Special Article

Pitfalls of Mechanical Ventilation in Thailand

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Pitfalls in the respiratory care and mechanical ventilation for patients continue to prevail in intensive care unit (ICU) or in some hospital wards in Thailand. There are two reasons that explain this phenomenon. Firstly, there are no professional respiratory therapists in Thailand. Secondly, most caregivers do not possess the adequate knowledge and skills required for respiratory care and for initiating, maintaining and weaning patients off mechanical ventilation. Physicians and nurses have to practice in respiratory care and mechanical ventilation without participating in adequate training during their undergraduate studies and postgraduate training. In reality, physicians pay almost no attention to respiratory care. They leave the respiratory toilet, ventilator changes and monitoring of the patients to nurses who have many other tasks to attend to. To solve this problem will require restructuring of the Thai healthcare system. The Parliament will need to pass a "Respiratory Therapy Profession Act" to certify "respiratory therapists" as a new, registered health profession. The Office of the Civil Service Commission has to take the responsibility for creating the job title and a job description for respiratory therapists. Academic institutes have to provide training courses in respiratory therapy and grant appropriate levels of diplomas or certificates in respiratory therapy. Did actics and clinical skills required for respiratory care have to be sufficiently integrated into the curricula for medical students as well as nursing students. Physicians and nurses need to master their skills and acquired appropriate knowledge in respiratory care and mechanical ventilation until we can assure the necessary number of registered or certified respiratory therapists here in Thailand to help avoid such pitfalls.

Keywords: *Mechanical ventilation in Thailand, Pitfalls, Respiratory therapist*

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Errors in the respiratory care and mechanical ventilation for patients continue to prevail in some Intensive Care Unit (ICU) or ward in all hospitals in Thailand[1-4]. There are two reasons that explain this phenomenon; there are no professional respiratory therapists in Thailand, and most caregivers do not possess the adequate knowledge and skills required for respiratory care and for initiating, maintaining and weaning a patient off mechanical ventilation. Physicians and nurses have had to practice respiratory care and mechanical ventilation without participating in adequate training during their undergraduate studies and postgraduate training[5,6]. In reality, physicians pay almost no attention to respiratory care. They leave the respiratory toilet, ventilator changes and monitoring of the patients to the nurses who have many other tasks to perform. To solve this problem will require a re-structuring of the healthcare system[7,8]. The Parliament will need to pass a "Respiratory Therapy Profession Act" to certify respiratory therapists as a new, registered health profession. The Office of the Civil Service Commission has to take the responsibility for creating the job title and a job description for respiratory therapists. Academic institutes have shown a need to provide respiratory therapy courses and grant appropriate levels of diplomas or certificates in respiratory therapy. Didactics and the clinical skills required for respiratory care have to be sufficiently integrated into the curricula for medical students and nursing students.

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The pitfalls in mechanical ventilation in Thailand can be summarized as follow:

Pitfalls in the initiation of mechanical ventilation[9-12]

Errors in judgment as to whether or not mechanical ventilation is indicated at a particular moment. This is due to the inability of caregivers to assess the pulmonary reserve of the patients. Most physicians memorize and use the threshold values of the reserve indices, such as, tidal volume and respiratory rate without correctly assessing the true reserves. As a result, some patients who should have been mechanically ventilated were not. On the other hand, those who should not be mechanically ventilated

were.

Failure to establish the ventilatory pattern of the patient prior to connecting the patient to a ventilator. This results into patient-ventilator dyssynchrony that requires heavy sedation and paralysis. Patients with acute respiratory failure are frequently dyspneic and tachypneic, particularly following tracheal intubation. Setting up the ventilator to ventilate the patient who has very high inspiratory flow demand, high tidal volume, and high respiratory rate is very difficult, at times, impossible. To avoid this pitfall, one has to determine the ventilatory pattern of the patient. Then, with the use of a manual resuscitator that provides high fractionated inspired oxygen (FiO_2), the physician can now assist the patients' every breath using a higher inspiratory flow than the flow demanded by the patient[9-15]. This relaxes the respiratory muscles and assures that we are helping the patient breathe at all times. In time, the patients' breathing rate will diminish until the patient stops breathing. We then adjust the manual ventilation to the ventilatory settings for that patient prior to connecting the patient to the ventilator. This makes the initiation of mechanical ventilation as "smooth as silk".

There has been failure to monitor the patient and correct any hemodynamic instability with the initial phase of positive pressure ventilation. All patients with acute respiratory failure tend to be dehydrated and have elevated sympathetic tone. After applying the appropriate ventilatory support, sympathetic stimulation ceases and all patients develop hypotension to a variable extent[10,16]. Blood pressure should be monitored every 5 minutes during the first 15 to 30 minutes after starting mechanical ventilation to prevent patient collapse.

Pitfalls during the maintenance of mechanical ventilation

Utilizing an inappropriate mode for ventilatory support:

1) Physicians and nurses do not set goals as to the use of full ventilatory support or partial ventilatory support. Continuous mandatory ventilation (CMV) is normally the popular initial mode set on the ventilator without attention to the degree of support necessary[17,18].

2) Using the CMV mode without setting the ventilator with enough flow to allow the respiratory muscles a period of rest. Respiratory muscles continue to work and, in some cases, have to work even harder than they did when not being ventilated[13-15,19]. In short, full ventilatory support could turn out to be just either partial ventilatory support, no support at all, or even an obstacle to ventilator support.

3) The patient receives full ventilatory support while partial ventilatory support is actually intended. Setting the respiratory rate too high in the SIMV mode causes hyperventilation and converts the SIMV setting into the CMV mode[10-12]. Excessive pressure support levels may result in the ventilator's flow being higher than the patient's actual flow demand. This converts the pressure support ventilation (PSV) mode into a full ventilatory support mode[10-12].

4) Although pressure-controlled ventilation (PC-V) has been in use for over 40 years and has proven to be superior to volume-controlled ventilation (VC-V)[10-12], VC-V continues to be widely used in Thailand. The main reason for this pitfall is that most users have little knowledge about PC-V, how it works and what are its advantages over VC-V. Most physicians and nurses misunderstood that the classic volume-controlled, pressure-cycled ventilator (e.g. Bird Mark 7 ventilator) are pressure-controlled ventilators. In addition, many hospitals do not have ventilators that are capable to run PC-V.

Inappropriate settings of the ventilatory parameters. This is due to the fact that the physicians and/or nurses who are responsible for setting up the ventilators are not educated enough in the principles of the ventilator settings. They do not know which parameters on the ventilator interface, which are essential and which are not. They also do not possess the knowledge of the principles of the settings for each particular parameter, such as, tidal volume, respiratory rate, inspiratory time, inspiratory flow rate, trigger sensitivity, pressure limit, or positive end-expiratory pressure. Some physicians set I:E ratio on the ventilator interface without realizing the fact that they are actually setting up the peak inspiratory flow rate.

Physicians and nurses who care for the mechanically ventilated patients are unaware as to whether the patients are being sufficiently ventilated. They are also unaware of what may be wrong and what the solutions are. Thus, they mistakenly maintain the patients' ventilator with the inappropriate settings.

Failure to prevent properly complications that are associated with mechanical ventilation. For example, some physicians incorrectly prevent ventilator-associated lung injury by limiting the tidal volume rather than lowering the peak alveolar pressures or plateau airway pressures[19]. In addition, some attempted to prevent ventilator-associated pneumonia without

applying adequate humidification and avoiding mucosal injury resulting from improper suctioning techniques. These incorrect measures and misconception would not prevent the patients from variable complications. Some of them may even worsen complications.

Pitfalls in the disconnection of mechanical ventilation [20,21]***:***

Incorrect decision as to when to disconnect the patient off mechanical ventilation. This incorrect decision could result in premature or delayed weaning. This pitfall is due to the inability to assess correctly the patients' pulmonary reserves. Many physicians assessed their patients by focusing only at a few certain weaning parameters (e.g. tidal volumes, respiratory rates, and rapid shallow breathing indices) stated in medical textbooks without assessing the real patients clinically.

In attentiveness to spontaneous breathing trials. This is secondary to the attending physicians' and nurses' workloads and duties to other patients that make it difficult to monitor closely the patient during the spontaneous breathing trials.

Misconception or technical errors during spontaneous breathing trials. Some of these include suddenly disconnecting patients from the ventilator without any support in order to assess the readiness for weaning; using inadequate pressure support on a patient who was intubated with a small-sized endotracheal tube; inadequate oxygen flow through the nebulizer resulting in an FiO_2 that is lower than the patient maintained while on the ventilator; using an automatic weaning mode (e.g. Adaptive Support Ventilation (ASV), SmartCare, INTELLiVENT-ASV) without knowing its limitation, and inadequate humidification during the spontaneous breathing trial.

Using nurse-driven, protocol-directed weaning rather than a respiratory therapist-driven, protocol-directed one[22,23]. It has been proven that a nurse-driven, protocol-directed weaning is not as effective as is a respiratory-therapist-driven one. When compared to respiratory therapists, most nurses do not have enough knowledge, skills, and experiences in several aspects of mechanical ventilatory support, for example, in assessing patients' readiness to wean, pulmonary reserves, determining the method of spontaneous breathing trials, appropriate care during the spontaneous breathing trial. More importantly, excessive workloads of nurses may prevent them from closed monitoring patients who are being weaned[24,25].

Until we restructure the respiratory care system in Thailand by opening up a new profession "certified respiratory therapists", physicians and nurses need to master the appropriate skills and be given the opportunity to obtain the sufficient knowledge that is required to avoid the above-mentioned pitfalls.

Potential conflicts of interest

None.

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ความผิดพลาดของการใช้เครื่องช่วยหายใจในประเทศไทย

ทนันชัย บุญบูรพงศ์

กับดักที่มักเป็นต้นเหตุให้เกิดความผิดพลาดในการใช้เครื่องช่วยหายใจมีอยู่ตลอดเวลาในทุกหอผู้ป่วยและทุกโรงพยาบาลในประเทศไทย ทั้งนี้เป็นเพราะประเทศไทยยังขาดวิชาชีพนักบำบัดระบบการหายใจ ร่วมกับการที่แพทย์และพยาบาลขาดความรู้และทักษะในการบำบัดระบบการหายใจและการใช้เครื่องช่วยหายใจ ในสถานการณ์จริงแพทย์มักไม่สนใจการบำบัดระบบการหายใจเลย โดยมักปล่อยให้เป็นความรับผิดชอบของพยาบาลแทน ซึ่งภารกิจของพยาบาลก็ล้นมืออยู่แล้ว แต่กลับต้องดูแลบำบัดระบบการหายใจด้วยอย่างหลีกเลี่ยงไม่ได้ เพราะเป็นผู้ปฏิบัติงานอยู่กับผู้ป่วยตลอดเวลา การจะกู้กับดักหรือกลบหลุมพรางของการใช้เครื่องช่วยหายใจในประเทศไทยให้สำเร็จจึงจำเป็นต้องอาศัยความร่วมมือจากทุกฝ่าย รัฐสภาต้องผ่านพระราชบัญญัติวิชาชีพนักบำบัดระบบหายใจหรือพระราชบัญญัติประกอบโรคศิลปะสาขาการบำบัดระบบการหายใจ สำนักงานข้าราชการพลเรือนต้องกำหนดตำแหน่งนักบำบัดระบบการหายใจให้เพียงพอในทุกโรงพยาบาล ในขณะที่สถาบันการศึกษาก็ต้องจัดให้มีการเรียนการสอนศาสตร์แห่งการบำบัดระบบการหายใจทั้งในระดับปริญญาและอนุปริญญา นอกจากนี้ยังต้องบูรณาการความรู้ทางการบำบัดระบบการหายใจเข้าไปในหลักสูตรแพทยศาสตรบัณฑิตและพยาบาลศาสตรบัณฑิตอย่างเพียงพอ ก่อนที่ประเทศไทยจะมีนักบำบัดระบบการหายใจ แพทย์และพยาบาลระดับปฏิบัติการก็ต้องหาความรู้และพัฒนาทักษะให้เพียงพอที่จะหลีกเลี่ยงกับดักหรือหลุมพรางที่มีอยู่มากมายเหล่านี้