CPR- Are We Getting it Right?

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CLINICAL EDUCATION SPECIALIST

CPR- Are We Getting it Right?

1. Review current AHA recommendations.
2. Discuss ventilation during CPR
3. Examine oxygenation outcomes.
4. Consider new research

Circulation
Volume 142, Issue 16_Suppl_2, 20 October 2020; Pages S366-S468
https://doi.org/10.1161/CIR.0000000000000916

American Heart Association.

2020 AMERICAN HEART ASSOCIATION GUIDELINES FOR CARDIOPULMONARY RESUSCITATION AND EMERGENCY CARDIOVASCULAR CARE

Part 3: Adult Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

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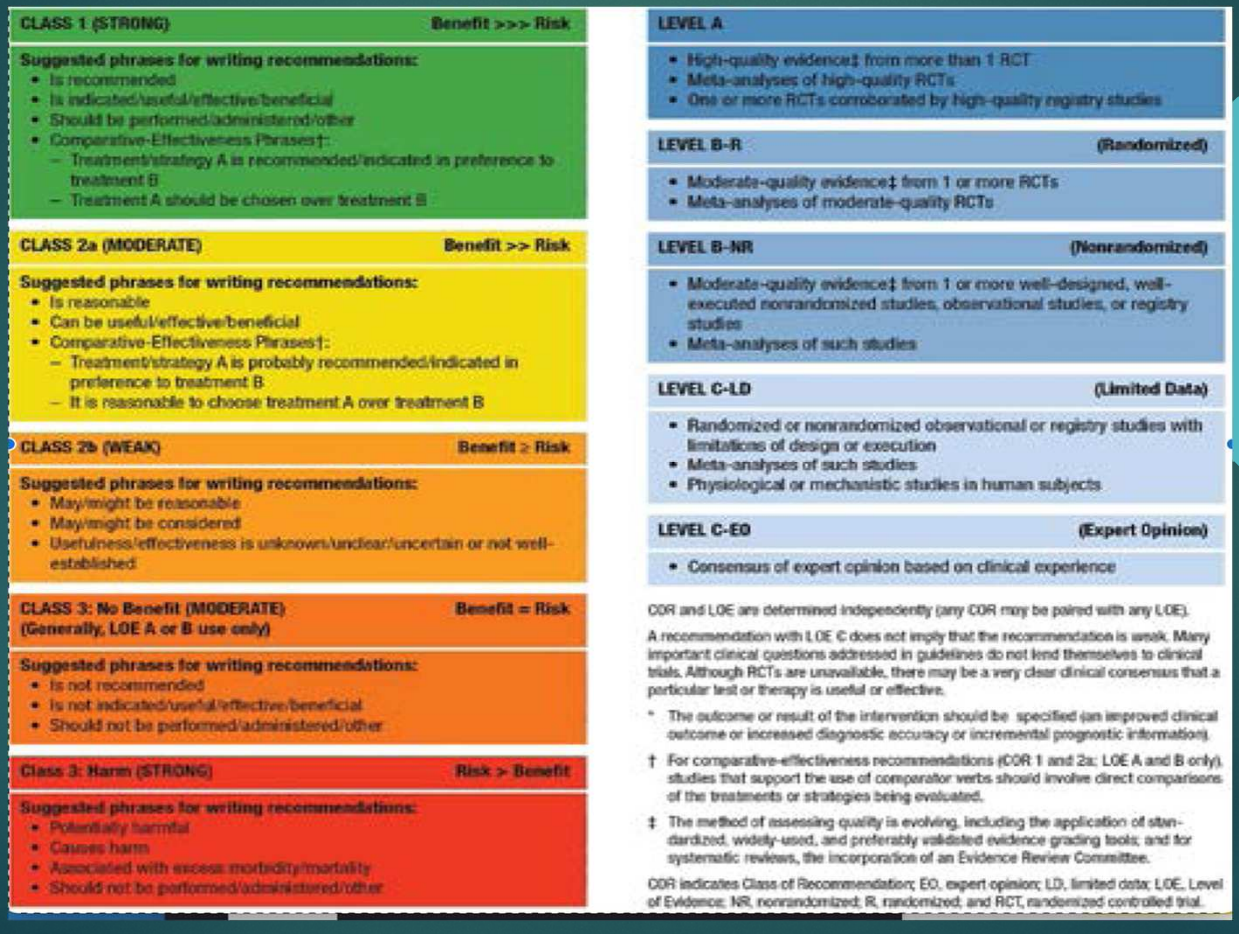
Class (strength) of Recommendation



CLASS 1 (STRONG) — **Benefit >>> Risk**

Suggested phrases for writing recommendations:
- Is recommended
- Is indicated/useful/effective/beneficial
- Should be performed/administered/other
- Comparative-Effectiveness Phrases†:
  - Treatment/strategy A is recommended/indicated in preference to treatment B
  - Treatment A should be chosen over treatment B

CLASS 2a (MODERATE) — **Benefit >> Risk**

Suggested phrases for writing recommendations:
- Is reasonable
- Can be useful/effective/beneficial
- Comparative-Effectiveness Phrases†:
  - Treatment/strategy A is probably recommended/indicated in preference to treatment B
  - It is reasonable to choose treatment A over treatment B

CLASS 2b (WEAK) — **Benefit ≥ Risk**

Suggested phrases for writing recommendations:
- May/might be reasonable
- May/might be considered
- Usefulness/effectiveness is unknown/unclear/uncertain or not well-established

CLASS 3: No Benefit (MODERATE) — **Benefit = Risk**
(Generally, LOE A or B use only)

Suggested phrases for writing recommendations:
- Is not recommended
- Is not indicated/useful/effective/beneficial
- Should not be performed/administered/other

Class 3: Harm (STRONG) — **Risk > Benefit**

Suggested phrases for writing recommendations:
- Potentially harmful
- Causes harm
- Associated with excess morbidity/mortality
- Should not be performed/administered/other

LEVEL A
- High-quality evidence‡ from more than 1 RCT
- Meta-analyses of high-quality RCTs
- One or more RCTs corroborated by high-quality registry studies

LEVEL B-R — **(Randomized)**
- Moderate-quality evidence‡ from 1 or more RCTs
- Meta-analyses of moderate-quality RCTs

LEVEL B-NR — **(Nonrandomized)**
- Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies
- Meta-analyses of such studies

LEVEL C-LD — **(Limited Data)**
- Randomized or nonrandomized observational or registry studies with limitations of design or execution
- Meta-analyses of such studies
- Physiological or mechanistic studies in human subjects

LEVEL C-EO — **(Expert Opinion)**
- Consensus of expert opinion based on clinical experience

COR and LOE are determined independently (any COR may be paired with any LOE).

A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Although RCTs are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

* The outcome or result of the intervention should be specified (an improved clinical outcome or increased diagnostic accuracy or incremental prognostic information).

† For comparative-effectiveness recommendations (COR 1 and 2a; LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

‡ The method of assessing quality is evolving, including the application of standardized, widely-used, and preferably validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.

COR indicates Class of Recommendation; EO, expert opinion; LD, limited data; LOE, Level of Evidence; NR, nonrandomized; R, randomized; and RCT, randomized controlled trial.

Class of Strength Recommendation

CLASS (STRENGTH) OF RECOMMENDATION	
CLASS 1 (STRONG)	Benefit >>> Risk
Suggested phrases for writing recommendations: ▪ Is recommended ▪ Is indicated/useful/effective/beneficial ▪ Should be performed/administered/other ▪ Comparative-Effectiveness Phrases†: ◦ Treatment/strategy A is recommended/indicated in preference to treatment B ◦ Treatment A should be chosen over treatment B	
CLASS 2a (MODERATE)	Benefit >> Risk
Suggested phrases for writing recommendations: ▪ Is reasonable ▪ Can be useful/effective/beneficial ▪ Comparative-Effectiveness Phrases†: ◦ Treatment/strategy A is probably recommended/indicated in preference to treatment B ◦ It is reasonable to choose treatment A over treatment B	

LEVEL C-LD	(Limited Data)
▪ Randomized or nonrandomized observational or registry studies with limitations of design or execution ▪ Meta-analyses of such studies ▪ Physiological or mechanistic studies in human subjects	

COR indicates Class of Recommendation; EO, expert opinion; LD, limited data; LOE, Level of Evidence; NR, nonrandomized; R, randomized; and RCT, randomized controlled trial.

Recommendations for Fundamentals of Ventilation

Recommendations for Fundamentals of Ventilation During Cardiac Arrest		
COR	**LOE**	**Recommendations**
2a	C-LD	1. For adults in cardiac arrest receiving ventilation, tidal volumes of approximately 500 to 600 mL, or enough to produce visible chest rise, are reasonable.
2a	C-EO	2. In patients without an advanced airway, it is reasonable to deliver breaths either by mouth or by using bag-mask ventilation.
2b	C-EO	3. When providing rescue breaths, it may be reasonable to give 1 breath over 1 s, take a "regular" (not deep) breath, and give a second rescue breath over 1 s.
3: Harm	C-LD	4. Rescuers should avoid excessive ventilation (too many breaths or too large a volume) during CPR.

Recommendation for Ventilation in Patients with Spontaneous Circulation (Respiratory Arrest)

Recommendation for Ventilation in Patients With Spontaneous Circulation (Respiratory Arrest)		
COR	**LOE**	**Recommendation**
2b	C-LD	1. If an adult victim with spontaneous circulation (ie, strong and easily palpable pulses) requires support of ventilation, it may be reasonable for the healthcare provider to give rescue breaths at a rate of about 1 breath every 6 s, or about 10 breaths per minute.

2019 AHA Review and Update

Recommendation-Specific Supportive Text

1. Since the last review in 2010 of rescue breathing in adult patients, there has been no evidence to support a change in previous recommendations. A study in critically ill patients who required ventilatory support found that bag-mask ventilation at a rate of 10 breaths per minute decreased hypoxic events before intubation.[18]

The research says ….

Death by hyperventilation: A common and life-threatening problem during cardiopulmonary resuscitation

Aufderheide, Tom P. MD; Lurie, Keith G. MD

Author Information

Critical Care Medicine 32(9):p S345-S351, September 2004. | **DOI:** 10.1097/01.CCM.0000134335.46859.09

Objective:

To examine the hypothesis that excessive ventilation rates during performance of CPR by overzealous but well-trained rescue personnel causes a significant decrease in coronary perfusion pressure and an increased likelihood of death.

- Study was performed on both humans and porcine animal trial
- In the *in vivo* human aspect of the study, we set out to objectively and electronically record rate and duration of ventilation during performance of CPR by trained professional rescue personnel in a prospective clinical trial in intubated, adult patients with out-of-hospital cardiac arrest
- In the *in vivo* animal aspect of the study, to simulate the clinically observed hyperventilation, nine pigs in cardiac arrest were ventilated in a random order with 12, 20, or 30 breaths/min, and physiologic variables were assessed. Next, three groups of seven pigs in cardiac arrest were ventilated at 12 breaths/min with 100% oxygen, 30 breaths/min with 100% oxygen, or 30 breaths/min with 5% Co_2/95% oxygen, and survival was assessed.

Table 1. Clinical observational study

Consecutive Case	Ventilation Rate (Breaths/Min)	Ventilation Duration (Secs/Breath)	% Positive Pressure
Group 1			
1	32	1.15	61
2	45	0.85	64
3	34	0.91	51
4	49	0.64	52
5	19	0.99	31
6	39	0.60	40
7	38	0.78	49
Mean ± SEM	37 ± 4[a]	0.85 ± 0.07[b]	50 ± 4
Group 2			
8	15	1.10	27
9	31	1.38	71
10	15	1.12	28
11	15	1.00	25
12	26	1.30	57
13	30	1.17	59
Mean ± SEM	22 ± 3[a]	1.18 ± 0.06[b]	44.5 ± 8.2
Group 3	30 ± 3	1.0 ± 0.7	47.3 ± 4.3

Results

- Trained rescue professionals averaged 30 breaths per minute during resuscitation efforts
- No patients survived
- In the porcine study – of 21 animals in 3 separate groups
- Survival rates were six of seven, one of seven, and one of seven with 12, 30, and 30 + Co_2 breaths/min, respectively (p = .006).
- The porcine study demonstrated that hyperventilation decreased coronary perfusion and survival rates by >70%

Conclusions

- Despite seemingly adequate training, professional rescuers consistently hyperventilated patients during out-of-hospital CPR. Subsequent hemodynamic and survival studies in pigs demonstrated that excessive ventilation rates significantly decreased coronary perfusion pressures and survival rates, despite supplemental Co_2 to prevent hypocapnia. This translational research initiative demonstrates an inversely proportional relationship between mean intratracheal pressure and coronary perfusion pressure during CPR. Additional education of CPR providers is urgently needed to reduce these newly identified and deadly consequences of hyperventilation during CPR. These findings also have significant implications for interpretation and design of resuscitation research, CPR guidelines, education, the development of biomedical devices, emergency medical services quality assurance, and clinical practice.

An evaluation of manual tidal volume and respiratory rate delivery during simulated resuscitation

J. Brady Scott MSc, AE-C, Julie M. Schneider MS, RN, Karen Schneider LPN and Jie Li PhD

American Journal of Emergency Medicine, 2021-07-01, Volume 45, Pages 446-450, Copyright © 2020 Elsevier Inc.

- Cross sectional study during ACLS renewal during the MEGA CODE portion of the course
- A total of 52 subjects (15 male) were enrolled in the study, with an average height of 169 (157,178) cm. Fifteen physicians (including 2 physician assistants), 34 nurses, and 3 respiratory therapists participated. Among the participants, 18 participants chose small gloves, 24 chose medium, and 10 chose large. Twenty-two, 14, and 16 participants had clinical experiences <5 years, 5–10 years, and >10 years, respectively. Sixteen, 21, 8, and 7 participants had ICU experiences <1 year, 1–5 years, 5–10 years, and >10 years, respectively.
- Self inflating resuscitation bags were used-NIC02 monitor was used to collect RR and Tidal Volume

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- After the second scenario was completed, the study participants filled out a questionnaire regarding demographic information such as profession, height, sex, and years of clinical experience. They also answered questions regarding their confidence and knowledge about tidal volume delivery.
- When the participants were blinded to tidal volume measurement, male participants delivered higher tidal volumes than females (685 ± 134 vs 587 ± 168 ml, $P = 0.05$). There was a statistically significant difference in tidal volumes for the three groups with different sizes of gloves ($P = 0.027$)The participants with medium-sized gloves delivered smaller tidal volumes than those with large-sized gloves (566 ± 181 vs 728 ± 153 ml, $P = 0.020$), but did not differ from those with small-sized gloves (566 ± 181 vs 618 ± 114 ml, $P = 0.531$), and no difference was found between groups with large and small-sized gloves ($P = 0.179$).
- However, the differences among the three groups were not significant after they were able to see the monitor.

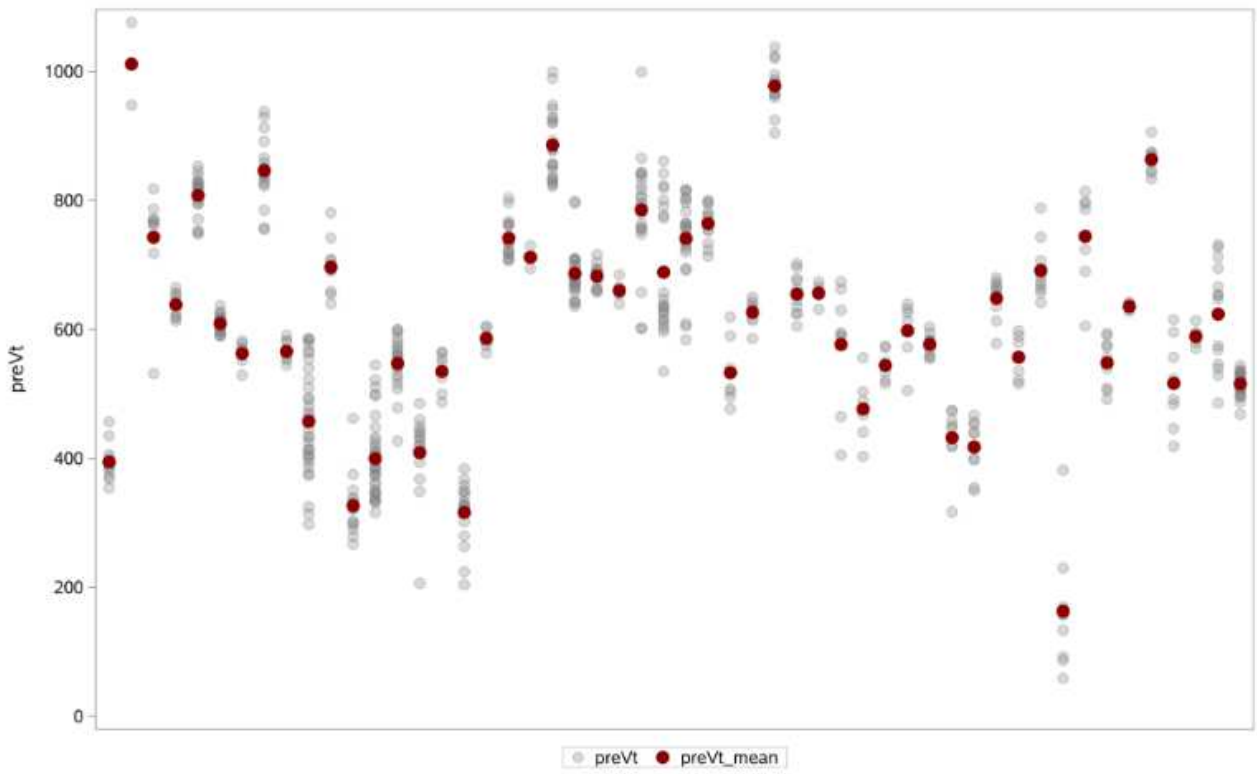

Fig.1

A scatter plot showing the variability of pre-feedback tidal volumes delivered by study participants. The X-axis represents the individual participants in the study. The Y-axis represents the pre-feedback tidal volume in millilitres. The dark gray circles represent the mean tidal volume delivered. The gray circles represent the volume delivered by each squeeze of the self-inflating adult resuscitation bag.

An evaluation of manual tidal volume and respiratory rate delivery during simulated resuscitation

J. Brady Scott MSc, AE-C, Julie M. Schneider MS, RN, Karen Schneider LPN and Jie Li PhD

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- The scatter plot of tidal volume delivery of all the 52 participants is shown previously. Using a variance of 20% as the criteria to determine if the tidal volume delivery was variable for each individual, 67.3% (35/52) of participants delivered variable tidal volumes between breaths. For those who delivered tidal volume consistently (≤20% variance), there was a significant difference among physicians, nurses, and respiratory therapists (20%, 32.4% and 100%, respectively, $P = 0.026$). Also, there was a significant difference between glove sizes (small: 55.6%, medium: 12.5%, and large: 40%, $P = 0.011$).There was no significant difference between sexes or among participants with years of clinical/ICU experiences.

Conclusion:

Tidal volumes delivered with an adult self-inflating resuscitation bag vary greatly during simulated ACLS/CPR. Sex and glove size appeared to impact tidal volume delivery when the participants were unaware of what they were delivering. Visual or audio feedback might improve the quality of tidal volume delivery during manual ventilation. Education efforts aimed at improving knowledge and confidence in regards to tidal volume delivery during manual ventilation are needed.

Do we hyperventilate cardiac arrest patients? John F. O'Neill°, Charles D. Deakin – Resuscitation (volume 73 Issue 1, April 2007 pages 82-85)

Table 1 Summary of ventilatory variables resulting from manual ventilation during cardiopulmonary resuscitation of 12 patients

	Median	Min	Max
Patient weight (kg)	80.0	60	120
Time from initial arrest (min)	43.0	29	56
Minute volume (l/min)	13.0	4.6	21.3
Respiratory rate—median (min^{-1})	21.0	7	37
Respiratory rate—max (min^{-1})	25.5	9	41
Tidal volume (ml)	618.5	374	923
Peak end-expiratory pressure (cmH_2O)	1.3	0	6.9
Mean airway pressure (cmH_2O)	13.9	5.1	37.4
Peak inspiratory pressure (cmH_2O)	60.6	46	106.1
Compliance-dynamic (ml/cmH_2O)	20.4	5	68.2
% Time airway pressure >0 cmH_2O (%)	95.3	87.9	100

Conclusions

Hyperventilation was common, mostly through high respiratory rates rather than excessive tidal volumes. This is the first study to document tidal volumes and airway pressures during resuscitation. The persistently high airway pressures are likely to have a detrimental effect on blood flow during CPR. Guidelines on respiratory rates are well known, but it would appear that in practice they are not being observed.

How do RT's measure up?

Heart Lung. 2021 May-June; 50(3): 471–475. PMCID: PMC7604178

Published online 2020 Nov 1. doi: 10.1016/j.hrtlng.2020.10.012 PMID: 33138977

Manual bag valve mask ventilation performance among respiratory therapists

Rachel E. Culbreth* and Douglas S. Gardenhire

Manual bag valve mask ventilation performance among respiratory therapists

Rachel E. Culbreth* and Douglas S. Gardenhire

- Respiratory therapists (*n*=98) were instructed to ventilate a manikin for 18 breaths. Linear regression was utilized to determine associated predictors with the outcomes: delivered tidal volume, pressure and flow rate.

Summary of manual ventilation performance among respiratory therapists by years of experience (n=98)

	Experience					Total
	0-5 years N=29 (29.6%)	6-10 years N=15 (15.3%)	11-20 years N=13 (13.3%)	21+ years N=41 (41.8%)	F-value or Fisher, p-value	98 (100%)
Mean Tidal Volume (ml)	586.21	553.04	621.64	619.35	F=1.00, p=0.41	599.70
Flow Rate (l/min)	76.43	73.16	76.95	79.31	F=3.13, p=0.02	77.20
Pressure (cmH2O)	26.12	25.03	26.53	26.94	F=3.03, p=0.02	26.35
Inspiratory Time (sec)	0.71	0.75	0.81	0.75	F=0.77, p=0.55	0.75
Rise Time (sec)	0.47	0.52	0.54	0.47	F=0.53, p=0.71	0.49
Sex						
Male	2 (6.9%)	8 (53.3%)	3 (23.1%)	18 (43.9%)	P=0.21	31 (31.6%)
Female	27 (93.1%)	7 (46.7%)	10 (76.9%)	23 (56.1%)		67 (68.4%)
Frequency of BVM use						
0-5	14 (48.3%)	8 (53.3%)	9 (69.2%)	27 (65.9%)	P<0.001	58 (59.2%)
5-10	4 (13.8%)	2 (13.3%)	1 (7.7%)	2 (4.9%)		9 (9.2%)
10+	11 (37.9%)	5 (33.3%)	3 (9.7%)	12 (29.3%)		31 (31.6%)

Manual bag valve mask ventilation performance among respiratory therapists

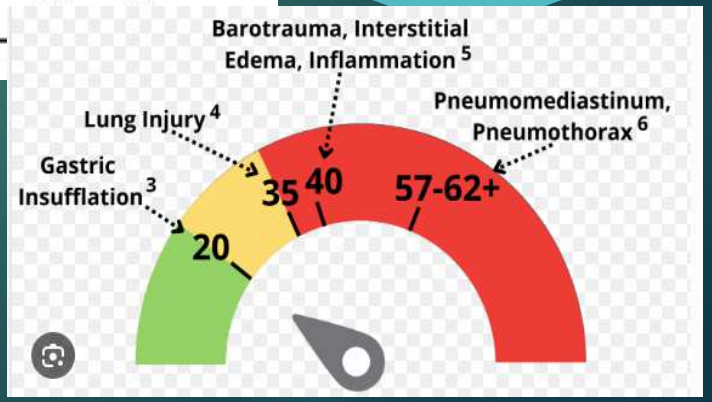
Rachel E. Culbreth*, Douglas S. Gardenhire

Department of Respiratory Therapy, Byrdine F. Lewis College of Nursing and Health Professions, Georgia State University, Atlanta, GA, USA

Summary of manual ventilation performance among the most experienced and most confident respiratory therapists (n=98)

	No. of providers (n)	Volume (ml)	No. of providers who delivered >600 ml	Pressure (cmH2O)	No. of providers who delivered >20 cmH2O	Flow (l/min)	Inspiratory time (sec)	Inspiratory Rise time (sec)
All	98	599.70	41 (41.8%)	26.35	69 (70.4%)	77.20	0.75	0.49
Experience >10 Years	54 (55.1%)	619.90	27 (50.0%)	26.84	35 (64.8%)	78.74	0.76	0.48
Self-Rated Confidence 5/5	49 (50.0%)	616.22	24 (49.0%)	29.80	39 (79.6%)	84.01	0.71	0.47
Experience >10 years and Self-Rated Confidence 5/5	28 (28.6%)	631.43	15 (53.6%)	30.55	20 (71.4%)	86.10	0.71	0.46

15-20cmH20 is considered unsafe and leads to gastric insufflation



Making it safe

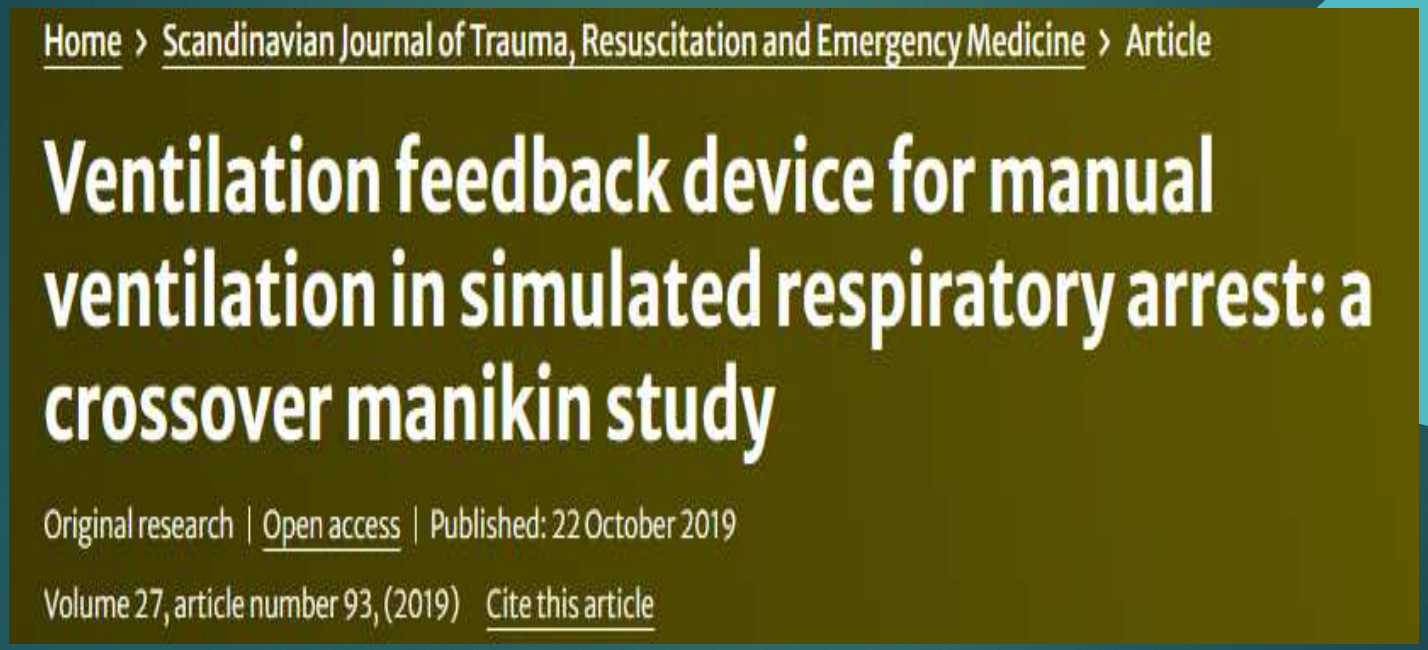
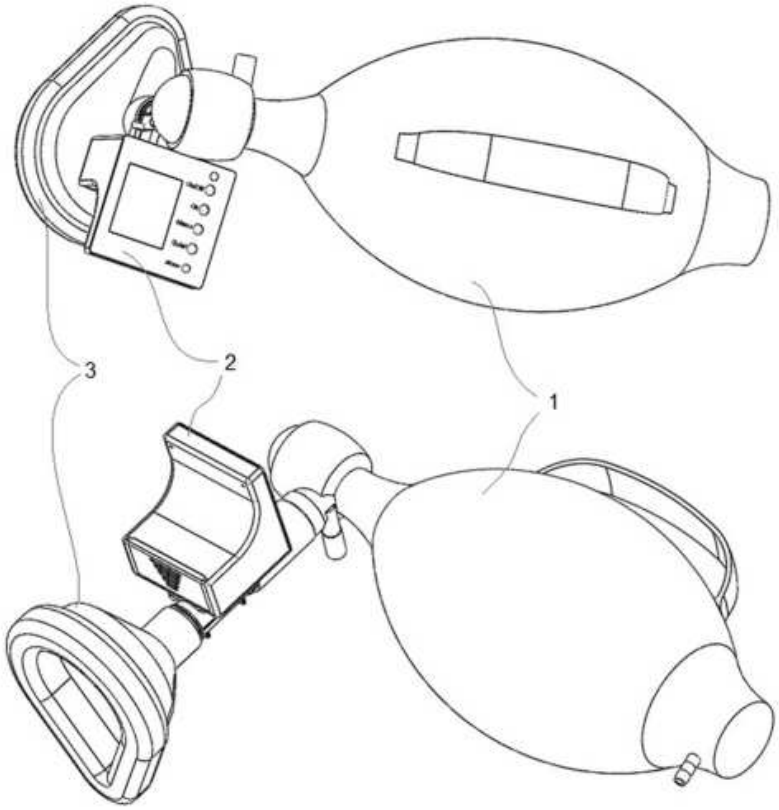


Fig. 1



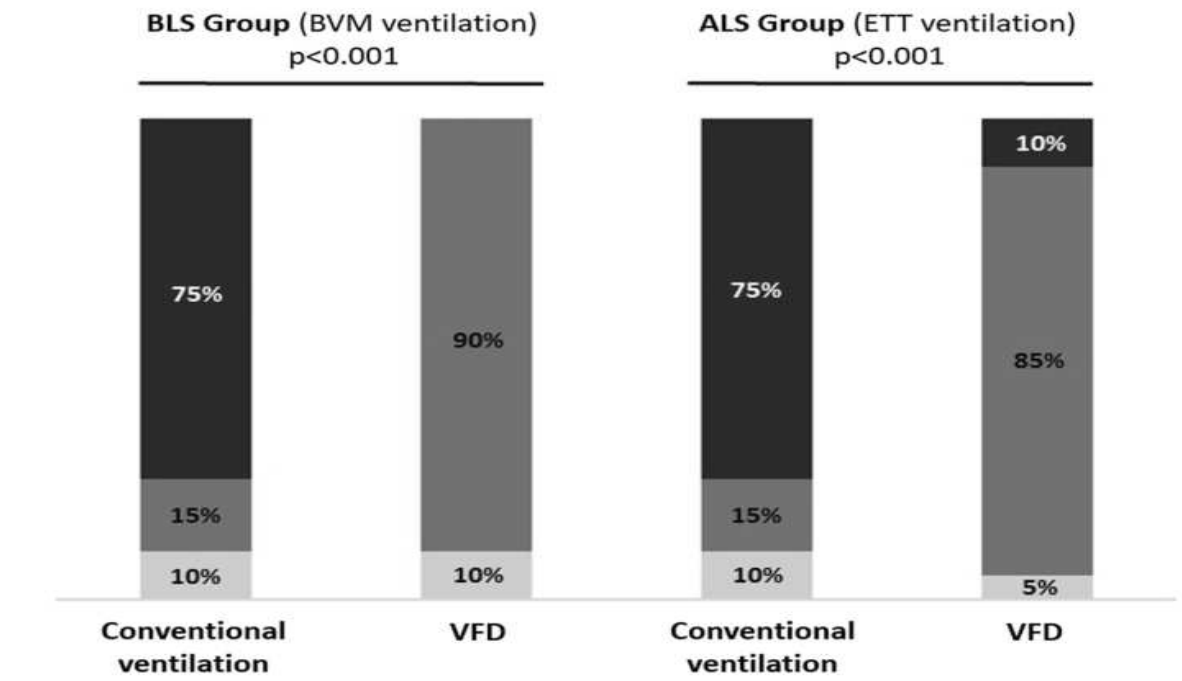
1. Manual Resuscitator
2. Ventilation Feedback Device
3. Ventilation Mask

VFD plugged between a self-inflating bag (i.e. manual resuscitator) and a mask

Ventilation Feedback Device Study

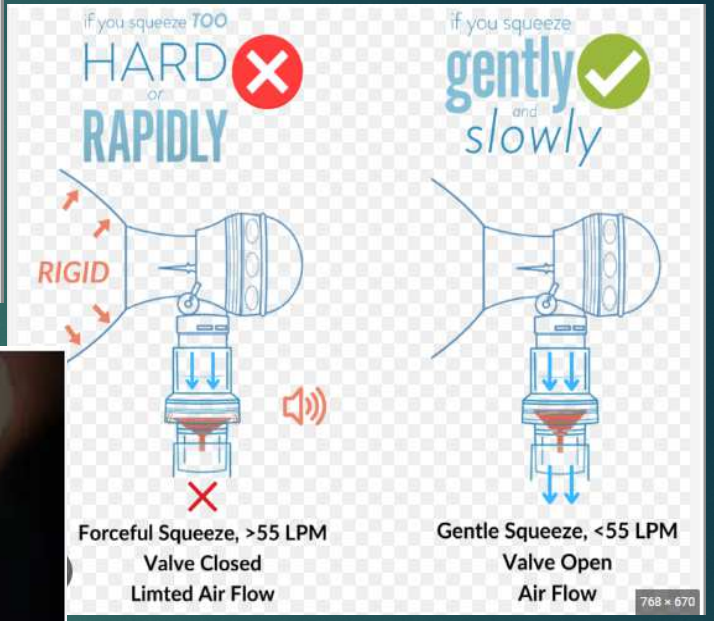
Khoury, A., De Luca, A., Sall, F.S. *et al.* Ventilation feedback device for manual ventilation in simulated respiratory arrest: a crossover manikin study. *Scand J Trauma Resusc Emerg Med* **27**, 93 (2019). https://doi.org/10.1186/s13049-019-0674-7

Fig. 4



Comparison of the proportion of hypoventilation (■), adequate ventilation (■) and hyperventilation (■)between conventional manual ventilation and guided ventilation with VFD in the BLS and ALS groups (n = 40 participant

Safety First



https://archeon-medical.com/en/archeon-en

Lets not forget 02

Recommendations for Adjuncts to CPR		
COR	**LOE**	**Recommendations**
2b	C-LD	1. If an experienced sonographer is present and use of ultrasound does not interfere with the standard cardiac arrest treatment protocol, then ultrasound may be considered as an adjunct to standard patient evaluation, although its usefulness has not been well established.
2b	C-LD	2. When supplemental oxygen is available, it may be reasonable to use the maximal feasible inspired oxygen concentration during CPR.
2b	C-LD	3. An abrupt increase in end-tidal CO_2 may be used to detect ROSC during compressions or when a rhythm check reveals an organized rhythm.
2b	C-EO	4. Routine measurement of arterial blood gases during CPR has uncertain value.
2b	C-EO	5. Arterial pressure monitoring by arterial line may be used to detect ROSC during chest compressions or when a rhythm check reveals an organized rhythm.

AHA recommendations

Early Post resuscitation

Recommendations for Considerations in the Early Postresuscitation Period

COR	LOE	Recommendations
1	B-NR	1. A comprehensive, structured, multidisciplinary system of care should be implemented in a consistent manner for the treatment of post–cardiac arrest patients.
1	B-NR	2. A 12-lead ECG should be obtained as soon as feasible after ROSC to determine whether acute ST-segment elevation is present.
2a	C-EO	3. To avoid hypoxia in adults with ROSC in the immediate postarrest period, it is reasonable to use the highest available oxygen concentration until the arterial oxyhemoglobin saturation or the partial pressure of arterial oxygen can be measured reliably.

02 and ventilation post ROSC

Recommendations for Oxygenation and Ventilation After ROSC

COR	LOE	Recommendations
1	B-NR	1. We recommend avoiding hypoxemia in all patients who remain comatose after ROSC.
2b	B-R	2. Once reliable measurement of peripheral blood oxygen saturation is available, avoiding hyperoxemia by titrating the fraction of inspired oxygen to target an oxygen saturation of 92% to 98% may be reasonable in patients who remain comatose after ROSC.
2b	B-R	3. Maintaining the arterial partial pressure of carbon dioxide ($Paco_2$) within a normal physiological range (generally 35–45 mm Hg) may be reasonable in patients who remain comatose after ROSC.

> Resuscitation. 2021 Apr:161:115-151. doi: 10.1016/j.resuscitation.2021.02.010. Epub 2021 Mar 24.

European Resuscitation Council Guidelines 2021: Adult advanced life support

Jasmeet Soar [1], Bernd W Böttiger [2], Pierre Carli [3], Keith Couper [4], Charles D Deakin [5],

Oxygen during CPR

During cardiac arrest the blood flow and oxygen reaching the brain is low even with effective CPR. Based on the physiological rationale and expert opinion, ILCOR recommends giving the highest feasible inspired oxygen concentration during cardiac arrest to maximise oxygen delivery to the brain thereby minimising hypoxic-ischaemic injury.[1] Immediately after ROSC, as soon as arterial blood oxygen saturation can be monitored reliably (by pulse oximetry or arterial blood gas analysis), titrate the inspired oxygen concentration to maintain the arterial blood oxygen saturation between 94–98% or arterial partial pressure of oxygen (PaO_2) of 10 –13 kPa or 75–100 mmHg. (See Post Resuscitation Care).[246]

Resuscitation
Volume 152, July 2020, Pages 107-115

Review

Oxygenation and ventilation targets after cardiac arrest: A systematic review and meta-analysis

Mathias J. Holmberg [a b], Tonia Nicholson [c], Jerry P. Nolan [d e], Steve Schexnayder [f], Joshua Reynolds [g], Kevin Nation [h], Michelle Welsford [i], Peter Morley [j], Jasmeet Soar [k], Katherine M. Berg [a c],

on behalf of the Adult Pediatric Advanced Life Support Task Forces at the International Liaison Committee on Resuscitation (ILCOR)

Show more

Oxygenation and ventilation targets after cardiac arrest: A systematic review and meta-analysis

- To perform a systematic review and meta-analysis of the literature on oxygenation and ventilation targets after successful resuscitation from cardiac arrest in order to inform an update of international guidelines.
- Conclusions
- We identified a large number of studies related to oxygenation and ventilation targets in cardiac arrest. The majority of studies did not reach statistical significance and were limited by excessive risk of bias. Point estimates of individual studies generally favored normoxemia and normocapnia.

Ten rules for optimizing ventilatory settings and targets in post-cardiac arrest patients. Denise Battaglini, Paolo Pelosi & Chiara Robba Critical Care Volume 26, article number 390, (2022)

Rule Seven: Oxygenation should be accurately targeted to normoxia

Hypoxemia and hyperoxemia may be injurious to the patient

Hypoxemia -

In post arrest patients alters cerebral aerobic metabolism that may lead to neuronal injury and cell death – Threshold not well-defined – usually 60mmHg (may be incorrect)

Hyperoxemia –

May increased production of reactive oxygen species in the mitochondria and oxidative damage to brain cells

Pa02 values of >300mmHg are associated with poor neurologic outcome and mortality in post-arrest patients

May depend on duration of hyperoxemia

Ten Rules

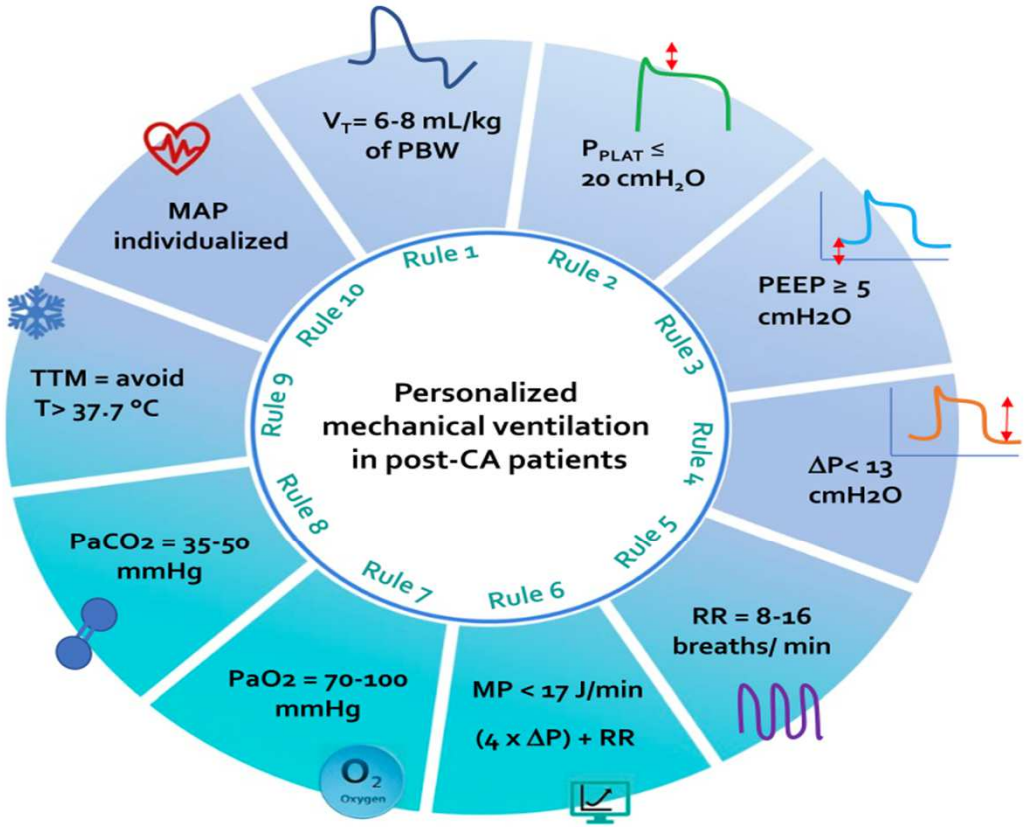


Fig. 4 Ten key rules for optimizing ventilator setting in post-CA patients according to an organ protective mechanical ventilation strategy. V_T = tidal volume, PBW = predicted body weight, PEEP = positive end-expiratory pressure, RR = respiratory rate, ΔP = driving pressure, MP = mechanical power, PaO_2 = arterial partial pressure of oxygen, $PaCO_2$ = arterial partial pressure of carbon dioxide, TTM = target temperature management, MAP = mean

What is the mechanical power during mechanical ventilation?

$$\frac{5.8 \times (23 + 5 + 43/6)}{20} = 10.2 \text{ J/min}$$

Data currently suggests that a MP of 17.0 J/min is associated with higher risk of death

August 2022

The Journal of Emergency Medicine
Volume 63, Issue 2, August 2022, Pages 221-231

Selected Topics: Critical Care

Hyperoxemia is Associated With Poor Neurological Outcomes in Patients With Out-of-Hospital Cardiac Arrest Rescued by Extracorporeal Cardiopulmonary Resuscitation: Insight From the Nationwide Multicenter Observational JAAM-OHCA (Japan Association for Acute Medicine) Registry

Masaaki Nishihara [a b], Ken-ichi Hiasa [a], Nobuyuki Enzan [a], Kenzo Ichimura [c], Takeshi Iyonaga [a b], Yuji Shono [b], Masahiro Kashiura [d], Takashi Moriya [d], Takanari Kitazono [b], Hiroyuki Tsutsui [a]

Objective

The aim of this study was to test the hypothesis that hyperoxemia is associated with poor neurological outcomes in patients treated by ECPR.

Results

Of 34,754 patients with OHCA, 453 patients were included. The neurological outcome was significantly lower in the high-PaO_2 group than in the low-PaO_2 group (15.9 vs. 33.5%; $p < 0.001$). After adjusting for potential confounders, high PaO_2 was negatively associated with favorable neurological outcomes (adjusted odds ratio [aOR] 0.48; 95% confidence interval [CI] 0.24–0.97; $p = 0.040$). In a multivariate analysis with multiple imputation, high PaO_2 was also negatively associated with favorable neurological outcomes (aOR 0.63; 95% CI 0.49–0.81; $p < 0.001$).

Conclusions

Hyperoxemia was associated with worse neurological outcomes in OHCA patients with ECPR.

In conclusion:

- In review of all studies – there is consideration and concern for inadequate ventilation as well as oxygenation which is associated with poor outcomes and an increase in mortality
- New technology allows for monitoring volumes and and pressure along with limiting excessive flow and pressure, are they being used? Determined to be worth the cost? Accessible to all?
- Even once a patient is on a ventilator are suggested recommendations being followed? Who is making changes, and why?
- There are many questions to be answered and much, much more research is needed to examine any and all of these issues.

Be the change!