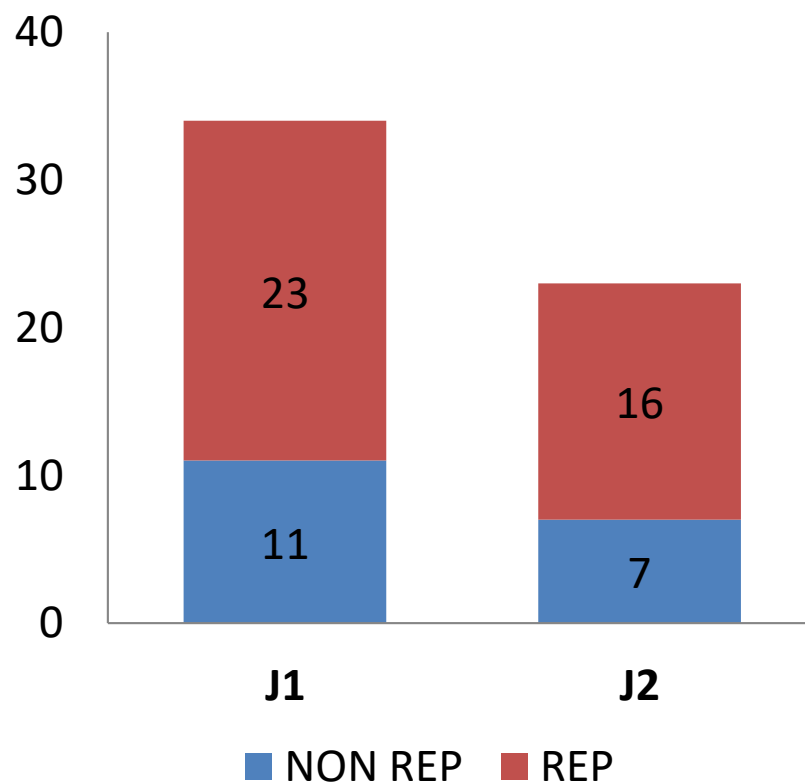


Réponse à la majoration de la PEP

Re-oxygénation

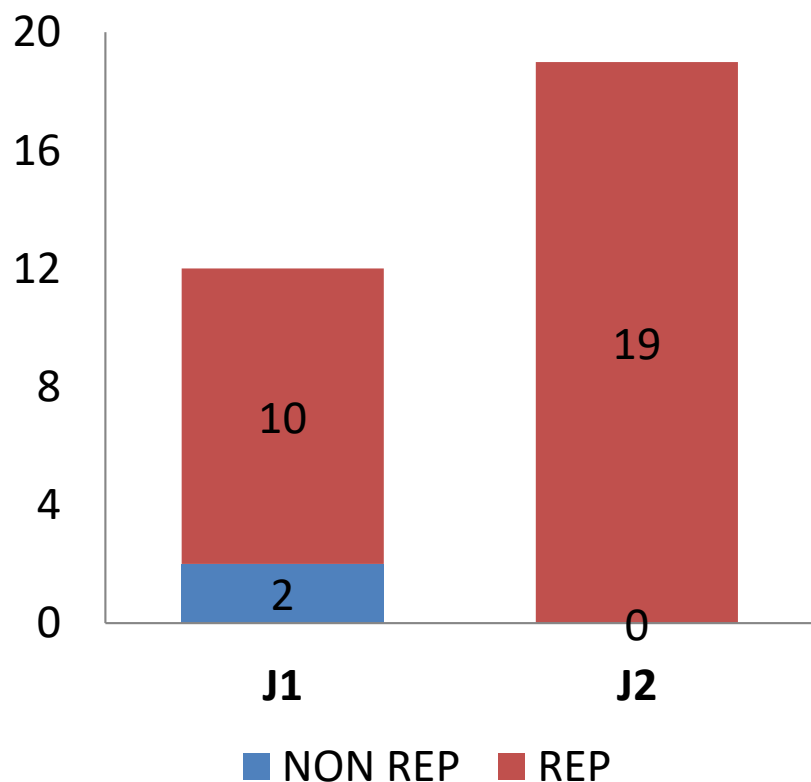


Re-aération

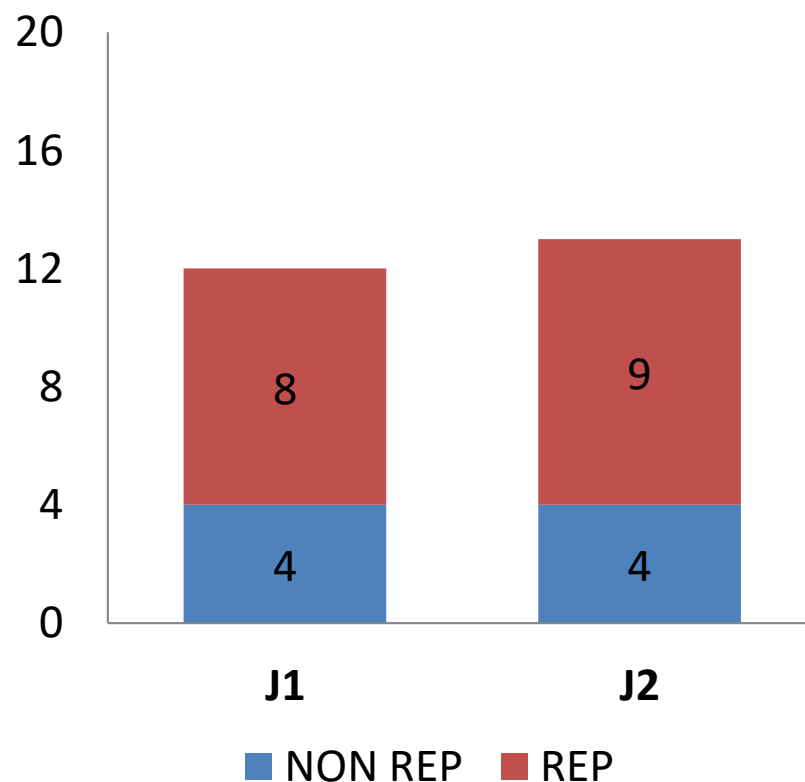


Réponse à la fibroaspiration

Re-oxygénation

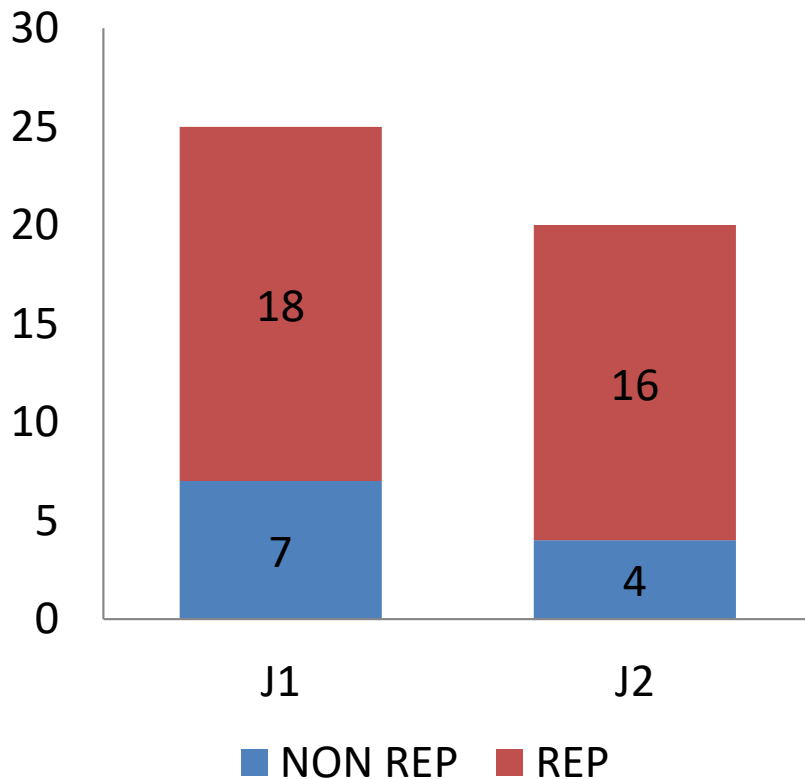


Re-aération

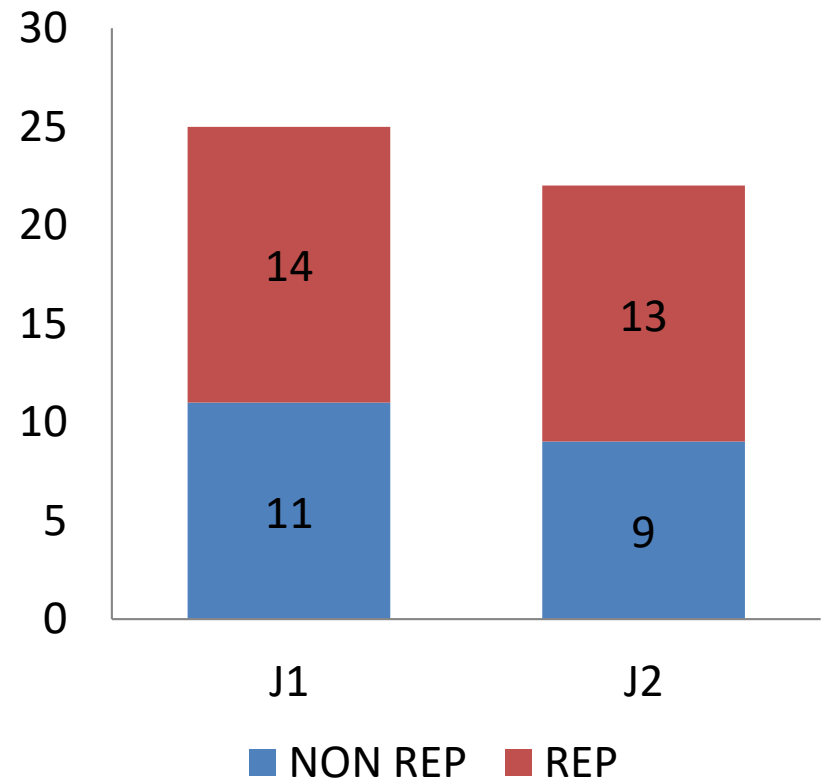


Réponse aux autres interventions

Re-oxygénation



Re-aération



Morbidité atélectasies (association)

	Absente (n=107)	Primaire (n=65)	Secondaire (n=63)	p
PAVM	12 (11,2%)	7 (10,8%)	22 (34,9%)	<0,001
VAE	7 (6,5%)	7 (10,8%)	16 (25,4%)	0,002
SDRA	20 (18,7%)	29 (44,6%)	6 (9,5%)	<0,001
Durée ventilation (jours)	4,0 [2,0-6,0]	5,0 [3,0-10,0]	10,0 [7,0-17,0]	<0,001
Séjour en réa (jours)	6,0 [4,0-10,0]	10,0 [5,5-15,5]	17,0 [9,0-28,0]	<0,001
Séjour à l'hôpital (jours)	13,0 [5,0-25,0]	17,0 [7,0-35,0]	24,0 [9,0-43,0]	0,002
Mortalité réa	23 (21,5%)	21 (32,3%)	28 (44,4%)	<0,001
Mortalité hôpital	29 (27,1%)	22 (33,8%)	30 (47,6%)	<0,001

Rôle de l'obésité

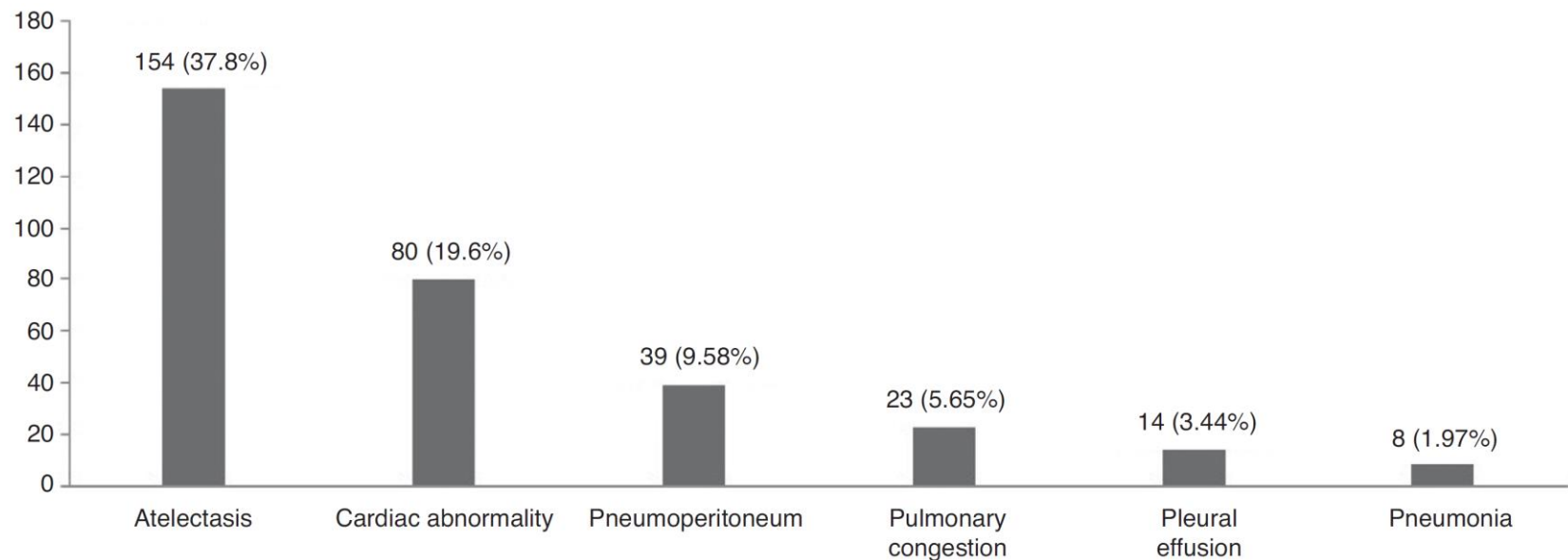
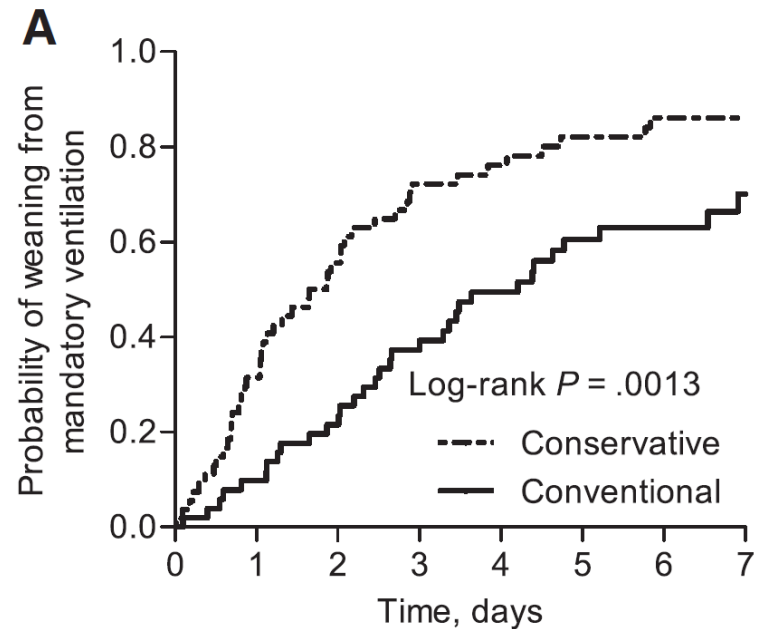
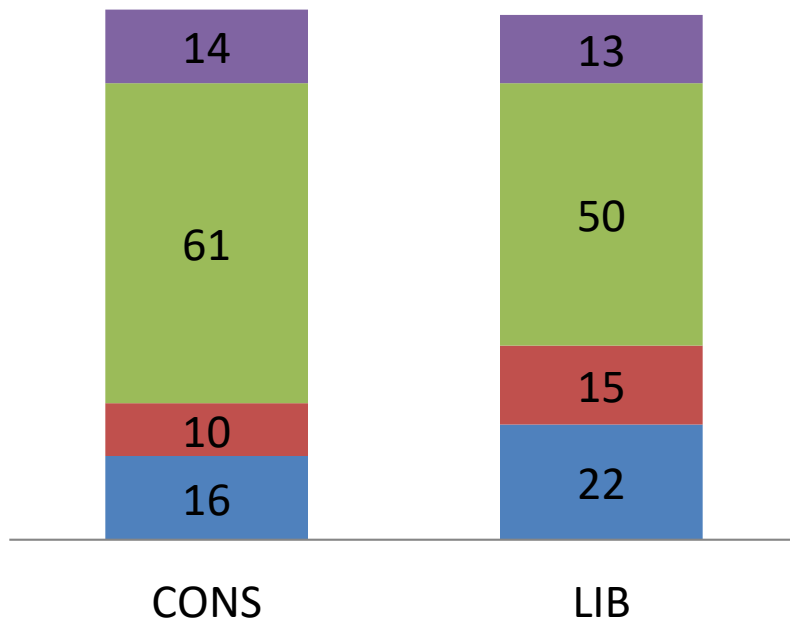


Figure 1 Prevalence of radiographic alterations.

Rôle de la FiO2

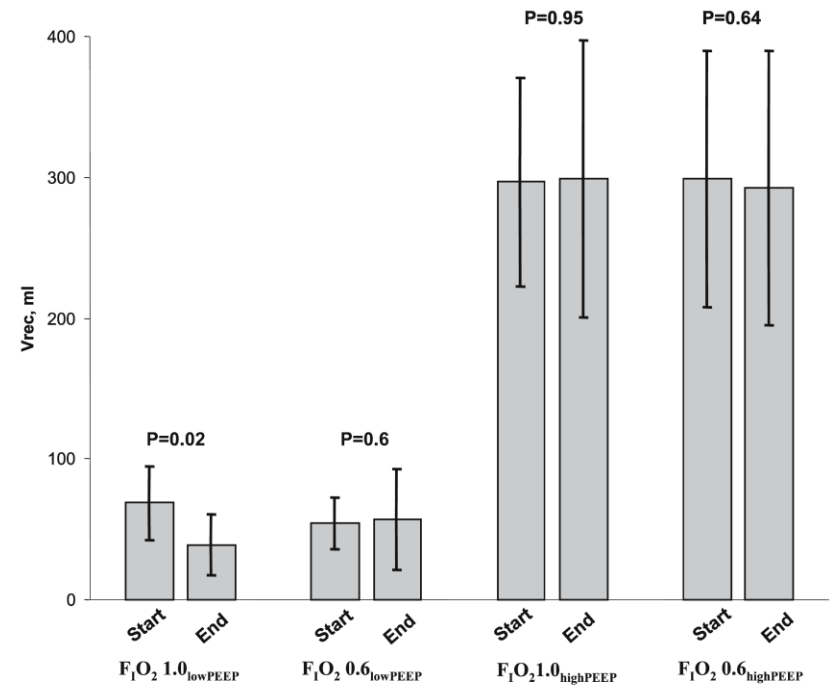
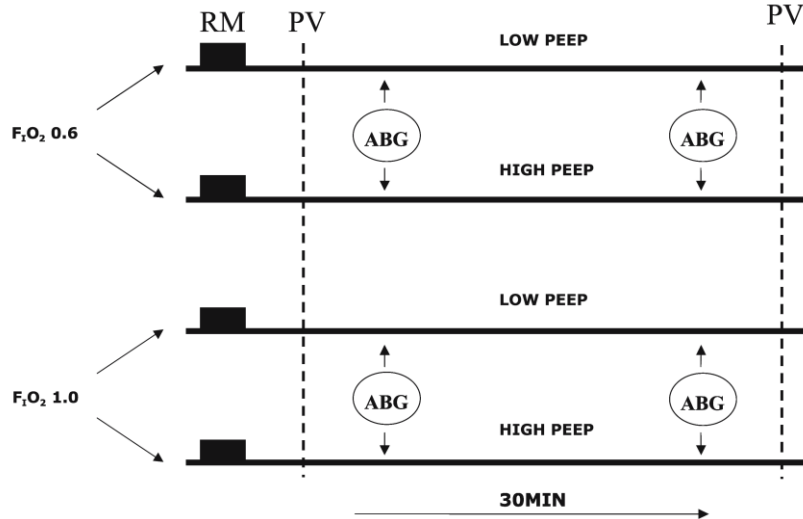
SCORE ATELECTASIE

0 1 2 3



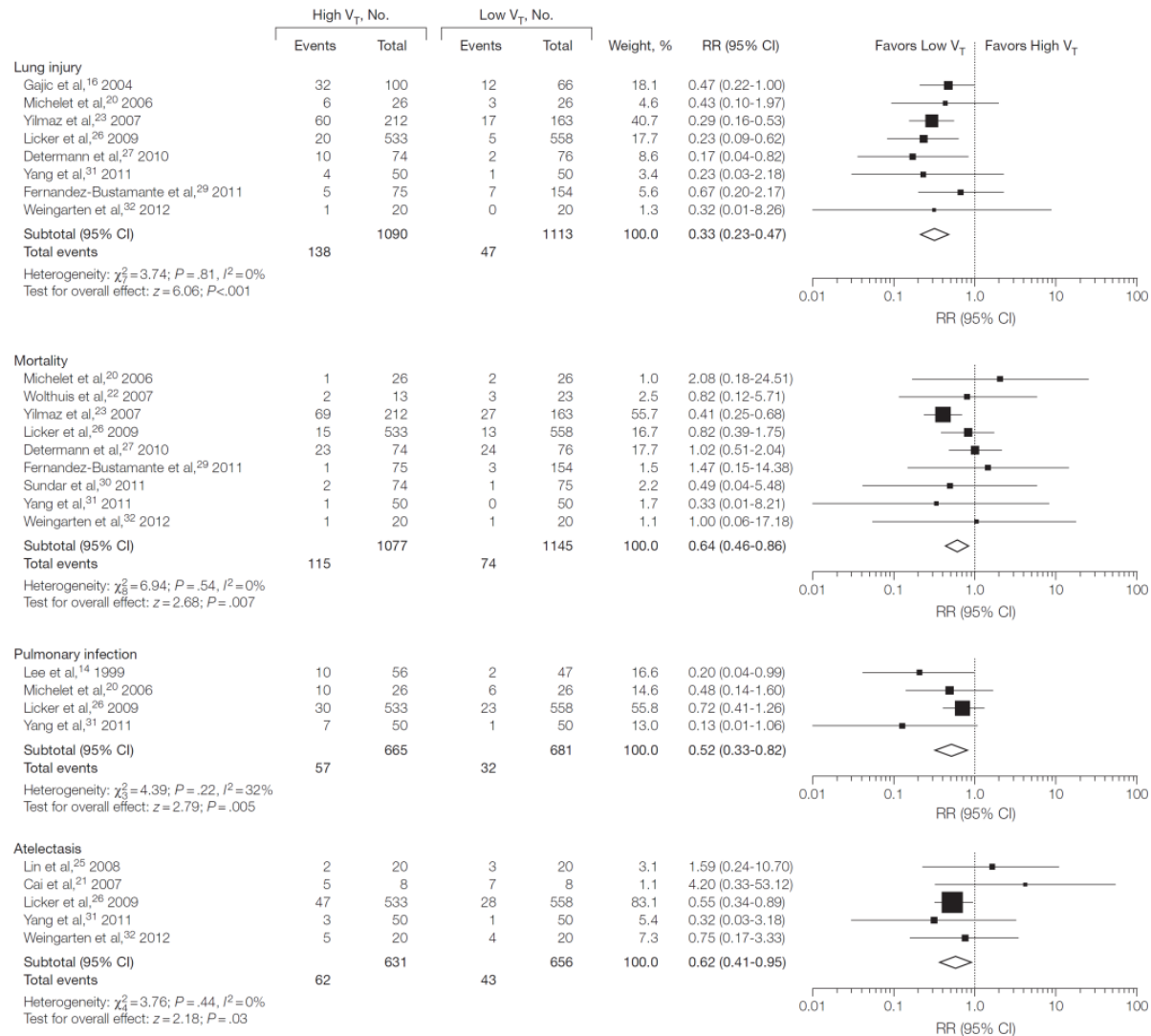
Conventional	51	47	41	32	24	18	12	8
Conservative	54	38	25	16	13	10	8	6

Rôle de la FiO2



Rôle du Vt

Figure 2. Effect of Ventilation With Smaller Tidal Volume in Patients With Healthy Lungs at the End of the Follow-up Period for Each Study



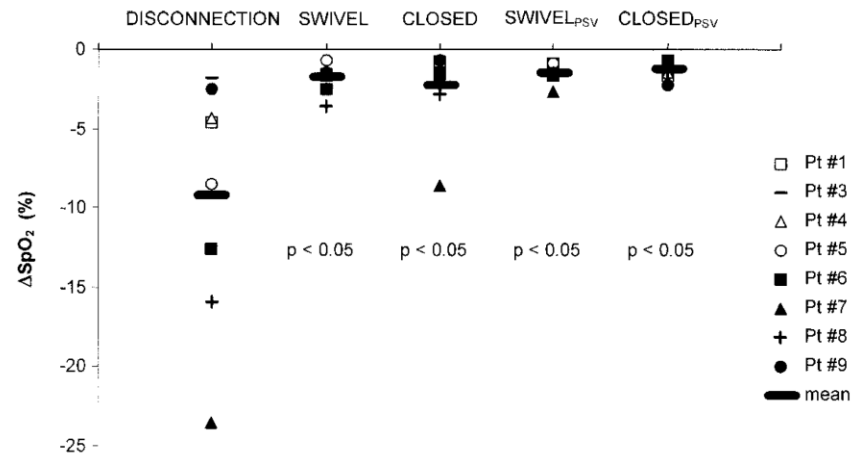
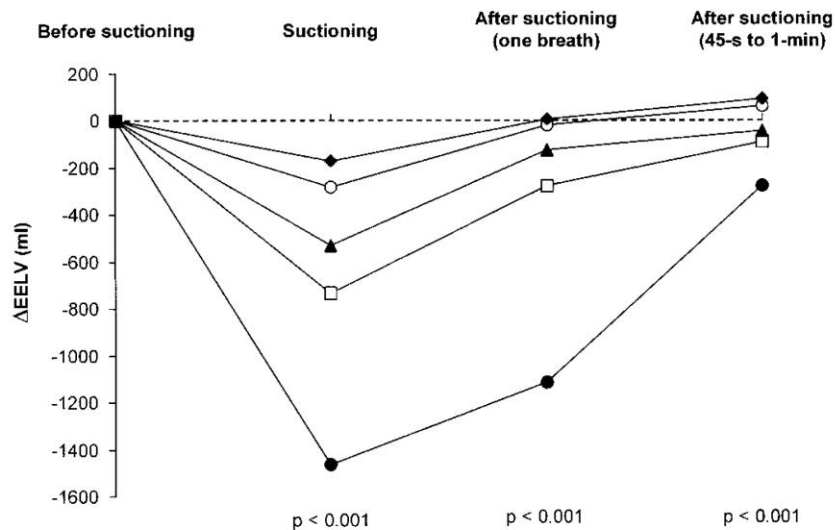
A pooled estimate of risk ratio (RR) was calculated in the individual studies using a fixed-effects model according to Mantel and Haenszel. The size of the data markers indicates the weight of the study in the final analyses. V_T indicates tidal volume.

Prévention des atélectasies

 Possible (evidence from observational studies alone and/or inconsistent evidence from randomized controlled trials)  Probable (evidence from randomized controlled trials and/or meta-analyses)	Duration of Ventilation	Pneumonia	Atelectasis	ARDS	Fluid Overload
Minimize sedation					
Paired SATs and SBTs					
Early mobility					
Low tidal volume ventilation					
Conservative fluid management					
Conservative transfusion thresholds					

Figure 2. Potential strategies to prevent ventilator-associated events (VAEs). The framework to prevent VAEs reported in this review favors interventions that (1) shorten the average duration of mechanical ventilation and (2) target one or more of the four conditions that most frequently trigger VAEs. Demonstrated here is the interplay between these two objectives. ARDS = acute respiratory distress syndrome; SATs = spontaneous awakening trials; SBTs = spontaneous breathing trials.

Rôle des aspirations



Conséquences atélectasies

- Altérations physiologiques
 - Hypoxie
 - Baisse de compliance
 - Dysfonction vasculaire pulmonaire
- Association pronostique, mais nécessité modèle mixte pour causalité

Traitements

- Les traitements habituels (PEP et fibroaspiration) semblent efficaces chez au moins 50% des patients
- L'association des traitements reste à évaluer

Conclusions

- Problème fréquent en ventilation mécanique
- Nombreux facteurs favorisants
- Association avec la morbimortalité
- Analyses en modèles mixte et risques compétitifs nécessaires