The Imperatives of Critical Care Physiotherapy

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Abstract

Multiple factors make critically ill patients to be on bed with resultant deconditioning of body multi-system. Physiotherapy is an essential part of multidisciplinary team involved in the management of patients with critical illness.The rehabilitation plan ensures that the patient is treated with the functional needs of the patient in focus. The determinants of implementation of critical care physiotherapy are the patient's need, the level of consciousness of the patient and the physical strength of the patient. Physiotherapy in critical care setting provides several benefits for the critically ill. Thus, there is imperatives of critical care physiotherapy.

Key Words: *Deconditioning, Rehabilitation, critically ill, multi-system, critical care physiotherapy.*

Introduction

Physiotherapy has been recommended as a main component in the management of patients with critical illness.Early physiotherapy is aimed at improving patient's quality of life and preventing critical care unit (CCU) - associated complications like deconditioning, ventilator dependency and respiratory conditions.This intervention prevents and mitigates adverse effects of prolonged bed rest and mechanical ventilation during critical illness. Multiple factors make critically ill patients to be on bed rest. This includes altered level of consciousness, drugs that prevent mobility (sedatives), traumatic injuries, and surgical complications. In 1960's a number of bed rest studies revealed the detrimental physiological effects of inactivity[1]. Bed rest is at a cost and the cost is profound deconditioning of the body.

Deconditioning is described as a state of decreased functional capacity of multiple organ systems, the severity of which is dependent on the degree and duration of immobility. Early progressive mobilization is essential in minimizing functional decline[2]. Physiotherapists are part of the multidisciplinary team in intensive care units. Critical care is the specialized care of patients whose conditions are life-threatening and who require comprehensive care and constant monitoring, usually in intensive care units (ICUs) and high dependency units (HDUs). Physiotherapists use a comprehensive multisystem assessment that includes the respiratory, cardiovascular, neurological, and musculoskeletal systems to formulate individualized treatment plans. Critically ill patients frequently suffer long term physical and psychological complications. They are on long term mechanical ventilation and as a result, 25% display significant muscle weakness, and approximately 90% of long term ICU survivors will have ongoing muscle weakness.

Clinical Implications of Bed Stay

Bed rest decrease VO_2 max, and the extent of the loss depends on the length of the bed

rest, with VO_2 max decreasing approximately 0.9% per day over 30 days of bed rest[3, 4]. The decrease in VO_2 max during bed rest appears to be independent of gender and age. However, more fit individuals may experience a greater absolute decrease in VO_2 max compared to less fit individuals[5, 6]. 26% decrease in VO_2 max and cardiac output has been reported after 20 days of bed rest[1]. Similarly, a 17% decrease in VO_2 max following 10 days of bed rest resulted from a 23% decrease in cardiac output[3, 4]. The primary cause of decreased cardiac output and VO_2 max following bed rest is a decrease in stroke volume. Rapid diuresis occurs within the initial 24-48hr of bed rest, resulting in a 10-20% decrease in plasma volume[5, 6]. The primary mechanism for the decrease in stroke volume following bed rest is decrease preload due to a decrease in plasma volume. Bed rest in the supine position results in loss of plasma volume averaging about 600 mL. This loss contributes to the propensity for postural hypotension and syncope. Syncope under any circumstance can result in injury. The possibility of injury is increased if syncope occurs while getting out of a high hospital bed[3, 7].

In the respiratory system, there is potential decrease in lung volumes (secondary to muscle weakness, positioning), reduced expectoration, increased respiratory rate and increased work of breathing. The skeletal system is also affected. Skeletal system functions optimally when exposed to gravity. *Wolff's law* states that the build-up or breakdown of bone is proportionate to the forces being applied (weight bearing, muscle forces and gravity). Maintaining normal bone mass requires a balance between the action of osteoblasts and the osteoclasts. Removal of normal weight bearing activity during bed rest disrupts this balance, and resorption is favoured, resulting initially in an alteration in calcium balance, and later in bone loss[8]. The bones of the lower limbs are the most susceptible to decrease bone mass[9]. Bone mass in the vertebral column decrease by 0.9% following five weeks of bed rest[10]. Greater trochanter bone mass decrease by 4% and spine bone mass decrease by 3% after 12 weeks of bed rest[11]. The following are expected in a patient in critical care unit. Physical Inactivity leading to muscular atrophy and generalized weakness. Diaphragmatic weakness due to prolonged mechanical ventilation. Pressure Ulcers of various grades. Compromised cardiac and respiratory function. Deep vein thrombosis. Infections.

Goals of Physiotherapy Intervention

The short term goals in critical care intervention includes early activity – both passive and active to maintain integrity of musculoskeletal system. Positioning of patients to allow gravity to help sputum drain from the lungs. The use of manual techniques like shaking and vibrations to the ribs to loosen and clear sputum. Suctioning may be needed to suck out the excess sputum. There is also the vital role in weaning a patient off ventilation. Long term goals include a plan for extensive rehabilitation programme to reintegrate and re-initiate the patient into the society. The rehabilitation plan ensures that the patient is treated with the functional needs of the patient in focus. The determinants of implementation of critical care physiotherapy are the patient's need, the level of consciousness of the patient and the physical strength of the patient. The goals of respiratory physiotherapy management are promotion of secretion clearance; maintenance or recruitment of lung volume; optimization of oxygenation, and prevention of respiratory complications in both the intubated and spontaneously breathing patient[12].

There is Prophylactic and therapeutic roles of critical care physiotherapy, prophylactic in all patients confined to bed where there is risk of bronchial obstruction/ ventilatory failure (severe operation, trauma, consciousness disorder) and therapeutic in several cases, principally broncho-pulmonary diseases e.g asthma, obstructive emphysema, pneumonia, bronchiectasis, pulmonary abscess, atelectasis, pulmonary & pleural fibrosis.

Indications and Contra Indications For Critical Care Physiotherapy

The clinical conditions where critical care physiotherapy is indicated are Cardiac conditions cystic fibrosis;bronchiectasis; respiratory muscle weakness in neuromuscular conditions e.g spinal muscular dystrophy; tracheal surgery;surgery for chest wall deformitiesheart/lung transplant; head injuries; premature infants requiring surgery; sepsis; chest infections, neurosurgery (brain tumors, insertion of shunts); burns; road traffic accident; serious fall; severe pneumonia; major surgery; conditions where there is threatened airway; all respiratory arrests; sudden fall in level of consciousness; repeated/prolonged seizures; rising arterial carbon dioxide tension with respiratory acidosis. The contraindications are myocardial infarction; unexplained hemoptysis; pulmonary embolism (P/E) in acute stage; pulmonary hemorrhage; acute pulmonary edema; pneumothorax; risk of increased intra cranial pressure especially when there is plan for postural drainage treatment.

Importance of Pulse Oximetry in CCU

Pulse oximetry is amongst the basic monitoring requirements in CCU, others being,heart rate; blood pressure; respiratory rate; hourly urine output; body temperature; blood gases and 24hourly special drainage volume as in chest tube thoracotomy drainage, CTTD.Pulse oximetry is quick noninvasive and completely painless test with no risk apart from potential skin irritation from the adhesive used in some types of probes. It uses small clamp-like device usually placed on a finger, earlobe/toe. It is fairly accurate with results within a 2% difference either way of actual value.It is significant in the critical care setting as it gives forewarning about the presence of hypoxemiathus leading to a quicker treatment of serious hypoxemia and possibly circumvent serious complications.The presence of pulse oximetry may reduce the number of arterial blood gas samples obtained in the CCU and in the emergency units; reduction in pulmonary transfers to the CCU due to early recognition and treatment of post-operative pulmonary complications. The subsequent maintenance of oxygenation within the physiologic limits might help avert irreversible injury[13]. Pulse oximetry is used to assess patient's ability to tolerate increased exercise administration.

Clinical Benefits of Critical Care Physiotherapy

The beneficial effects of physiotherapy in critical care setting are clearance of lung secretion; promotion of Lung Functions; reduction of Work of Breathing, WOB; reduced incidence of ventilator associated pneumonia; improvement in exercise tolerance; relaxation of contracted respiratory muscles; prevention of respiratory complications and resolution if already present; reduced time spent on Mechanical Ventilation, M/V; reduced time spent on intensive care; reduced cost of care; improvement in Quality of Life, QoL of the patient; reduction in mortality rates and promotion of speedy discharge from the hospital[14, 15, 16, 17].

Summary

Critical Care Physiotherapist views cardiopulmonary system as a whole, interacting with other body systems for optimal function and understands the functions of the multidisciplinary team in the management of critical care patients, including intensive care and cardiopulmonary rehabilitation, and describe the physiotherapist's role in the multidisciplinary team. Physiotherapy interventions incorporate cardiopulmonary goals as well as neuromuscular and musculoskeletal goals for patients to reach maximal rehabilitation potential. The current rehabilitation needs of patient are identified; patient risk of developing physical and non-physical morbidity are identified. For patient at risk, rehabilitation is started as early as clinically possible, which should include measures to prevent avoidable physical and non-physical morbidity and individualized, structured rehabilitation programme with frequent follow-up reviews.

Ethical Clearance – This is an article

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Conflict of Interest – Nil

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