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To evaluate pressure support ventilation as a weaning mode in operation theatre on patients undergoing elective surgeries under general anaesthesia

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Abstract

Background: Pressure support ventilation is pressure limited Ventilatory mode in,which each breath is patient triggered and supported.[1] PSV has been used for long time in critical care but has only recently been introduced to General Anaesthetic practice[2] .

Aim

Primary Objectives

1. To compare the effects of pressure support ventilation and manually assisted spontaneous ventilation on patient hemodynamic parameters during extubation.
2. To compare the Endotracheal tube removal time and Emergence time following General anesthesia with controlled mechanical ventilation in the two groups respectively (pressure support ventilation group and manually assisted spontaneous ventilation group).

Secondary Objectives

1. To compare the postoperative pulmonary complications after extubation with pressure support ventilation and manually assisted spontaneous ventilation respectively.

Material And Method: After approval by institutional ethical committee and written informed consent 80 patients of ASA grade 1 and 2 posted for elective surgeries under General Anesthesia age ranging from 18-60 years were taken and were randomly divided in the two groups:

Group A: with the start of surgical closure and discontinuation of anesthetic agents; patients were shifted to PSV mode from Controlled mechanical ventilation mode and were extubated using PSV MODE.

Group B: with the start of surgical closure and discontinuation of anesthetic agents; patients were shifted to spontaneous ventilation from controlled mechanical ventilation and were extubated using traditional manually assisted spontaneous ventilation.

Results : The ET tube removal time and Emergence time were significantly reduced in patients extubated using PSV mode (9.833±0.765 and 13.40±0.663) as compared to traditional manually assisted ventilation group (15.366±0.912 and 22.90±0.576) with reduced postoperative pulmonary complications ,better

hemodynamic stability and reduced incidence of ET tube bucking in the PSV group.

Conclusion: From our study we conclude that use of pressure support ventilation as a weaning mode in operation theatre reduces the endotracheal tube removal time and emergence time with better hemodynamic stability and reduced post operative pulmonary complications as compared to traditional manually assisted spontaneous ventilation.

Keywords: pressure support ventilation, General Anesthesia, manually assisted spontaneous ventilation.

Introduction

Pressure support ventilation [1][2] is a Spontaneous mode of Assisted mechanical ventilation where Preset Airway Pressure generated by ventilator assist each of the inspiratory efforts.

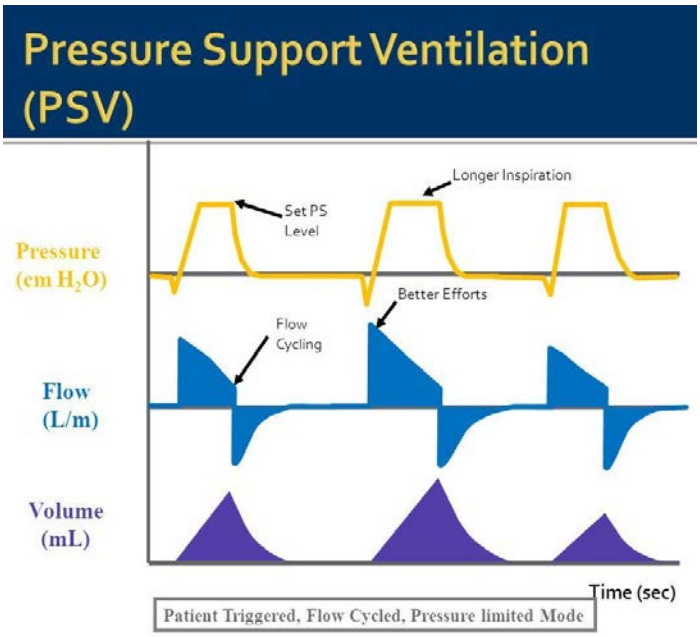
PSV in comparison to Spontaneous Ventilation has shown to Decrease the work of breathing, with better patient ventilator synchrony and Improved breathing comfort.

PSV has been successfully used for long time in critical care but has only recently been introduced to General Anesthesia practice[3][4]with more and more workstations incorporating PSV as inbuilt mode.

PSV is a patient triggered, pressure targeted and flow cycled mode of ventilation which can be added to unload the spontaneous breaths and reduce the patient work of breathing[5][6] through ventilator system, circuits and artificial airways which in turn helps to prevent excessive fatigue.

Use of pressure support is important when intermittent mandatory rate is low(<4 to 6 breaths/minute) [.The level of PSV ranges from 5-10cm H2O,the set pressure depends on assessment of tidal volume achieved and apparent work of breathing.

This study focuses on ET removal time and emergence time as well as hemodynamics and patient comfort while extubating patients using PSV as compared to traditional manually assisted spontaneous ventilation in patients undergoing elective surgeries under general anesthesia.



Aims and Objectives

Primary Objectives

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Secondary Objectives

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Material and Methods

The present study was conducted in department of Anesthesia; GMC Bhopal and associated Hamidia

Hospital in patients posted for elective surgeries under general anaesthesia.

After approval by institutional ethical committee and written informed consent;80 patients of ASA grade 1 and 2 posted for elective surgeries under general anesthesia ; age ranging from 18-60 years were taken.

Exclusion Criterion

- Major Surgeries.
- Anticipated difficult airway.
- History of serious pulmonary, coronary artery or cervical spine disease.
- Patients on b blocker, Antihypertensives ,Antidepressants and Anticonvulsants

Monitoring

- In the operation theatre, intravenous line, pulse oximeter , electrocardiograph and a non invasive blood pressure monitor was attached. Heart rate, Non invasive blood pressure, Peripheral oxygen saturation (SpO2) and Electrocardiogram(ECG) was noted with the start of surgical closure(baseline),at the time of extubation,1 and 5 minutes after extubation.

Premedication

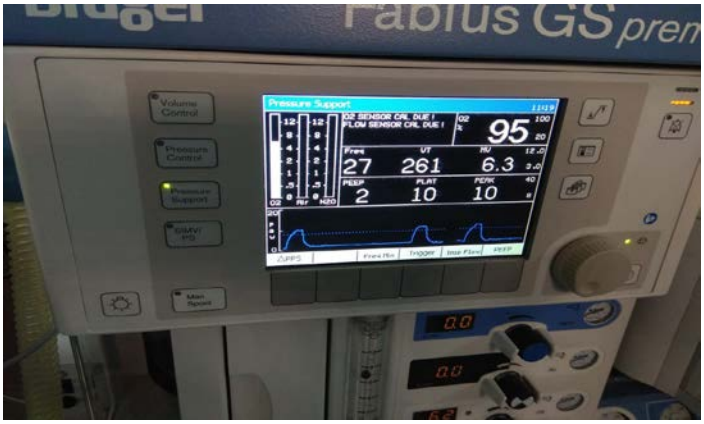
- Inj. Ondansetron 0.08mg/kg, Inj Glycopyrrolate 0.01mg/kg, Inj Midazolam 0.05 mg/kg, Inj fentanyl 2mcg /kg i.v.

Induction

- Injection Propofol 1-2mg/kg i.v. and injection Succinylcholine 1-2mg/kg i.v. for facilitation of induction and endotracheal intubation.

Maintenance

- 50%O2+50%N2O+0.2-1% Isoflurane + injection Atracurium for muscle relaxation with controlled mechanical ventilation.
- The randomisation of two groups was performed using sealed envelopes but the investigator was not blinded to the groups.
- In group A with the start of surgical closure and discontinuation of Anesthetic agents, patients were shifted to PSV mode from Controlled mechanical ventilation mode and extubated using PSV MODE.
- In group B with the start of surgical closure and discontinuation of Anesthetic agents, patients were shifted to manually assist spontaneous ventilation from controlled mechanical ventilation and extubated using manually assisted spontaneous ventilation.



Statistical Analysis

The data was compiled and subjected to stastical analysis. Results are tabulated and analyzed using spss software. Student t test is used for continuous variables and Chi square test for discrete variables is applied. Results are expressed as Mean±SD. P value<0.05 will be considered

significant and p value<0.01 will be considered highly significant.

Observation and Results

1. The demographic parameters of age, weight, sex, ASA physical status and total anesthesia duration were comparable in both the groups and showed no significant difference (p>0.05).

parameters	Group A (Mean± SD)	Group B (Mean± SD)	P value
AGE	34.10±12	36.07±10	0.44
SEX(male) (female)	45% 55%	38% 62%	0.56
WEIGHT	64.3±12.05	63.5±11.57	0.75
HEIGHT	162.6±9.2	164±8.7	0.65
BMI	23.79±2.5	24.28±2.7	0.47
ASA 1 ASA 2	75% 25%	71% 29%	0.62
Total Anesthesia duration	87.70±2.57	88.03±2.81	0.67

2. Endotracheal Tube Removal Time And Emergence Time

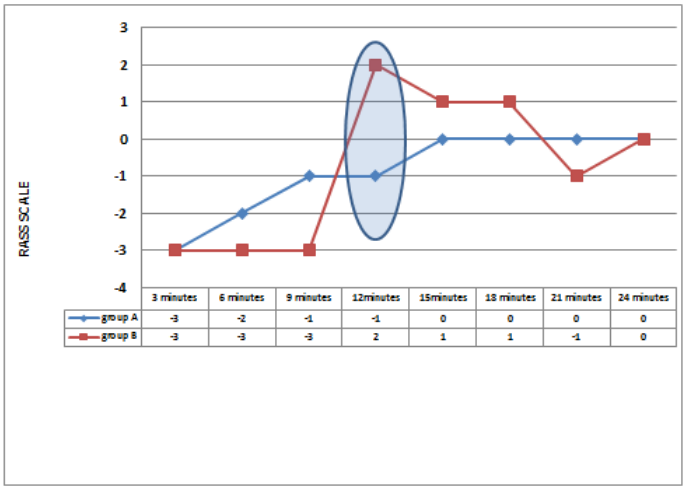
	Group A	Group B	P Value
Et Tube Removal Time(Minutes)	9.833±0.765	15.366±0.912	0.0001(Highly Significant)
Emergence Time(Minutes)	13.40±0.663	22.90±0.576	0.0001(Highly Significant)

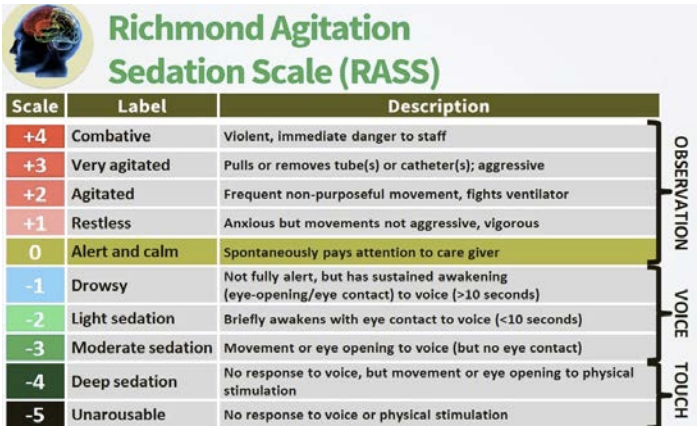
- **ET Tube removal time** is defined as the time from discontinuation of all anesthetic drugs to the patient is awake according to RASS scale(RASS -1 TO +1).
- **Emergence time** is defined by time from discontinuation of all anesthetic drug to obtain a 10 point score on a five question test :1) month of birth,2) date of surgery,3) day of week,4) address of patient ,5) Simple addition.

3. Comparison of RASS Scale Between Two Groups

We have also compared the RASS every 3 minutes from discontinuation of anesthetic agents. Initially the RASS was comparable in both the groups with value of -3 where patients were moderately sedated. At 6 minutes RASS was -2 in group A where patients were lightly sedated ,then at around 9 minutes patients were extubated with RASS OF -1 to +1 and emerges completely from anesthesia at around 15 minutes with RASS of 0 (alert and calm).

While in group B ;patients remained moderately sedated upto 9 minutes(RASS of -3) with phase of agitation at around 12 minutes(RASS of +2);extubated at around 18 minutes with RASS of +1 and emerges completely from anesthesia at around 24 minutes (RASS =0).

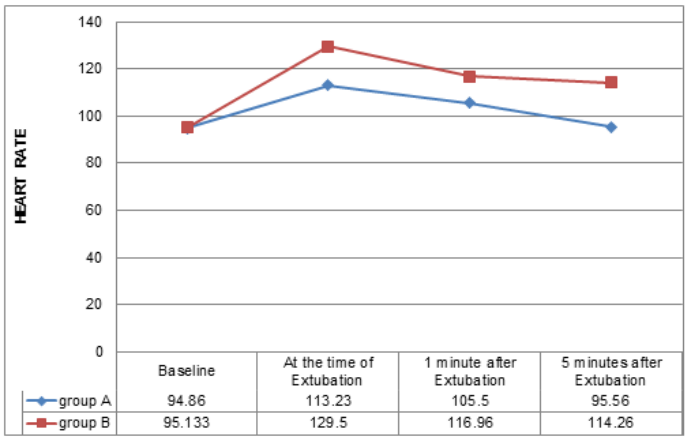




4. Comparison Of Heart Rate Between Two Groups

Time interval	Group A	Group B	P-value
Baseline heart Rate	94.86±3.87	95.133±3.70	0.78(Not Significant)
At the time of Extubation	113.23±2.23	129.50±4.73	0.0001(Highly Significant)
1 minute after Extubation	105.50±1.74	116.96±2.33	0.0001(Highly Significant)
5 minute after Extubation	95.56±3.190	114.26±2.48	0.0001(Highly Significant)

In both groups, heart rate increased at the time of extubation as compared to Baseline but the increase in heart rate was significantly more in manually assisted spontaneous ventilation group in comparison to PSV group.

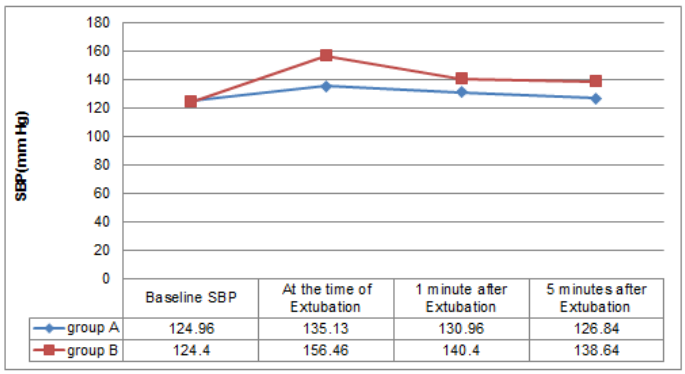


5. Comparison of Systolic Blood Pressure Between Two Groups

Time interval	Group A	Group B	P-value
Baseline SBP	124.96±2.136	124.40±2.154	0.68(Not Significant)
At the time of Extubation	135.13±2.568	156.46±4.379	0.0001(Highly Significant)
1 minute after Extubation	130.96±5.86	140.40±4.66	0.0001(Highly Significant)
5 minute after Extubation	126.84±4.82	138.64±5.64	0.0001(Highly Significant)

Significant difference in the mean systolic blood pressure was observed at the time of extubation and in post extubation period in the two groups.

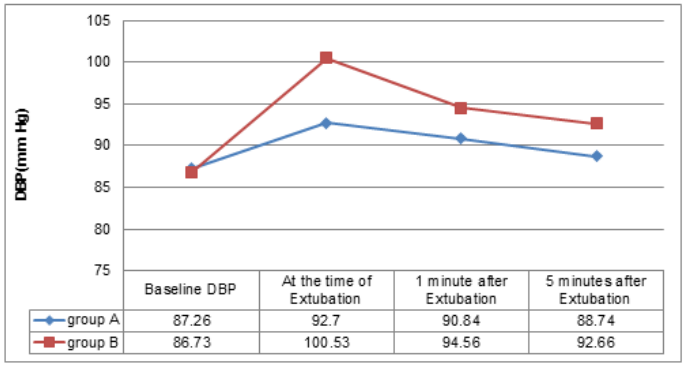
The PSV group showed lower systolic blood pressure upto 5 minutes post extubation and the difference was statistically highly significant.



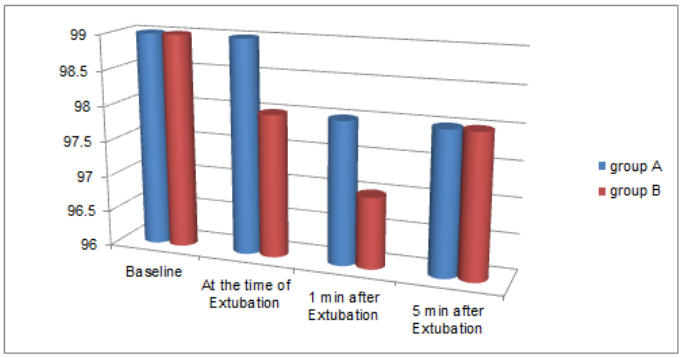
6. Comparison of Diastolic Blood Pressure Between Two Groups

Time interval	Group A	Group B	P-value
Baseline Diastolic blood pressure	87.26±2.515	86.73±3.14	0.76(Not Significant)
At the time of Extubation	92.70±5.19	100.53±3.46	0.0001(Highly Significant)
1 minute after Extubation	90.84±3.64	94.56±3.87	0.0001(Highly Significant)
5 minute after Extubation	88.74±4.56	92.66±4.48	0.0001(Highly Significant)

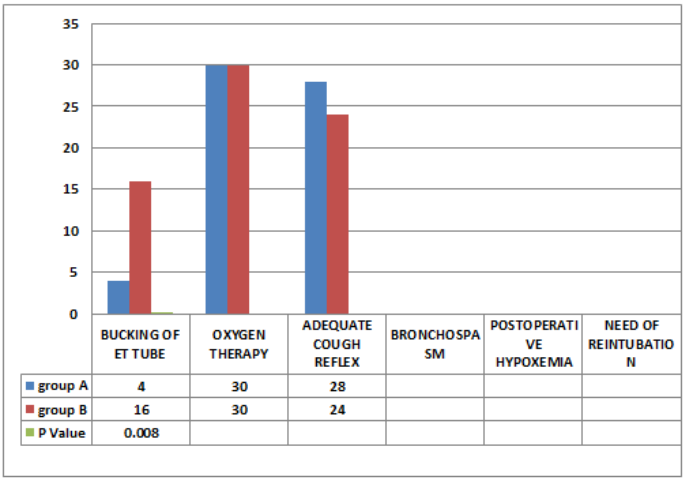
Similar to SBP, the Diastolic blood pressure also increases in both the groups at the time of extubation and in post extubation period but the increase in DBP was more in manually assisted spontaneous ventilation group as compared to PSV group and the difference was statistically highly significant.



7. Comparison of Spo2 Between Two Groups



8. Comparison of Respiratory Outcomes Between Two Groups



Discussion

Our study showed that the use of Pressure Support Ventilation as the weaning mode in operation theatre after General Anesthesia decreases the ET Tube removal time and Emergence time with better hemodynamic stability and reduced postoperative pulmonary complications.

Multiple Studies, including Cochrane reviews and Meta-analyses have supported the effectiveness of PSV for weaning in ICU but there is scarcity of studies to assess its utility in operating room and general anaesthesia.

Xavier Capdevila; Boris jung and jaber[3] et al tested a hypothesis that PSV allows reduction in emergence time and LMA removal time after General Anesthesia compared to volume controlled mechanical ventilation. In this study 36 consecutive ASA grade 1 and 2 patients

scheduled for knee arthroscopy under general anesthesia were included.Hemodynamics and ventilatory variables were recorded before and 10 minutes after General Anesthesia,induction,at surgical incision ,at the end of anesthetic drug infusion and when the patient was totally awake, LMA removal time and drug consumption were recorded and they found that LMA removal time was significantly higher in CMV group(18+6min) as compared to SB(8+4) and PSV group(13+6).

Brimacombe[7] et al reported that PSV provides more effective gas exchange than does unassisted ventilation with CPAP during anesthesia with LMA.

Shefali Patel D, Murthy V[8] et al conducted a Randomised weaning trial comparing assist control to pressure support ventilation to determine the work of breathing , respiratory muscle strength and patient-ventilator asynchrony while extubating patients by assist control ventilation (ACV) and pressure support ventilation (PSV) and concluded that the median duration of weaning was 34 (range 7–100) hours in the ACV group and 27 (range 10–169) hours in the PSV group (p=0.88).

Ruan SY ,Wu HD[9]et al: performed a prospective observational study in 80 consecutive adult patients with mechanical ventilation to identify the factors contributing to different responses of a patient to the two SBT methods. The 80 patients were given SBT with both a T-piece and pressure support ventilation of 6 cm H2O (PS-6) on the day of extubation. Stratified analysis was used to evaluate the effects of age.In this study they found that the geriatric patients, patients with poor lung compliance (≤40 ml/cmH2O) and chronic obstructive pulmonary disease had a higher heart rate (difference [95% CI]: 4 [0,8], 5 [2,9], 5 [0,10] beats/minute, respectively) and systolic blood pressure (10 [4,16], 11 [5,16], 7 [0,13] mmHg, respectively) after the T-tube trial. Through this research they concluded that poor lung compliance ,old age and impaired respiratory muscle strength is a contributing factor leading to difference in responses obtained by spontaneous breathing trials with a T-piece and low-level of pressure support ventilation.

Burns KEA, Sollman[10] et al:conducted a randomized trials comparing SBT techniques in intubated adults or children. Primary objectives were successful spontaneous breathing trial or need of reintubation. The research showed that patients who underwent pressure support (PS) compared with T-piece SBTs (nine trials, n=1901) were as likely to pass an initial SBT (risk ratio (RR) 1.00, 95% confidence interval (CI) 0.89-1.11; I^2=77%) and more likely to be ultimately extubated successfully (RR 1.06, 95% CI 1.02-1.10; 11 trials, n=1904; I^2=0%).

Guntzelchiappa AM[11] et al :Twenty-one patients who had received MV for≥48 h and who met the study inclusion criteria for weaning were assessed. Eligible patients were randomized to TT and PSV. Cardiovascular and respiratory responses (respiratory rate –f, tidal volume-V_T, mean blood pressure (MBP) and diastolic blood pressure (DBP), end tidal dioxide carbone ($P_{ET}CO_2$), peripheral oxygen saturation (SpO_2) and HRV indices in frequency domain (low-LF, high frequency (HF) and LF/HF ratio were evaluated and they found that TT increased f (20±5 vs 25±4 breaths/min, P<0.05), MBP (90±14 vs 94±18 mmHg, P<0.05), HR (90±17 vs 96±12 beats/min, P<0.05), $P_{ET}CO_2$ (33±8 vs 48±10 mmHg, P<0.05) and reduced SpO_2 (98±1.6 vs 96±1.6%, P<0.05). In addition, LF increased (47±18 vs 38±12 nu, P<0.05) and HF reduced (29±13 vs 32±16 nu, P<0.05), resulting in higher LF/HF ratio (1.62±2 vs 1.18±1, P<0.05) during TT. Conversely, V_T increased with PSV (0.58±0.16 vs 0.50±0.15 L, P<0.05) compared with TT.

In the present study ,our results of ET Tube removal time and Emergence time as well as hemodynamic parameters at the time of extubation are consistent with above studies. PSV has been widely used as assisted ventilatory support for better patient –ventilator synchrony as compared to manually assisted spontaneous ventilation.PSV facilitates the use of spontaneous ventilation during emergence by decreasing the work of breathing [12] and improved minute ventilation may lead to more rapid elimination of anesthetic vapours.On the other hand , Manually Assisted spontaneous breathing during the process of weaning increases work of breathing which is associated with patient agitation during extubation and potential for respiratory compromise leading to Bronchospasm and other pulmonary complications.

Thus the efficacy of PSV depends on breath by breath interaction between the patient demand for spontaneous flow and the ventilator flow. The smoothness of extubation using PSV depends on this better patient-ventilator synchrony and reduced work of breathing as compared to manually assisted spontaneous ventilation.

In comparison to traditional manually assisted spontaneous ventilation, PSV permitted to compensate the extra workload due to ventilator ,particularly because the decelerating flow form which helps to deliever a high peak flow even with relatively short inspiratory time [13][14]while in spontaneous ventilation ,patient peak flow demands may be higher than the peak flow delievered by squeezing the reservoir bag and that may create patient-ventilator asynchrony [15] and delayed emergence from anesthesia.

Conclusion

Thus through this study we can conclude that PSV provides better patient ventilator synchrony during extubation with preserved hemodynamic stability and improved patient outcomes as compared to Manually Assisted spontaneous ventilation.

References

1. Branson RD,CampbellRS:Pressure support ventilation.Patient ventilator synchrony and ventilator algorithms.Respir care 43:1045-1047,1998.
2. Brochard L, Harf A, Lorino H. Lemaire (1989) Inspiratory pressure support prevents diaphragmatic fatigue during weaning from mechanical ventilation. Am Rev Respir Dis 139:513–521.
3. Jaber S, Capdevila X (2007) Pressure-support Ventilation in the Operating Room. Anesthesiology107:671.
4. Capdevila X, Jung B, Bernard N, Dadure C, Biboulet P, Jaber S. Effects of pressure support ventilation mode on emergence time and intra-operative ventilatory function: a randomized controlled trial. PLoS One. 2014 Dec 23;9(12).
5. Tassaux D,StrasserS,FonsecaS,DalmsE,JolietP.Comparative study of triggering ,pressurization and cycling between ventilators .Intensive care medicine 28:1254-1261.
6. Christie JM,Smith RA. Pressure support ventilation decreases inspiratory work of breathing during general anesthesia and spontaneous ventilation.AnesthesiaAnalg 75:167-171.
7. keller C,Sparr HJ ,Luger TJ,Brimacombe J:Patients outcome with CPAP vs PSV in non paralysed adults with the laryngeal mask .Can J Anaesth 1998;45:564.
8. Shefali Patel D, Murthy V et al: Randomised weaning trial comparing assist control to

pressure support ventilation. Arch Dis Ed 2012 Nov 97(6);29-33.

9. Ruan SY ,Wu HD et al: Comparison of physiological responses to spontaneous breathing trials with a T tube and low level pressures support. Anaesth Intensive Care 2013 Jan 41(1):41-5.
10. Burns KEA, Sollman et al: Trials directly comparing alternative spontaneous breathing trial techniques. Crit Care 2017 June 1;21(1)
11. Guntzel chiappa AM et al: Spontaneous breathing trial in T tube negatively impact on autonomic modulation of heart rate compared with pressure support in critically ill patients. Clinical Respir J 2017 jul 11(4);489-495.
12. Cinnella G,ContiG,LofasoF,LorinoH,Harf A et al(1996)effects of assisted ventilation on the work of breathing:volume controlled versus pressure controlled ventilation .Am J Respircrit care medicine 153:1025-1033.
13. Jaber S,CoiselY,ChanquesG,FutierE,ConstantinJM,et al(2012).A multicentre observational study of intraoperative ventilatory management during General Anesthesia:Tidal volume and relation to body weight.Anesthesia 67:999-1008.
14. Zoremba M,KalmusG,DetteF,Kuhn C Wulf H(2010)Effect of intraoperative pressure support versus pressure controlled ventilation on oxygenation and lung function in moderately obese adults.Anesthesia 65:124-129.
15. Brochard L(2002) When ventilator and patient end of inspiration does not coincide:Am J Respir critical care medicine166:2-3.

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