

Tilt Table Practice Improved Ventilation in a Patient with Prolonged Artificial Ventilation Support in Intensive Care Unit

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Abstract

Patients who are on prolonged ventilator support in critical care unit present wide variety of complications, which range from reduction in oxygen uptake to various musculoskeletal impairments. Early mobilization and rehabilitation are encouraged to manage these complications effectively. Use of tilt table to motivate early mobilization in the intensive care unit for ventilator practices is not a usual practice. However, this new technique has attracted involvements of clinicians and therapists for its therapeutic benefits to the patient. Herein we describe a case of a seventy eight-year-old male patient who suffered Motor car accident, and was on ventilator support in intensive care unit for more than one month. He underwent treatment using a tilt table protocol with other routine treatment, which benefited him based on clinical as well as physiological variables. For practitioners in intensive care units, this report may offer perceptivity into the alternate practice of early mobilization using tilt table, and for investigators it may promote interest for further studies.

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Keywords • Rehabilitation • intensive care unit • mobilization • tilt table

Introduction

Rehabilitation of a critical care patient requiring prolonged ventilator support is always a challenging task for a multidisciplinary team in an intensive care unit (ICU).¹ Even after the patient is medically stable, the clinicians and therapists need to manage a multitude of medical problems by rehabilitating the patients with prolonged ventilator support. These problems include reduced oxygen uptake, impaired gaseous exchange, severe acquired neuromusculoskeletal weakness, pneumonia, postural hypotension, joint contractures, bedsores and severe depression.² Early rehabilitation in ICU is recommended as an effective management strategy to reduce these complications that coexist with prolonged ventilation of patients in ICU.³

The practice of progressively tilting the patient using a tilt table in ICU has always been a debatable procedure among physiotherapists.⁴ Due to the lack of published studies therapeutic benefits for the tilt table procedure among patients in ICU are ill-defined.⁴ However, recent evidence supports the tilt table procedure as one of the main treatment technique for patients who are on prolonged ventilation.⁵ As the awareness of this practice is slowly picking up among the practitioners, the present report introduces a patient with tracheostomy tube subjected to progressive tilting using a tilt table, and gradual weaning from the ventilator support.

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Case Description

A 78-year-old man, admitted to a hospital following Motorcar Accident on 3rd September 2009. The patient had multiple fractures on the left 2nd, 4th, 5th, 6th ribs, pneumothorax, and an open comminuted fracture of the left proximal and middle phalanx of the little finger. Following admission to the ward, a chest tube was inserted but removed on the next day. On the second day of admission, the patient was tachypnoeic and with an oxygen saturation of 90%. He was eventually ventilated noninvasively with Bi-level Positive Airway Pressure (BiPAP). Nine days after the admission, the patient was transferred to a general intensive care unit (GICU) and intubated with endotracheal tube. He subsequently underwent Tracheostomy on 15th October 2009 and the tracheostomy tube was removed two weeks later.

The patient was referred for physiotherapy on the 3rd day of admission for basal atelectasis secondary to left multiple rib fractures. In a period between 6th to 11th September 2009, the patient was fastened with BiPAP mask, venturi mask 60%, presenting with paradoxical breathing pattern and poor cough reflex without expectoration. The readings of chest expansion measurements showed 2 centimeters in axillary level and three centimeters in xiphoid level. Auscultation findings disclosed reduced air entry with crepitations heard over the left lower lung fields. Arterial blood gas reading showed a pH of 7.15, a PaO₂ of 85, PaCO₂ of 47, HCO₃ of 24, and a Base Excess of +1. Haziness was remarkable over the left lower zones in anterior-posterior view of the chest X-ray. To mobilize the secretions, chest manipulation techniques were performed over the left posterior aspect of the chest wall. In order to remove the secretions cough paddings were given over the cracked ribs while coughing. This was followed with diaphragmatic and lateral costal segmental breathing exercises.

On 12th to 14th September, the patient was on endotracheal tube, ventilated with synchronized intermittent mandatory ventilation (SIMV), and continuous positive airway pressure (CPAP). His pattern of breathing appeared to be paradoxical breathing with unsatisfactory gaseous exchange. Chest expansion measurement reading demonstrated 2.5 cm in the axillary level and 3 cm in the xiphoid level. On Auscultation, reduced air entry with occasional crepitations was heard over the fields of left lower lung. Arterial blood gas reading showed a pH of 7.20, a PaO₂ of 80, a PaCO₂ of 46, a HCO₃ of 27, and Base Excess of +1 (respiratory acidosis) with compensated metabolic

alkalosis. Consolidations were noted over lower lung zones in the chest X-ray. Modified postural drainage, and chest manipulation techniques such as vibration and clapping carried out over the left posterior chest wall, but the results were not satisfactory as judged by clinical and laboratory biochemical factors (pH: 7.25, PaO₂: 85, PaCO₂: 45, HCO₃: 24, and Base Excess: +1).

During the period from 15th to 29th of October 2009, the patient was on tracheostomy tube with SIMV and CPAP. Occasionally he was on oxygen mask over the tracheostomy tube while the condition was stable. Observation disclosed paradoxical breathing pattern and auscultation showed that there was no air entry in the lung, which the left part of it was collapsed as noted on the chest X-ray. The readings of chest expansion measurement showed 2.5 cm in the axillary level and 3 cm in the xiphoid level. Since the patient did not show stable clinical and biochemical factors (pH: 7.18, PaO₂: 80, PaCO₂: 50, HCO₃: 27, and Base Excess: +1), a tilt table method of intervention was initiated. Tilt table procedure was carried out to preclude bed rest complications, and to promote ventilation along with routine chest physiotherapy.

Tilt Table Protocol

On 20th September 2009, the patient was held to lie on the tilt table with chest, pelvic and knee straps. Enough padding was provided over the chest when applying the chest strap. The chest strap was secured comfortably, so that the patient could breathe comfortably, and the vital signs were assured to prove hemodynamic stability. Initially tilt table was propped up for 10 degrees, and blood pressure and pulse oximetry saturation were checked. When there was a drop in blood pressure (<100 mmHg) and saturation (<85% oxygen saturation), the tilt table was returned back to supine position. If the blood pressure and oxygen saturation were not satisfactory, the position preserved and the subject was asked to do breathing exercises. Further tilting to 45 degrees was performed slowly and progressively, if the patient condition was stable and satisfactory on clinical and biochemical factors. The total session lasted for 30 minutes (figure 1 and 2). Then active breathing exercises, active assisted exercises of both upper and lower limb, and active exercises of both upper limbs and lower limbs were carried out along with the synchrony of ventilator. When the patient reached a progression of 60 to 90 degrees in the tilt table, ambulation was carried out on an ambulatory chair.

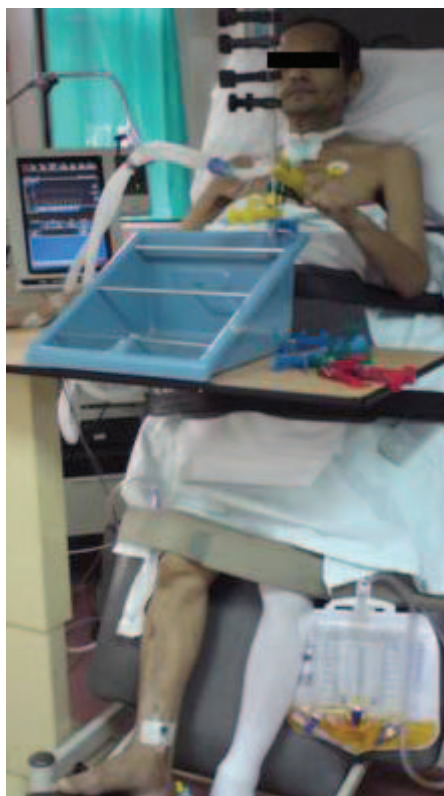


Figure 1: The patient tilted on the tilt table and does functional activities training while on ventilator.

The tilt table protocol was carried out on a daily basis as an adjunct to other chest physiotherapy techniques including active assisted and active exercises of both upper and lower limbs, and ambulation on an ambulatory chair was carried out on alternate days during the period 24th to 28th September 2009. After a week of tilting protocol, the patient showed progression in arterial blood gases (pH: 7.35, PaO₂: 95, PaCO₂: 40, HCO₃: 22, and Base Excess: +1). He was able to breathe with CPAP continuously when he was awake. Then the patient was able to withstand without CPAP support for 6 hours. During the tilt table procedure on the fourth week, the patient managed to withstand tilt table without ventilator. The lung fields were clear in the chest x-ray. Chest expansion measurement also improved with 3 cm in axillary level and 3.5 cm in xiphoid level. The tilt table session was stopped on the 5th week, and the patient was rehabilitated for on gait training. Ambulation was started with a walking frame with full support, and the patient referred to geriatric inpatient for further physiotherapy management.

Discussion

Using tilt table for early rehabilitation of patients in ICU is a new trend of practice among



Figure 2: Patient tilted to 60 degrees on the tilting table. The therapist performs active assisted exercises as the patient is on the ventilator support.

the therapists. A recent study had reported that early mobility in the ICU is safe, and can cause a significant decrease in short-term physical impairment.³ In our patient, we attempted early mobility for the patient using tilting table, a significant modern technique from our routine practice. In conventional physiotherapy practice, early mobilization is tried at the bedside by active assisted and active limb exercises. Besides, a therapist has to wait for many days until a patient can sit up unsupported before starting to train them for standing balance or some functional activities. So in traditional approach, the prolonged bed rest complications might not be addressed effectively. However, tilting the patient stimulated a more functional movement and weight bearing pattern, improved the aerobic system, improved the gaseous exchange, and more likely contributed to the weaning the patient from the ventilator.

The present case report stresses the benefits of using a tilt table, which prompts standing in a faster and better manner than other approaches. We suggest that even a weak and exhausted patient could be considered for vertical positioning as long as the vital signs such as blood pressure, pulse rate and arterial gas saturation are stable.⁶ This technique also gave the therapist more freedom to easily perform other exercises for the patient, since the therapist is no longer needed to support the patient. We think that it might even reduce the rate of musculoskeletal disorders met by the therapist in ICU practice.

To discuss the clinical reasoning of the tilt table management in ICU, recent studies stated there was improvement in the capillary membrane permeability, minute ventilation, and increased energy spending among patients in upright standing posture.^{7,8} This could be the possible reason for the change in the ventilatory features, which in turn leads to a better gas exchange. Zafiropoulos and colleagues believed that the betterments in physiologic changes were thought to be largely due to positional changes from supine to standing.⁹ The findings of the present case report are similar to those of an earlier report,⁵ in which patients, who had been ventilated for more than five days, were exposed to tilt table standing at 70 degrees from the horizontal for five minutes.⁵ The study showed that the patient's tidal and minute ventilation increased significantly but temporarily.⁵ However, there is no documented randomized control trials that has examined the therapeutic benefits of using tilt table in an ICU setting. This case has created areas of research interest among our special interest group in Cardiorespiratory, Physiotherapy Department, Hospital Kuala Lumpur, and studies are underway to produce evidence-based practice towards using tilt table in ICU. There is no a published guideline available to comment on the contraindications of this procedure.⁴ We think that this practice deserves high quality studies to examine therapeutic benefits and contraindications of the technique using short-and long-term follow up procedures. Standing with the aid of a tilt table in ICU setting might have a reasonable therapeutic role in the early rehabilitation and prognosis of the patients. Therefore, this procedure can be considered as an alternative way of improving the patients' overall condition as well as ventilation.

Conclusion

The finding of the present study suggest that the use of tilt table can enhance the respiratory function of an ICU patients, and shortens

the rate of his/her recovery

Conflict of Interest: None declared

References

- 1 Perme CS, Southard RE, Joyce DL, et al. Early mobilization of LVAD recipients who require prolonged mechanical ventilation. *Tex Heart Inst J* 2006; 33: 130-3.
- 2 Silva APD, Maynard K, Cruz MRD. Effects of motor physical therapy in critically ill patients: literature review. *Rev Bras Ter Intensiva* 2010; 22: 85-91.
- 3 Truong AD, Fan E, Brower RG, Needham DM. Bench-to-beside review: mobilizing patients in the intensive care unit--from pathophysiology to clinical trials. *Crit Care* 2009; 13: 216.
- 4 Chang AT, Boots R, Hodges PW, Paratz J. Standing with assistance of a tilt table in intensive care: A survey of Australian physiotherapy practice. *Aust J Physiother* 2004; 50: 51-4.
- 5 Chang AT, Boots RJ, Hodges PW, et al. Standing with the assistance of a tilt table improves minute ventilation in chronic critically ill patients. *Arch Phys Med Rehabil* 2004; 85: 1972-6.
- 6 Stiller K. Safety Issues That Should Be Considered When Mobilizing Critically Ill Patients. *Crit Care Clin* 2007; 23: 35-53.
- 7 Chang AT, Boots RJ, Brown MG, et al. Ventilatory changes following head-up tilt and standing in healthy subjects. *Eur J Appl Physiol* 2005; 95: 409-17.
- 8 Hoste EA, Roosens CD, Bracke S, et al. Acute effects of upright position on gas exchange in patients with acute respiratory distress syndrome. *J Intensive Care Med* 2005; 20: 43-9.
- 9 Zafiropoulos B, Alison JA, McCarren B. Physiological responses to the early mobilisation of the intubated, ventilated abdominal surgery patient. *Aust J Physiother* 2004; 50: 95-100.