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Review Article

Adaptive Support Ventilation (ASV) Mode, a Review of Its Clinical Implementation

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Abstract

Mechanical ventilation is a corner stone in critical care. There are many modes of mechanical ventilation which are currently available. Understanding their concept, initial settings, management, and weaning is vitally important before initiating on a critical care patient. There are many newer mode of ventilation and the clinicians might be susceptible of their value to critical care patient's survival and wellbeing. And due to the unavailability of well robust research supporting their value; their use is not maximize. It could be argued that the development if Evidenced Based guidelines over such a specific aspect of critical care will take significant time which should not delay the use of the sophisticated modes of mechanical ventilation such as ASV. On the other hand, the concrete understanding of these mode operation and limitation is vital in order to maintain a safe practice. This article not only will aim to review ASV mode and its management but also will provide clinicians with a summary of its clinical implications and limitations.

Keywords: ASV; Mechanical ventilation; Dual modes

Introduction

ASV is a dual control breath to breath mode of ventilation, which uses the most sophisticated close loop techniques [1]. This mode is design to allow patient triggered breaths and at the same time it could provide a time triggered breaths, when the patient is unable to breath. This mode is always pressure limited and it could be time cycled when it is a mandatory breath or flow cycled when it is a spontaneous breath. ASV could provide full, assisted or spontaneous types of breath and alternate support according to the patient condition.

Aims of the Mode

This mode of ventilation was proven to be safe for weaning patients and facilitate faster liberation form mechanical ventilation. It is also was identified that it facilitate chronic weaning with positive outcomes [2]. And in a stable post critical surgical procedures [3].

Initial Settings

This mode of ventilation only require to sit the patients' Ideal Body Weight (IBW) for the ventilator to calculate and determine the needed volume also the clinician chose the patients gender, PEEP, high pressure alarm which is set10 cm H_2o above the limit and finally, the clinician set the minute ventilation % (MV%) according to the recommended support needed depending on the lung pathology as shown in (Table 1).

Mode Management

There are many published method of ASV mode management by means of reducing the MV%. However, there is no enough evidence to support the implementation of one against the other. Studies recommend weaning the MV% once the patients' condition is improving [4], while others found no difference in patients' outcomes once compared between weaning it or not [5].

Table 1: Recommended MV% sittings according to the manufacturer recommendations.

Lung abnormality	Recommended MV%
Normal	100%
Asthma	90%
ARDS	120%
Others	110%
Temp > 38.5	Extra 20%
500 m above sea level	Extra 5%

Clinicians have no control over the other sittings it is automatically adjusted by the mode algorithm and the close loop feedback. Hence, the mode will change the sittings depending on the patient's lung mechanics i.e. the airways resistant and the lung compliance.

When it is not Recommended?

- Obese patient post major thoracic surgery where they are prone to derecruitment due to their restrictive lung disease, due to the reduction in their Functional Residual Capacity (FRC). One study shows that the tidal volume will be lowered in patients with restrictive lung diseases who are on ASV mode [6]
- Patient with increase respiratory drive due to sepsis, burn and fever, since the ventilator would provide less support and miss interpret their efforts as readiness to wean due to the improved lung compliance.
- It could provide more than acceptable volume for
    1. Chronic Obstructive Pulmonary Disease (COPD) patients due to unsafe higher tidal volume ranges. In contrast, one powered single centre

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randomized control trial indicated that despite the high volume delivered [6], it did facilitate faster weaning when compared with PSV [7] However, it could be argued that COPD patients are usually difficult to wean and should be carefully managed to prevent any iatrogenic harms such as air leaks which might occur as a result due to their highly compliant lung.

2. Acute Respiratory Distress Syndrome (ARDS) and Acute Lung Injury (ALI) hence, one research indicated that ASV could provide more than 10ml/kg in such case [8] which does not follow lung protective strategies currently recommended for such lung abnormality [9].

When Extubation is Recommended?

1. When the targeted ABG values is reached which includes acceptable oxygenation PaO_2>60 on FiO_2<40
2. Hemodynamically stable
3. Low inspiratory pressure (under 8cmH_2o) to deliver acceptable volumes.
4. The patient is clinically stable with adequate respiratory effort and equal bilateral air entry
5. The patient is weaned from sedation, oriented with adequate level of consciousness

Comparison with Other Weaning Modes

A literature search on comparative studies between ASV and other weaning modes were conducted, for the aim of identifying the advantages of ASV over any of them if any. In one study compared between ASV and Synchronised Intermittent Mandatory Ventilation (SIMV) followed by Pressure Support (PS) following a three phases protocol ASV group were extubated faster than SIMV followed by PS group [10]. however, there was major concerns within their weaning protocol which could delay the weaning process for the SIMV group such as waiting for the patient to trigger 6 spontaneous breaths in addition to the set 12 mandatory breaths which might not considered as a proper approach. Hence, most of the stable post-operative patients would not need to breathe more than 12 Breathes Per Minute (BPM).

Almost the same team conducted same study [11]. However, the major concern within the weaning protocol was edited; by depending on the normalization of the $PaCO_2$ value instead of taking extra 6 spontaneous breaths, which might be considered as a more reliable indicator for the patients allocated to the SIMV group to be eligible for the next phase of weaning. And although this time the ASV mode showed no superiority over SIMV followed by PS in the length of tracheal intubation, ICU stay, and amounts of postoperative sedation, the advantages of less clinician intervention needed might considered as an advantage for the ASV mode. Furthermore, it would be interesting to investigate the differences between ASV mode and SIMV+PS mode, since most of the current ventilators provide SIMV + PS as a single mode. Hence, it could be argued that this mode would provide more support to the patient's spontaneous effort which might facilitate faster weaning.

ASV and Pressure Control (PC) modes were compared followed by PSV in weaning [5]. And although, their protocol for the PC group stated that once there was detected spontaneous breaths it was their indicator to switch the patients to PSV, the mandatory breaths on PC was set at 12-15 BPM which might be satisfactory for stable post-operative patients. However, there was no difference between both groups in time till extubation. Interestingly, they stated that ASV delivered significantly higher tidal volumes, which might be beneficial for post open heart surgery patients who are prone to derecrutment, but it might be against the current recommendation about protective lung strategies using less volume.

Conclusion

There is not enough evidence to proof ASV superiority over other weaning modes of ventilation. And although the mode minimizes clinician's intervention which might minimize errors and prevent delay in weaning, their intervention might be needed when the ventilator provides more/less support needed when it is used as an initial mode of ventilation. Additionally, every published study about ASV had used the mode with different protocol. Thus, future studies comparing between various published protocols might be needed.

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