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Original Article

Is Adaptive Support Ventilation Superior Over Assist/Control Mode Ventilation in Critically Ill Patients?

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ABSTRACT

Background: ASV is an adaptive mode of ventilation where a target ventilator pattern is automatically chosen. This study was undertaken to compare the clinical parameters between ASV and ACMV mode of ventilation.
Material and Methods: A prospective study was undertaken in 60 critically ill patients who were randomly divided in to two equal groups i.e., ASV and ACMV modes of mechanical ventilation. Group A patients were ventilated by using ASV mode of ventilation and 30 patients of Group B were ventilated by using ACMV mode of ventilation. The patients particulars including number of days of ventilation, number of days of in ICU and number deaths were entered. APACHE and SOFA scores were calculated and compared.
Results: About 40.0% of the cases in ACMV group and 33.3% in ASV group were aged more than 60 years. Males were higher in ACMV group and females in ASV group. Mean number of days of ventilation in ACMV group was 6.8 days in ASV group was 5.53 days. Mean number of days of stay in ICU was 9.53 days in ACMV group and 8.53 days in ASV group which was statistically significant. About 10.0% of the cases in ACMV group and 6.7% of the cases in ASV group died during follow up. Mean APACHE score was 22.13 in ACMV group and 18.0 in ASV group and it was statistically significant between the two groups. SOFA score was 5.8 ACMV group and 4.57 in ASV group which was statistically significant.
Conclusion: This study concludes that, ASV mode of ventilation is superior to ACMV mode in reduction of ICU stay, duration of ventilation, low APACHE & SOFA scores.

Key Words: *Mechanical ventilation, Intensive care Unit, Adaptive Support ventilation, Conventional ventilation*

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INTRODUCTION

In intensive care units, mechanical ventilatory support is frequently employed. The basic goal of the majority of ventilatory support systems is to maintain adequate ventilation and oxygenation since doing so decreases effort of breathing (WOB) and increases patient comfort up until the condition that necessitated the use of this approach is reversed or treated. Numerous ventilatory modes have been created in an effort to achieve these goals, with the hope that they may lessen problems, save the time required for mechanical ventilation, and ultimately enhance clinical results [1].

The open-loop control and closed-loop control are the two fundamental types of ventilation. The closed-loop control entails a positive or negative feedback of the information on the patient's respiratory mechanics, based on measurements taken practically continuously, which can be updated or adjusted in a more physiological and individualised ventilatory support manner [2, 3].

A closed-loop ventilation mode called adaptive support ventilation (ASV) is intended to give intubated patients who are either actively breathing or passively ventilated a minimum minute ventilation that is user-set [3, 4& 5].

Based on user inputs (patient's predicted body weight (PBW), minimum minute volume, and pressure limit), and data from the ventilator monitoring system (respiratory system expiratory time constant and dynamic compliance), ASV automatically chooses a target ventilatory pattern [6]. The ventilator continuously adapts to match changes in respiratory mechanics by using automatic controls for level of inspiratory pressure above positive end-expiratory pressure (PEEP), frequency, and inspiratory time of ventilator-initiated breaths. The algorithm chooses ventilatory parameters in order to minimise total work of inspiration. The application of ASV for partial ventilatory support and weaning is the main focus of the available literature studying the effects of ASV in patients [7, 8& 9].

ASV combines different ventilatory modes, including Pressure Support Ventilation (PSV), Pressure Controlled Ventilation (PCV), Synchronised Intermittent Mandatory Ventilation (SIMV), and Pressure Controlled Ventilation (PIMV), if the patient's respiratory rate (RR) is higher than the target. Because of this, it is also known as the "no mode,""integrated mode," or "three in one way" by numerous authors [5].

Another name for the CMV mode is assist-control (AC) ventilation. The patient receives a predetermined number of guaranteed mechanical breaths per minute in the CMV mode. There are two ways to start these required breaths. By exerting sufficient inspiratory effort, the patient can start a breath (patient-triggered breaths), or the ventilator will automatically start breathing at regular intervals if the patient doesn't [10].

Controlled studies comparing ASV and conventional ventilation (CV) during total ventilatory support are limited to specific contexts: ventilation during percutaneous dilatational tracheotomy and postoperative ventilation after elective cardiac surgery. In comparison with CV, these studies found slower ventilatory pattern with larger tidal volume during ASV.

Controlled studies comparing ASV and conventional ventilation (CV) during total ventilatory support are only available in two situations: postoperative ventilation following elective heart surgery [10]and ventilation during percutaneous dilatational tracheotomy. These studies discovered a slower ventilatory rhythm and a greater tidal volume during ASV compared to CV [11].

MATERIAL AND METHODS

A prospective study was undertaken in 60 critically ill patients who were randomly divided in to two equal groups. i.e., ASV and ACMV modes of mechanical ventilation. The patients who were critically ill requiring mechanical ventilation were included. The patients who refused and discharged against medical advice were excluded from the study. A random sampling method was adopted to select the subjects.

Approval form institution ethics committee was obtained before the study was started. An informed bilingual consent was obtained before including the study subjects. Group A included 30 patients who had undergone ASV mode of ventilation and 30 patients in group B had undergone ACMV mode of ventilation. The patient particulars including number of days of ventilation, number of days stay in ICU and number deaths were collected in each group. APACHE and SOFA were score calculated and ABG monitoring was done regularly along with all other regular investigations.

The data thus obtained was collected in a predesigned proforma. The data was then compiled in a Microsoft excel sheet and transferred and analysed using Statistical Package for Social services (SPSS vs 20). Independent sample T test and chi square test were used as test of significance.

RESULTS

Table 1: Distribution of the study group according to age

Age group	ACMV ventilationn (%)	ASV ventilationn (%)
21 – 30 years	1 (3.3)	4 (13.3)
31 – 40 years	5 (16.7)	4 (13.3)
41 – 50 years	9 (30.0)	10 (33.3)
51 – 60 years	3 (10.0)	2 (6.7)
More than 60 years	12 (40.0)	10 (33.3)
Total	30 (100)	30 (100)

χ^2 value=2.346 df=4 p value, Sig=0.672, NS

About 40.0% of the cases in ACMV group and 33.3% with ASV group were aged more 60 years in this study. There was no statistically significant and hence age is comparable between the two groups.

Table 2: Distribution of the study groups according to sex

Sex	ACMV ventilationn (%)	ASV ventilationn (%)
Male	19 (63.3)	14 (46.7)
Female	11 (36.7)	16 (53.3)
Total	30 (100)	30 (100)

χ^2 value=1.684 df=1 p value, Sig=0.194, NS

Table 3: No of days of ventilation and Number of days of stay in ICU in study groups

Mean ± SD	ACMV ventilation	ASV ventilation	T value	P value, sig
Number of days of ventilation	6.8 ± 1.0	5.53 ± 1.33	4.17	0.000, Sig
Number of days of stay in ICU	9.53 ± 1.25	8.53 ± 1.17	3.201	0.002, Sig

Mean duration of ventilation in ACMV cases was 6.8 days while it was 5.53 days in ASV ventilation. Mean duration of stay in ICU was 9.53 days and ASV ventilation is 8.53 days which was statistically significant ($p<0.05$).

Table 4: Deaths in the study group

Death	ACMV ventilationn (%)	ASV ventilationn (%)
No	27 (90.0)	28 (93.3)
Yes	3 (10.0)	2 (6.7)
Total	30 (100)	30 (100)

χ^2 value=0.218 df=1 p value, Sig=0.64, NS

In ACMV ventilation group, the deaths were 10% while it was 6.7% in ASV mode of ventilation. However, this difference was not statistically significant.

Table 5: APACHE AND SOFA score in the study groups.

Mean ± SD	ACMV ventilation	ASV ventilation	T value	P value, sig
APACHE Score	22.13 ± 5.83	18.0 ± 5.09	2.925	0.005, Sig
SOFA score	5.8 ± 1.82	4.57 ± 1.3	3.009	0.004, Sig

Mean APACHE score in ACMV mode of ventilation was 22.13 and 18.0 in ASV mode of ventilation. This difference was statistically significant. The SOFA score in ASV mode of ventilation was 5.8 and 4.57 in ASV mode of ventilation which was also statistically significant.

DISCUSSION

This study was mainly undertaken to compare usefulness of ASV mode of ventilation with conventional ACMV mode of ventilation. This study had shown that, most of the cases in both the groups was more than 60 years. Number of males was higher in ACMV group and females were higher in ASV group of ventilation but this was not statically significant. A study by Kirakli et al, the mean age in ASV group of COPD patients was 64 years and PSV group was 65 years and males outnumbered females [13]. Another study by Fayed et al had noted that, ASV cases were aged 55 years and PSV cases 61 years and majority were males [14].In a study by Gruber et al, the mean age in ASV group was 68 years and PRVCa group was 62 years and males were more than females [15].A study by Alikiali et al had shown that, the mean age of patients in SIMV group was 47.8 years and 59.7 years in ASV group and males patients were higher than females [16].

Mean duration of ventilation was significant higher in ACMV ventilation in comparison with ASV mode of ventilation. Mean duration of stay in ICU was also higher in ACMV type of ventilation when compared with ASV mode of ventilation. In a study by Kirakli et al, COPD patients were ventilated for 48 hours in ASV group and 67 hours in PSV group [13].A study by Fayed et al had noted that, duration of mechanical ventilation was 60 hours in ASV and 120 hours in PSV group. The length of stay in ICU was 4 days in ASV group and 6 days in PSV ventilation [14].In a study by Gruber et al, the duration of mechanical ventilation was 165 minutes in ASV group and 480 minutes in PRVCa ventilation group [15].A study by Alikiali et al had shown that, the mean duration of SIMV ventilation was 6.45 days while ASV ventilation was 7.5 days which higher in contrary to this study results.

The death rate was slightly higher in ACMV mode of ventilation which was not statistically significant. Hence, ASV mode of ventilation may not significantly prevent death in patients on mechanical ventilation.

The APACHE (22.13 vs 18. $P<0.05$) and SOFA (5.8 vs 4.57, $p<0.05$) scores were significantly higher in ACMV mode of ventilation than ASV mode of ventilation. A study by Kirakli et al had shown that, the mean APACHE score in ASV cases was 16 and PSV group was also 16 [13]. A study by Fayed et al had reported that, the mean APACHE II score was 20.5 in ASV group and 23.5 in PSV group [14]. Gruber et al reported Parsonnet score and EuroSCORE where EuroSCORE was higher in ASV group than PRVCa group [15]. Alikiali et al reported that, the mean APACHE score was 15.8 in SIMV group and 17.8 in ASV group [16].

CONCLUSION

This study had shown that, mean number of ventilation days and duration of stay in ICU was significantly lower in ASV group. Mean APACHE scores and SOFA scores were significantly higher in ASV group. Hence, ASV helps in reduction of ICU stay, duration of ventilation, APACHE scores and SOFA scores.

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