International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182 Print ISSN: 2349-5979
www.allsubjectjournal.com
Volume 2; Issue 12; December 2015; Page No. 509-513

Awareness about ventilator graphics among physiotherapist in India-A multi centre survey

[1] Akanksha Sharma, [2] Subin Solomen, [3] Pravin Aaron

[1] Padmashree Institute of physiotherapy, Kommaghata campus, Kengeri, Bangalore, India.

[2] Prof COPMS, EMS Memorial Cooperative hospital and research centre, Perinthalmanna, Kerala.

[3] Prof Padmashree Institute of physiotherapy, Kommaghata campus, Kengeri, Bangalore, India.

Abstract
Background: Extensive literature is present about use of ventilator graphics by anaesthetist but the importance of these graphics while giving chest physiotherapy and no of physiotherapist incorporating these graphics in clinical practice was often lacking. Objective of the study was to find out awareness about ventilator graphics among physiotherapists in India in relation to identification of increased airway resistance, dynamic hyperinflation and to find out the association of level of qualification on knowledge of ventilator graphics for problem identification and correction.
Method: Exploratory cross sectional survey questionnaire was send via email to 500 hospitals in India. A period of six weeks for completion was given in an attempt to ensure good response rates. If response was not obtained within six weeks, two subsequent reminders were sent to the hospitals with a further time gap of six weeks.
Results: Of the 250 physiotherapist surveyed only 105 responded (response rate 36%). out of 105 questionnaire received only 15 physiotherapist were using ventilator graphics and when level of awareness of use of graphics among them is calculated it was found that good awareness is positively associated with MPT's compared to BPT's with (p=0.169) which was not statistically significant.
Conclusion: Although response rate was low 14% of physiotherapist uses ventilator graphics for problem identification and correction. Out of 105 respondents physiotherapist who were aware of use of graphics have competency indicator of 66%. Study concluded that there is significant lack of awareness about ventilator graphics among physiotherapist in India. Results underline the necessity of an educational program regarding ventilator graphics so that these graphics can be used as an assessment tool in objective examination of ventilated patient.

Keywords: Awareness, Chest Physiotherapy, Ventilator graphics, Competency indicator.

1. Introduction

Ventilator graphics are the display graphics and numerical data about ventilation. Today real-time bed side pulmonary graphics have become standard care in most ICU's, the information presented by graphics in real time is a continuous display, not only the snapshot of previous pulmonary function technology but also more similar to a "motion picture" of each individual breath [1].

Ventilator graphics are presented in one or two ways. The most common is to plot control variable (pressure, volume and flow) on vertical axis and time on horizontal axis this type of graphic is often called as scalar graph. The other type of graph plots one control variable against another (such as flow on vertical axis and volume on horizontal axis) this type of graphic display is often referred to as loop graph [2].

Clinicians can measure static and dynamic compliance, inspiratory and expiratory resistance and intrinsic positive end expiratory pressure (PEEP) by placing esophageal balloon. However, esophageal balloons are not routinely employed in clinical practice; [3-5] these ventilator waveforms that are routinely available are used [6].

These graphics are used in ICU to monitor functions of ventilator to set appropriate tidal volume, PEEP, flow rate, for problem identification and correction by adjusting sensitivity, auto PEEP and removal of secretions. Graphics can monitor response to bronchodilator therapy, to calculate compliance, resistance and work of breathing. Finally helping clinicians to make adjustments.

Studies have also shown that increased airway resistance seen in conditions like me conium aspiration syndrome, respiratory distress syndrome (RDS) and bronchopulmonary dysplasia can be detected by observing flow –volume loop [7] whereas pressure/volume curve offers unique opportunity of evaluating alveolar recruitment/derecruitment at bed side that makes a curve a valuable tool for ventilator management of acute lung injury [8].

A case report illustrates that by using waveform display on pressure support ventilation asynchrony can be detected and by manipulating inspiratory rise time and breath termination criteria patient ventilator synchrony can be improved [9].

Ventilator graphics plays a key role in identifying dynamic hyperinflation in patient receiving mechanical ventilation [10].

An intensive care unit (ICU) is a specially staffed and equipped hospital ward dedicated to the management of patient with life threatening illness, injuries or complications [11]. Physiotherapists in ICU are part of multidisciplinary team involved in treatment of critically ill patient's. Physiotherapists lies closely with medical, nursing and other allied health professionals regarding patient's condition, progression and plans [12].

In ICU physiotherapist play role in positioning, postural drainage, vibration, manual lung inflation, coughing, tracheal suctioning breathing exercises, mobilization, application of aerosol, humidification, incentive spirometry, forced expiratory technique, bronchodilator and mucolytic agents [13].

Traditionally physiotherapist give above mentioned treatment to the ventilated patients by taking subjective assessment like auscultation but sound heard on auscultation may be due to presence of secretions or due to presence of water in the tube [14]. Also technique of vibration applied for clearance of secretion to the ventilated patients is given at the end of inspiration since there is no objective way of assessing end of inspiratory phase physiotherapist has to rely on ventilator graphics to apply vibration. Studies have shown change in minute ventilation, tidal volume and spontaneous breath triggered by the patient during PNF application can only be recorded with the help of ventilator graphics [15].

Despite the extensive literature we could not find any evidence of research about physiotherapist knowledge on ventilator graphics. The objective of the study was to find out awareness about ventilator graphics among physiotherapist in India, to find out association of level of qualification on knowledge of ventilator graphics, to find out association of level of experience with knowledge of ventilator graphics, to design an educational program regarding use of graphics based on findings of empirical phase and to orientate the researcher regarding literature on the topic and assist the researcher in development of questionnaire.

2. Methodology

Study design was exploratory cross sectional survey. The study population was physiotherapist working in ICU setup for more than 2 years of working experience. They were included if they are graduates, post graduates and PhD in physiotherapy. Undergraduates and trainee were excluded from the study. The study was reviewed and approved by the institutional ethical committee, Padmashree institute of physiotherapy.

Hospitals with well-equipped ICU set up were selected for the study. The lists of hospitals were obtained from internet and a total of 500 hospitals were identified. Hospitals in which anesthetist, respiratory therapist and nurses are employed to deal with ventilator settings were also excluded. Finally a total of 250 hospitals were shortlisted.

A customized self-design questionnaire was used for the study. Survey questionnaire was prepared, expert in the field of cardio respiratory physiotherapy with 5years of working experience were consulted for their comments on questionnaire design, structure and content and a final questionnaire was prepared and it was validated. The questionnaire was divided into two parts A) preliminary part B) main part. Details of questionnaire are included in the annexure.

Questionnaire was emailed to the head of the department of physiotherapy of the hospitals selected. As per the inclusion criteria, physiotherapists who are currently working in cardio respiratory department with two years of working experience were requested to fill the questionnaire. A covering letter was included explaining the purpose of the questionnaire, identifying the researcher and ensuring the confidentiality. A period of six weeks for completion was given in an attempt to ensure good response rates. If response was not obtained within the stipulated time period, two subsequent reminders were sent to the hospitals with a time gap of six weeks for the first reminder and four weeks for the second reminder.

Data analysis was performed by statistical software namely SPSS 15, and R environment version 2.11.1. Descriptive statistical analysis has been carried out in present study. Data was summarized using number and percentage. Significance is 95% confidence interval has been computed to find out significant features. Confidence interval with lower limit more than 50% is associated with statistical significance. fisher's exact test has been to find the significance of association of level of awareness between MPT and BPT. Karl Pearson correlation was used to find out the relationship between score of question in questionnaire with the level of experience. Microsoft word and excel have been used to generate graphs and tables.

3. Results & Discussion

3.1 Results

Of the 250 physiotherapists surveyed only 105 responded (response rate 36%). With the largest response rate from Karnataka, Andhra Pradesh, Tamil Nadu, Delhi and Gujarat (table 1). Out of 105 questionnaires received only 15 physiotherapists were found to be aware about ventilator graphics. A large percentage of response was obtained from nonteaching hospitals 78%. Most of the respondents were BPT (70%) while only (30%) were found to be MPT. Majority of physiotherapists 55% were found to have less than five years of experience. Only a small variation of 7% was among male and female distribution of physiotherapists.

Table 2 summarizes detailed wise answer of 105 respondents. The very first question of the questionnaire got the highest score of 86% which states that both scalar and loop graph can be used for problem identification and correction. The 17th question got the second highest score of 80% among all the 15 respondents. the response of two main questions "how will u measure response to bronchodilator therapy" and how will u measure presence of secretions in ventilated patients ?" have confidence interval with lower limit of 46% and were not statistically significant. The no of statement in questionnaire was 23, so the max score obtained can be 23. In the study mean score obtained was 15.20 with a standard deviation of 6.96. The percentage of mean score to the total score was 60.06%. The median score was 15.

Table 1: State Wise Response

State	No Sent	No Received	Proportion of Response %
Andhra Pradesh	29	16	6.4
Assam	5	1	0.4
Chandigarh	2	2	0.8
Delhi	30	18	7.2
Goa	2	1	0.4
Himachal Pradesh	2	2	0.8
Jammu And Kashmir	5	1	0.4
Gujrat	25	11	4.4
Karnataka	41	22	8.8
Kerala	10	3	1.2
Maharashtra	20	3	1.2
Orissa	2	1	0.4
Pondicherry	2	2	0.8
Punjab	5	0	0
Rajasthan	10	5	2

Tamilnadu	25	9	3.6
Uttar Pradesh	28	5	2
West Bengal	3	1	0.4
Madhya Pradesh	4	2	0.8
Total	250	105	36.4

Table 2: Awareness of use of graphics

Statements	Number of Physiotherapists (n=15)	%	95%CI
Q1	13	86.7	62.12-96.26
Q2	12	80.0	54.81-92.95
Q3	11	73.3	48.06-89.10
Q4	9	60.0	35.75-80.18
Q5	9	60.0	35.75-80.16
Q6	7	46.7	24.81-69.88
Q7	11	73.3	48.06-89.10
Q8	10	66.7	41.71-84.82
Q9	12	80.0	54.81-92.95
Q10	9	60.0	35.75-80.16
Q11	9	60.0	35.75-80.16
Q12	10	66.7	41.71-84.82
Q13	11	73.3	48.06-89.10
Q14	10	66.7	41.71-84.82
Q15	12	80.0	54.81-92.95
Q16	10	66.7	41.71-84.82
Q17	7	46.7	24.81-69.88
Q18	10	66.7	41.71-84.82
Q19	8	53.3	30.12-75.19
Q20	10	66.7	41.71-84.82
Q21	11	73.3	48.06-89.10
Q22	8	53.3	30.12-75.19
Q23	9	60.0	35.75-80.16

3.2 Discussion

This multicenter survey identified the awareness about ventilator graphics among physiotherapists in India. Out of 250 questionnaires send, only 105 responded. Burns and Groove (2001-430) regard response rate of 50% as satisfactory[16] and in our study response rate was only 36% which is considered as low. Reason for such a low response rate is hypothesized to be the distribution of sample population which can be contacted only through email and phone but no personal meetings or face to face interaction was made. Also the length of the questionnaire which was quite time consuming, this could have reduced response rate.

According to the results of our survey out of 105 respondents the majority of respondents were BPT. This may be because in most of the hospitals of India graduates are employed in comparison to postgraduates.

Results also show that the majority of hospitals in India were found to be equipped with ventilator such as Dragger (37%) and Bennett (37%). A very small percentage were using Siemens and other's such as Maquet and Hamilton, out of these ventilators only dragger do give information about ventilator graphics but newer ventilators such as Macquet and Hamilton which gives complete information were not incorporated on large scale. This is hypothesized to be one of the factors that contribute to lack of awareness.

According to our survey out of 105 respondents only 14% were found to be incorporating ventilator graphics as an assessment. Out of that 14%, only 40% were having good score, 20% moderate and 40% were having poor score which can be due to fluctuations of experience among physiotherapists. We tried to find out the relation between level experience and the awareness but it was not statistically significant (p-0.57), this may be because experienced physiotherapists are not attending seminars, workshops and CME's to upgrade their knowledge.

The very first question of the questionnaire got the highest score of 86% which states both scalar and loop graph can be used for problem identification and correction, only 14% were found to be using either scalar or loop graphs, reason for such a small variation is attributed to the type of ventilator used in ICU as fewer ventilators display either only scalar or loop graph.

It was also found that 80% of the respondents were incorporating all the scalar graphs in their clinical setting and only 20% gave more preference any one amongst volume/time, flow/time and pressure/time. This preference can be due to above postulated reasons.

Normally flow/time scalar and flow/volume loops are used to identify presence of air trapping or auto PEEP, 60% of respondents agree with this. The key indicator for identification of auto-PEEP is, expiratory portion of the curve does not return to baseline and inspiration starts before expiration, this was correctly identified by 73% respondents, From this conclusion can be made that whenever end-expiratory flow is far from zero, respiratory system is dynamically hyperinflated[17]

Bronchodilators are commonly employed for treatment of ventilator supported patients with asthma and COPD. Bronchodilators help by reversing bronchoconstriction, decreasing airway resistance, decreasing dynamic hyperinflation and PEEP [18, 19] Changes in flow/time scalar and flow/volume loops can be considered which shows increase PEFR and decrease expiratory time on bronchodilator administration. In our study 60% of respondents were found to be using flow/time scalar and flow/loop graphs to measure response to bronchodilator therapy but only 46% were able to correctly identify the difference between pre and post bronchodilator therapy with respect to changes in PEFR and expiratory time. Study also revealed that 73% of respondents were able to identify the difference between mechanical, assisted and spontaneous breath using both pressure/time scalar and pressure/volume loops.

Another common finding seen on both flow/volume and pressure/volume loop is the presence of an endotracheal leak. The amount of leak is the difference in measured inspiratory and expiratory tidal volume. Leaks prevent the normal "closure" of pressure/volume loop and expiratory limb just hangs on. Flow/volume loop of the expiratory portion of loop reaches the volume axis before origin. Leaks may also be suspected by looking at volume/time scalar's, whereby expiratory portion fails to return to baseline. Use of volume/time scalar and flow/volume loop to detect Presence of ETT leak, only 66% of the respondents agree to it but majority 80% agreed that key point in identification is that expiratory portion of curve will not return to baseline.

In absence of pathology expiratory phase of ventilation is considered as passive but in conditions such as asthma and COPD expiratory phase becomes active in order to blow extra air trapped due to narrowing of airways. This was correctly identified by only 60% of the respondents.

Question on use of pressure/volume loop to identify spontaneous breath (which goes clockwise), controlled breath (which goes counter clockwise) and assisted breath (which goes clockwise to counter clockwise) was found to be the correct answer among 60% respondents.

For mechanical ventilation to effectively unload patients respiratory muscles, it must provide inspiratory flow in synchrony with patients own respiratory rhythm otherwise it may lead to asynchrony which can be best visualized on pressure/time scalars which will appear concave. In our survey 73% individuals were correctly identify use of pressure/time scalar graph for presence of asynchrony while only 53% could make out its concave appearance when dyssynchrony was present. While an equal response of 66% each from physiotherapists was obtained on questions regarding identification of increased airway resistance in which loop becomes wider and on measurement of decreased compliance in which loop moves down and angle becomes <40 degrees. The most reliable indicator of the presence of excessive secretion in the airway is the presence of "saw tooth" pattern of loops. This question got the second highest score of 80% among all the 15 respondents.

Study also revealed two interesting facts one, most commonly used method for identification of presence of secretions in ventilated patients is auscultation as only 46% respondents were found to be incorporating the use of flow/volume loop to detect presence of secretions. And the other being, most commonly measured variable by physiotherapists after chest physiotherapy is saturation. Both these points strongly suggest that clinical use of ventilator graphics is often lacking. It was also found that response to PNF respiration by observing spontaneous breath on ventilator was common practice among only 53% respondents.

Vibration applied at the end of inspiration during chest physiotherapy can only be objectively identified using ventilator graphics 66% physiotherapists agree with it, while 73% agreed that spiking during inspiration indicates water in circuit. The response of two main questions "how will u measure response to bronchodilator therapy?" and "how do you measure presence of secretions in ventilated patients?" have confidence interval with lower limit of 46%.

Good awareness is found to be positively associated with MPT's compared with BPT's with p value of 0.169 which was not statistically significant, this is probably because out of 15 respondents all 3 BPT's and 3 MPT's (out of 12 MPT's) have less score (<50%) with respect to awareness. According to descriptive score of the study it is concluded that overall competence for use of graphics in MPT's is 66.06%.

Limitations of the study was such a poor response rate, no of questionnaire send to different states were not homogenous and questionnaire was send through email not through direct contact. The further studies can be done to compare knowledge and competence levels of physiotherapists employed in private and academic hospitals with more response. This study could be replicated in order to test knowledge regarding ventilator graphics among physiotherapists who have done post graduation in cardio respiratory disorders. The secondary study could be conducted in order to determine knowledge of physiotherapy staff that had received training following development of educational program. This study could be replicated in order determine skills in practice regarding ventilator graphics.

4. Conclusion

The objective of the study was to find out awareness about ventilator graphics among physiotherapist in India, to find out the association of level of qualification on knowledge of ventilator graphics for problem identification and correction, to orientate the researcher regarding literature on the topic, in order to highlight important aspects and assists the researcher in development of questionnaire. Out of 105 respondents (response rate36%) 15 were using ventilator graphics and when level of awareness of use of graphics among them is calculated it was found that good awareness is positively associated with MPT's compared to BPT's which was not statistically significant (p=0.169). The mean score was 15.20out of 23.the knowledge among the physiotherapist about the awareness of using ventilator graphics is only 66.06%. These results underline the necessity of an educational program regarding ventilator graphics among physiotherapist. This customized self designed questionnaire can be used as an assessment tool in objective examination of ventilated patient.

5. References

1. Michael A, Becker RRT, Steven M. Donn. Real-Time pulmonary graphic monitoring. RT clinics in Perinatology 2007; 34:1-17.
2. Susan P. Pilbeam. Mechanical ventilation: physiological and clinical application. 3rd edition. Mosby publisher. Chapter 1998; 4:42-61.
3. Truwit JD, Marini JJ. Evaluation of thoracic mechanics in the ventilated patient. Part I: Primary measurements. J Critical Care. 1988; 3:133-150.
4. Truwit JD, Marini JJ. Evaluation of thoracic mechanics in the ventilated patient. Part II: applied mechanics. J Critical Care. 1988; 3:199-213.
5. Branson RD, Hess DR. Bedside monitoring of respiratory mechanics. In: Branson RD, Hess DR, Chatburn RL editors. Respiratory care equipment, 2nd ed. Philadelphia: Lippincott, Williams &Wilkins, 1999, 303-324.
6. Rajiv Dhand. Ventilatory graphics and respiratory mechanics in obstructive lung diseases; respiratory care 2005; 50(2):246-289.
7. Kris C. Sekar. Trends in conventional mechanical ventilation and pulmonary graphics in the newborn. Chinese Medical Journal. 2010; 123(22):3319-3325.
8. Maggiore SM, Richard JC, Brochard L. What has been learnt from P/V curves in patients with acute lung injury/acute respiratory distress syndrome. European Respiratory J Suppl. 2003; 42:22s-26s.
9. Haynes JM. Patient-ventilator asynchrony in a sleeping patient receiving pressure-support ventilation. Respiratory Care 2008; 53:1085-8.
10. Lluı´s Blanch MD PhD, Francesca Bernabe´ MD, Umberto Lucangelo MD. Measurement of Air Trapping, Intrinsic Positive End- Expiratory Pressure, and Dynamic Hyperinflation in Mechanically Ventilated Patients. Respiratory Care 2005; 50(1):110-123.
11. T.E OH. Intensive care manual. 4th edition illustrated. Butterworth Heinemann publisher, 1997, 3-4.
12. Kumar JA, Maiya AG, Pereira D. Role of physiotherapists in intensive care units of India: A

multicenter survey. Indian J Critical Care Medicine. 2007; 11:198-203.
13. Mackenzie CF, ciesla N, imle PC. Chest physiotherapy in intensive care unit.2nd edition. Williams and Wilkins, 1989, 93-187.
14. Jennifer A Pryor. Physiotherapy for respiratory and cardiac problems. 2nd edition. Churchill Livingstone, 1998, 272.
15. Chang A, Paraz J, rolltson J. Venilatory effects of neurophysiological facilitation and passive movement inpatient with neurological injury. Australian journal of physiotherapy. 2002; 48:305-309.
16. Burns N, Grove S. The practice of nursing research: conduct, critique and utilization. 4th edition. W.B. Saunders Philadelphia, Pennsylvania, USA, 2001.
17. Lluı´s Blanch Francesca Bernabe´, Umberto Lucangelo. Measurement of Air Trapping, Intrinsic Positive End-Expiratory Pressure, and Dynamic Hyperinflation in Mechanically Ventilated Patients. Respiratory Care. 2005; 50(1):110-123.
18. Dhand R, Jubran A, Tobin MJ. Bronchodilator delivery by metered dose inhaler in ventilator-supported patients. American Journal Respiratory Critical Care Med 1995; 151(6):1827-1833.
19. Dhand R, Duarte AG, Jubran A, Jenne JW, Fink JB, Fahey PJ *et al*. Dose-response to bronchodilator delivered by metered-dose inhaler in ventilator-supported patients. American journal Respiratory Critical Care Medicine. 1996; 154(2 Pt 1):388-393.