International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Index Copernicus Value (2016): 79.57 | Impact Factor (2017): 7.296

Effect of Neurophysiological Facilitation [NPF] of Respiration on Ventilation of Mechanically Ventilated Patients: An Experimental Study

Dr. Hardini Prajapati

[MPT in Cardiopulmonary], Lecturer and PG Guide, Ahmedabad Institute Of Medical Sciences, Nr. S P ring road, Gota-Kalol Highway, Lapkaman, Ahmedabad, Gujarat

Abstract: ***Background: Mechanical ventilation is a useful modality for patients who are unable to sustain the level of ventilation necessary to maintain gas exchange function .Mechanically ventilated patients are prone to all disorders of immobility, thus the role of physiotherapy includes patient's respiratory as well as postural care. NPF of respiration is the use of selective external proprioceptive and tactile stimuli that produce reflexive movement responses in the ventilatory apparatus to assist respiration. Aim and Objective: To study the effectiveness of NPF of respiration on ventilation of mechanically ventilated patients. Objective is to assess the difference between pre and post NPF on respiratory rate, tidal volume, minute volume and chest expansion. Method: An experimental study was conducted on 10 mechanically ventilated [SIMV/CPAP modes] patients of emergency ward of V.S. General Hospital, Ahmadabad, to assess pre and post difference in RR, Vt, Ve and chest expansion, by applying intercostal stretch, abdominal co contraction and anterior stretch posterior basal lift. It was a onetime study to see short time effects. Result: Statistical analysis showed that there was significant improvement in all outcome measures after application of NPF techniques. RR improved significantly [P=0.0116] after application of anterior stretch posterior basal lift. Tidal volume improved very significantly after application of abdominal co contraction [p= 0.009] and with anterior stretch posterior basal lift [P=0.001]. Minute volume improved very significantly after abdominal co contraction [P= 0.019] and after anterior stretch posterior basal lift [P=0.0001]. Chest expansion increased very significantly after application of all techniques [P<0.01]. Conclusion: NPF of respiration can improve the ventilation of mechanically ventilated patients for very short time.***
Key words: Neurophysiological facilitation of respiration, intercostal stretch, abdominal co contraction and anterior stretch posterior basal lift, mechanically ventilated patients

1. Introduction

Mechanical ventilation is a useful modality for patients who are unable to sustain the level of ventilation necessary to maintain the gas exchange functions [oxygenation and CO_2 elimination][1]. Indications for mechanical ventilation vary greatly among patients. Mechanical ventilation may be indicated in conditions due to physiological changes [eg. Deterioration of lung parenchyma], disease states [eg. COPD, chest trauma], medical or surgical procedures [eg. Post op recovery], as well as many other conditions leading to ventilator failure or oxygenation failure. Use of mechanical ventilation also varies greatly from short term to long term and from acute care in the hospital to extended care at home.[1]

Thus mechanically ventilated patients are prone to develop all the disorders of immobility**,** such as hypostatic pneumonia, muscle wasting, limb contractures and pressure sores. All such problems are multiplied by infections and patients who are intubated are very prone to chest infections in particular. It is often the case that good chest physiotherapy can prevent or treat chest complications without recourse to antibiotics, and its frequent application is vital.[2] Even the mechanically ventilated patient are having chances to develop other complications like retention and collection of secretions, reduced depth of breathing, broncho spasm and dependency. The roll of chest physiotherapy is vital.

Commonly utilized techniques in this period include secretion mobilizing and removal techniques of percussion, vibration and suction.[3]Teqniqe to increase depth of ventilation include positioning, IPPV and manual hyper inflation.[3, 5]

NPF techniques are useful in the chest care of unconscious patients who are on mechanical ventilator.NPF of respiration is the use of selective external proprioceptive and tactile stimuli that produce reflexive movement responses in the ventilator apparatus to assist respiration.

Bethune (1975) described a number of PNF techniques reported to increase the depth of breathing, decrease the respiratory rate and increase the arousal in patient with a decreased level of consciousness. The NPF techniques have not been objectively tested to determine whether they are capable of increasing the depth of breathing.

The study done by Angela Chang [2002], demonstrates that NPF can improve the short term ventilation of patients with reduced consciousness following neurological injury and provides preliminary support to use NPF as a technique to improve short-term ventilation. Thus in order to establish whether an increase in lung ventilation does occur following NPF in mechanically ventilated patients, this study has been undertaken. The alternative hypothesis is there is an effect of NPF of respiration on ventilation of mechanically ventilated patients.

2. Material and Methodology

Total 10 male [n=7] and female [n=3] patients [age 20 to 50 years], who were unconscious and on SIMV/CPAP modes of mechanical ventilator, were selected conveniently from emergency ward of V.S. general hospital, Ahmedabad, Gujarat. Non sedated patients with neurological injuries

were selected. Whereas haemodynamically unstable patients, patients with ribs, sternum or vertebral fractures, patients with any chest anomalies and patients with chest or face burns were excluded from study. Written informed consent was taken from patients' relatives and procedure was explained to them. All NPF techniques were given in supine lying position with limbs in neutral position. Techniques given were Intercostal stretch, abdominal co contraction and anterior stretch posterior basal lift.

Intercostal stretch [Technique1] was given to each intercostal space interiorly and laterally in cephalo-caudal direction and at each space the technique was applied for 10 repetitions. Alternatively abdominal co contraction [Technique2] was bilaterally applied for 20 repetitions on each side. Anterior stretch posterior basal lift technique [Technique3] was bilaterally applied for 10 repetitions and lift was maintained for 10 seconds. Each technique was randomly allocated to each patient with difference of half an hour between applications of each technique. Patients' vitals were monitored throughout the treatment.

Prior and immediately after the application of each technique, patient's spontaneous respiratory rate[RR], spontaneous tidal volume[Vt], minute volume[Ve] and middle chest expansion [at nipple level] were documented.

3. Findings

Result: Total 10 patients with mean age of 45.3±20.08were selected. Data were analyzed on SPSS software to see the effect of different NPF techniques on their RR, Vt, Ve and chest expansion. Parameters were expressed as mean values±standard deviation. All data were then analyzed statistically by appropriate tests. A difference when p was < 0.05 was considered significant.

Table 1: Effect of different NPF techniques on spontaneous RR

Spt. RR	Tech 1	Tech 2	Tech 3
pre	14.5±10.28	14.4±10.38	14±9.56
post	14.8±8.87	14.9±10.13	15.7±9.38
t value	0.33	0.51	3.16
p value	0.7517	0..6223	0.0116

Table 2: effect of different NPF techniques on spontaneous tidal volume

Spt. Vt	Tech 1	Tech 2	Tech 3
pre	355.7±135.6	337.3±138.8	340.7±139.9
post	402.5±181.3	414.9±157.23	389.7±129.7
t value	2.15	3.26	4.81
p value	0.0601	0.0097	0.0010

Table 3: effect of different NPF techniques on minute volume

Ve	Tech 1	Tech 2	Tech 3
pre	5.26±3.592	4.86±3.87	4.71±3.52
post	5.95±4.061	6.15±4.33	6.13±3.93
t value	1.250	2.845	6.76
p value	0.2429	0.0193	0.0001

Table 4: effect of different NPF techniques on chest expansion

Chest expansion	Tech 1	Tech 2	Tech 3
pre	0.43±0.14	0.45±0.10	0.45±0.11
post	0.68±0.21	0.67±0.24	0.56±0.11
w value	36	28	31
p value	0.0078	0.0156	0.0234

4. Discussion

Spontaneous respiratory rate was improved significiantly after application of anterior streatch basal lift where as no improvement was seen after application of intercostals stretch and abdominal co contraction, but clinically improvement was found Spontaneous tidal volume, minute volume and middle chest expansion showed improvement after application of each technique. Improvement in ventilation was there for very short time. This improvement was because of many different mechanisms behind NPF techniques as suggested by Bethune (1975).Improvement in ventilation due to intercostals stretch is due to reflexive activation of intercostals and diaphragm by the intercostals afferents that innervate them by stimulation of intercostals stretch recaptors. When anterior stretch basal lift was applied, there was a sustain streatch given to the anterior intercostals and thus there was a stimulation of stretch recaptors in inter costal. Hence there was a reflexive improvement in intercostals and diaphragm movements which resulted in improved ventilation. Application of abdominal co contraction also improved ventilation but exact mechanism behind this is not known. it that been suggested that co contraction of abdomen can facilitate respiration (Rood 1973). Present study is also supported by the study done by Angela Chang et al. in 2002, which concluded that NPF (peri oral stimulation and Intercostals stretch) can increase ventilation of patients with decreased consciousness but for very short time. Dr Jennifer Nitz (2003) studied facilitation of respiration in mayo tonic dystrophy patients and it was found that NPF techniques were the main contributor in improvement of the oxygen saturation. So this study demonstrates an improvement in short term ventilation after application of different NPF techniques. But the long term effects on pulmonary morbidity, prevention of infection and resolution of atelectasis were not addressed in the current study and could be the basis of future trials. Further study is needed to determine the optimal duration of the neuro physiological facilitation techniques. Major limitation of this study was the small sample size.

5. Conclusion

It can be concluded from the study that, neuro physiological facilitation of respiration can improve the ventilation for short time in patients who are on mechanical ventilator provides preliminary support of NPF as a technique to improve short term ventilation.

References

[1] Chang DW. Clinical application of mechanical ventilation. Cengage Learning; 2001,2nd edition.

[2] Downie PA, Innocenti DM, Jackson SE. Cash's textbook of chest, heart and vascular disorders for physiotherapists.
[3] Ciesla ND. Chest physical therapy for patients in the intensive care unit. Physical Therapy. 1996 Jun 1;76(6):609-25.
[4] Bethune DD. Neurophysiological facilitation of breathing in the unconscious adult patient. Physiotherapy Canada. 1975;5:241-5.
[5] Pryor JA, Webber BA. Physiotherapy for respiratory and cardiac problems: adults and paediatrics. Elsevier Health Sciences; 2002.
[6] Angelo zhang and Jennifer paratz and Julia rollstone (2002) ventilatory effect of NPF and passive movements in patient with neurological injury.
[7] Guyton AC. Textbook of medical physiology. 8th. WB Saunders Company, Philadelphia. 1991:782.
[8] Bockenhauer SE, Chen H, Julliard KN, Weedon J. Measuring thoracic excursion: reliability of the cloth tape measure technique. The Journal of the American Osteopathic Association. 2007 May 1;107(5):191-6.
[9] Arcot J Chandrasekhar 1997 screening physical exam Loyola University Chicago.
[10] Nitz J, Burke B. A study of the facilitation of respiration in myotonic dystrophy. Physiotherapy research international. 2003 Nov;7(4):228-38.
[11] Eklund G, Von Euler C, Rutkowski S. Spontaneous and reflex activity of intra costal gamma motoneurones. The Journal of physiology. 1964 May 1;171(1):139-63.
[12] Peiper**,** A. (1963) Cerebral Function in Infancy and childhood Newyork.
[13] Escourrou PJ, Delaperche MF, Visseaux A. Reliability of pulse oximetry during exercise in pulmonary patients. Chest. 1990 Mar 1;97(3):635-8.
[14] Joy Varghese (2003): effects of neurophysiological facilitation of respiration in respiratory care of people with intellectual disability.
[15] Caurse et al (2002): chest physiotherapy in mechanically ventilated children A review critical care medicine 28 (5).
[16] Van der Touw et al (1998):Cardio respiratory effects of manually compressing the rib cage during tidal expiration in mechanically ventilated Patients recovering from acute severe asthma.
[17] Samuel S.Sprague ,Philip D.Hopkins (2003): Use of inspiratory strength training to wean six patients who were ventilator dependent.
[18] Ling-Ling Chiang ,Li Ying Wang,Chin –Pying Wu et al (2006) : Effects of physical training on functional status in patients with prolong mechanical ventilation.
[19] Combes A.,Costa MA,Trouillet JL et al : Morbidity mortality and quality of life outcomes of patients requiring more then fourteen days of mechanical ventilation:2003
[20] Martin UJ(2002):Whole body rehabilitation in long term ventilation.
[21] Nava S (1998)Rehabilitation of patients admitted to a respiratory intensive care unit.
[22] Euler C(1986):Breathing behaviour .In Euler C.Lagercrantz.A neurobiology of the control of breathing.
[23] Frazier DT,Xu Fadi ,Lee LY (1997).Respiratory related reflexes and the cerebellum.
[24] Rood M (1973):Unpublished lectures given at the University of Western Ontario, London,Ontario.
[25] Ada L Canning C and Paratz J(1990) Care of the unconscious head injured patients.
[26] Make B et al (1984) :Rehabilitation of ventilator dependent subjects with lung diseases: The concept and initial experience.
[27] Criner GJ: Care of the patient requiring invasive mechanical ventilation.