Co brání protektivní ventilaci v klinické praxi?

Stibor B.

ICU, Landesklinikum Baden bei Wien, Austria

Co brání protektivní ventilaci v klinické praxi?

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ICU, Landesklinikum Baden bei Wien, Austria

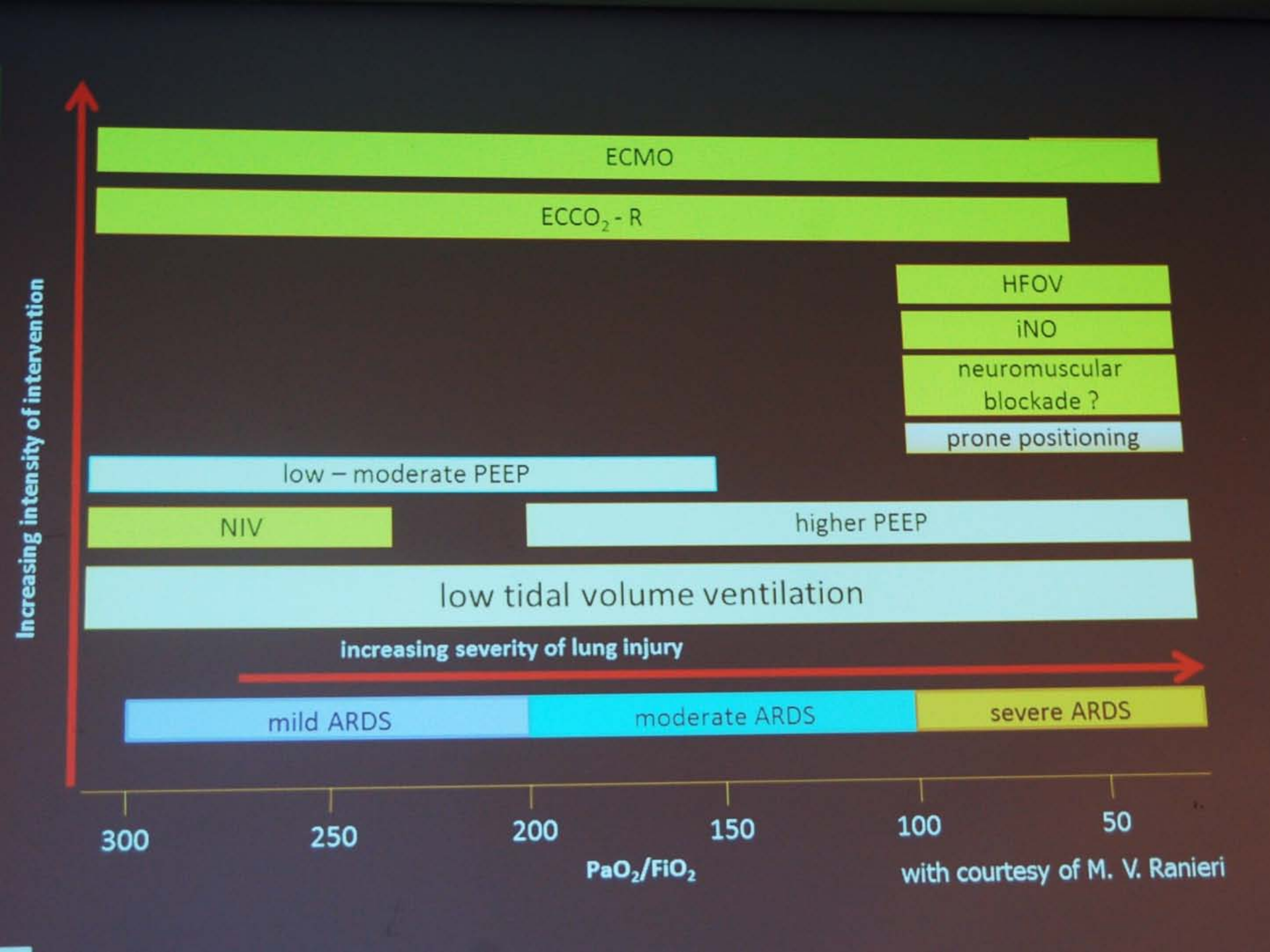
přehled

1. léčebné modality u ARDS
2. umělá plicní ventilace
3. ventilujeme protektivně – studie?
4. příčiny
5. nedostatečný monitoring
6. mylná kalkulace dechového objemu
7. nevyužití ostatních metod
8. subjektivní příčiny

léčebné modality u ARDS

léčebné modality ARDS

- ✓ léčba vyvolávající příčiny
- ✓ umělá plicní ventilace *(protektivní)*
- ✓ symptomatická terapie
  (restriktivní tekutinová bilance)
- ✓ pronační poloha
- ✓ metody mimotělní plicní náhrady
- ✓ *rescue postupy*


ECMO
ECCO2 - R
HFOV
iNO
neuromuscular blockade ?
prone positioning
low – moderate PEEP
NIV
higher PEEP
low tidal volume ventilation
increasing severity of lung injury
mild ARDS
moderate ARDS
severe ARDS
Increasing intensity of intervention
300
250
200
150
100
50
PaO2/FiO2
with courtesy of M. V. Ranieri

umělá plicní ventilace

1952

umělá plicní ventilace

- ✓ standardní **léčebná metoda** u respirační insuficience
- ✓ **etablovaná** desítky let

- ✓ zcela **nefyziologická** (ventilace přetlakem)
- ✓ barotrauma, volumotrauma, atelektrauma = **biotrauma**

Cave: umělá plicní ventilace poškozuje plíce **!!**

The New England
Journal of Medicine

VOLUME 342 MAY 4, 2000 NUMBER 18

VENTILATION WITH LOWER TIDAL VOLUMES AS COMPARED WITH TRADITIONAL TIDAL VOLUMES FOR ACUTE LUNG INJURY AND THE ACUTE RESPIRATORY DISTRESS SYNDROME

THE ACUTE RESPIRATORY DISTRESS SYNDROME NETWORK*

ventilation options in ARDS

lung protective ventilation
- lower tidal volume (6 ml/kg IBW)
- higher PEEP
- $P_{plateau}$ < 30 mm Hg
- FiO_2 < 0,60
inverse ratio ventilation IRV
open lung concept
baby lung concept, permissive hypercapny

P_{plat}

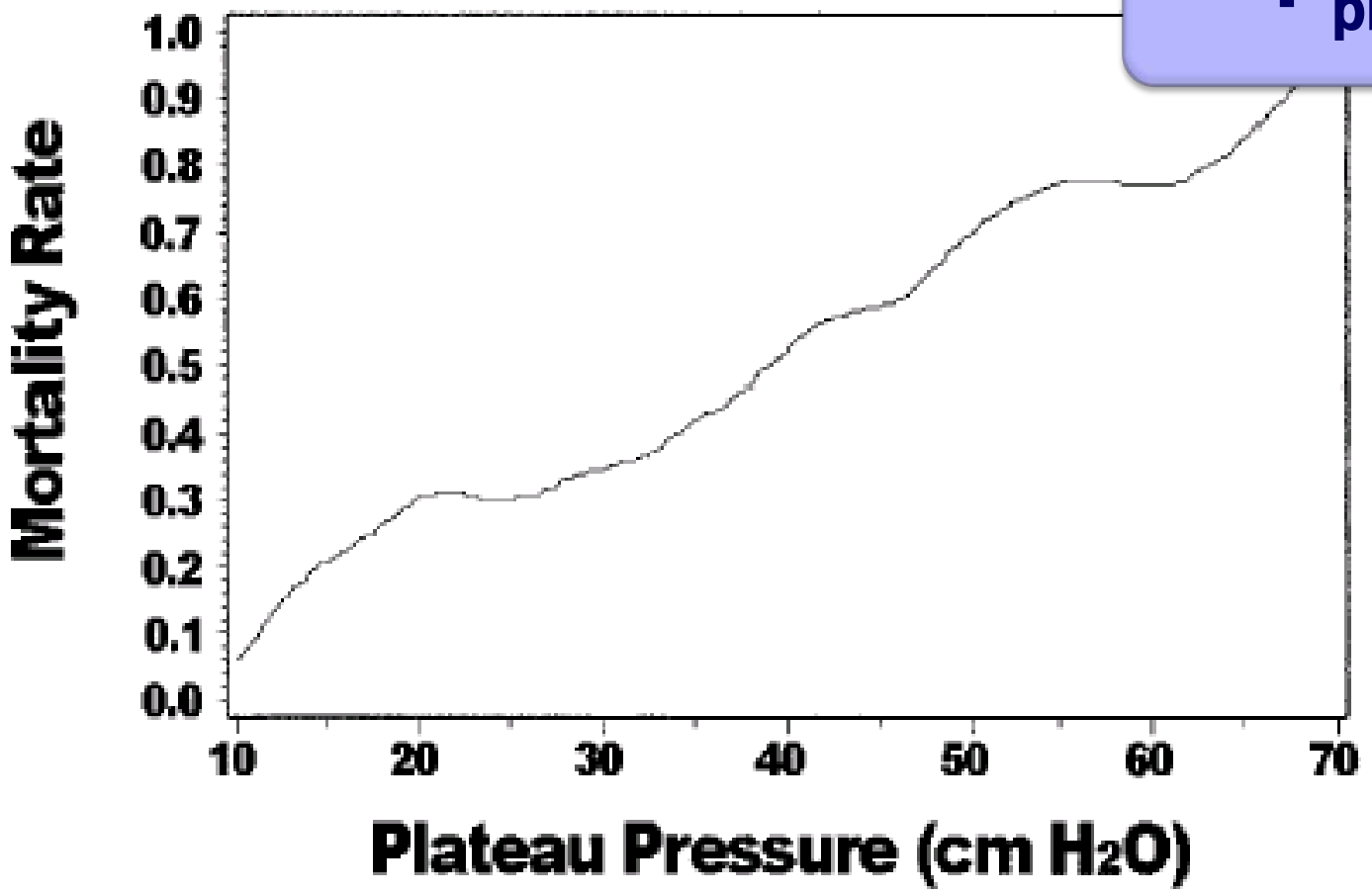
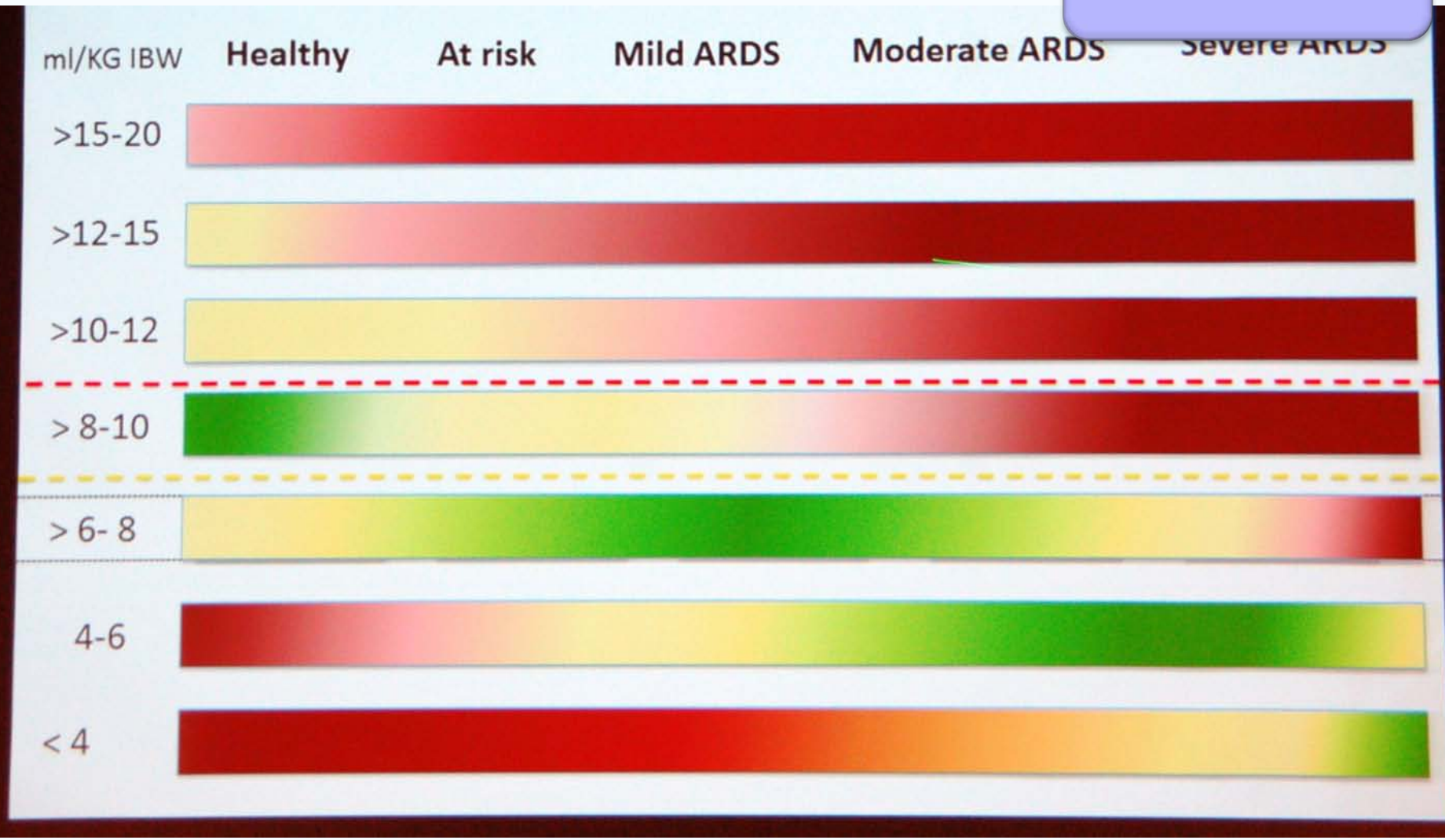


Figure 2. Relationship of mortality to inspiratory plateau pressure on the first day after randomization in a clinical trial of tidal volume reduction in ALI (11).

***Brower** et al. AJRCCM 2002*

V_t

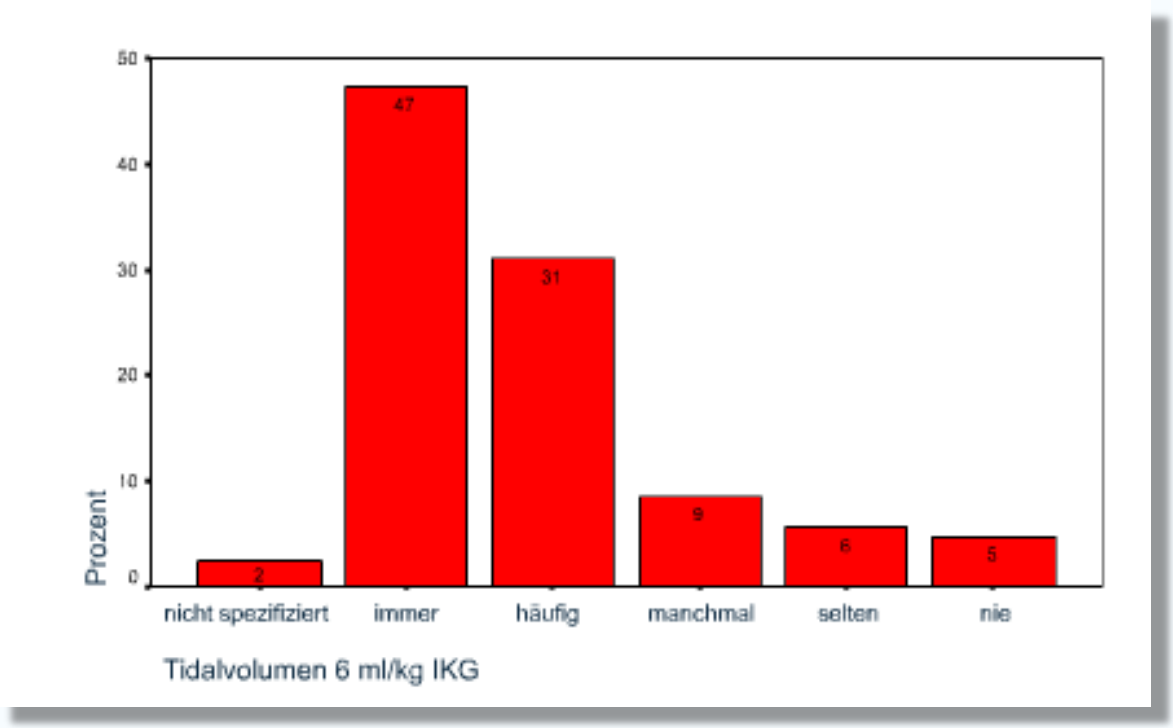

ml/KG IBW
Healthy
At risk
Mild ARDS
Moderate ARDS
Severe ARDS
>15-20
>12-15
>10-12
> 8-10
> 6- 8
4-6
< 4

ventilujeme

protektivně?

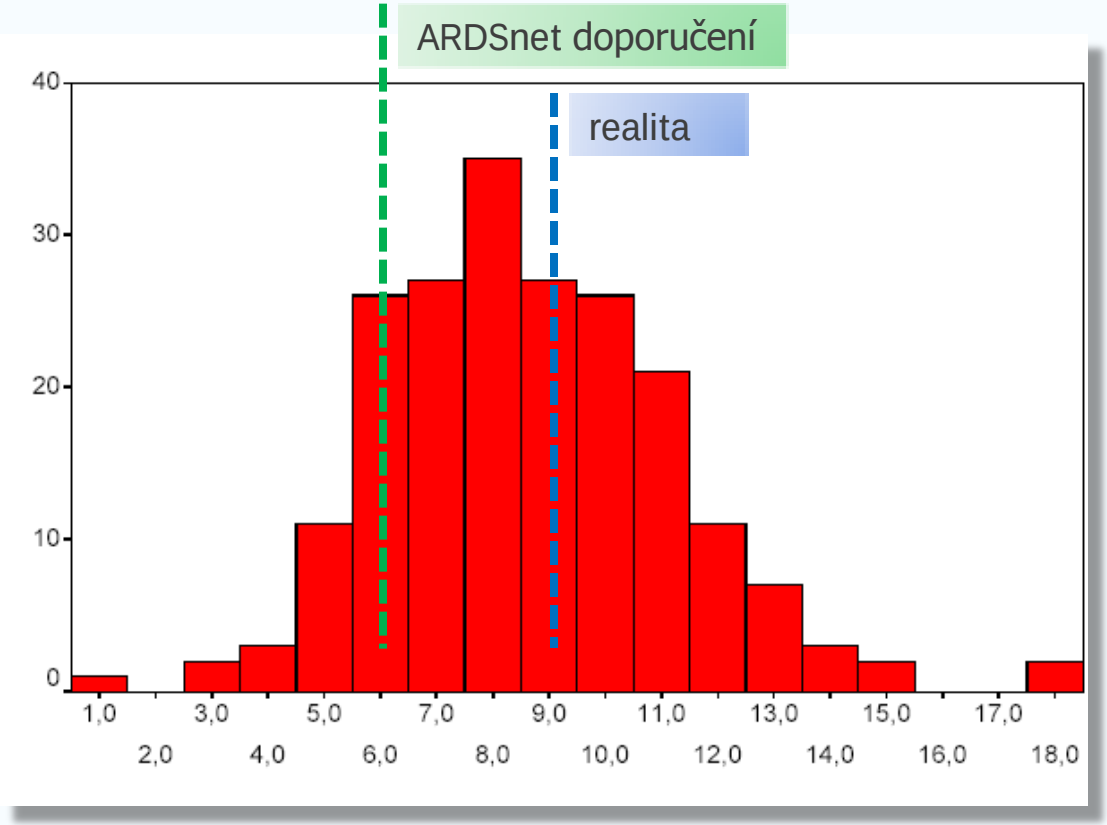
ventilujeme protektivně?

ventilace nízkými objemy **6 ml/kg** IBW při ARDS



***Brunkhorst** et al. Infection 2005;33 (Suppl. 1): A112*

ventilujeme protektivně?



- ✓454 ICU (310 klinik)

odpovídá:

- ✓2075 ICU (19 000 lůžek)
- ✓1380 klinik (490 000 lůžek)

***Brunkhorst** et al. Infection 2005;33 (Suppl. 1): A112*

Feature Articles

Practice and perception—A nationwide survey of therapy habits in sepsis*

Brunkhorst et al. Crit Care Med 2008;36 (10): 2719-25.

- ✓ one-day cross-sectional survey
- ✓ representative sample of German ICUs
- ✓ adult patients with severe sepsis or septic shock
- ✓ practice recommendations by German Sepsis Competence Network (SepNet)
- ✓ external intensivists visited ICUs

Feature Articles

Practice and perception—A nationwide survey of therapy habits in sepsis*

Brunkhorst et al. Crit Care Med 2008;36 (10): 2719-25.

- ✓ **214** ICUs
- ✓ **152** patients had ARDS
- ✓ responsible ICUs-directors reported that they **always** adhered to recommendations

low-tidal volume ventilation **<6 ml**/kg PBW was documented in **2.6%** of these patients

Practice and perception—A nationwide survey of therapy habits in sepsis*

***Brunkhorst** et al. Crit Care Med 2008;36 (10): 2719-25.*

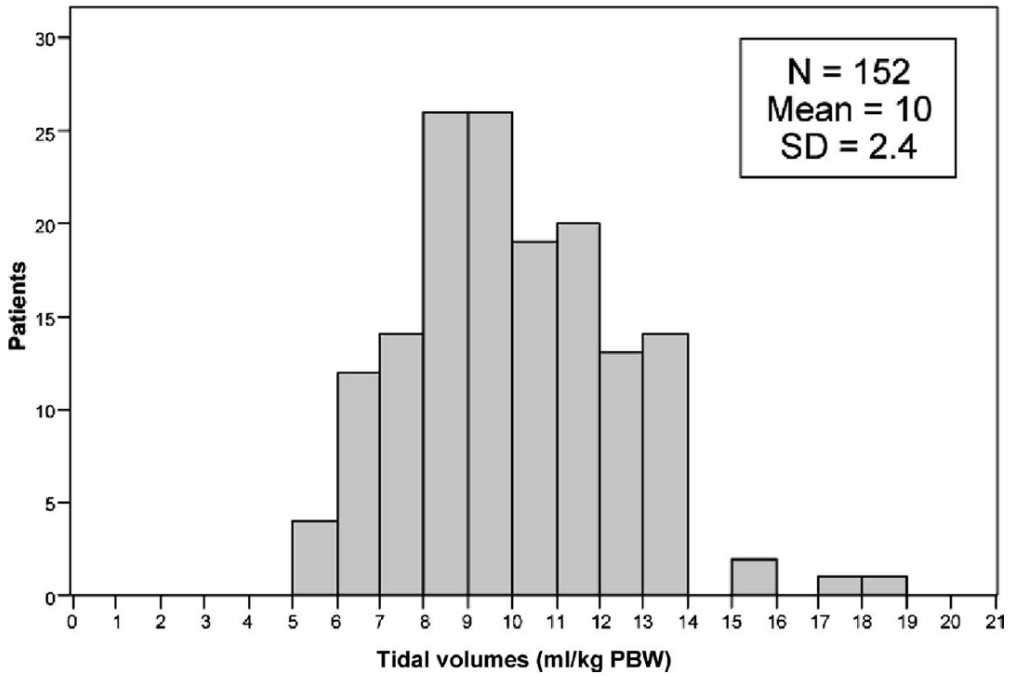


Figure 1. Range of tidal volumes in patients with severe sepsis/septic shock and acute lung injury/acute respiratory distress syndrome. Maximal tidal volumes (mL/kg predicted body weight [*PBW*]) in 152 patients with severe sepsis and septic shock.

V_t *(ml/kg/PBW)*	*%*
≤ 6	**2,6**
6 - 8	**17,1**
> 8	**80,3**

Potential Reasons Why Physicians Underuse Lung-Protective Ventilation: A Retrospective Cohort Study Using Physician Documentation

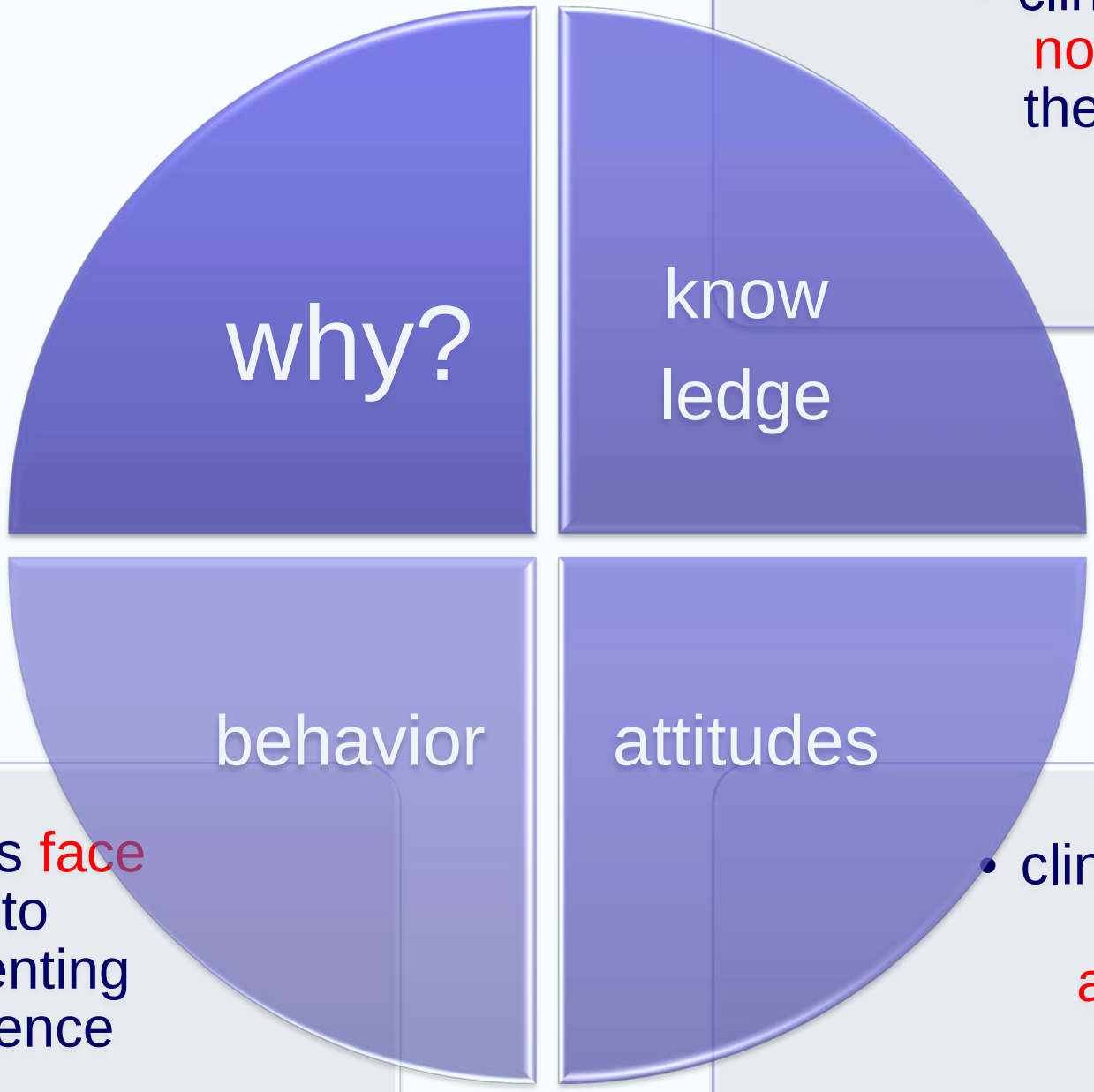
Mark E Mikkelsen MD, Pali M Dedhiya MD, Ravi Kalhan MD, Robert J Gallop PhD, Paul N Lanken MD, and Barry D Fuchs MD

Mikkelsen *et al. Respir Care 2008;53(4):455– 461.*

women	
V_t *(ml/kg/PBW)*	*%*
≤ 6	0
6 - 8	15
> 8	**85**

men	
V_t *(ml/kg/PBW)*	*%*
≤ 6	8,2
6 - 8	42
> 8	**48,8**

proč?



- clinicians are not aware of the evidence

- clinicians face barriers to implementing the evidence

- clinicians are not in agreement with the evidence

proč neventilujeme protektivně?

objektivní důvody

- ventilace není dostatečně monitorována (nevím o problému)
- protektivní ventilace nezajistí oxygenaci a CO_2 eliminaci
- dechový objem počítán dle ABW místo IBW
- dechové objemy jsou „nezvykle“ malé (V_t 6 $ml.kg^{-1}$ IBW)
- nevyužití či nedostupnost ostatních metod (pronace, plicní ECMO…)
- Hawthorne efekt

subjektivní důvody

- nedostatečná komunikace v týmu, neznalost, únava, lenost …

nedostatečný monitoring

TYPEFACE DESIGNED FOR DOCTORS

pronace

02.01.2010

	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05
Respirator Eins																			
Hamilton Mod	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV
.																			
FIO²(s) %	90	90	80	70	70	70	70	65	65	65	65	65	60	60	60	60	60	60	60
..																			
% Min. Vol. %																			
MVset l/min																			
TV set ml																			
...																			
I:E(s)	1,52	1,52	1,52	1,52	1,52	1,52	1,52	1,52	1,52	1,52	1,52	1,52	1,52	1,52	1,52	1,52	1,52	1,52	1,52
Tinsp set %																			
....																			
Paw (s) cmH2O																			
PS set cmH2O	15																		
PEEP2(s) cmH2O	18	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
PEEP(s) cmH2O	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
.....																			
ETS %	25																		
Druckrampe msec	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Respirator Meß																			
Hamilton Mod	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV	PCMV
FIO²(m) %	90	89	80	70	70	70	70	65	65	65	65	65	60	61	61	60	61	61	61
..																			
f total /min	15	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
f spontan /min	0																		
AF(CO2) /min																			
AF(EKG) /min	15	15	15																

SpO2 %	97	98	100	97	97	98	98	97	98	98	98	98	97	97	97	97	97	97	98
ETCO2 mmHg																			
.....																			
I:E(m)	1,49	1,49	1,49	1,49	1,49	1,49	1,49	1,49	1,49	1,49	1,49	1,49	1,49	1,49	1,49	1,49	1,49	1,49	1,49
Tinsp(m) s	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Texp(m) s	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
....																			
Ppeak (m) cmH2O	38	37	38	38	38	38	38	38	38	38	38	38	38	38	39	38	38	38	38
PEEP(m) cmH2O	15	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
PEEPint cmH2O	0,0	0,0	0,0					4,0	0,0	2,0	1,0		7,0	1,0					6,0
...																			
VTinsp(m) ml	542	740	669	709	709	708	701	857	785	773	728	755	760	736	767	762	774	760	774
VTexp(m) ml	538	729	647	670	669	669	669	792	731	726	694	727	718	708	742	726	718	725	747
ExpMinVol l/min	8,1	10,7	10,3	10,8	10,7	10,7	10,7	12,7	11,6	11,6	11,4	11,7	11,6	11,4	11,9	11,7	11,7	11,7	11,8
.																			
InspFlow l/min	60,0	53,0	55,0	59,0	60,0	60,0	60,0	61,0	62,0	61,0	62,0	64,0	64,0	63,0	64,0	64,0	65,0	64,0	64,0
ExpFlow l/min	67,4	67,5	69,8	69,9	69,7	69,4	69,0	70,1	71,6	71,5	71,6	72,4	71,2	72,1	73,7	72,8	73,0	72,0	75,1
Compl stat ml/cmH2O	30	41	35	36	36	36	36	45	41	40	37	38	38	38	39	39	40	39	40
Resistance cmH2O/l/	5	9	7	8	7	7	7	6	8	7	7	6	6	6	6	6	6	6	5
Blutgasanalyse																			
#PHI	7,030			7,246	7,265	7,269						7,317			7,317				7,328

mylná kalkulace V_t

ARDSnet 6 ml/kg IBW

IBW (kg) Männer = 50 + 0,91 x (Größe (cm) - 152,4)

Empfehlung / Einstellhilfe für das Tidalvolumen am Beatmungsgerät:

Größe (cm)	IBW (kg) Männer	"protektiv" V_T = 6 ml/kg IBW	"ultra-protektiv" V_T = 3 ml/kg IBW
152	50	300	150
155	52	312	156
157	55	330	165
160	57	342	171
162	59	354	177
165	62	372	186
167	64	384	192
170	66	396	198
172	68	408	204
175	71	426	213
177	73	438	219
180	75	450	225
182	78	468	234
185	80	480	240
187	82	492	246
190	85	510	255
193	87	522	261
195	89	534	267
197	91	546	273
200	94	564	282

IBW (kg) Frauen = 45,5 + 0,91 x (Größe (cm) - 152,4)

Empfehlung / Einstellhilfe für das Tidalvolumen am Beatmungsgerät:

Größe (cm)	IBW (kg) Frauen	"protektiv" V_T = 6 ml/kg IBW	"ultra-protektiv" V_T = 3 ml/kg IBW
152	46	276	138
155	48	288	144
157	50	300	150
160	52	312	156
162	55	330	165
165	57	342	171
167	59	354	177
170	62	372	186
172	64	384	192
175	66	396	198
177	69	414	207
180	71	426	213
182	73	438	219
185	75	450	225
187	78	468	234
190	80	480	240
193	82	492	246
195	85	510	255
197	87	522	261
200	89	524	267

nevyužití

ostatních

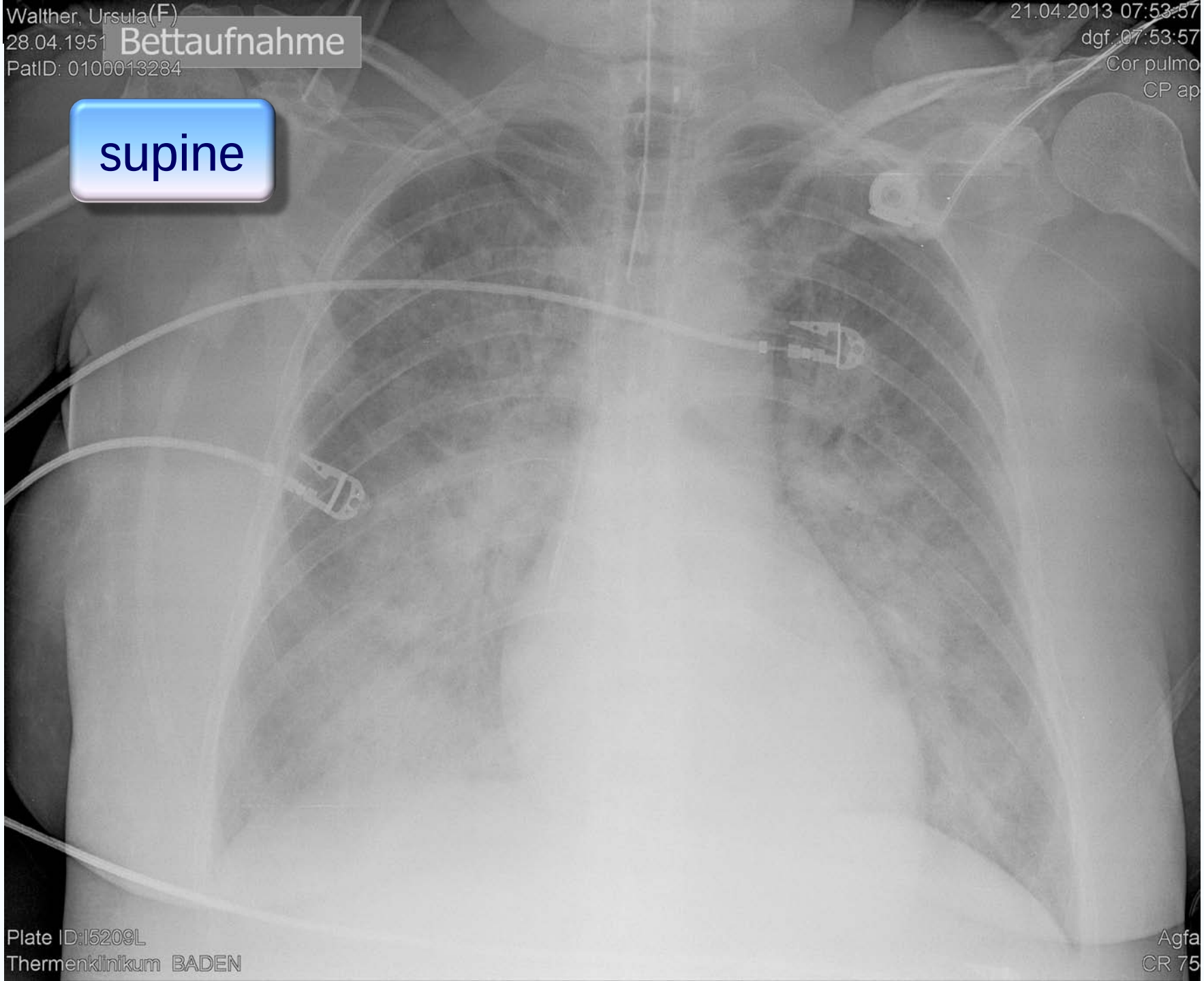
metod

non-ventilation options in ARDS

method	*standard*
prone position	+
extracorporeal lung support (ECLS)	+/-
(oxygenation + CO_2 elimination)	
HFOV	-
NO inhalation	--
surfactant	--
liquid ventilation	--

pronační
poloha


116
112/48
98
24
HABEL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supine
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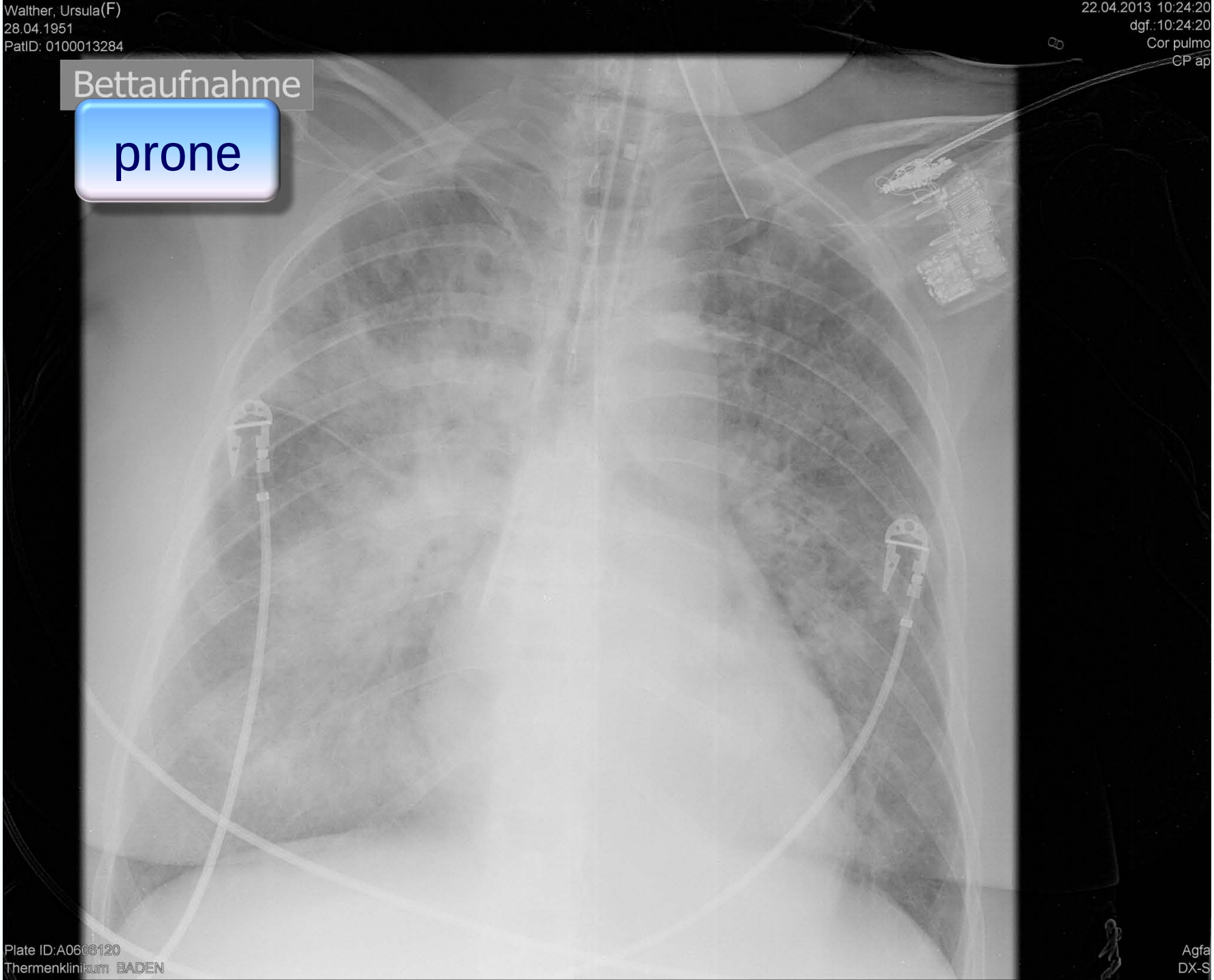
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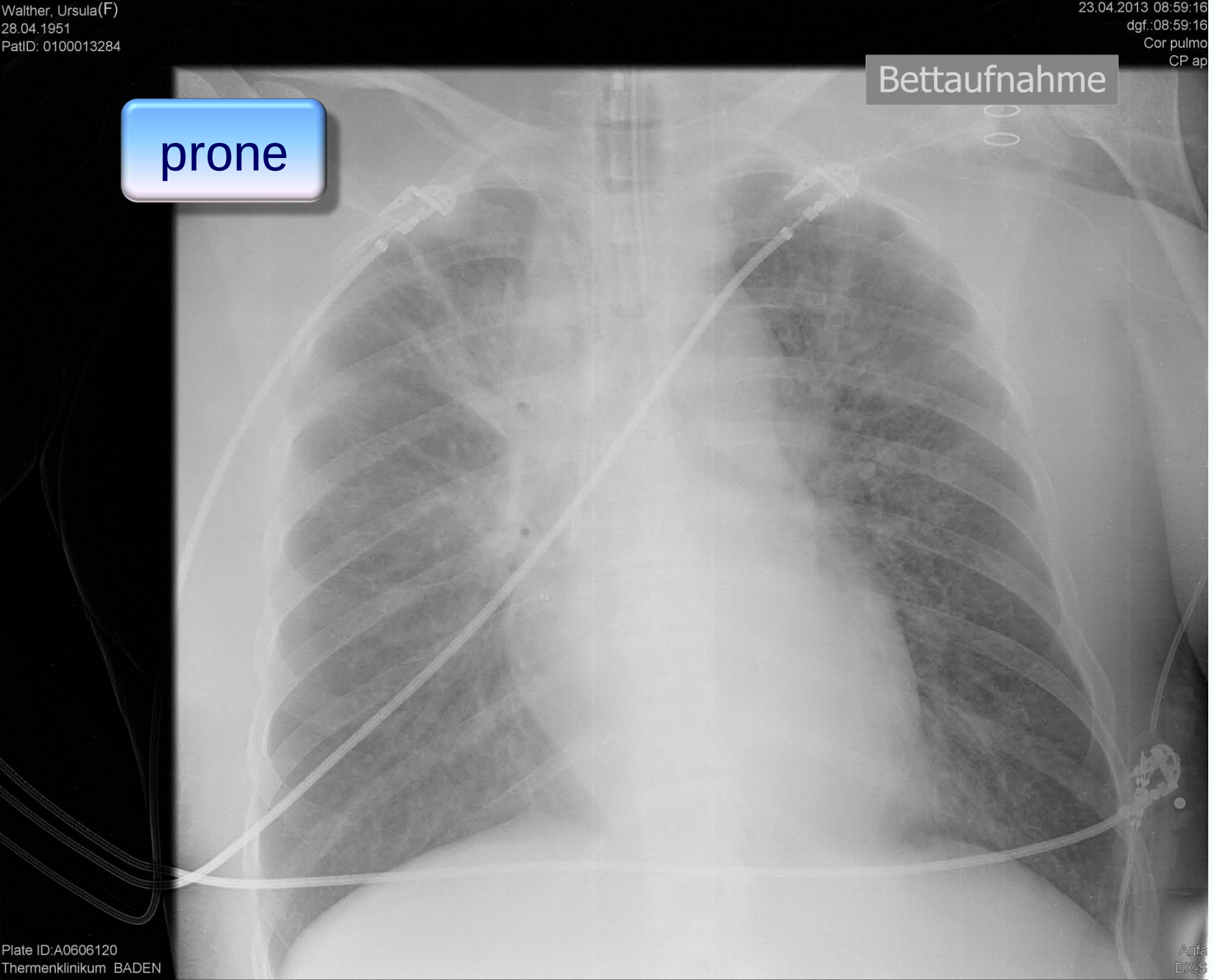
DX-S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CP ap
Bettaufnahme
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Thermenklinikum BADEN
Agfa
DX-S

The NEW ENGLAND JOURNAL of MEDICINE

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Prone Positioning in Severe Acute Respiratory Distress Syndrome

Claude Guérin, M.D., Ph.D., Jean Reignier, M.D., Ph.D., Jean-Christophe Richard, M.D., Ph.D., Pascal Beuret, M.D., Arnaud Gacouin, M.D., Thierry Boulain, M.D., Emmanuelle Mercier, M.D., Michel Badet, M.D., Alain Mercat, M.D., Ph.D., Olivier Baudin, M.D., Marc Clavel, M.D., Delphine Chatellier, M.D., Samir Jaber, M.D., Ph.D., Sylvène Rosselli, M.D., Jordi Mancebo, M.D., Ph.D., Michel Sirodot, M.D., Gilles Hilbert, M.D., Ph.D., Christian Bengler, M.D., Jack Richecoeur, M.D., Marc Gainnier, M.D., Ph.D., Frédérique Bayle, M.D., Gael Bourdin, M.D., Véronique Leray, M.D., Raphaele Girard, M.D., Loredana Baboi, Ph.D., and Louis Ayzac, M.D., for the PROSEVA Study Group*

METHODS

In this multicenter, prospective, randomized, controlled trial, we randomly assigned 466 patients with severe ARDS to undergo prone-positioning sessions of at least 16 hours or to be left in the supine position. Severe ARDS was defined as a ratio of the partial pressure of arterial oxygen to the fraction of inspired oxygen (FIO_2) of less than 150 mm Hg, with an FIO_2 of at least 0.6, a positive end-expiratory pressure of at least 5 cm of water, and a tidal volume close to 6 ml per kilogram of predicted body weight. The primary outcome was the proportion of patients who died from any cause within 28 days after inclusion.

RESULTS

A total of 237 patients were assigned to the prone group, and 229 patients were assigned to the supine group. The 28-day mortality was 16.0% in the prone group and 32.8% in the supine group ($P<0.001$). The hazard ratio for death with prone positioning was 0.39 (95% confidence interval [CI], 0.25 to 0.63). Unadjusted 90-day mortality was 23.6% in the prone group versus 41.0% in the supine group ($P<0.001$), with a hazard ratio of 0.44 (95% CI, 0.29 to 0.67). The incidence of complications did not differ significantly between the groups, except for the incidence of cardiac arrests, which was higher in the supine group.

CONCLUSIONS

In patients with severe ARDS, early application of prolonged prone-positioning sessions significantly decreased 28-day and 90-day mortality. (Funded by the Programme Hospitalier de Recherche Clinique National 2006 and 2010 of the French Ministry of Health; PROSEVA ClinicalTrials.gov number, NCT00527813.)

ECLS

awake ARDS


81
95
WIENER ZEITUNG
Hypo sucht ihren Friedhof selbst aus
WIEN


MAQUET

subjektivní důvody


Vertrauen Sie mir,
ich bin Arzt!
Verlag

…děkuji Vám za pozornost