Kinésithérapie et réanimation digestive

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- ***Problématique***

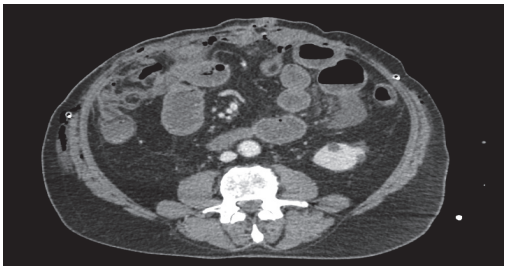
Cas clinique

- Patient suivi pour une **éventration complexe** opérée à plusieurs reprises
- ATCD de **SAS appareillé + BPCO**
- **Syndrome occlusif grêlique** évoluant depuis 1 semaine traité médicalement sur obstacle situé au sein du sac d'éventration (probable bride)
- **Chirurgie en urgence**: résection grêlique avec anastomose en 1 temps. Pas de péritonite constatée. Réfection de paroi avec fermeture sur plaque.

Cas clinique

Cas clinique

Cas clinique



Cas clinique

- **Post-op immédiat:**
  - Extubation précoce, patient dyspnéique
  - Mise en place d'une VNI prophylactique séquentielle + continue nocturne (ATCD de SAS appareillé + BPCO)
  - Réintubation en urgence la nuit suivante dans un tableau de **détresse respiratoire aiguë**

Insuffisance respiratoire aiguë postopératoire

- **Chirurgie abdominale:**
  - 6 à 80% d'IRA postopératoire
  - mortalité de 6 à 29%

Ferreyra, Ann Surg 2008; Kroenke, Chest 1993

- **Chirurgie hépatique majeure**
  - 25% des cas
  - mortalité 29%

Jaber, Chest 2005

- **Chirurgie colorectale:**
  - 5 à 14% des cas

Janny, AFAR 2007

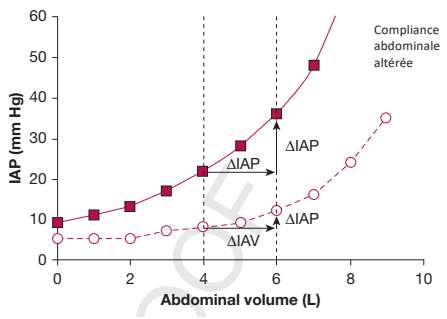
- **Chirurgie thoracique:**
  - 40% atélectasies majeures
  - 30 à 50% d'IRA nécessitant une ventilation mécanique

Freynet, Interact Cardiovasc Thorac Surg 2007

- *Problématique*
- ***Physiopathologie***

- *Problématique?*
- ***Physiopathologie***
  - ***Hyperpression intra-abdominale***

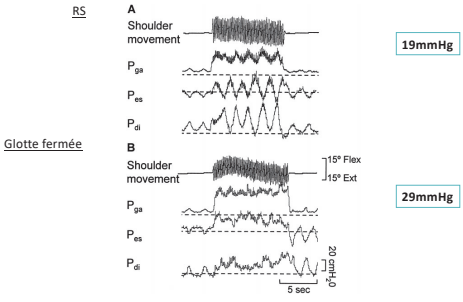
Syndrome compartimental



Malbrain ML et al; Anaesthesiol Intensive Ther. 2014;46(5):406-432

Syndrome compartimental

Variations physiologiques de la PIA



J Appl Physiol (1985). 2000 Sep;89(3):967-76

Syndrome compartimental

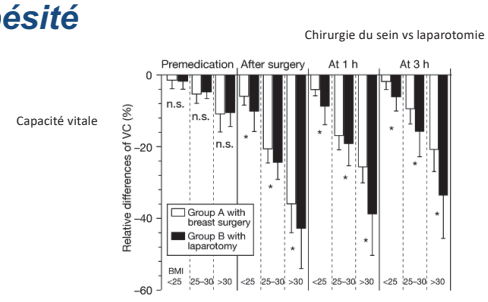
- **PIA normale** = 0-5 mmHg chez l'adulte sain

Söderberg, Scand J Urol Nephrol 1970; 4:155-6
Sanchez, Am Surg 2001; 67:243-8
De Keulenaer, Intensive Care Med 2009

- **Variations normales de la PIA**:
  - respiration (↑ PIA à l'inspiration)
  - vomissement, défécation…
  - exercice physique
- **HIA « physiologique »** : grossesse, obésité morbide
- **Pneumopéritoine chirurgical** = modèle HIA transitoire

Syndrome compartimental

Obésité

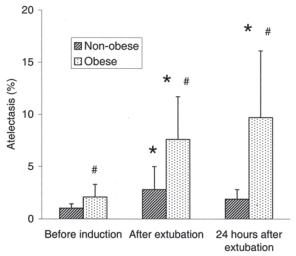


Impact de l'obésité sur la fonction respiratoire

Von Ungern BS BJA 2004; 92:202-7

Syndrome compartimental

Obésité

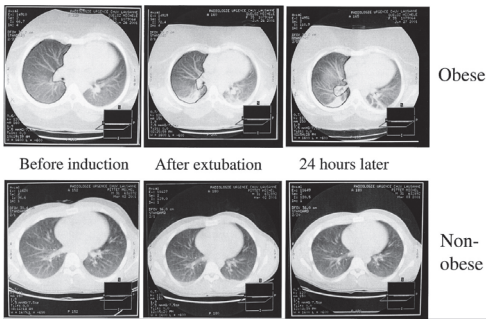


Impact de l'obésité sur la fonction respiratoire

Eichenberger, A. et al. Anesth Analg 2002;95:1788-1792

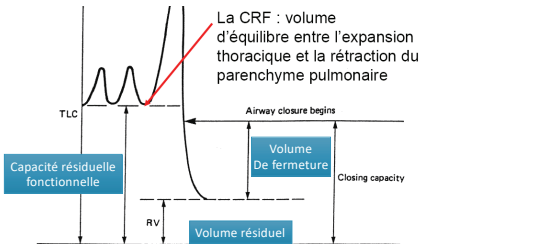
Syndrome compartimental

Obésité



Syndrome compartimental

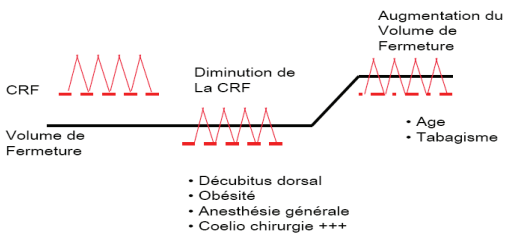
Relation CRF-volume de fermeture



Si CRF<volume de fermeture => un maximum d'alvéoles seront fermées
Apparition d'atélectasies

Syndrome compartimental

Relation CRF-volume de fermeture



- Décubitus dorsal
- Obésité
- Anesthésie générale
- Coelio chirurgie +++

Nunn JF. Br J Anaesth 1990;65:54-62

Syndrome compartimental

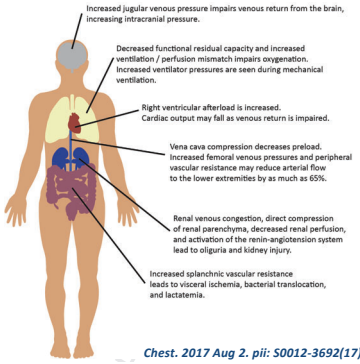
Study/Year	Population	Findings
Trauma		
Ivatury et al[39]/1998	70 patients with "severe abdominal trauma"	32% incidence of ACS
Balogh et al[33]/2003	188 consecutive patients with major torso trauma requiring shock resuscitation	14% incidence of ACS
Balogh et al[40]/2011	81 consecutive shock/trauma patients admitted to an ICU	0% incidence of ACS; 75% incidence of IAP > 12 mm Hg
Burn		
Ivy et al[36]/2000	10 severely burned patients	20% incidence of ACS requiring surgical decompression; 70% incidence of peak IAP > 25 mm Hg
Strang et al[37]/2014	Systematic review of 50 publications, reporting 1,616 severely burned patients	4%-17% prevalence of ACS; 65%-75% prevalence of IAP > 12 mm Hg
Ruptured abdominal aortic aneurysm		
Karkos et al[41]/2014	Meta-analysis of 1,134 patients in 39 studies undergoing endovascular repair of ruptured abdominal aortic aneurysms	8%-17% incidence of ACS
Adkar et al[38]/2017	1,241 patients undergoing endovascular repair of ruptured abdominal aortic aneurysms	7% incidence of need for concomitant laparotomy*
Pancreatitis		
Al-Bahrani[42]/2008	18 patients with severe acute pancreatitis	56% incidence of ACS
Aitken et al[43]/2014	218 patients admitted to a medical ICU with acute pancreatitis	1% incidence of ACS; 14% incidence of IAP > 12 mm Hg on admission
Mixed populations		
Malbrain et al[44]/2004	1-d snapshot prevalence study of all 97 patients in 13 general and specialized ICUs across 6 countries	8% prevalence of ACS; 59% prevalence of IAP > 12 mm Hg

Chest. 2017 Aug 2. pii: S0012-3692(17)31319-3

Syndrome compartimental

Conséquences

- ↗ PIC
- Poumons:
  - ↘ CRF
  - ↗ Pressions VA
- Compression VCI:
  - ↘ Retour veineux
- Reins:
  - Congestion veineuse rénale
  - ↘ PPR
- ↗ RV spanchnique
  - Ischémie mésentérique
  - Translocation



Chest. 2017 Aug 2. pii: S0012-3692(17)31319-3

Syndrome compartimental

Définition

Hyperpression intra-abdominale

PIA > 12 MmHg

Syndrome compartimental abdominal

PIA > 20 mmH

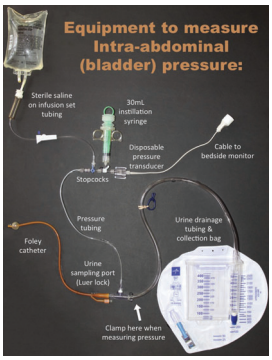
+

Défaillance d'organe récente (SOFA > 3)

World Society of the Abdominal Compartment Syndrome (WSACS)

Syndrome compartimental

Mesure de la PIA



Chest. 2017 Aug 2. pii: S0012-3692(17)31319-3

Syndrome compartimental

Mesure de la PIA

- Patients en **décubitus dorsal** 0°
- **Rincer** la tubulure au SSI avant zéro du capteur de pression
- Injection < **25ml de SSI** dans la vessie (colonne d'eau) et clamper après capteur
- **Attendre** 30-60s (relaxation du muscle vésical)
- Mesure de la pression **en fin d'expiration** et absence de contraction abdominale

NB: 1mmHg = 1,36cmH20

- *Problématique?*
- ***Physiopathologie***
  - ***Hyperpression intra-abdominale***
  - ***Dysfonction diaphragmatique post-opératoire***

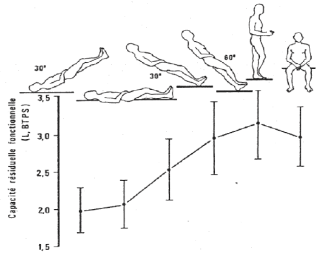
Dysfonction diaphragmatique

- Réduction de la capacité motrice des muscles respiratoires dans les suites d'une intervention chirurgicale thoracique et/ou abdominale

Ford G et al; Diaphragm function after upper abdominal surgery in humans Am Rev Respir Dis 1983 ; 127 : 431-6

Dysfonction diaphragmatique

Effets de la position sur les volumes pulmonaires



Macklem PT: Handbook of physiology, vol 3, 1986

Dysfonction diaphragmatique

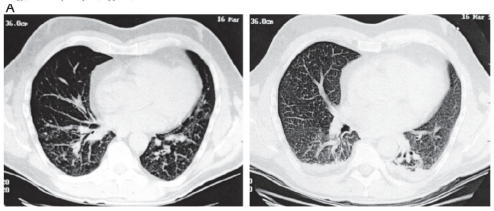
Prevention of Atelectasis Formation During Induction of General Anesthesia

Marco Rusca, MD*, Stefania Proietti, MD†, Pierre Schnyder, MD†, Philippe Frascarolo, PhD*, Göran Hedenstierna, MD, PhD‡, Donat R. Spahn, MD*, and Lennart Magnusson, MD, PhD*

Departments of *Anesthesiology and †Diagnostic Radiology, University Hospital, Lausanne, Switzerland; and ‡Department of Clinical Physiology, University Hospital, Uppsala, Sweden

Anesth Analg 2003;97:1835–9

A



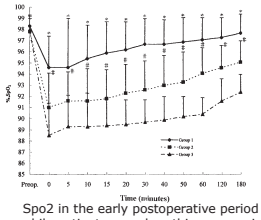
Before induction — After intubation

Atélectasies immédiates, 50% encore présentes à H24

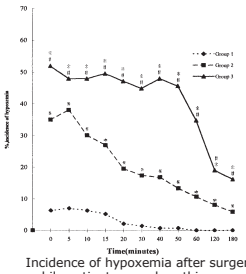
Dysfonction diaphragmatique

Selon le type de chirurgie

Group 1: superficial plastic surgery
Group 2: upper abdominal surgery
Group 3: thoracoabdominal surgery



Spo2 in the early postoperative period while patients were breathing room air



Incidence of hypoxemia after surgery while patients were breathing room air

Xue FS et al. The influence of surgical sites on early postoperative hypoxemia in adults undergoing elective surgery. Anesth Analg 1999; 88:203–219.

Dysfonction diaphragmatique

Selon le type de chirurgie

Group 1: superficial plastic surgery
Group 2: upper abdominal surgery
Group 3: thoracoabdominal surgery

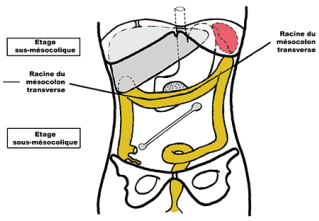
	All patients (n = 994)	Group 1 (n = 288)	Group 2 (n = 452)	Group 3 (n = 254)
Recovery room				
Mild airway obstruction	65 (6.5)	16 (5.6)	32 (7.1)	17 (6.7)
Inadequate hemostasis	3 (0.3)	0 (0)	1 (0.2)	2 (0.79)
Hypothermia[a]	43 (4.3)	9 (3.1)	21 (4.7)	13 (6.7)
Fever[b]	31 (3.1)	18 (6.3)	9 (2.0)*	4 (1.6)*
Postoperative period				
Upper airway infection	18 (1.8)	2 (0.7)	9 (2.0)	7 (2.8)
Intrathoracic infection[c]	8 (0.8)	0 (0)	1 (0.2)	7 (2.8)†
Intraabdominal infection	5 (0.5)	0 (0)	3 (0.6)	2 (0.8)
Death	1 (0.1)	0 (0)	0 (0)	1 (0.4)

Xue FS et al. The influence of surgical sites on early postoperative hypoxemia in adults undergoing elective surgery. Anesth Analg 1999; 88:203–219.

Dysfonction diaphragmatique

Volumes pulmonaires après chirurgie

- Variation de la densité des récepteurs sympathiques viscéraux
- Etage sous-mésocolique:
  - ⇒Pas de dysfonction diaphragmatique majeure
  - ⇒Peu de complications respiratoires

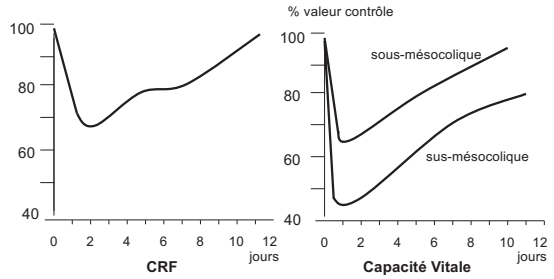


Etage sus-mésocolique
- Œsophage abdominal
- Estomac
- Duodéno-pancréas
- Rate
- Foie
- Voies biliaires

Etage sous-mésocolique
- Jéjuno-iléon (intestin grêle)
- Colon (gros intestin)
- Rectum

Dysfonction diaphragmatique

Volumes pulmonaires après chirurgie



Ford G et al; Diaphragm function after upper abdominal surgery in humans Am Rev Respir Dis 1983 ; 127 : 431-6

Dysfonction diaphragmatique

Selon le type d'incision

Analysis 2.1. Comparison 2 pulmonary function, Outcome 1 Percentage change in vital capacity day 1 post-operative.

Review: Transverse verses midline incisions for abdominal surgery

Comparison: 2 pulmonary function

Outcome: 1 Percentage change in vital capacity day 1 post-operative

Study or subgroup	Transverse incision N	Mean(SD)	Midline incision N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Ali 1979	10	57 (5.5)	9	40 (5)		40.9 %	17.00 [12.28, 21.72]
Armstrong 1990	29	54 (16.5)	31	49 (15.5)		13.9 %	5.00 [-3.11, 13.11]
Lacy 1994	25	50 (13.8)	25	46 (19)		10.8 %	4.00 [-5.21, 13.21]
Lindgren 2001	21	68 (17)	19	68 (17)		8.2 %	0.0 [-10.55, 10.55]
Proske 2005	47	44 (16)	47	44 (13)		24.3 %	0.0 [-5.89, 5.89]
Total (95% CI)	**132**		**131**			**100.0 %**	**8.08 [5.06, 11.10]**

Heterogeneity: Chi² = 24.49, df = 4 (P = 0.00006); I² =84%

Test for overall effect: Z = 5.24 (P < 0.00001)

Test for subgroup differences: Not applicable

.100 .50 0 50 100

Favours midline Favours transverse

Recours à l'analgésie et la CV pulmonaire peuvent être réduits par une incision médiane

Brown SR, Tiernan J, Transverse verses midline incisions for abdominal surgery, October 5, 2011

Dysfonction diaphragmatique

Selon le type d'incision

Analysis 3.1. Comparison 3 pulmonary complications, Outcome 1 pulmonary complications.

Review: Transverse verses midline incisions for abdominal surgery

Comparison: 3 pulmonary complications

Outcome: 1 pulmonary complications

Study or subgroup	transverse n/N	midline n/N	Odds Ratio M-H,Fixed,95% CI	Odds Ratio M-H,Fixed,95% CI
Becquemin 1985	0/10	3/16		0.10 [0.00, 2.03]
Brown 2004	1/14	0/14		3.22 [0.12, 86.09]
Garcia-Valdecasas 1988	1/63	5/66		0.20 [0.02, 1.73]
Griensel 1980	97/286	84/286		1.23 [0.87, 1.76]
Helm 2009	2/75	0/75		5.14 [0.24, 108.81]
Ioata 2004	6/196	11/199		0.54 [0.20, 1.49]
Lacy 1994	5/25	7/25		0.64 [0.17, 2.39]
Lindgren 2001	0/17	3/23		0.17 [0.01, 3.47]
Seeru 1994	0/97	2/84		0.17 [0.01, 3.58]
Sohrab 2008	0/19	0/23		0.0 [0.0, 0.0]
Soler 2009	17/99	13/100		1.39 [0.63, 3.03]
Total (95% CI)	**901**	**911**		**1.01 [0.76, 1.34]**

Total events: 129 (transverse), 130 (midline)

Heterogeneity: Chi² = 12.97, df = 9 (P = 0.17); I² =28%

Test for overall effect: Z = 0.08 (P = 0.94)

Test for subgroup differences: Not applicable

0.1 0.2 0.5 1 2 5 10

Favours transverse Favours midline

Pas de différence en terme de complication et de temps de récupération

Brown SR, Tiernan J, Transverse verses midline incisions for abdominal surgery, October 5, 2011

Dysfonction diaphragmatique

Coeliochirurgie

	$Perco_2$ (mm Hg)	MV (L/min)	Ppeak (cm H_2O)	Pplat (cm H_2O)	C (mL/cm H_2O)	V 1.0 (%)	n
During anesthesia							
Supine, lithotomy	35.2 (0.7)	6.4 (0.2)	14.0 (0.6)	13.5 (0.6)	50 (2.4)	76 (1.1)	20
Trendelenburg	35.0 (0.3)	5.3 (0.2)*	14.8 (0.6)	14.7 (0.6)	41 (2.4)*	81 (1.3)	20
During laparoscopy							
5 min	35.9 (0.3)	7.0 (0.3)*	22.7 (0.9)*	22.1 (0.8)*	28 (1.7)*	86 (1.2)*	20
20 min	35.6 (0.2)	7.4 (0.2)	23.3 (0.9)	22.8 (0.8)	28 (1.5)	86 (1.2)	20
35 min	35.4 (0.3)	7.6 (0.3)	23.8 (0.9)	23.2 (0.9)	27 (1.6)	87 (1.0)	20
50 min	35.8 (0.3)	7.7 (0.3)	23.8 (1.0)	23.1 (0.9)	26 (1.5)	88 (0.9)	20
65 min	35.6 (0.3)	8.0 (0.3)	24.5 (0.9)	24.1 (0.9)	27 (1.4)	87 (0.9)	19
80 min	35.6 (0.3)	7.8 (0.4)	25.0 (1.3)	24.5 (1.4)	27 (1.7)	87 (1.1)	14
Before deflation	35.5 (0.3)	8.0 (0.3)	24.5 (0.9)	24.1 (0.9)	26 (1.4)	88 (0.9)	20
After deflation							
Trendelenburg	35.9 (0.3)	8.3 (0.4)	19.2 (0.7)*	18.0 (0.7)*	40 (1.9)*	82 (0.9)*	20
Supine, lithotomy	35.4 (0.4)	7.0 (0.2)*	15.2 (0.5)*	14.5 (0.5)*	46 (2.2)*	78 (1.0)*	20

Results are given as mean (se).

* Significantly different from the previous value: $P < 0.05$.

MV = minute ventilation; Ppeak = peak airway pressure; Pplat = plateau inspiratory pressure; C = compliance; V 1.0 = expiratory resistance.

- Au cours de la cœlioscopie, la pression des voies respiratoires ↑ et la compliance du système respiratoire ↓
- La compliance est diminuée de 20 % par la position de Trendelenburg et de 30 % par l'élévation de la pression intra-abdominale

Hirvonen EA et al, Ventilatory effects, blood gas changes and oxygen consumption during laparoscopic hysterectomy Anesth Analg 1995 ; 80 : 961-6

Dysfonction diaphragmatique

Coelio vs laparo

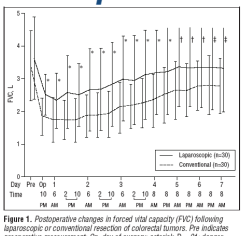


Figure 1. *Postoperative changes in forced vital capacity (FVC) following laparoscopic or conventional resection of colorectal tumors. Pre indicates preoperative measurement; Op, day of surgery; asterisk, P = .01; dagger, P<.05; and double dagger, P = .06.*

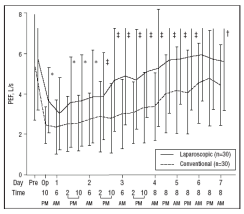


Figure 3. *Postoperative changes in peak expiratory flow (PEF) following laparoscopic or conventional resection of colorectal tumors. Pre indicates preoperative measurement; Op, day of surgery; asterisk, P<.05; dagger, P = .06; and double dagger, P<.01.*

- Effets respiratoires moins prononcés et de plus courte durée
- CV et le VEMS se normalisent le plus souvent avant le 2e jour postopératoire, alors que la normalisation de la CRF se fait entre le 3e et le 5e jour.

Schwenk W et al; Pulmonary function following laparoscopic or conventional colorectal resection Arch Surg 1999 ; 134 : 6-12

Dysfonction diaphragmatique

Coelio vs laparo

Table 4 Postoperative atelectasis after laparoscopic (LC) or open (OC) cholecystectomy. *$P < 0.05$ between groups (chi-square test for trend)

	LC ($n=42$)	OC ($n=40$)
Microatelectasis	7	14
Focal	3	7
Segmental	2	3
Lobar	0	0
Normal	30	15*

Radiographie thoracique avant et après la chirurgie

Karayiannakis A et al, Postoperative pulmonary function after laparoscopic and open cholecystectomy Br J Anaesth 1996 ; 77 : 448-52

Coelio vs laparo

Short term benefits for laparoscopic colorectal resection (Review)

- Altération moindre de la fonction ventilatoire postopératoire
- Douleur postopératoire moindre
- Pas de différence en terme de morbidité pulmonaire
  OR: 0.70 [0.36-1.34]

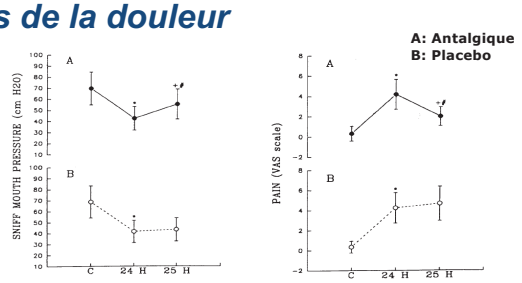
The Cochrane Database of Systematic Reviews 2005, Issue 2

Effets des agents anesthésiques

- Limités à la période postopératoire immédiate
  =>Morphiniques
  ✓Hypoventilation alvéolaire
  ✓Suppression de la toux et du soupir
  ✓Dépression de la réponse ventilatoire à l'hypoxie, l'hypercapnie
- Dépression du tonus des muscles intercostaux
- Raccourcissement du périmètre thoracique

⇒Réduction de la compliance
⇒Réduction du VPT
⇒Réduction de la CRF d'environ 20%
⇒Zones d'atélectasies postop

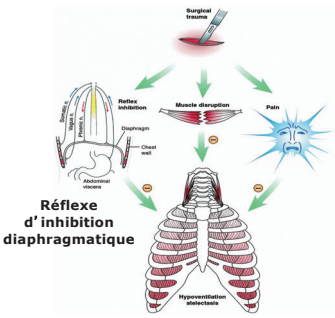
Effets de la douleur



Rôle dans le réflexe d'inhibition diaphragmatique probable
=> rôle des récepteurs abdominaux pariétaux?

Vassilakopoulos T et al, Contribution of pain to inspiratory muscle dysfunction after upper abdominal surgery , Am J Respir Crit Care Med 2000 ; 161 : 1372-5

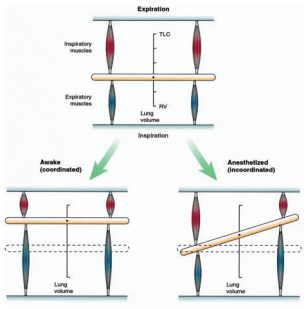
Effets de la douleur



Réflexe d'inhibition diaphragmatique

Origine multifactorielle:
- « agression » chirurgicale
- inhibition phrénique réflexe
- réaction inflammatoire
- agents anesthésiques
- douleur postopératoire

Anesthesiology 2000;92:1467-72



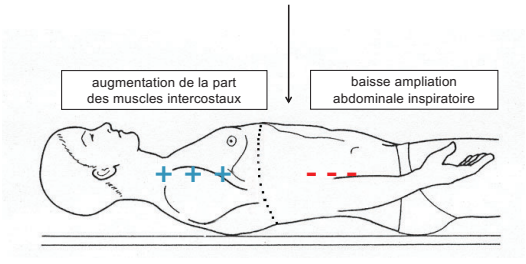
- **Patient normal**: bonne synchronisation des muscles inspi et expi et fonctionnement du diaphragme tel un piston
- **Anesthésie**: asynchronisme des muscles respiratoire. Réduction de type restrictive des volumes postop

- **↓ CRF**
- **↓ CV (30-40%)**
- **↑ Atelectasies**

=>Maximale à J1

=>Durée jusqu'à J15

Warner DO Anesthesiology 2000;92 (5): 1467

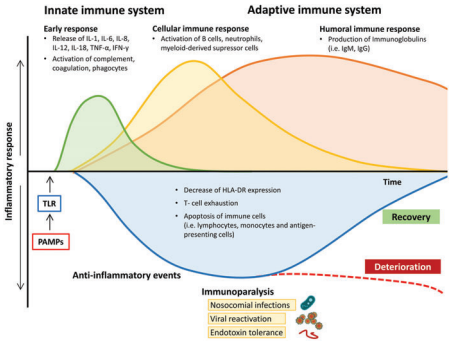


- *Problématique?*
- ***Physiopathologie***
  - ***Hyperpression intra-abdominale***
  - ***Dysfonction diaphragmatique post-opératoire***
  - ***Atteinte alvéolo-capillaire***

Altération de la membrane alvéolo-capillaire

- **Altération de l'épuration muco-ciliaire**
  - ✓Intubation endotrachéale
  - ✓Conditionnement hydro thermique et FiO2 du gaz inhalé (atélectasie de résorption)
  - ✓Ventilation mécanique
- **Inhalation du liquide gastrique**
- **Altération du surfactant**
  - Gaz halogénés
- **Surcharge hydrosodée** (remplissage excessif)

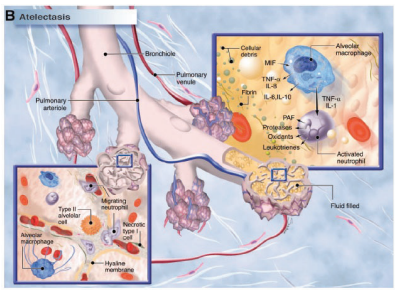
Exercice physique et Sepsis



Front. Med. 8:628302. doi: 10.3389/fmed.2021.628302

Altération de la membrane alvéolo-capillaire

Inflammation

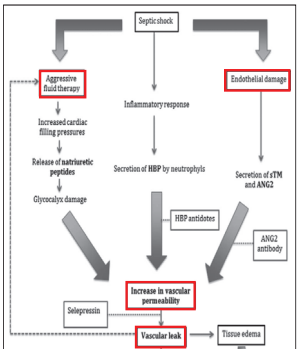


⇒**Libération systémique des cytokines pro-inflammatoires**

⇒ **Altération de la perméabilité de la membrane alvéolocapillaire**

Duggan M et al. Anesthesiology 2005 ; 102:838-854.

Altération de la membrane alvéolo-capillaire



- **Sepsis avec libération de cytokines**
- **Transfusion massive**
- **Lésions de cisaillement alvéolaire**

Crit Care Med. 2016 Dec;44(12):2263-2269.

Altération de la membrane alvéolo-capillaire

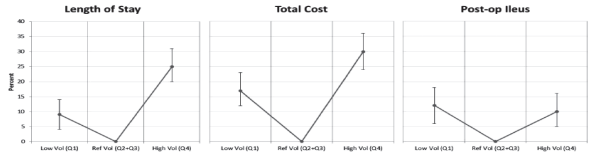
Déséquilibre de la volémie

Altération de la membrane alvéolo-capillaire

Perioperative Fluid Utilization Variability and Association With Outcomes

Considerations for Enhanced Recovery Efforts in Sample US Surgical Populations

Chirurgie colique
n= 84722

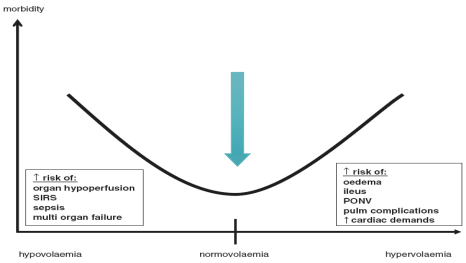


Morbidité de l'hypovolémie ET l'hypervolémie

Thacker et al. Ann Surg 2015

Altération de la membrane alvéolo-capillaire

Déséquilibre de la volémie

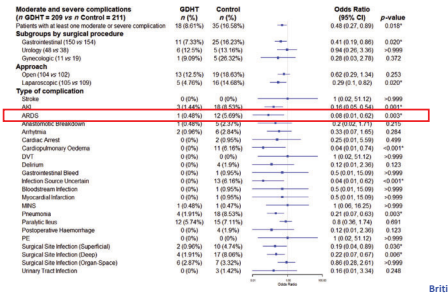


Bellamy M C Br J Anaesth 2006

Altération de la membrane alvéolo-capillaire

Effect of goal-directed haemodynamic therapy on postoperative complications in low–moderate risk surgical patients: a multicentre randomised controlled trial (FEDORA trial)

BJA



Monitoring du remplissage vasculaire

- Etude prospective, multicentrique randomisée
- Chirurgie majeure programmée
- Groupe interventionnel avec MAP >70 mm Hg et IC >2.5 vs traitement standard
- 450 patients inclus

British Journal of Anaesthesia, 120 (4): 734e744 (2018)

- *Problématique?*
- ***Physiopathologie***
  - ***Hyperpression intra-abdominale***
  - ***Dysfonction diaphragmatique post-opératoire***
  - ***Atteinte alvéolo-capillaire***
  - ***Fonte de la masse musculaire***

Perte de la masse musculaire

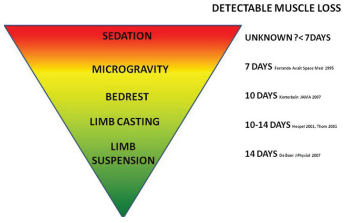
The impact of extended bed rest on the musculoskeletal system in the critical care environment

Extreme Physiology & Medicine

Selina M. Parry[1*] and Zudin A. Puthucheary[2,3]

Réductions de la **masse musculaire et de la densité osseuse**, en parallèle, des altérations des autres systèmes du corps humain qui apparaissent **dès les premiers jours**

THE IMMOBILITY PYRAMID



Extrem Physiol Med. 2015 Oct 9;4:16

- *Problématique*
- *Physiopathologie*
- ***Exemple clinique***

Cas clinique

- Patiente de 36 ans en surcharge pondérale
- Prise en charge pour un tableau de coliques hépatiques récidivantes depuis plusieurs mois.
- **Empierrement cholédocien** à la bili-IRM
- Chirurgie programmée difficile (8h). Conversion par laparotomie sous-costale. Extraction de lithiase de la voie biliaire principale mécanique et par lithotripsie au laser.
- **Sepsis** périopératoire et détresse respiratoire

  => Réintubation à J2
- **Pancréatite aiguë** sur TDM

Cas clinique

- Evolution respiratoire initialement favorable

  => PIA=18mmHg
- Puis brutale dégradation respiratoire à **J10**
  - Fi02=100%; P/F=60, Sa02 à 85%
  - Curarisation + DV + NO
  - Sécrétions sales et abondantes
  - Majoration de la **PIA à 26 mmHg** (**20** après curarisation)

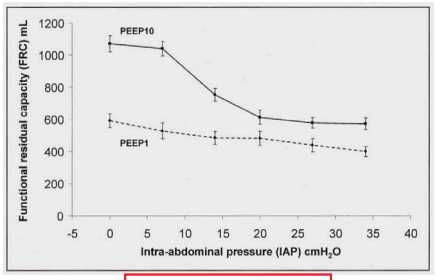
Cas clinique

Vt=5ml/kg
Autopep=2
FiO2=100%

	12h	14h	16h	20h
Vt	270	270	270	270
PEEP tot	8	12	16	20
FR	27	27	27	27
Pplat	38	41	40	45
Sa02	84	88	90	95

Cas clinique

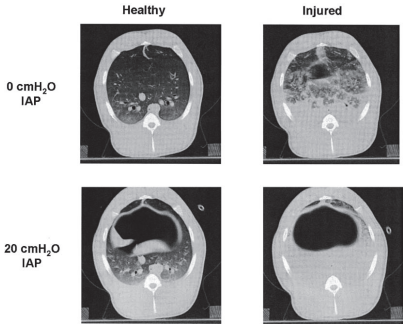
Relation CRF-volume de fermeture



PEEP minimise la réduction de CRF

Crit Care Med **2013; 41:1870-1877)**

Cas clinique



Am J Respir Crit Care Med. 2004 Feb 15;169(4):534-41

Cas clinique

Ventilation protectrice ?

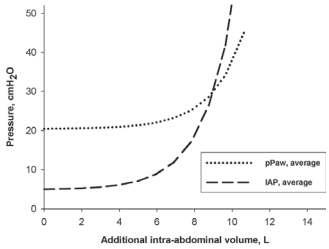
	12h	14h	16h	20h
Vt	270	270	270	270
PEEP tot	8	12	16	20
FR	27	27	27	27
Pplat	38	41	40	45
Pression motrice	30	29	24	25
Sa02	84	88	90	95

Pression motrice= variation de pression alvéolaire induite par le volume courant
Reflet de la compliance dynamique

Cas clinique

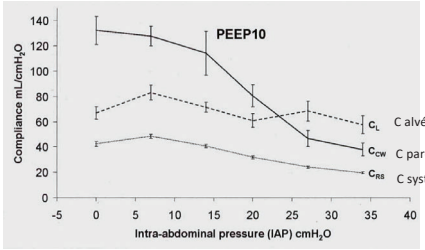
The respiratory pressure—abdominal volume curve in a porcine model

Adrian Regli[1,2,3,4*], Bart Leon De Keulenaer[1,3], Bhajan Singh[6,7,8], Lisen Emma Hockings[2,5], Bill Noffsinger[6,8] and Peter Vernon van Heerden[2,3,9]



⇒ Augmentation exponentielle de la Pplat

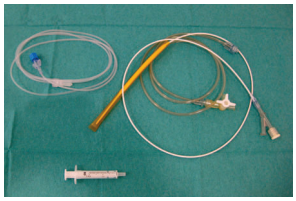
Cas clinique

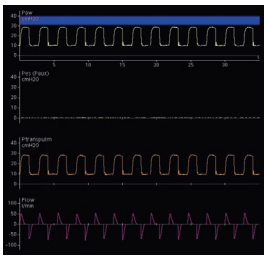


⇒Atteinte de la compliance pariétale
⇒Pas d'atteinte de la compliance alvéolaire

Crit Care Med 2013; 41:1870-1877

Cas clinique

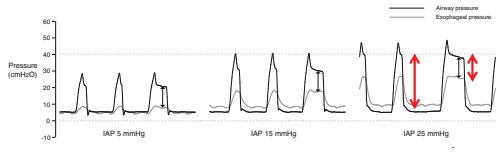




Cas clinique

Driving pressure: a marker of severity, a safety limit, or a goal for mechanical ventilation?

Guillermo Bugedo*, Jaime Retamal and Alejandro Bruhn



⇒ Surestimation de la PM **des voies aériennes** en cas d'HIA
⇒ PM **transpulmonaire** reste constante

Bugedo et al. Critical Care (2017) 21:199

Cas clinique

Vt	270
PEEP tot	15
FR	27
Pplat	41
Ppl Inspi	30
Ppl Expi	19
PTP Inspi	11
PTP Expi	-4

PM transpulmonaire
(Pplat-PEEP)-(Ppli-Pple)
=15

PTP inspi = Plat – Ppl inspi
PTP expi = PEEP – Ppl expi

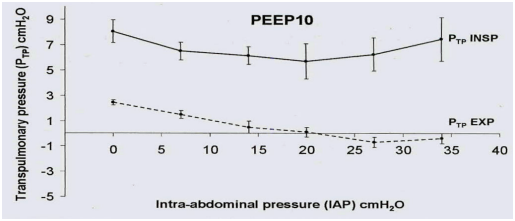
Cas clinique

Vt	270
PEEP tot	15
FR	27
Pplat	41
Ppl Inspi	30
Ppl Expi	19
PTP Inspi	11
PTP Expi	-4

PTP inspi = Plat – Ppl inspi
PTP expi = PEEP – Ppl expi

Cas clinique

Lésions de cisaillement

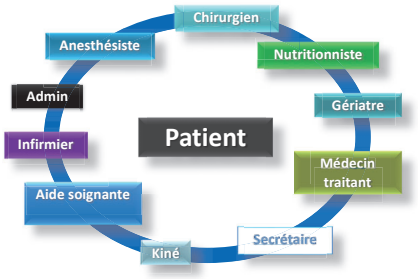


PTPexp négative = Collapsus alvéolaire

Cas clinique

- *Problématique*
- *Physiopathologie*
- *Interlude: cas clinique*
- ***Prise en charge***

Récupération accélérée



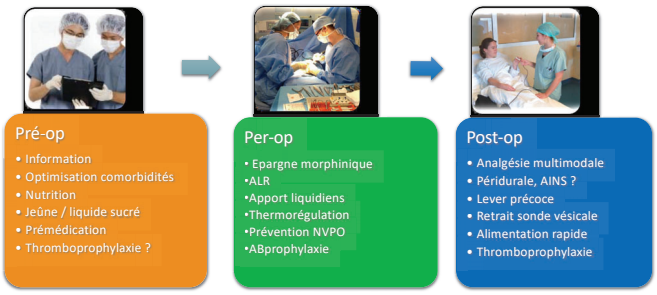
Approche **multidisciplinaire** pour une prise en charge **globale**

Récupération accélérée

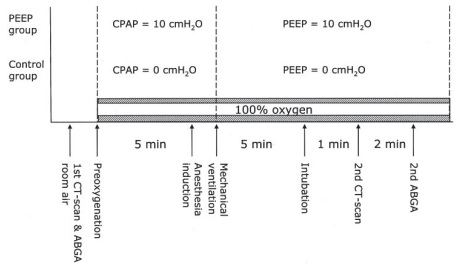
Organisation spécifique des soins selon un «**chemin clinique**»

- **Informer** le patient et le former à la démarche
- **Anticiper l'organisation** des soins et la sortie du patient
- **Réduire** les conséquences du **stress chirurgical**
- **Contrôler la douleur** dans toutes les situations
- Favoriser et stimuler **l'autonomie** des patients

Récupération accélérée

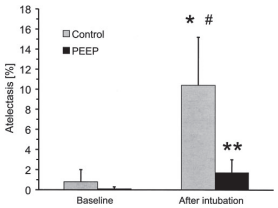


VNI à l'induction



Coussa M et al. Prevention of atelectasis formation during the induction of general anesthesia in morbidly obese patients. Anesth Analg 2004; 98:1491–1495

VNI à l'induction



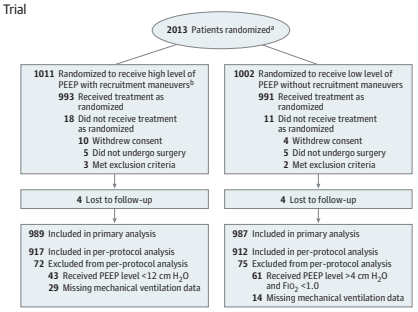
	Control (n = 9)	PEEP (n = 9)	P-value
Pao_2 before induction (mm Hg) (Fio_2 = 0.21)	80 ± 7 (66–87)	85 ± 8 (71–94)	0.10
Pao_2 after induction (mm Hg) (Fio_2 = 1.0)	315 ± 100 (223–480)	457 ± 130 (231–610)	0.035
$Paco_2$ before induction (mm Hg)	36 ± 3 (30–40)	36 ± 3 (32–41)	0.76
$Paco_2$ after induction (mm Hg)	40 ± 4 (34–45)	36 ± 7 (29–52)	0.07

Coussa M et al. Prevention of atelectasis formation during the induction of general anesthesia in morbidly obese patients. Anesth Analg 2004; 98:1491–1495

PEEP Peropératoire

Effect of Intraoperative High Positive End-Expiratory Pressure (PEEP) With Recruitment Maneuvers vs Low PEEP on Postoperative Pulmonary Complications in Obese Patients
A Randomized Clinical Trial

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT



JAMA. 2019 Jun 18;321(23):2292-2305

PEEP Peropératoire

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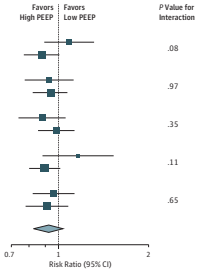
A Randomized Clinical Trial

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Subgroups of Patients	High PEEP No. With PPC	High PEEP Total No.	Low PEEP No. With PPC	Low PEEP Total No.	Risk Ratio (95% CI)	P Value for Interaction
Type of surgery						
Nonlaparoscopic	79	240	74	253	1.09 (0.90-1.32)	.08
Laparoscopic	130	740	156	727	0.88 (0.77-1.01)	
Body mass index[a]						.97
<40	76	336	94	376	0.93 (0.77-1.13)	
≥40	135	653	139	611	0.94 (0.82-1.08)	
Peripheral oxygen saturation, %						.35
<96	88	317	112	342	0.88 (0.74-1.06)	
≥96	123	672	121	645	0.99 (0.86-1.13)	
Type of incision						.11
Peripheral	32	126	25	126	1.16 (0.89-1.53)	
Upper abdominal	179	863	208	861	0.90 (0.80-1.02)	
Waist-to-hip ratio, cm						.65
<1.0	97	467	100	457	0.97 (0.83-1.13)	
≥1.0	98	447	112	449	0.92 (0.78-1.08)	
All patients	211	989	233	987	0.93 (0.83-1.04)	



JAMA. 2019 Jun 18;321(23):2292-2305

Ventilation protectrice peropératoire

ORIGINAL ARTICLE

A Trial of Intraoperative Low-Tidal-Volume Ventilation in Abdominal Surgery

Lung-Protective Ventilation
V_T 6 to 8 ml/kg PBW
PEEP 6 to 8 cmH_2O
Recruitment Maneuver

VS.

Traditional Ventilation
V_T 10 to 12 ml/kg PBW
No PEEP
No Recruitment Maneuver

Recruitment maneuver = CPAP 30 cmH_2O during 30 sec
After intubation and every 30min thereafter

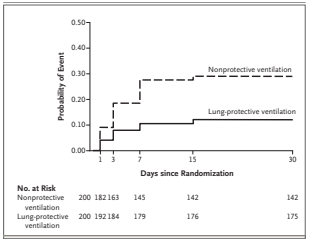
In both groups:
- **Plateau pressure < 30 cmH_2O**
- **Volume-controlled ventilation mode**
- **FiO_2 adjusted to maintain SpO_2 ≥ 95%**
- **RR adjusted to maintain $ETCO_2$ between 35 and 40 mmHg**

NEJM 369;5 nejm.org august 1, 2013

Ventilation protectrice peropératoire

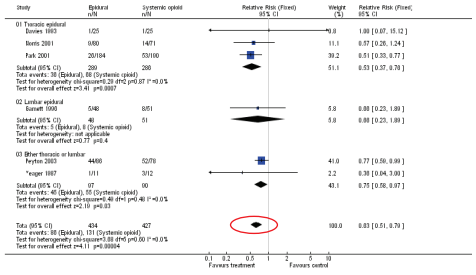
ORIGINAL ARTICLE

A Trial of Intraoperative Low-Tidal-Volume Ventilation in Abdominal Surgery



NEJM 369;5 nejm.org august 1, 2013

Analgésie postopératoire

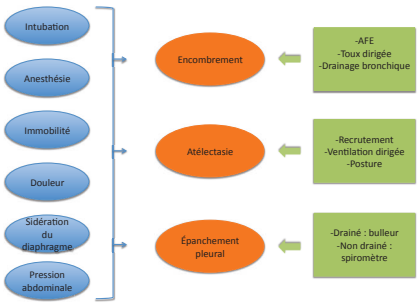


Analgésie péridurale

Cochrane Data Syst Rev 2006;3:CD005059

Stratégies préventives

Kinésithérapie



Stratégies préventives

Preoperative Intensive Inspiratory Muscle Training to Prevent Postoperative Pulmonary Complications in High-Risk Patients Undergoing CABG Surgery

A Randomized Clinical Trial

JAMA

Table 2. Duration of Postoperative Hospitalization and Level of PPCs Between the IMT and Usual Care Groups*

Outcome	IMT Group (n = 139)	Usual Care Group (n = 137)	Odds Ratio (95% CI)	*P* Value
Duration of postoperative hospitalization, median (range), d	7 (5-41)	8 (6-70)		.02
Level of PPC				
Grade 1	114 (82.0)	89 (65.0)	1.90 (1.09-3.38)	.02
Grade 2	14 (10.1)	18 (13.1)	0.63 (0.41-0.95)	.02
Grade 3	10 (7.2)	24 (17.5)	0.44 (0.23-0.84)	.01
Grade 4	1 (0.7)	6 (4.4)	0.20 (0.02-1.64)	.09
PPC grade ≥2	25 (18.0)	48 (35.0)	0.52 (0.30-0.92)	.02
Pneumonia	9 (6.5)	22 (16.1)	0.40 (0.19-0.84)	.01

Abbreviations: CI, confidence interval; IMT, inspiratory muscle training; PPC, postoperative pulmonary complication.
*Data are presented as number (percentage) unless otherwise specified.

JAMA, October 18, 2006—Vol 296, No. 15

Mobilisation précoce en réanimation

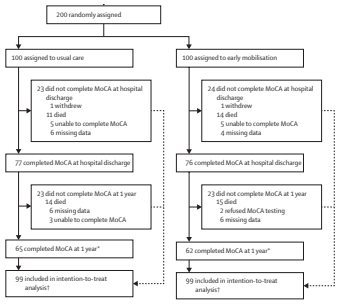
Effect of early mobilisation on long-term cognitive impairment in critical illness in the USA: a randomised controlled trial

Bhakti K Patel, Krysta S Wolfe, Shruti B Patel, Karen C Dugan, Cheryl L Esbrook, Amy J Powlik, Megan Stulberg, Crystal Kemple, Megan Tarle, Erin Zelony, Donald Hedeker, Anne S Pohlman, Vineet M Arora, Jesse B Hall, John P Kress

Patients adultes (âgés de ≥18 ans) sans déficit fonctionnel et ventilés mécaniquement pour une durée > 24h

Au cours des 96 premières heures de ventilation mécanique

Single-centre, parallel, randomised controlled trial



Lancet Respir Med . 2023 Jun;11(6):563-572

Mobilisation précoce en réanimation

Effect of early mobilisation on long-term cognitive impairment in critical illness in the USA: a randomised controlled trial

Bhakti K Patel, Krysta S Wolfe, Shruti B Patel, Karen C Dugan, Cheryl L Esbrook, Amy J Powlik, Megan Stulberg, Crystal Kemple, Megan Tarle, Erin Zelony, Donald Hedeker, Anne S Pohlman, Vineet M Arora, Jesse B Hall, John P Kress

	Usual care group (n=99)	Intervention group (n=99)
Age, years	54·5 (41·9-64·7)	57·9 (42·3-66·8)
Sex		
Female	44 (44%)	41 (41%)
Male	55 (56%)	58 (59%)
Race		
African American	72 (73%)	68 (69%)
White, non-Hispanic	21 (21%)	26 (26%)
White, Hispanic	4 (4%)	4 (4%)
Asian	2 (2%)	1 (1%)
Barthel Index Score	100 (100-100)	100 (100-100)
BMI, kg/m²	29·8 (24·2-35·2)	28·2 (23·7-33·1)
Level of education		
High school education or higher	91 (92%)	91 (92%)
Less than high school education	8 (7%)	8 (7%)
APACHE II score	23 (16-27)	23 (18-29)

	Usual care group (n=99)	Intervention group (n=99)
Sepsis*	56 (57%)	63 (64%)
Diabetes	26 (26%)	23 (23%)
Primary diagnosis for ICU admission		
Acute hypoxaemic respiratory failure	35 (35%)	44 (44%)
Acute ventilatory failure	24 (24%)	17 (17%)
Threatened airway	21 (21%)	19 (19%)
Sepsis*	12 (12%)	14 (14%)
Liver failure	3 (3%)	1 (1%)
Gastrointestinal haemorrhage	1 (1%)	2 (2%)
Other	3 (3%)	2 (2%)

Lancet Respir Med . 2023 Jun;11(6):563-572.

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	Usual care group (n=99)	Intervention group (n=99)	p value
Time from intubation to first PT or OT session (days)	4·7 (3·3-6·8)	1·1 (0·8-2·0)	<0·0001
Number of daily therapy sessions			
Mechanical ventilation	0 (0-0)	2 (1-3)	<0·0001
ICU admission	0 (0-1)	4 (2-6)	<0·001
During hospitalisation	2 (1-4)	5 (3-9)	<0·0001
Delirium duration in ICU (days)	1 (0-3)	0 (0-2)	0·0050
Proportion of ICU days in delirium	25% (0-55·6)	0% (0-28·6)	0·0011
Coma duration in ICU (days)	0 (0-1)	0 (0-0)	0·62
Proportion of ICU days in coma	0% (0-6·3)	0% (0-0)	0·67

Data are median (IQR) or n (%), unless otherwise stated. ICU=intensive care unit. OT=occupational therapy. PT=physical therapy. *Days 1–28. †Home discharge without need for services versus all other discharge possibilities.

Sedation and analgesia			
Patients with propofol infusion	71 (72%)	69 (70%)	0·75
Propofol dose, mg/day	1872·4 (915·2-2803·0)	1259·9 (550·1-2615·0)	0·093
Patients with dexmedetomidine infusion	48 (49%)	48 (49%)	1·00
Dexmedetomidine dose, µg per day	417·8 (99·9-1452·1)	441·7 (221·9-1030·3)	0·97
Patients with benzodiazepine infusion	9 (9%)	12 (12%)	0·49
Benzodiazepine dose, mg per day	21·6 (7·8-39·9)	22·3 (8·1-38·1)	1·00
Patients with opiate infusion	84 (85%)	77 (78%)	0·20
Fentanyl dose, µg per day	1647·2 (652·2-2448·2)	1084·1 (531·1-2404·1)	0·32
Ventilator free days*	24·6 (20·8-26·1)	25·2 (22·9-26·4)	0·18
Duration of mechanical ventilation (days)	3·4 (1·9-6·0)	2·7 (1·6-4·5)	0·11
ICU length of stay (days)	5·6 (2·9-9·8)	4·7 (3·0-8·9)	0·51
Hospital length of stay (days)	9·5 (6·0-17·3)	9·7 (5·9-16·8)	0·70
Discharge destination			
Death	11 (11%)	14 (14%)	..
Hospice	2 (2%)	2 (2%)	..
Outside hospital	4 (4%)	1 (1%)	..
Long-term acute care	7 (7%)	4 (4%)	..
Subacute rehabilitation	10 (10%)	4 (4%)	..
Acute rehabilitation	12 (12%)	12 (12)	..
Home with outpatient therapy	17 (17%)	11 (11%)	..
Home	36 (36%)	51 (52%)	0·032†

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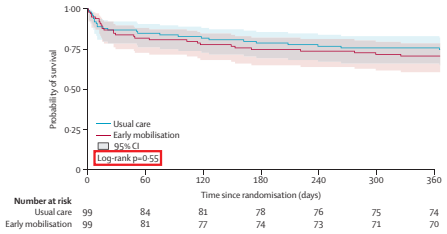

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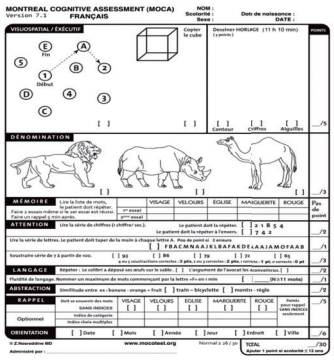
	Usual care group (n=99)	Intervention group (n=99)	Absolute difference	p value
Primary outcome				
Cognitive impairment at 1 year	43 (43%)	24 (24%)	−19·2% (−32·1 to −6·3)	0·0043
MoCA* score at 1 year	23 (21–26)	26 (24–28)	3 (1 to 4)	0·0001
Hospital discharge outcome				
Cognitive impairment	68 (69%)	53 (54%)	−15·2% (−28·6 to −1·7)	0·029
MoCA score	20 (16–23)	23 (19–27)	3 (2 to 5)	0·0004
ICU-acquired weakness†	38 (38%)	21 (21%)	−17·1% (−29·7 to −4·7)	0·0083
Total MRC score	49 (44–56)	56 (48–60)	7 (1 to 9)	0·0017
Functional independence	46 (47%)	66 (67%)	20·2% (6·7 to 33·7)	0·0041
Quality of life				
SF-36 physical component score	39·6 (31·8–48·5)	45·7 (29·7–55·6)	4·1 (−0·53 to 8·4)	0·081
Impaired physical health‡	39 (39%)	29 (29%)	−10·1% (−23·3 to 3·1)	0·13
SF-36 mental component score	47·6 (38·3–55·3)	53·3 (44·3–57·2)	5·7 (−0·16 to 6·9)	0·061
Impaired mental health	22 (22%)	13 (13%)	−9·1% (−19·6% to 1·5)	0·094

	Usual care group (n=99)	Intervention group (n=99)	Absolute difference	p value
1-year follow-up				
ICU-acquired weakness	14 (14%)	0	−14·1% (−21·0 to −7·3)	0·0001
Total MRC score	56 (49–60)	58 (56–60)	2 (0 to 4)	0·0073
Functional independence	61 (62%)	64 (65%)	3·0% (−10·4 to 16·5)	0·66
Quality of life				
SF-36 physical component score	41·1 (31·8–49·4)	52·4 (45·3–56·8)	11·3 (6·3 to 13·8)	<0·0001
Impaired physical health	30 (30%)	8 (8%)	−22·2% (−32·7 to −11·7)	0·0001
SF-36 mental component score	55·2 (49·5–59·7)	55·9 (50·2–58·9)	0·7 (−2·7 to 2·3)	0·98
Impaired mental health	9 (9%)	7 (7%)	−2·0% (−9·6 to 5·6)	0·60
Institution-free days	335 (121–356)	338 (111–355)	3 (−8 to 5)	0·88

Data are n (%) or median (IQR), unless otherwise specified. ICU=intensive care unit. MoCA=Montreal Cognitive Assessment. MRC=Medical Research Council. SF-36=Medical Outcomes Study Short Form-36 *MoCA score of less than 26 defined cognitive impairment. †ICU-acquired weakness defined as a combined MRC score of less than 48. ‡At least 15D below population norms (ie, <40).

Lancet Respir Med . 2023 Jun;11(6):563-572.

Mobilisation précoce en réanimation



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Effets indésirables

	Usual care group (n=99)	Intervention group (n=99)	p value
At least one AE due to mobilisation	0 (0%)	6 (6%)	0·029
Type of AE			
Tachycardia	0 (0%)	2 (2%)	1·00
Hypotension	0 (0%)	1 (1%)	1·00
Tachypnoea	0 (0%)	1 (1%)	1·00
Oxygen desaturation	0 (0%)	1 (1%)	1·00
Arterial catheter removal	0 (0%)	1 (1%)	1·00
Rectal tube removal	0 (0%)	1 (1%)	1·00

Data are n (%). More than one adverse event (AE) occurs in one patient.

Lancet Respir Med . 2023 Jun;11(6):563-572

Mobilisation précoce en réanimation

ORIGINAL ARTICLE

Early Active Mobilization during Mechanical Ventilation in the ICU

The TEAM Study Investigators and the ANZICS Clinical Trials Group*

TEAM trial

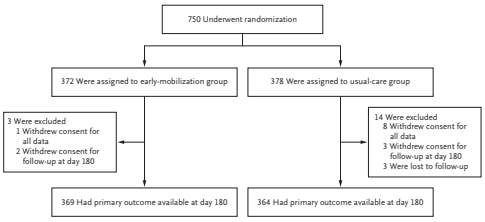
Minimisation de la sédation

Kinésithérapie quotidienne

Mobilisation active

Patients adultes sous ventilation mécanique >24h

Etat suffisamment stable pour rendre la mobilisation possible



N Engl J Med. 2022 Nov 10;387(19):1747-1758.

Mobilisation précoce en réanimation

Characteristic	Early Mobilization (N = 371)	Usual Care (N = 370)
Age — yr	60.5±14.8	59.5±15.2
Female sex — no. (%)	128 (34.5)	146 (39.5)
Body-mass index†	29.9±7.9	30.4±7.8
Frailty and function		
Median score on Clinical Frailty Scale (IQR)‡	3 (2 to 4)	3 (2 to 4)
Median score on Functional Comorbidity Index (IQR)§	2 (1 to 3)	2 (1 to 3)
Median score on WHODAS 2.0 (IQR)¶	10.4 (2.1 to 25.0)	8.7 (2.1 to 22.7)
Highest score on the ICU Mobility Scale in wk before ICU admission‖	9.9±0.6	9.8±0.7
Median interval from hospital admission to randomization (IQR) — hr	88.3 (50.5 to 137.0)	81.6 (48.2 to 147.0)
Median interval from ICU admission to randomization (IQR) — hr	60.1 (35 to 92.3)	61.3 (33.8 to 96.1)
ICU admission type — no. (%)		
Planned ICU admission after elective surgery	68 (18.3)	58 (15.7)
Unplanned ICU admission	303 (81.7)	312 (84.3)
Median RASS score at randomization (IQR)**	−3 (−4 to −2)	−3 (−4 to −2)
Measurements and interventions at randomization††		
Positive end-expiratory pressure — cm of water	8.9±3.0	8.8±3.1
Pao_2:Fio_2	226±79.1	230±85.2
Receipt of vasopressors by infusion — no. (%)	228 (61.5)	231 (62.4)
Receipt of renal-replacement therapy — no. (%)	82 (22.1)	79 (21.4)
APACHE II score‡‡	18.2±6.8	18±6.9
Diagnosis subgroup — no. (%)§§		
Sepsis¶¶	246 (66.3)	245 (66.2)
Trauma	15 (4.0)	14 (3.8)
Covid-19	7 (1.9)	10 (2.7)

N Engl J Med. 2022 Nov 10;387(19):1747-1758.

Mobilisation précoce en réanimation

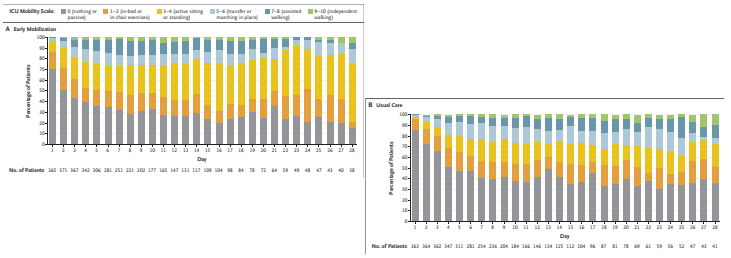
Characteristic	Early Mobilization (N = 371)	Usual Care (N = 370)	Between-Group Difference (95% CI)†
Patients who were assessed by a physiotherapist on day of randomization — no./total no. (%)	320/370 (86.5)	265/363 (73.0)	13.5 (6.7 to 20.3)
No. of days per patient when physiotherapy assessment occurred	0.94±0.11	0.81±0.24	0.14 (0.12 to 0.16)
No. of minutes of active mobilization per day	20.8±14.6	8.8±9.0	12.0 (10.4 to 13.6)
Mobilization milestones‡			
IMS 3 or higher			
Patients — no. (%)	331 (89.2)	330 (89.2)	0 (−4.3 to 4.3)
Median no. of days since randomization (IQR)	3 (1 to 6)	4 (2 to 7)	−1 (−2.2 to −0.2)
IMS 4 or higher			
Patients — no. (%)	287 (77.4)	286 (77.3)	0.1 (−6.0 to 6.1)
Median no. of days since randomization (IQR)	3 (2 to 7)	5 (3 to 8)	−2 (−3.4 to −0.6)
IMS 7 or higher			
Patients — no. (%)	176 (47.4)	150 (40.5)	6.9 (−0.2 to 14.0)
Median no. of days since randomization (IQR)	5 (3 to 8)	7 (4 to 13)	−2 (−3.4 to −0.7)
Median peak IMS (IQR)	6 (4 to 8)	6 (4 to 8)	0 (−1 to 1)

ICU mobility scale

marcher avec l'aide de ≥2 personnes

N Engl J Med. 2022 Nov 10;387(19):1747-1758.

Mobilisation précoce en réanimation



Au total, 77 % des patients des deux groupes étaient capables de se tenir debout après un intervalle médian de 3 jours vs 5 jours (différence, -2 jours ; IC à 95 %, -3,4 à -0,6).

N Engl J Med. 2022 Nov 10;387(19):1747-1758.

Mobilisation précoce en réanimation

Outcome	Early Mobilization (N = 371)	Usual Care (N = 370)	Difference or Odds Ratio (95% CI)†	P Value
Primary outcome				
Days alive and out of hospital at day 180‡				
Median no. (IQR)	143 (21 to 161)	145 (51 to 164)	−2.0 (−10 to 6)	0.62
Key secondary outcomes				
Death at day 180				
Patients — no. (%)	83/369 (22.5)	71/364 (19.5)	1.15 (0.81–1.65)§	
Median no. of days since randomization (IQR)	17 (9 to 41)	19 (12 to 50)	−2.0 (−12.0 to 8.0)	
Median no. of ventilator-free days at day 28 (IQR)	21 (8 to 25)	21 (11 to 25)	0.0 (−1.4 to 1.4)	
Median no. of ICU-free days at day 28 (IQR)	16 (0 to 21)	17 (3 to 22)	−1.0 (−3.1 to 1.1)	
Functional outcomes in survivors at day 180¶				
Score on EQ-5D-5L utility score‖	0.7±0.3	0.7±0.3	0.0 (−0.0 to 0.1)	
Score on EQ Visual Analogue Scale**	70.2±19.7	69.0±20.1	2.0 (−5.7 to 9.7)	
Median score on Barthel Index of ADL (IQR)††	100 (100 to 100)	100 (95 to 100)	0	
Median score on IADL (IQR)‡‡	8.0 (7.0 to 8.0)	8.0 (6.0 to 8.0)	0.2 (−0.9 to 1.3)	
Median score on WHODAS 2.0 (IQR)§§	12.5 (2.1 to 33.3)	14.6 (4.2 to 38.9)	−1.8 (−6.9 to 3.4)	

N Engl J Med. 2022 Nov 10;387(19):1747-1758.

Mobilisation précoce en réanimation

Adverse events — no. (%) ¶¶	Early Mobilization (N = 371)	Usual Care (N = 370)	Difference or Odds Ratio (95% CI)†	P Value
Patients with ≥1 adverse event potentially due to mobilization — no. (%)	34 (9.2)	15 (4.1)	2.55 (1.33–4.89)§	0.005
Adverse events per patient — no. (%)				0.02
0	337 (90.8)	355 (95.9)		
1	19 (5.1)	11 (3.0)		
2	4 (1.1)	2 (0.5)		
≥3	11 (3.0)	2 (0.5)		
Type of adverse events — no. (%)‖‖				
Altered blood pressure	13 (3.5)	8 (2.2)		0.27
Cardiac arrhythmia	13 (3.5)	4 (1.1)		0.03
Oxygen desaturation	8 (2.2)	1 (0.3)		0.02
Pain or agitation	4 (1.1)	1 (0.3)		0.37
Removal of invasive line	2 (0.5)	2 (0.5)		1.00
Gastrointestinal	2 (0.5)	1 (0.3)		1.00
Tachypnea	3 (0.8)	0		0.25
Altered neurologic state	1 (0.3)	1 (0.3)		1.00
Other	4 (1.1)	0		0.12

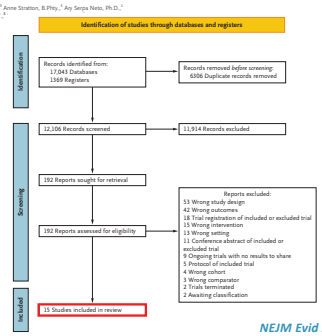
N Engl J Med. 2022 Nov 10;387(19):1747-1758.

Mobilisation précoce en réanimation

The Effect of Mobilization at 6 Months after Critical Illness — Meta-Analysis

Michelle Paton, M.Phty.,[1,2] Sarah Chan, D.Phty.,[2] Claire J. Tipping, Ph.D.,[2] Anne Stratton, B.Phty.,[2] Ary Serpa Neto, Ph.D.,[3] Rebecca Lane, Ph.D.,[2] Paul J. Young, Ph.D.,[1,4,5] Lorena Romero, M.B.I.S.,[6] Carol L. Hodgson, Ph.D.[1,5,7,8]

NEJM Evidence

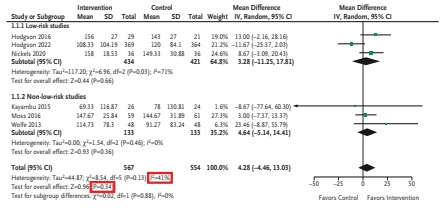


NEJM Evid 2023;2(2) DOI: 10.1056/EVIDoa22002

Mobilisation précoce en réanimation

NEJM Evidence

Forest Plot Comparison of Days Alive and Out of Hospital to Day 180.



En utilisant des analyses bayésiennes, la probabilité que l'intervention ait augmenté le nombre de jours en vie et hors de l'hôpital était de 75,1 %.

NEJM Evid 2023;2(2) DOI: 10.1056/EVIDoa22002

Mobilisation précoce en réanimation

NEJM Evidence

Table 1. Outcomes Including Sensitivity Analyses.[a]

Outcome	Studies	Patients/Events	P	I^2	Effect Measure		95% CI
Days alive and out of hospital	6	1121	0.34	41	MD	4.28	−4.46 to 13.03
Low-risk studies only	3	855	0.66	71	MD	3.28	−11.25 to 17.81
Mortality	15	2703	0.47	0	Risk ratio	1.05	0.92 to 1.19
Low-risk studies only	8	1499	0.24	0	Risk ratio	1.11	0.93 to 1.34
Adverse events	5	17,618	0.83	97	Risk ratio	1.13	0.37 to 3.43
Low-risk studies only	4	12,269	0.06	85	Risk ratio	1.94	0.98 to 3.86
PF measured with PROM	7	1109	0.0007	0	SMD	0.2	0.09 to 0.32
Low-risk studies only	4	636	0.3	33	SMD	0.14	−0.12 to 0.4
PF measured in person	6	454	0.11	0	SMD	0.15	−0.03 to 0.34
Low-risk studies only	3	182	0.32	0	SMD	0.15	−0.14 to 0.44
Strength	5	390	0.41	0	SMD	0.08	−0.12 to 0.28
Low-risk studies only	3	164	0.52	0	SMD	−0.1	−0.41 to 0.21
HRQoL							
SF-36 PCS	8	783	0.38	38	MD	1.11	−1.38 to 3.6
SF-36 MCS	8	783	0.57	42	MD	0.77	−1.86 to 3.4
Utility scores	4	772	0.84	0	SMD	−0.01	−0.16 to 0.13

Probabilité de 95,1 % que l'intervention améliore la fonction physique à 6 mois (différence moyenne standardisée, 0,2 ; intervalle de confiance à 95 %, 0,09 à 0,32)

Possibilité de 66,4 % d'augmentation des événements indésirables avec la mise en œuvre de la mobilisation active précoce et une probabilité de 72,2 % d'augmentation de la mortalité à 6 mois

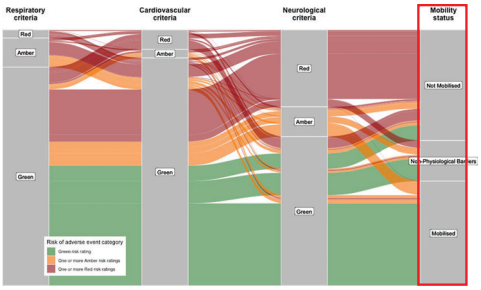
NEJM Evid 2023;2(2) DOI: 10.1056/EVIDoa22002

Médecine personnalisée

Feasibility of mobilisation in ICU: a multi-centre point prevalence study of mobility practices in the UK

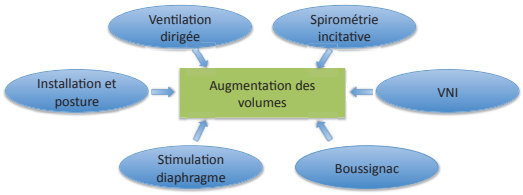
Risque calculée pour chaque défaillance d'organe et l'état de la mobilité

Proportion de patients mobilisés dans les 48-72 heures, selon leur état physiologique



Black et al. Critical Care (2023) 27:217

Kiné respiratoire



VNI préventive

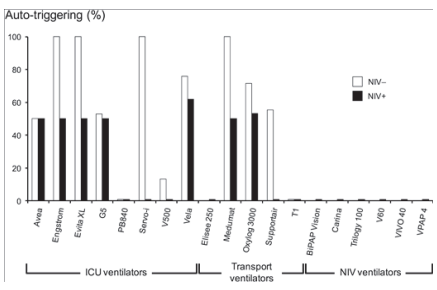
VNI: Effets bénéfiques

1. Humidification
2. FiO_2 max. 100%
3. Assistance Respiratoire = AI
4. PEP
5. Effets cardiaques

VNI: Effets délétères?

1. Intolérance
2. Asynchronies
3. Intubation retardée
4. Barotrauma: V_T

VNI préventive



Carteaux G et al. Patient-ventilator & asynchrony during noninvasive ventilation: a bench and clinical study. Chest 2012; 142:367–376.

VNI préventive

Nasal-Continuous Positive Airway Pressure Reduces Pulmonary Morbidity and Length of Hospital Stay Following Thoracoabdominal Aortic Surgery

Detlef Kindgen-Milles, Eckhard Müller, Rolf Buhl, Hinrich Böhner, Dennis Ritter, Wilhelm Sandmann and Jörg Tarnow

CHEST

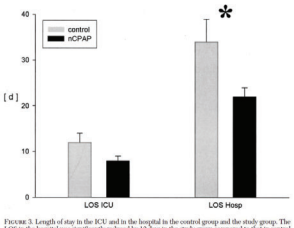


FIGURE 3. Length of stay in the ICU and in the hospital in the control group and the study group. The LOS in the hospital was significantly reduced by 12 days in the study group compared to that in control group. LOS ICU = length of stay in the ICU. LOS Hosp = length of stay in the hospital. * = $p < 0.05$ for comparison of the control group vs the study group.

VNI préventive

Nasal-Continuous Positive Airway Pressure Reduces Pulmonary Morbidity and Length of Hospital Stay Following Thoracoabdominal Aortic Surgery

Detlef Kindgen-Milles, Eckhard Müller, Rolf Buhl, Hinrich Böhner, Dennis Ritter, Wilhelm Sandmann and Jörg Tarnow

CHEST

Table 2—*Pulmonary, Cardiac, and Other Relevant Complications in the Study and Control Groups

Complications	nCPAP Group (n = 25)	Control Group (n = 25)	p Value
Pulmonary complications	7	24	0.019
Pneumonia	0	3	
Atelectasis	2	5	
$PaO_2/FIO_2 < 100$	4	12	
Reintubation	1	4	
Cardiac complications	4	8	NS
Myocardial infarction	0	1	
Cardiac arrhythmia	4	7	
Acute renal failure	1	3	NS
Postoperative delirium	5	4	NS

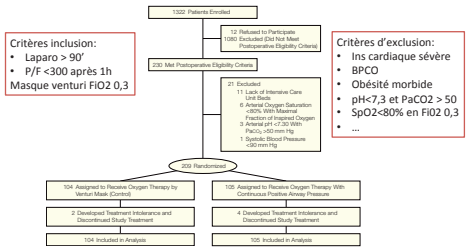
VNI préventive

Continuous Positive Airway Pressure for Treatment of Postoperative Hypoxemia

A Randomized Controlled Trial

Squadrone V and al

JAMA 2005



Critères inclusion:
- Laparo > 90'
- P/F <300 après 1h

Masque venturi FiO2 0,3

Critères d'exclusion:
- Ins cardiaque sévère
- BPCO
- Obésité morbide
- pH<7,3 et PaCO2 > 50
- SpO2<80% en Fi02 0,3
- ...

VNI préventive

Continuous Positive Airway Pressure for Treatment of Postoperative Hypoxemia

A Randomized Controlled Trial

Squadrone V and al

JAMA 2005

	Control (n = 104)	CPAP (n = 105)
Sex, No. (%)		
Men	64 (62)	71 (68)
Women	40 (38)	34 (32)
Age, mean (SD), y	65 (10)	66 (9)
Body mass index, mean (SD)*	26.3 (4.5)	26.5 (4.7)
Current smoker, No. (%)†	21 (20)	19 (18)
SAPS II, mean (SD)‡	28 (8)	27 (7)
Type of surgery, No. (%)		
Colectomy	38 (36)	39 (36)
Gastrectomy	7 (6)	6 (6)
Pancreatico-duodenectomy	18 (17)	19 (18)
Retroperitoneal mass	4 (3)	3 (4)
Liver resection	24 (22)	22 (21)
Liver transplant	13 (12)	16 (15)
Pathology, No. (%)		
Cancer	64 (62)	67 (64)
Noncancer	40 (38)	38 (36)
Comorbidities, No. (%)		
Diabetes	11 (11)	16 (15)
Hypertension	42 (40)	37 (35)
Postoperative gases, mean (SD)		
PaO_2/FIO_2	255 (31)	247 (33)
Arterial, pH	7.39 (0.05)	7.38 (0.04)
$PaCO_2$, mm Hg	39 (5)	39 (7)
Mean arterial blood pressure, mean (SD), mm Hg	86 (10)	85 (11)
Time of surgical procedure, mean (SD), h§	226 (65)	227 (91)

VNI préventive

Continuous Positive Airway Pressure for Treatment of Postoperative Hypoxemia

A Randomized Controlled Trial

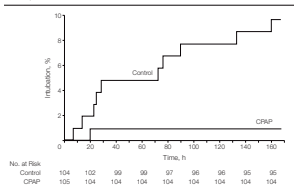
Squadrone V and al

JAMA 2005

Critère principal de jugement: intubation à J7

Arrêt à l'analyse intermédiaire pour supériorité CPAP p=0,005!!

› 2. Kaplan-Meier Estimates of Intubation Rate



VNI préventive

Continuous Positive Airway Pressure for Treatment of Postoperative Hypoxemia

A Randomized Controlled Trial

Squadrone V and al

JAMA 2005

Table 2. Secondary Outcomes

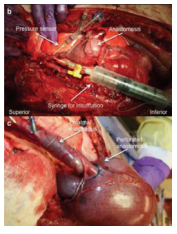
	Control (n = 104)	CPAP (n = 105)	Difference of Means (95% CI)	*P* Value*
ICU length of stay, mean, d	2.6	1.4	−1.2 (−2.0 to −0.3)	.09
Median (95% CI), d	1 (1-11)	1 (1-4)		
Hospital length of stay, mean (SD), d	17 (15)	15 (13)	−2 (−6 to 2)	.10
Median (95% CI)	12 (7-47)	11 (6-35)		
			Relative Risk (95% CI)	
Pneumonia, No. (%)†	10 (10)	2 (2)	0.19 (0.04 to 0.88)	.02
Infection, No. (%)‡	11 (10)	3 (3)	0.27 (0.07 to 0.94)	.03
Sepsis, No. (%)§	9 (9)	2 (2)	0.22 (0.04 to 0.99)	.03
Anastomotic leakage, No.	6	1		
Pneumonia, No.	3	1		
Deaths, No. (%)	3 (3)	0 (0)		.12

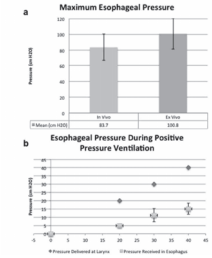
VNI préventive

Non-Invasive Positive Pressure Ventilation Following Esophagectomy: Safety Demonstrated in a Pig Model

Vignesh Raman, B.S.[1], Caitlyn E. MacGlaflin, M.S.[1], Cherie P. Erkmen, M.D.[1]

CHEST 2015





Optiflow

1. **Confort:** via lunettes et humidification
2. **Oxygénation:** Haut Débit = Haute FiO_2
3. **Effet PEP:** Oxygénation - Prévention des atélectasies?
4. **Lavage espace mort:** $PaCO_2$

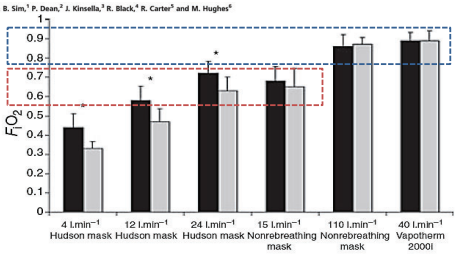
Augmentation de la PaO_2
Diminution de l'effort et de la fréquence respiratoire

Optiflow

Anaesthesia
Journal of the Association of Anaesthetists of Great Britain and Ireland
Anaesthesia, 2008, 63, pages 936-940 doi:10.1111/j.1365-2044.2008.05536.x

Performance of oxygen delivery devices when the breathing pattern of respiratory failure is simulated*

M. A. B. Sim,[1] P. Dean,[2] J. Kinsella,[3] R. Black,[4] R. Carter[5] and M. Hughes[6]

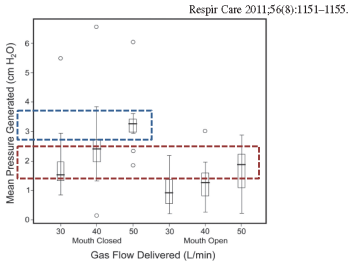


Optiflow

The Effects of Flow on Airway Pressure During Nasal High-Flow Oxygen Therapy

Rachael L Parke RN MHSc, Michelle L Eccleston RN, and Shay P McGuinness MB ChB

Respir Care 2011;56(8):1151–1155.

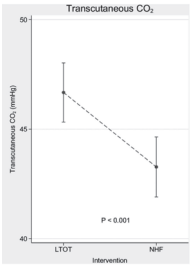


Optiflow

Lavage espace-mort

Nasal high flow oxygen therapy in patients with COPD reduces respiratory rate and tissue carbon dioxide while increasing tidal and end-expiratory lung volumes: a randomised crossover trial

Fraser et al., Thorax 2016

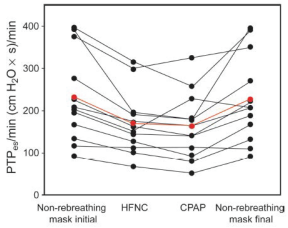


Optiflow

Physiologic Effects of High-Flow Nasal Cannula Oxygen in Critical Care Subjects

Frederic Vargas MD PhD, Mélanie Saint-Leger MD, Alexandre Boyer MD PhD, Nam H Bui MD, and Gilles Hilbert MD PhD

Diminution du travail respiratoire



Respir Care 2015;60(10):1369–1376

Optiflow

Table S5. Assessment of tolerance to the oxygenation strategy at inclusion and 1 hour after inclusion *

	High-Flow Oxygen group (n=106)	Standard Oxygen group (n=94)	NIV group (n=110)	P Value
Respiratory patient-discomfort at inclusion – mm †	38±31	44±29	46±30	0.20
Respiratory patient-discomfort at H1– mm †	29	40	43	<0.01
Grade of dyspnea at H1‡	76%	42%	58%	<0.001
Marked improvement – no. (%)	19 (22.1)	5 (6.8)	13 (14.3)	
Slight improvement– no. (%)	46 (53.5)	26 (35.1)	40 (44.0)	
No change– no. (%)	18 (20.9)	33 (44.6)	23 (25.3)	
Slight deterioration – no. (%)	3 (3.5)	9 (12.2)	8 (8.8)	
Marked deterioration – no. (%)	0 (0.0)	1 (1.3)	7 (7.7)	
Respiratory rate– breaths/min				
H1	28±7	31±7	31±8	<0.01
H6	27±7	29±8	29±7	0.13

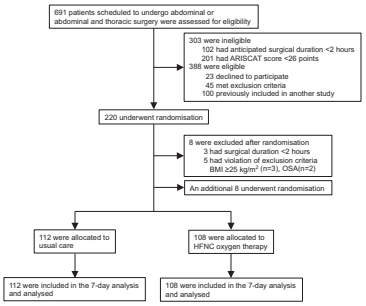
Frat JP, Thille AW et al., New England Journal of Medicine 2015; 372:2185-2196.

Optiflow

ORIGINAL

Effect of early postextubation high-flow nasal cannula vs conventional oxygen therapy on hypoxaemia in patients after major abdominal surgery: a French multicentre randomised controlled trial (OPERA)

Emmanuel Futier[1,2], Catherine Paugam-Burtz[3], Thomas Godet[1], Linda Khoy-Ear[3], Sacha Rozencwajg[4], Jean-Marc Delay[4], Daniel Verzilli[4], Jeremie Dupuis[1], Gerald Chanques[4,6], Jean-Etienne Bazin[1], Jean-Michel Constantin[1,2], Bruno Pereira[5], Samir Jaber[4,6] and OPERA study investigators



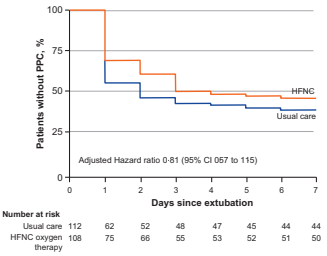
Intensive Care Med (2016) 42:1888–1898

Optiflow

Outcomes	No./total no. (%)		ARR or between-group difference (95 % CI)	*p* value
	Usual care	HFNC oxygen therapy		
Primary outcomes				
Postoperative hypoxaemia[a,b]				
1 h after extubation	27/112 (24)	23/108 (21)	−3 (−14 to 8)	0.62
After discontinuation of the study treatment	34/112 (30)	29/108 (27)	−4 (−15 to 8)	0.57
Secondary outcomes				
Need for supplemental oxygen therapy after treatment discontinuation	92/112 (82)	79/108 (73)	−9 (−20 to 2)	0.11
Pulmonary complications[c] within 7 days				
Grade 1 or 2	49/112 (44)	37/108 (34)	−10 (−25 to 4)	0.17
Grade ≥3	19/112 (17)	21/108 (20)	2 (−8 to 13)	0.63
Bronchial congestion	14/112 (13)	16/108 (15)	2 (−7 to 11)	0.62
Hypoxaemia[d]	30/112 (27)	30/108 (28)	0 (−11 to 13)	0.87
Pneumonia	10/112 (9)	10/108 (9)	0 (−7 to 8)	0.93
Need for intubation or NIV for respiratory failure[e]	14/112 (13)	20/108 (19)	6 (−4 to 16)	0.22
Surgical reoperation within 7 days[f]	5/112 (4)	2/108 (2)	−3 (−7 to 2)	0.45
Unexpected ICU admission	16/112 (14)	16/108 (15)	0 (−9 to 10)	0.91
ICU length of stay (days)	5 (3–13)	6 (4–16)	3 (−5 to 12)	0.53
Hospital length of stay (days)	11 (7–18)	12 (7–20)	0.5 (−3.5 to 4.5)	0.58
In-hospital mortality	3/112 (3)	2/108 (2)	−1 (−5 to 3)	0.68

Intensive Care Med (2016) 42:1888–1898

Optiflow



Among patients undergoing major abdominal surgery, early preventive application of high-flow nasal canula oxygen therapy after extubation did not result in improved pulmonary outcomes compared with standard oxygen therapy.

Intensive Care Med (2016) 42:1888–1898

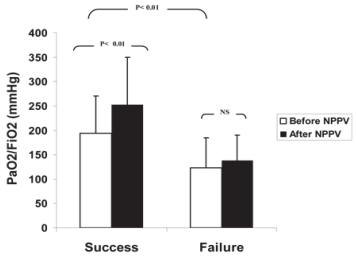
VNI curative

Outcomes of Patients With Acute Respiratory Failure After Abdominal Surgery Treated With Noninvasive Positive Pressure Ventilation

Samir Jaber, Jean-Marc Delay, Gérald Chanques, Mustapha Sebbane, Eric Jacquet, Bruno Souche, Pierre-François Perrigault and Jean-Jacques Eledjam

Chest 2005;128:2688-2695

96 patients présentant une IRA (groupe initialement hospitalisé en soins intensifs de 627 patients)



Jaber S et al Outcomes of patients with acute respiratory failure after abdominal surgery treated with noninvasive positive pressure ventilation Chest 2005 ; 128 : 2688-95

VNI curative

Outcomes of Patients With Acute Respiratory Failure After Abdominal Surgery Treated With Noninvasive Positive Pressure Ventilation

Samir Jaber, Jean-Marc Delay, Gérald Chanques, Mustapha Sebbane, Eric Jacquet, Bruno Souche, Pierre-François Perrigault and Jean-Jacques Eledjam

Chest 2005;128:2688-2695

Critères assez larges de détresse et hypoxémie

FDR d' échec:
- Hypoxémie plus sévère
- Amélioration PaO2 plus faible

Variables	Nonintubated (n = 48)	Intubated (n = 24)	p Value†
Body temperature, °C	37.2 ± 0.8	37.6 ± 0.8	NS
Systolic BP, mm Hg			
Before NPPV	136 ± 22	151 ± 27	NS
After NPPV	132 ± 28	144 ± 24	NS
Diastolic BP, mm Hg			
Before NPPV	72 ± 20	75 ± 17	NS
After NPPV	67 ± 15	71 ± 14	NS
Heart rate, beats/min			
Before NPPV	88 ± 15	99 ± 16	NS
After NPPV	85 ± 14	99 ± 17	NS
Respiratory rate, breaths/min			
Before NPPV	28.2 ± 3.4	28.6 ± 4.0	NS
After NPPV	23.1 ± 3.8‡	25.3 ± 5.1	NS
pH			
Before NPPV	7.39 ± 0.07	7.40 ± 0.07	NS
After NPPV	7.42 ± 0.06‡	7.40 ± 0.07	NS
Pa_{O_2}/Fi_{O_2}, mm Hg			
Before NPPV	194 ± 76	123 ± 62	< 0.01
After NPPV	253 ± 97‡	138 ± 52	< 0.01
Pa_{CO_2}, mm Hg			
Before NPPV	42 ± 7	40 ± 7	NS
After NPPV	39 ± 6‡	40 ± 8	NS

VNI curative

Outcomes of Patients With Acute Respiratory Failure After Abdominal Surgery Treated With Noninvasive Positive Pressure Ventilation

Samir Jaber, Jean-Marc Delay, Gérald Chanques, Mustapha Sebba Eric Jacquet, Bruno Souche, Pierre-François Perrigault and Jean-Jacques Eledjam

Chest 2005;128:2688-2695

Characteristics	Nonintubated (n = 48)	Intubated (n = 24)	p Value
Total NPPV trials per day, No.	5.4 ± 2.1	4.2 ± 3.5	NS
Duration of NPPV trial, min	26.9 ± 15.6	24.3 ± 13.9	NS
Total duration of NPPV use, d	3.1 ± 1.2	1.9 ± 1.1	< 0.01
Total duration of NPPV use, h	9.3 ± 3.2	4.2 ± 2.1	< 0.01
Pressure support level, cm H_2O	13.7 ± 2.3	13.5 ± 1.7	NS
PEEP level, cm H_2O	5.8 ± 2.4	5.6 ± 2.8	NS
Fi_{O_2}, %	50.0 ± 9.8	59.8 ± 12.3	NS
NPPV complications	2 (13)	3 (23)	NS
Gastric distension, No.	0	1	
Skin necrosis, No.	1	1	
Agitation, No.	1	1	
Major air leaks, No.	2	3	
ICU length of stay, d	17.3 ± 10.9	34.1 ± 28.5	< 0.01
Hospital length of stay, d	32.7 ± 12.3	45.4 ± 29.5	< 0.01
ICU mortality	3 (6)	7 (29)	< 0.01
Hospital mortality	4 (8)	9 (38)	< 0.01

VNI curative

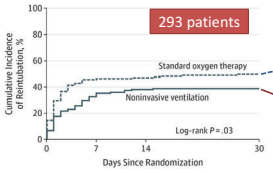
Research

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effect of Noninvasive Ventilation on Tracheal Reintubation Among Patients With Hypoxemic Respiratory Failure Following Abdominal Surgery
A Randomized Clinical Trial

Jaber et al., JAMA 2016; 315:1345-1353.

Figure 2. Cumulative Incidence of Reintubation Between Randomization and Day 30 According to Study Group



293 patients

O_2: 50%

VNI: 39%

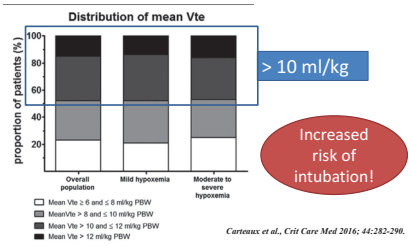
No. at risk

Standard oxygen therapy	145	79	76	71
Noninvasive ventilation	148	99	90	87

VNI curative

Failure of Noninvasive Ventilation for De Novo Acute Hypoxemic Respiratory Failure: Role of Tidal Volume

Guillaume Carteaux, MD[1,2,3]; Teresa Millán-Guilarte, MD[3]; Nicolas De Prost, MD, PhD[1,2,3]; Keyvan Razazi, MD[1,2,3]; Shariq Abid, MD, PhD[3]; Arnaud W. Thille, MD, PhD[3]; Frédérique Schortgen, MD, PhD[1,3]; Laurent Brochard, MD[3,4]; Christian Brun-Buisson, MD[1,2,3]; Armand Mekontso Dessap, MD, PhD[1,2,3]



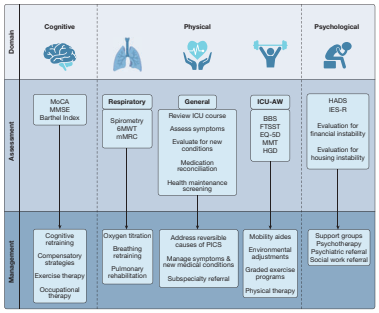
> 10 ml/kg

Increased risk of intubation!

Carteaux et al., Crit Care Med 2016; 44:282-290.

Conclusion

- Défi majeur dans la pratique clinique
- Evaluations répétées des fonctions physiques, psychologiques et cognitives en réanimation
- Approche individualisée, multimodale et interdisciplinaire
- Adhésion à l'« evidence based medecine »



CHEST Critical Care 2023; 1(1):100003