

The VORTRAN Automatic Resuscitator - VAR-Plus™ is ideal with changing compliance

The VORTRAN Automatic Resuscitator (VAR) is not a time-cycled ventilator and will respond automatically to changes in compliance, as seen in Acute Respiratory Distress Syndrome (ARDS). The VAR self-adjusts by increasing respiratory rate (RR) and decreasing tidal volume (TV) and delivers a stable minute ventilation (MV) when compliance decreases from a healthy 0.07 to a stiff 0.02 L/cm H₂O (Figure 1 & Figure 2). This is recommended by the ARDS Network’s publication, funded by the National Heart and Lung Institute, which showed a 22% lower mortality with low TV ventilation strategy in patients with ALI or ARDS.^[1] The VAR automatically delivers a lower TV and a higher respiratory rate (RR) and is ideal for ARDS patients with decreasing compliance.

INTRODUCTION

VAR-Plus (Model PCM) manufactured by VORTRAN Medical Technology 1 is the latest breakthrough in the family of disposable automatic resuscitators. It meets and exceeds ASTM guidelines for automatic resuscitators (F 920 – 93) for patients with a body mass of 10 kg and above.^[2] The unique feature of the VAR family of products is its ability to respond to changing compliance at any selected pressure setting. Because the VAR cycles at a settable PIP with intrinsic PEEP, the constant ΔP (Delta-P is the difference between PIP and PEEP) produces a reduced TV at a higher RR as compliance decreases.

METHODS

The Test and Training Lung (TTL, Model 3600i, by Michigan Instruments, Inc.) with PneuView Software was used in the bench top evaluation of VAR-Plus (Model PCM-5011). An in-line PEEP valve (Model BE 142, by Instrumentation Industries, Inc.) was used to elevate the PEEP from the baseline. The VAR-Plus was initially set to deliver approximately 800 mL TV for a patient with a compliance of 0.07 L/cm-H₂O by adjusting the PIP, intrinsic PEEP and inspiratory flow to achieve a respiratory rate of 10 BPM and I/E ratio of 1:2. After establishing the initial setting, the compliance setting on the TTL was steadily

Table 1 – Results of VAR-Plus with and without in-line PEEP Valve at Set PIP

COMPLIANCE (L/cm-H ₂ O)	PIP			PIP			PIP		
	PEEP			PEEP			PEEP		
	ΔP			ΔP			ΔP		
	BPM	TV	MV	BPM	TV	MV	BPM	TV	MV
0.07	11.5	815	9.4	8.0	855	6.8	10.2	794	8.1
0.06	13.4	671	9.0	9.1	722	6.6	12.1	675	8.2
0.05	16.4	532	8.7	11.4	590	6.7	14.1	564	8.0
0.04	20.7	402	8.4	14.2	451	6.4	17.1	445	7.6
0.03	27.9	285	7.9	18.6	316	5.9	22.0	318	7.0
0.02	41.9	178	7.5	28.1	197	5.6	31.7	204	6.4

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decreased by 0.01 and the VAR-Plus was left untouched. Changes in TV, RR and the resulting MV were recorded, at each compliance setting, for a PEEP of 5, 10 and 15 cm-H₂O.

DISCUSSIONS

The VAR automatically delivered a reduced tidal volume (TV) at a faster respiratory rate (as shown in Figures 1 and 2) from a healthy 0.07 to a stiff 0.02 L/cm H₂O setting, maintaining the low TV ventilation protocol as recommended by the ARDS Network. Without making any adjustments on the VAR-Plus, it will deliver a stable minute ventilation (MV = TV X RR) as shown in Figure 3.

CONCLUSIONS

The ARDS Network study found a 22% lower mortality in acute lung injury and ARDS patients who were ventilated with lower tidal volumes than in those ventilated with traditional tidal volumes ventilation.^[1] The VAR-Plus automatically delivers a lower TV at a higher rate and is ideal for ARDS patients with decreasing compliance.

REFERENCES

- [1] Kallet, Richard H MS RRT: Implementation of a Low Tidal Volume Ventilation Protocol for Patients with Acute Lung Injury or Acute Respiratory Distress Syndrome. Respir Care 2001;46(10):1024-1037.
- [2] Designation: F 920 - 93 (Reapproved 1999) An American National Standard. Standard Specification for Minimum Performance and Safety Requirements for Resuscitators Intended for Use With Humans.

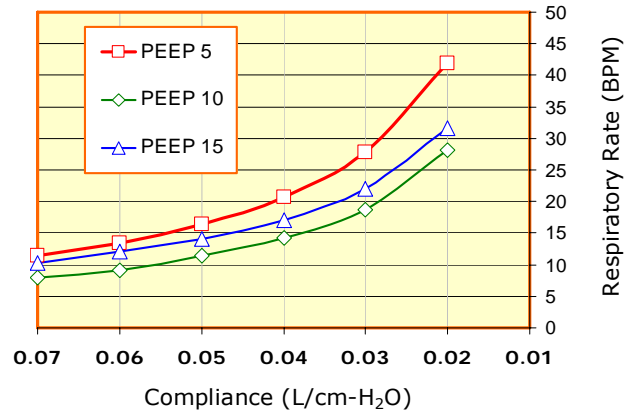


Figure 1
Rate Automatically Changes with Changing Compliance

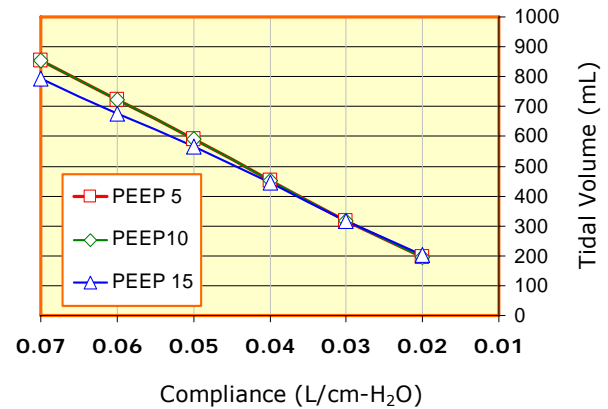


Figure 2
TV Automatically Changes with Changing Compliance

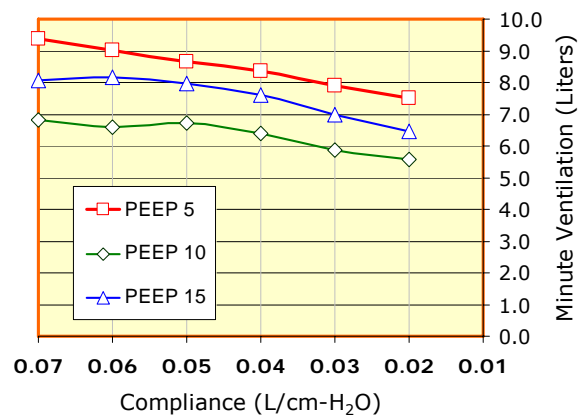


Figure 3
Delivered Minute Ventilation (MV) with Changing Compliance