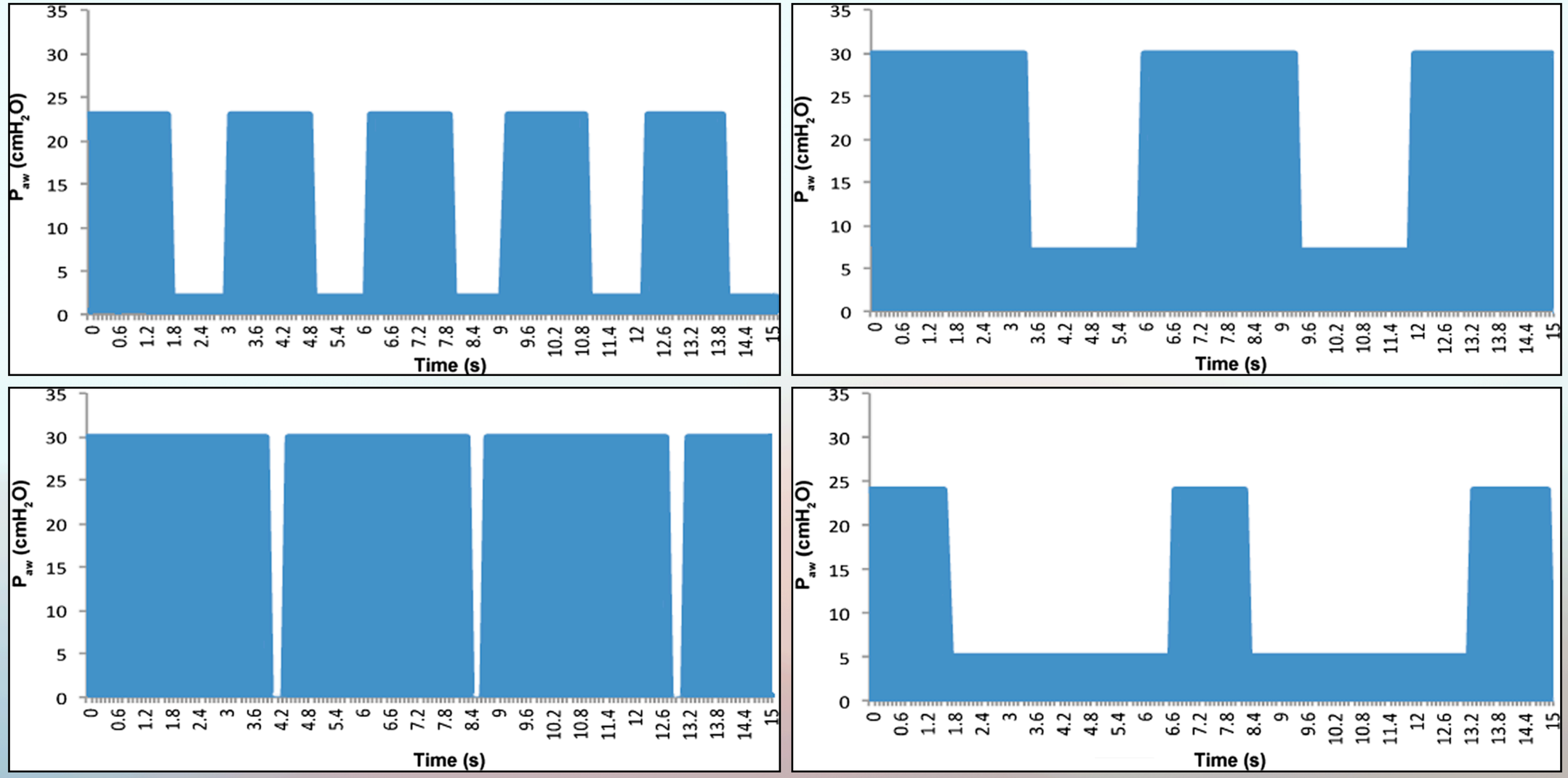
PRO: APRV

Beyond the Hype and Heterogeneity: A Reasoned Approach.

Ben Daxon, MD
Mayo Clinic

“Not All That Glitters is Gold”



PMID27207149

"Not All That Glitters is Gold"

[Ultrasound Corner]

CHEST

A Patient on Airway Pressure Release Ventilation With Sudden Hemodynamic Collapse

CrossMark

Leon L. Chen, MSc, AGACNP-BC, CCRN, CEN; Elena Mead, MD; and Michael J. Gale, MD

VIDEO

CHEST 2017; 152(1):e7-e9

We present a case of a man in his 50s with past medical history significant for schizophrenia and hypertension who was recently diagnosed with mycosis fungoides vs primary cutaneous T-cell lymphoma with extensive metastasis. Patient was admitted to the medical ICU and treated for sepsis of unknown source, likely pneumonia. Wound cultures grew *Pseudomonas*, methicillin-resistant *Staphylococcus aureus*, and *Proteus*. Laboratory results were notable for the following: WBC count, 88,000/µL; uric acid, 10.6 mg/dL; potassium, 5.3 mEq/L; phosphate, 6.5 mg/dL; lactate dehydrogenase, 693 U/L. The patient was started on broad-spectrum antibiotics and treated for sepsis and tumor lysis syndrome. An official echocardiogram on admission showed unremarkable results. The patient's clinical condition improved and he was transferred to the ward.

Twenty-four hours after transfer to the ward, the patient was found to be tachypneic and was subsequently transferred back to the ICU, intubated for hypoxemic respiratory failure, and placed on airway pressure release ventilation (APRV). Ventilator support was increased progressively because of profound hypoxemia. The patient's medical ICU course was further complicated by oliguric renal failure, requiring renal replacement therapy. Seventy-eight hours after intubation, the patient developed bradycardia and hypotension. A point-of-care ultrasound (POCUS) was done on an emergency basis at the bedside (Video 1).

Question: What is the etiology of the patient's shock and how should we proceed?

[No settings!]

AFFILIATIONS: From the Department of Anesthesiology and Critical Care Medicine, Memorial Sloan Kettering Cancer Center, New York, NY.

CORRESPONDENCE TO: Leon Chen, MSc, AGACNP-BC, CCRN, CEN, Intensive Care Unit, Memorial Sloan Kettering Cancer Center, 1275 York Ave, New York, NY 10065; e-mail: ChenL@mskcc.org

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Internal Medicine
The Japanese Society of Internal Medicine
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Intern Med 58: 3061, 2019
http://internmed.jp

[PICTURES IN CLINICAL MEDICINE]

Development of Lung Emphysema Due to APRV

Wakaki Kami, Takeshi Kinjo, Kazuya Miyagi and Jiro Fujita

Key words: emphysema, pneumothorax, acute respiratory distress syndrome, airway pressure release ventilation, barotrauma, pneumococcus

(Intern Med 58: 3061, 2019)
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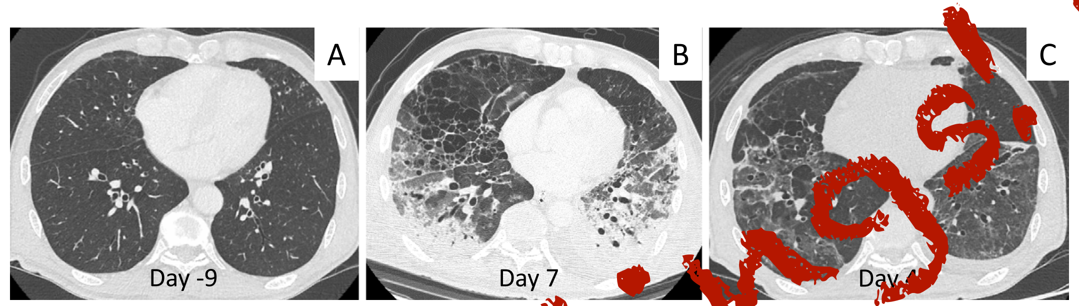

Picture.

A 69-year old man was diagnosed with acute respiratory distress syndrome (ARDS) due to invasive pneumococcal disease and underwent airway pressure release ventilation (APRV). Initially, his respiratory condition gradually improved, but on day 7, chest CT showed newly developed lung emphysema (Picture A and B). On day 8, right-side pneumothorax occurred and thoracic drainage was initiated. Eventually, his condition was ameliorated and respirator support was terminated on day 13. Follow-up CT revealed diminished emphysema on day 49 (Picture C).

APRV is usually applied to ARDS patients (1); however, continuous high pressure sometimes causes barotrauma. Indeed, Lim et al. reported that 4% of ARDS patients treated with APRV developed pneumothorax (2). The mechanism remains unknown and there are no previous reports of prelesion resulting in pneumothorax. This case suggests that the invasive nature of pneumococcus in addition to continuous high airway pressure by APRV might trigger lung emphysema, which might be an important indicator of the development of pneumothorax. Physicians should therefore be mindful of the development of emphysema in ARDS patients treated with APRV.

The authors state that they have no Conflict of Interest (COI).

[No settings!]

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2. Lim J, Litton E, Robinson H, Das Gupta M. Characteristics and outcomes of patients treated with airway pressure release ventilation for acute respiratory distress syndrome: a retrospective observational study. J Crit Care **34**: 154-159, 2016.

Department of Infectious, Respiratory and Digestive Medicine, Graduate School of Medicine, University of the Ryukyus, Japan
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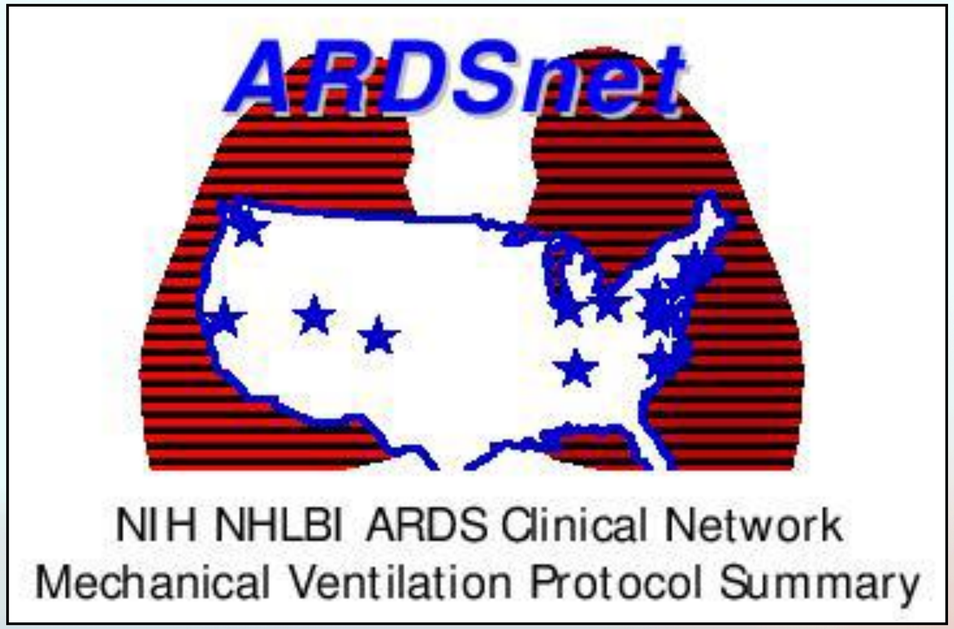
Correspondence to Dr. Takeshi Kinjo, t_kinjo@med.u-ryukyu.ac.jp

MAYO CLINIC

PMID28693784 PMID31243221

Its Not the Wand — Its the Wizard

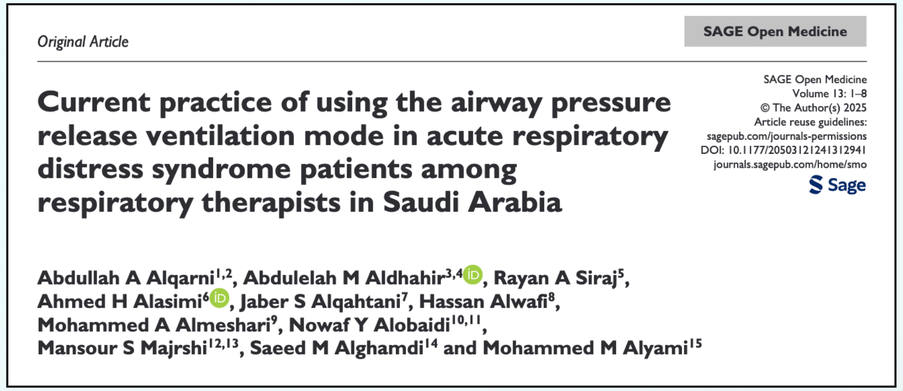


VS

MAYO CLINIC

PMID28693784 PMID31243221

No Consensus ≠ No Correctness



Original Article

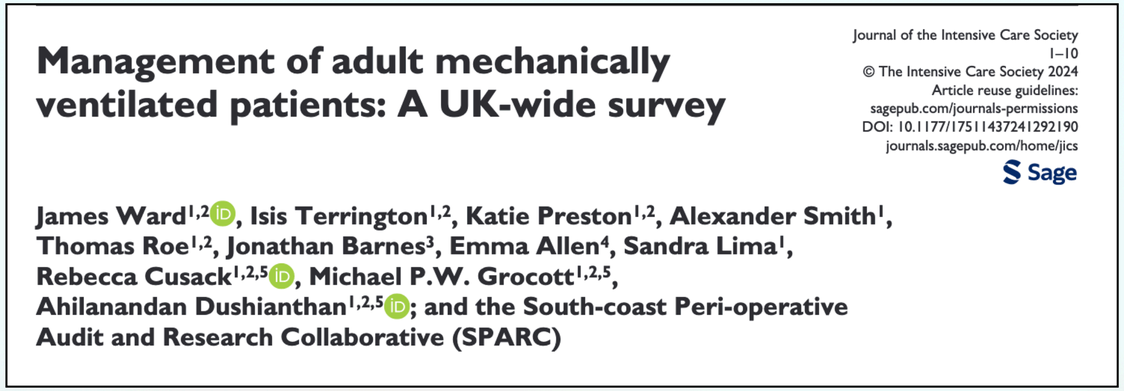
SAGE Open Medicine

Current practice of using the airway pressure release ventilation mode in acute respiratory distress syndrome patients among respiratory therapists in Saudi Arabia

SAGE Open Medicine
Volume 13: 1–8

DOI: 10.1177/20503121241312941
journals.sagepub.com/home/smo
Sage

Abdullah A Alqarni[1,2], Abdulelah M Aldhahir[3,4], Rayan A Siraj[5], Ahmed H Alasimi[6], Jaber S Alqahtani[7], Hassan Alwafi[8], Mohammed A Almeshari[9], Nowaf Y Alobaidi[10,11], Mansour S Majrshi[12,13], Saeed M Alghamdi[14] and Mohammed M Alyami[15]

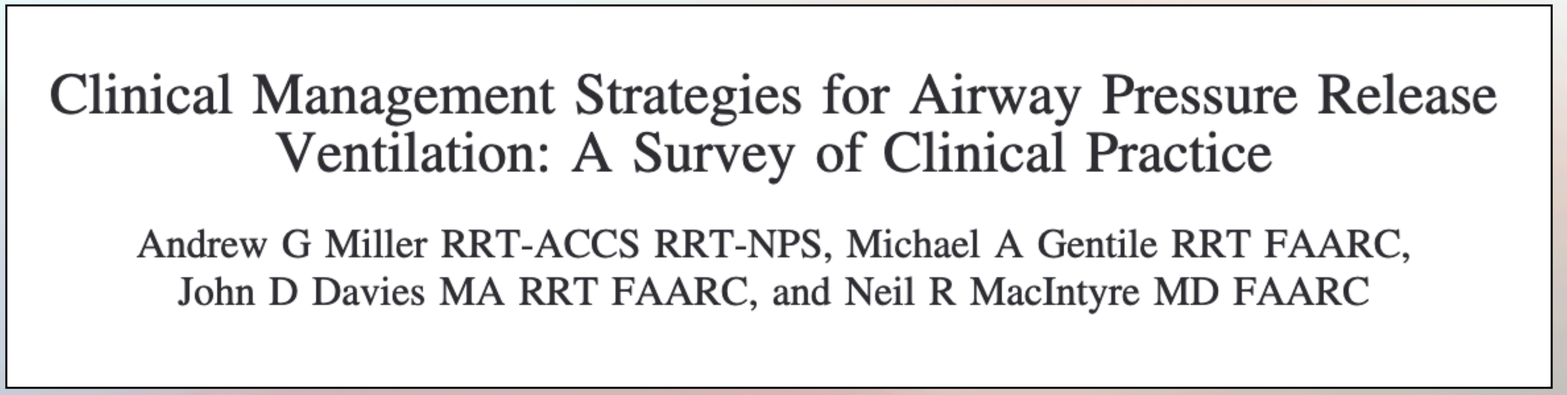


Management of adult mechanically ventilated patients: A UK-wide survey

Journal of the Intensive Care Society
1–10

DOI: 10.1177/17511437241292190
journals.sagepub.com/home/jics
Sage

James Ward[1,2], Isis Terrington[1,2], Katie Preston[1,2], Alexander Smith[1], Thomas Roe[1,2], Jonathan Barnes[3], Emma Allen[4], Sandra Lima[1], Rebecca Cusack[1,2,5], Michael P.W. Grocott[1,2,5], Ahilanandan Dushianthan[1,2,5]; and the South-coast Peri-operative Audit and Research Collaborative (SPARC)



Clinical Management Strategies for Airway Pressure Release Ventilation: A Survey of Clinical Practice

Andrew G Miller RRT-ACCS RRT-NPS, Michael A Gentile RRT FAARC, John D Davies MA RRT FAARC, and Neil R MacIntyre MD FAARC

No Consensus ≠ No Correctness

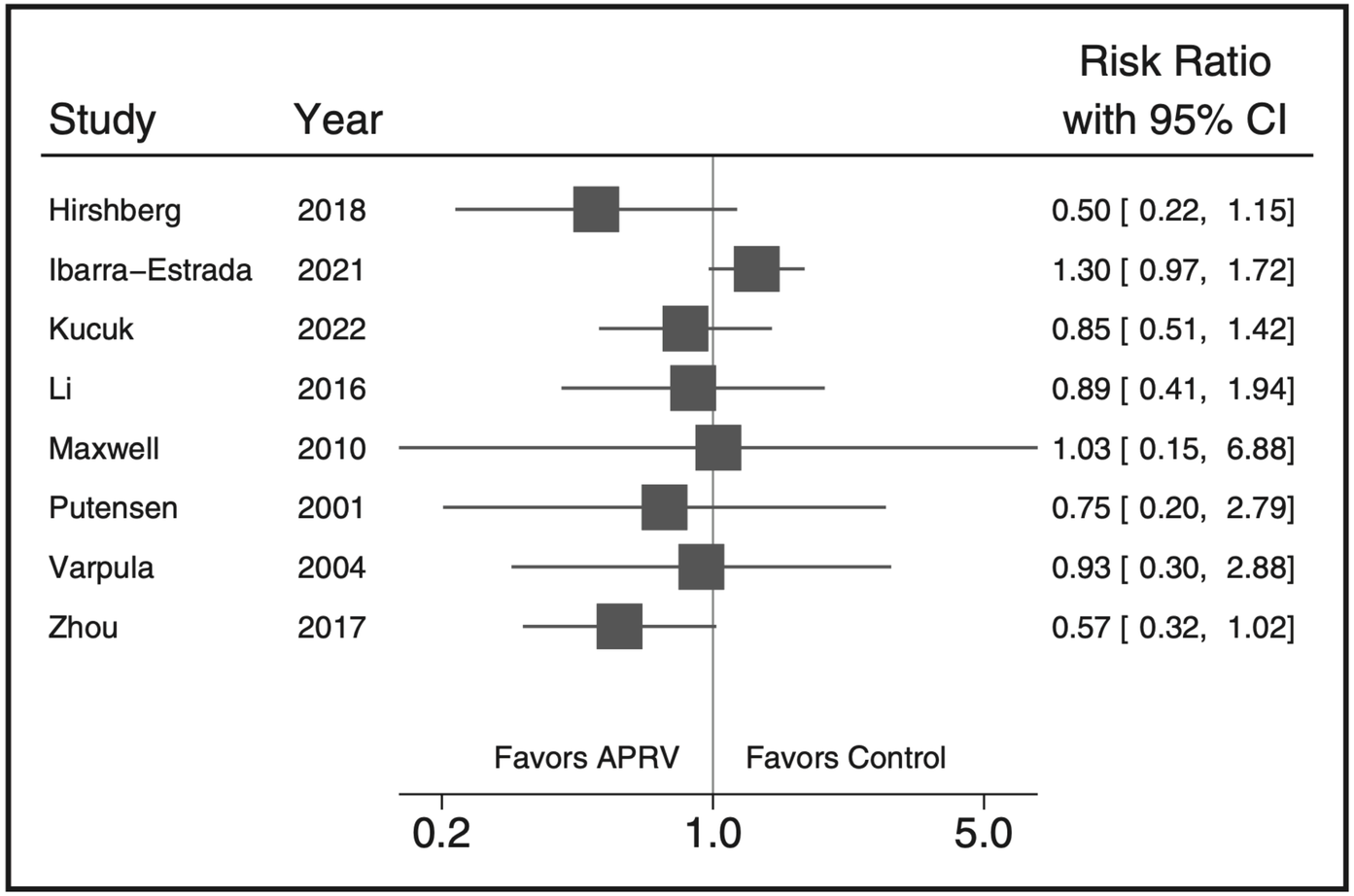
- Esophageal Balloons
- Paralysis
- “Best” PEEP
- Recruitment Maneuvers
- Optimum Sedation
- Early vs Late Intubation

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Epidemiology, Patterns of Care, and Mortality for Patients With Acute Respiratory Distress Syndrome in Intensive Care Units in 50 Countries

Giacomo Bellani, MD, PhD; John G. Laffey, MD, MA; Tài Pham, MD; Eddy Fan, MD, PhD; Laurent Brochard, MD, HDR; Andres Esteban, MD, PhD; Luciano Gattinoni, MD, FRCP; Frank van Haren, MD, PhD; Anders Larsson, MD, PhD; Daniel F. McAuley, MD, PhD; Marco Ranieri, MD; Gordon Rubenfeld, MD, MSc; B. Taylor Thompson, MD, PhD; Hermann Wrigge, MD, PhD; Arthur S. Slutsky, MD, MASc; Antonio Pesenti, MD; for the LUNG SAFE Investigators and the ESICM Trials Group

Positive Signs

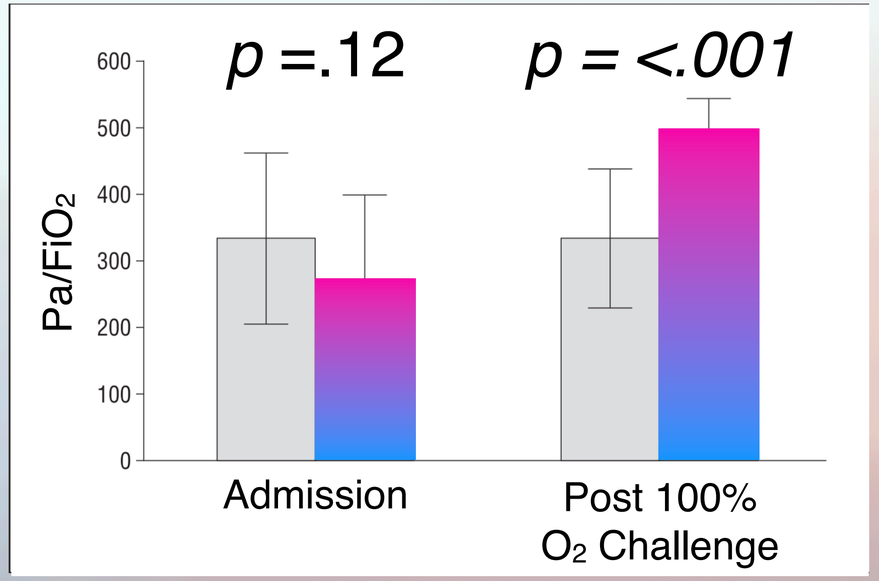


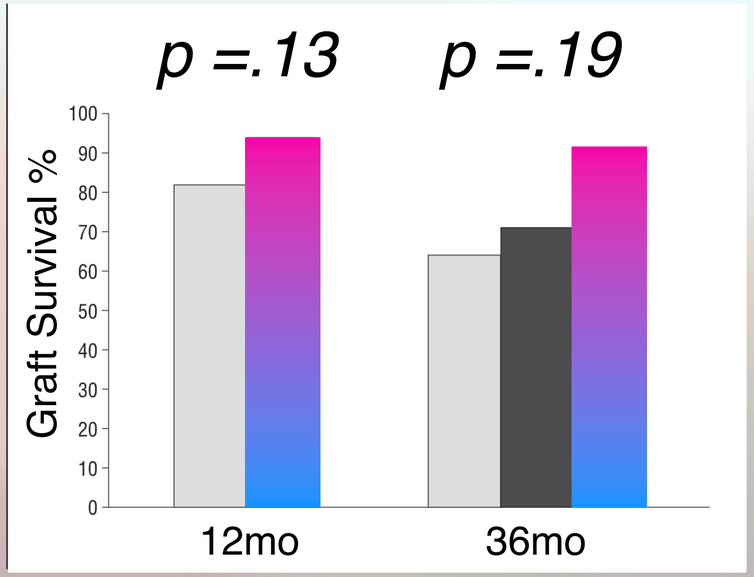
Lung TX

ORIGINAL ARTICLE

Airway Pressure Release Ventilation and Successful Lung Donation

Kenny Hanna, MD; Christopher W. Seder, MD; Jeffrey B. Weinberger, MD; Patty A. Sills, RN; Michael Hagan, MD; Randy J. Janczyk, MD





PMID: 21422364

Lung TX

S318 The Journal of Heart and Lung Transplantation, Vol 36, No 4S, April 2017

Recipient preoperative and perioperative characteristics were comparable. Postoperatively in group 1 there was a higher incidence of extracorporeal life support (27.3 vs 9.1%, p=0.019) and primary graft dysfunction 48 hours after surgery (33.3 vs 13.6%, p=0.025). There were no significant differences in chronic lung allograft dysfunction-free survival between group 1 and 2: 92.4 vs 94% at 1 year and 65.9 vs 75.5% at 3 years (p=0.99). The estimated cumulative survival rate (fig. 1) was also similar between groups: 68.2 vs 83.2% at 1 year and 68.2% versus 72% at 3 years (p=0.38).

Conclusion: Hanging as a donor cause of death is not associated with poor mid-term survival or chronic lung allograft dysfunction following transplantation. Hanging donors, when carefully evaluated and selected, should not be automatically excluded from transplant consideration. These results provide important justification for potentially broadening the donor pool safely.

Figure 1

Figure 2

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Native-Upper Lobe-Sparing Living Donor Lobar Lung Transplantation Enables to Maximize Donor Graft Respiratory Fluctuation

A. Takahagi, T.F. Chen-Yoshikawa, K. Ohata, M. Saito, R. Okabe, F. Gochi, H. Yamagishi, M. Hamaji, H. Motoyama, K. Hijiya, A. Aoyama, H. Date. Thoracic Surgery, Kyoto University Gradual School, Kyoto, Japan.

Purpose: In standard living-donor lobar lung transplantation (LDLLT), two lower lobe grafts are implanted to a recipient after bilateral pneumonectomy. We have developed a novel method for native upper lobe-sparing LDLLT to overcome a small-for-size graft in standard LDLLT. In the new procedure, lower lobe grafts are implanted orthotopically after right middle and lower bilobectomy and/or left lower lobectomy. We hypothesized that implanted donor grafts in native upper lobe-sparing LDLLT may work more efficiently than those in standard LDLLT.

Methods: LDLLT was performed in 55 patients in total at our institution between August 2008 and April 2015. Of them, 26 patients were eligible for this study who underwent bilateral LDLLT and were followed for more than one year without developing chronic lung allograft dysfunction: 20 who underwent standard LDLLT, and 6 who received native upper lobe-sparing LDLLT (group S). The standard LDLLT cases were further divided into an undersized group (group U, n=14) and a normal-sized group (group N, n=6), based on FVC size-matching (normal range, 75-125%). Using three-dimensional CT volumetry, donor graft volume was measured in the inspiratory and expiratory phases before and one year after LDLLT.

Results: The median FVC size-matching levels were 49.8% (range, 40.4-58.1%) in group S, 58.4% (range, 44.8-69.5%) in group U, and 88.4% (range, 82.0-102.3%) in group N. The median postoperative ratios volume of inspiration to expiration (post-IE graft volume ratio) were 2.54, 1.76, and 1.67 in the S, U, and N groups, respectively, and the median post-/pre-IE graft fluctuation ratios were 1.34, 0.78, and 0.66, respectively. Post-IE graft volume ratio of the group S was significantly higher than that of the other groups, and the change in the donor graft volume was significantly higher than in group N.

Conclusion: These results demonstrated that implanted donor grafts in native upper lobe-sparing LDLLT may function better than those in standard LDLLT.

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Lung Transplant Outcomes in Donors Managed with Airway Pressure Release Ventilation

S. Biswas Roy,[1] C. Haworth,[2] M. Olson,[3] P. Kang,[4] K.E. Varsch,[1] T.S. Panchabhai,[1] R.M. Bremner,[1] M.A. Smith,[1] R. Walia.[1] [1]Norton Thoracic Institute, St. Joseph's Hospital & Medical Center, Phoenix, AZ; [2]A.T. Still University, Mesa, AZ; [3]Grand Canyon University, Phoenix, AZ; [4]University of Arizona College of Public Health, Phoenix, AZ.

Purpose: Airway pressure release ventilation (APRV), a pressure-control type of mechanical ventilation, is used for lung recruitment in cadaveric donor lungs. APRV elevates PaO_2 in donor lungs, but clinical outcomes in transplant recipients with APRV-managed donor lungs are unreported.

Methods: We retrospectively reviewed patients who underwent lung transplantation (LTx) from 2012 to 2013. Patients were divided into 2 groups based on mode of ventilation used during donor management and organ extraction (Group A, non-APRV; Group B, APRV). Probability of survival at 90 days, 1 year, and 3 years was analyzed using Kaplan-Meier estimates. Multivariate Cox regression was used to calculate adjusted risk of survival.

Results: Of the 126 LTx (with cadaveric donors) performed during the study period, 9 recipients were excluded because their donors' lungs were maintained on portable ventilation perfusion systems. Of the remaining 117 patients, 81 (69%) were in Group A; 36 (31%) were in Group B. Baseline characteristics (e.g., preoperative recipient characteristics [age, sex, lung allocation score, type of end-stage lung disease]) were comparable between groups. Donors for Group B recipients were older (p=0.03) and had higher body mass index (p<0.001), higher incidence of chest trauma (p=0.008), longer duration of ventilation after brain death (p<0.001), and higher pre-explant PaO_2/FiO_2 ratios (p<0.001). After LTx, mechanical ventilation duration, postoperative length of stay, and median survival were similar in both groups. A Cox regression model showed comparable risk of death in both groups over 3 years (HR=0.83, 95% CI 0.43, 1.62).

Conclusion: APRV is an effective pre-LTx donor lung management strategy. Despite older donors with longer ventilation times, pre-explant PaO_2/FiO_2 ratios were still better in donors with APRV than without. Short- and long-term survival outcomes were comparable in LTx recipients at our center regardless of ventilation mode. Larger multi-center studies would likely validate these data.

Retro, LTx, single-center AZ

	Std	APRV	*p-value*	APRV Pt's
Age	36	46	0.036	"Older"
BMI	25.1	29.2	<0.001	"Fatter"
Vent hrs	47.6	71.1	<0.001	"Longer"
Chest Trauma	4.9%	22.2%	0.008	"Sicker"

Trend towards *improved* outcomes on APRV!

J Heart and Lung Trans. 2017 Apr;36(4S):318-9

PRO: APRV

Beyond the Hype and Heterogeneity: A Reasoned Approach.

Ben Daxon, MD
Mayo Clinic